Contents Xact 8 and XactPro 8

About the Manual and Help System

Xact is a professional tool for the graphic presentation of all types of data. Linked to this are a considerable number of functions, some complex, which we shall try to show you as clearly as possible in this manual.

We have therefore deliberately designed this slim manual with two aims in mind: firstly to get you started on completing your initial chart *quickly* (in the next section), and secondly so that you can *understand the principles and techniques* of using Xact.

The Overview Sections each offer an introduction to the topics they deal with and are intended to give you a *general picture*. The *Example* Sections have been conceived as practical exercises and you should work through these on your computer.

You will find the full documentation (the Reference Section) to Xact in the *Online Help* (electronic help system). The Online Help in Xact is context-sensitive and very detailed; it also contains various practical tips. **We therefore strongly recommend that you use the Online Help intensively.** On the next few pages you will find a brief introduction on using the Online Help.

The Online Help allows fast access to the desired information, is regularly updated and produces no litter. Those who prefer printed information can print out this Online Help – the help system makes this easy. However, you should be prepared for the approximately 700 sheets of paper that you will need.

The help system is less well-suited as an initial introduction because reading from the screen is hard work, and it is often difficult to view the text and program at the same time on small screens. And that is precisely why you are holding this manual.

Both the manual and the help system deal with Xact versions for MS Windows 3.1, Windows 95, Windows NT and IBM OS/2. The Xact versions differ optically, e.g. in the 3D effects of the dialog boxes, as nothing can stand in the way of the relentless march of "fashion". Nevertheless, you should still be able to find your way around.

Quick Start

Are you someone who prefers to put software manuals in the bookshelf unopened and go straight over to the program? Please try at least to read the section entitled *Quick Start...* and the *Overview* sections and also learn about the help system on this page so that you properly understand how Xact works and can fully exploit the program!

Systematic learning

If you would rather get to know Xact thoroughly, simply read the manual from start to finish. In any event, you should try out the exercises on your computer as you go along. If you find the subject matter of some sections less appealing, you should at least skim through them as they also contain *general information* on how Xact works!

How you can ask Xact questions - the help system

Many computer users flatly refuse to work with help systems. And they often have good reasons for doing so: help systems are only helpful if they function in a context-sensitive manner, contain sufficient cross-references and have a detailed index.

Context-sensitive help systems show you information on the topics you are working on at any given time. If for example you have just opened a complex dialog and do not understand what is being described, in a context-sensitive help system you click on *Help...* and are given some explanations. You can then obtain further information with clicks on the *cross references*. If you cannot find a function, the *Help Index* lists a large number of important keywords that will guide you directly to the important parts of the text.

Whenever you have questions on functions in Xact, use the Xact help system! There are various routes to the help system:

- In **graphic**s or *table* windows you can access the help system in the *Window menu*

- While you are working with Xact, *context-specific help* is readily available, and you will therefore find a button labeled *Help...* in every **dialog**.

- The **F1 key** always opens the help system and gives you context-sensitive information.

In principle help systems are organized like books with a table of contents and an index. In some books you find cross-references to other sections or pages in the book, and exactly the same is true of help systems. Here cross references in the text are marked in color and branch off to the relevant sites at the click of a mouse. You can return to passages you have previously selected with *Back* or *Previous topic*.

One enormous benefit of context-sensitive help systems is their great ease of access. With printed documentation you have to search for explanations to terms in dialogs for example; here a mouse-click on the *Help button* in the dialog is enough. The help system then gives a direct display of the relevant explanations.

In connection with *Help* you will find three entries in the *Window* menu:

- under *Help* you will find an article that matches your current activity within Xact
- under *Help index* you can search by keyword
- under *Table of contents*, as in a book, you will find a structured list of what the Help section contains.

The help system for MS Windows

Start Xact and in the *Window* menu select *Table of contents*. The window that now opens has four entries:

- *File*: *Print* topic enables you to print the section in question
- With *Printer Setup* you can adjust your printer. *Open* lets you load any help file, *End* closes the help window.
- Edi*t* enables you to copy the text and to add any comments.
- ? gives you assistance in using the help system.

You will find a number of buttons under the menu bar:

- *Contents* shows the list of contents for this electronic book. You will find underlined entries in the window. A double-click with the left-hand mouse button on the *underlined text* will open the first page of the relevant section. In

each section you will find cross references to further sections (underlined words) or explanations of terms (words with a dotted underline). You can view the explanations by clicking on the word once with the mouse button.

- Bac*k* takes you to the previous section or to the table of contents.

- *History* lists all the sections you have selected to date and thus allows you to simply jump over several sections at a time.

- ·*Search* gives you a list of all the *Section Titles* in the help system containing the **word entered**. The *Go to* button opens the relevant section.

The help system for OS/2

Start Xact and in the Window menu select Table of contents. In the menu bar of the window that opens you will find three entries:

- Functions : *Search...* opens the dialog of the same name (see explanation further down), *Print...* offers you various options for printing help pages. With the other entries you can copy section contents from the help system and paste them into other documents.

- *Options* offers you further ways of working with the help system. These have been described in detail under the menu option *Help* in *Help for help functions*.

The Table of Contents for Xact is now shown in a window. You will find a cross in front of some entries. Click on the cross and more sub-headings for each section title will be shown and the cross turns into a line. A click on the line will then close the sub-heading again.

A double-click on an entry in the table of contents opens the relevant section. Within a section you will find *words highlighted in blue*. A double-click on these words will bring you to further sections.

At the lower edge of the window you will find four buttons:

- *Previous topic* lets you go back one section.

- *Search...* opens a dialog for entering a search string. You can then look for this search string in different areas of the Xact help system, and also in all the help libraries on your computer. The contents of all sections are included in this search. As a full text search is possible here, typing in the search

string ***X*** for example will give you all words that contain an X, such as
"**Xact**" or even "**example**". The s**earch result** you obtain is in the form of a
list of the sections containing the hits. If you open a section from this list, the
words found will be highlighted in red.

- *Print...* lets you print out parts of the help or the entire system.

- *Index* shows the Xact help index in a window.

Preparations

First steps - starting Xact

When you first start Xact after a new installation by double-clicking the Xact icon (or Xact.exe), three windows are opened automatically. Xact will always start with these windows because the entry *Autostart window* is set in the windows.

In the background you'll see a window showing the previews of a all Xact Graphics windows of a directory on your hard disk. This window is called a **Graphic Explorer window** and makes working with already existing graphic windows easy (see below). On top of it you'll see two **table windows** (see below) ready to create charts from its data.

To switch the Autostart feature off uncheck the entry *Autostart windows*: you will find it in the *context* menu of a Graphics Explorer window or in the *File* menu in other windows.

If you are bursting with curiosity: goto the *Chart* menu of one of these table window and click on *Lines...* . In the dialog choose *Lines/Marker* and click on *OK* to create your first chart with Xact. This chart is created in a new *Graphics* window Xact opens for you. If you now move the mouse pointer over the chart you'll see the shape of the mouse pointer changing from arrow to cross, depending on the object it points to. The cross pointer indicates that you can change properties of an object. Open the context menu in this position to see what you can change - **and in any case at least read the chapter *Quick start - from data to chart* in this manual to get an overview on what you can do!**

Window types used in Xact

In Xact you can work with different types of windows:

Table windows contain data and text you need to create charts. This window type has the extension "XTF" and uses menus and context menus to work with, for more information see the chapter "The table window".

Graphics windows contain graphic objects and charts (consisting of graphic objects). This window type has the extension "XGF" and uses menus and context menus to work with, for more information see the chapter "Drawing & Illustrating".

Graphic Explorer windows let you see the previews of all Xact graphic windows in a directory, making working with many graphics windows and linked tables very easy. Each Graphic Explorer window (extension "XGE") has a title consisting of path and file name. It shows the previews of all Xact Graphic files (*.XGF) in the path given in the title. The shown previews are normalized in size. This enables you to identify small graphics as well as large graphics.

Graphic Explorer windows are managed only by context menus. Graphic Explorer windows can be sized as common resulting in a new distribution of the previews. To work with the shown files you must first select them using the mouse or keyboard. Selected files are shown inverted.

Open the context menu by a context click on one of the shown previews. The entries in this menu are more or less the same as in other Xact windows. Some important entries:

- *Actualize*: actualizes the previews shown in the window.

- *Select/Deselect all:* this entry changes after a selection in the window.

- *Sort by Name/Date:* this entry changes the sort mode of the window.

- *Selected windows:* the entries following this text in the context menu are only accessible, if a preview is selected.

- *Open with linked table windows*: opens all selected graphic files with all their linked tables tables.

- *Open linked table windows...*: creates a list of all selected graphic files and their linked tables. Click on a name to open the file. If linked table windows are not found - always after a new installation of Xact - the table name is searched in the path of the graphics file it belongs to (Message: Path of graph-

ics file). If the table name is not found there, it is searched in the actual table path (Message: Found in + path). If it is not found there, the given message is "File not found".

- The entries *Print...*, *Export...*, *Delete* work on all selected graphic files.

- *Autostart window*: A checkmark shows the actual state. Can be set for all Xact windows by clicking on the entry, in graphics- and table windows in the menu "File". But: In "Preferences/System" the radio button "Marked or last used window" must be set! All set auto start marks for all windows can be deleted by a click on the entry "Delete all autostart marks": in graphics and table windows in the menu "Window", in Graphic Explorer windows in "Options" in the context menu.
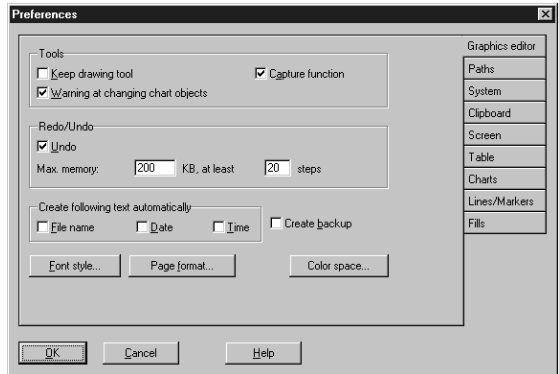
Drag & Drop of files with Graphic Explorer windows:

- *from Windows Explorer:* drag the wanted files from Windows Explorer to Xact Graphics Explorer and release the mouse key. The files are inserted in the window and physically copied (not moved!) to the path given in the title.

-*between Xact Graphic Explorer Windows:* drag the selected previews from one Graphic Explorer Window to the other. Release the mouse button: the Xact Graphic files are copied (not moved!) to the directory given in the title. But be aware: Linked tables are NOT COPIED! The pathes to the linked tables remain the same, after a graphics files was copied.
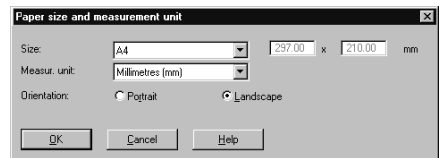
Preferences...

In the *File* menu you will find the *Preferences...* option which provides you with several dialogs in which you can largely specify the standard settings for Xact. The basic behavior of Xact is laid down in the Preferences. The settings made here apply to all the windows that are subsequently opened. They are saved when Xact is closed. Let us take a brief look:

As there are a lot of settings summarized in a very compact space, simply browse through the pages and read up on the functions using the *Online Help*.

We shall briefly discuss the most important of these basic settings here: now open a graphics window with command *New...* in the *File* menu. You will also find that your settings are in the *Page* menu of the window under Format.

Preparations

If you want to draw something, you first reach for a sheet of paper and get the necessary utensils ready. There is a similar procedure in Xact: first of all you specify the page format, decide on the system of measurements and rulers, etc. In Xact this happens the moment you open a chart or create a new one. Xact will first use the information saved in the *Preferences* (*File* menu). You can find full information on these settings in the *Online Help* !

The settings saved under *Preferences* are then used for all charts that you open with the option *New…* in the *File* menu, or for the charts opened automatically by Xact.

You can adjust most of the settings individually for the newly opened graphics window in the *Page* menu!

Page format and measurements system

You specify the format of a page (here the graphics window) in the *Preferences* on the *Graphics editor* page using the *Page format* option.

- In the *File* menu select the *Preferences* option and then the *Graphics editor* page in the notebook that appears.

- Click on *Page format… .*

- In the dialog shown below you can now select the *Page format*, the *orientation* and the *System of coordinates.*

All the positions, lengths and widths will be indicated by Xact in the units of measurement that you specify in the Page format dialog. You can choose to work in centimeters, millimeters, inches or other units depending on the application or your own personal preferences.

- Click on the field after *Measuring unit* and select *Centimeters* (cm) as the unit.

Replacing fonts

When reading a XGF file, Xact can replace any fonts that are not present in the system by other fonts. The replacement table for this is called XGFMAP.TXT and is located in the same directory as Xact. You can change and add to it yourself; you will find further information in the *Online Help* under *Replace fonts.*

If the box for *Write log-file* is checked on the *System* page of *Preferences*, each time an XGF file is loaded, the event will be recorded in a file (*.LOG) written into the directory of the loaded XGF file. It contains a list of the replacements that have been made (see *Online Help*)

- **When fonts are replaced, the lengths of the replacement font do not usually match those of the original. As a result, errors occur in the graphics document, which - if there is a lot of text - will be difficult to discover.**

- If you want to find out exactly how the **font-names** are written in Xact, you can click on the *Write font-list* button on the *System* page of *Preferences*. Xact then writes a list with the names: FONTLIST.TXT. You can find further information in the Online Help and in the file itself.

Create backup

If this option on the *Graphics editor* page of *Preferences...* is checked, when a graphics file is saved, the extension of the previous version will be changed to *.XG~ .

Around and about the graphics window

Let us have a short look at the *Page* menu of a graphics window:

Color spaces	Here you can choose between the models RGB, CMY, HSV and - if you own XactPro - CMYK.
Rulers	Xact displays rulers at the top and left-hand edges of a graphics window. They may be compared with the rulers on a drawing board. They are graduated according to the measuring unit you have selected. To save space, no rulers are displayed when a chart is first opened. You can show or hide them whenever you want using the *Show rulers* option in the *Page* menu.
Grid	Xact offers you another orientation aid in the form of the *Grid*, which is comparable to graph paper: so that your window is not littered with grid points, Xact only displays every 10th grid horizontal and vertical grid line if the spacing is very narrow. The interval between grid points can be freely defined but should not fall below 0.1 mm. As the grid is purely intended as a drawing aid, it is ignored in the printout.
Show grid	The grid can be activated and deactivated by clicking the *Show grid* box at the lower edge of the window.
Grid settings	By selecting *Grid options...* in the *Page* menu, you can define the distance between the grid points. If you check *Magnetic grid*, when you move objects, they will attach themselves to the nearest grid point. When you are drawing too, points can only be set at grid points.
Relative grid	If an object does not begin on a grid point, it will jump to the next one as soon as it is moved. During scaling, the absolute grid functions in the same way. This may be desirable when you are drawing, but can be very disruptive when your are working with charts. For this reason, if you select *Relative grid*, the object will not jump from grid point to grid point, but will simply be moved from its original position by the distance specified for the grid spacing.

Outline mode for greater speed

A computer generally draws lines more quickly than solid 2D objects. If you find redrawing complex charts occurs too slowly, you can check the *Outlines only switch* in the *status bar* at the bottom of the window and thus change to the so-called **outline mode**. In this mode only the edges of the individual objects are drawn, which considerably speeds up the display and also makes it easier to select hidden objects.

Even objects that have no frame, will be displayed as frames in the outline mode. The outline mode has no effect on the printout.

How the tool bar works

The way the toolbar functions varies according to the tool being used. Detailed information is given in the chapter *Drawing & Illustrating*.

The **drawing functions** – from the rectangle to the text object – and the **pipette** switch themselves off once the function has finished. This is shown by the fact that the arrow symbol is reactivated. However, if you now press the **space bar** the function that was last used will be **repeated**. In this way you can quickly draw a series of different rectangles by pressing the space bar once after each rectangle.

If, on the other hand, you want to draw several objects consecutively, without having to press the space bar inbetween, you can check *Keep drawing tool* on the *Graphics editor* page of *Preferences*. The drawing function you last selected will then be retained until you click on another symbol with the mouse.

The functions for **editing**, **cutting** and **rotating** objects are retained until you click on another symbol in the toolbar, another object or the background of the graphics window.

How the drawing functions work

You can use the drawing tools to create objects with optical characteristics that can be changed at any time. Whenever you create a **new object**, the optical characteristics depend on the settings in the *Object* menu. A new rectangle will therefore take on the settings that have been entered in *Line/frame...* and *Fill style...* .

How to manipulate the various individual tools is described in more detail in the section entitled *Creating objects.*

Working methods for charting with Xact:

Data

Tables

Charts

editing

editing

publishing

- artwork
- slides

Illustrating

labelling
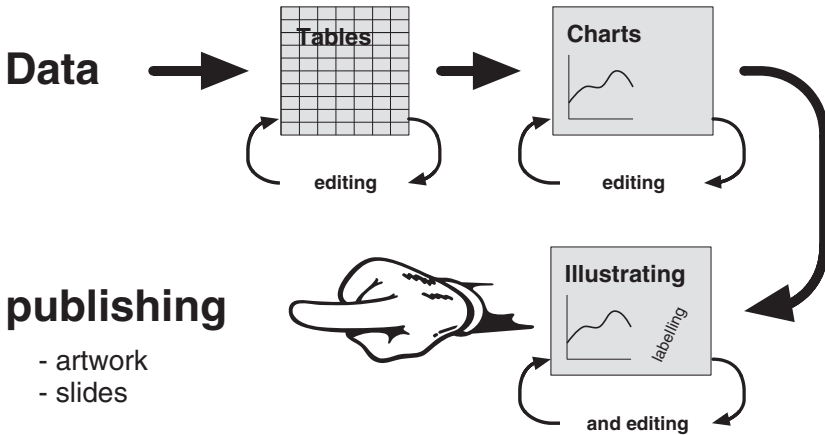
and editing

Quick start – from data to chart

This section shows you the typical procedure for creating a chart. To put it briefly, you will be given a rough overview of the steps "from data to chart". In the **table editor** you collect and edit the data, with the **chart functions** you edit the charts and with the **graphics editor** you alter their visual appearance. You will find more information on the individual types of chart and the functions of Xact in this manual and in the Online Help.

You will find more detailed information on working with the graphics editor in the section entitled *Drawing and Illustrating.*

In the Beginning there was the Number – The Tables

Your figures are the starting point for your work. If the data are already available as files, the first step is to load them into the table editor. The table editor window is like that of a spreadsheet. There you will find your data arranged in rows and columns. However, if your figures are not available on electronic storage media, you can also enter the data directly into the table editor.

Within a table you can choose any desired areas for graphic display. Xact has various methods of selecting data: the simplest is to select an area by moving the mouse while keeping the left-hand mouse button depressed. You can allocate the figures to the various axes of the graph. In the table editor Xact works on the basis of columns: you therefore mark each column as *Y columns*, *X columns*, etc. This step is called *defining column types* – you can read up on this in the section entitled ***The Table Editor*** and in the Online Help!

You save the completed table in the Xact table format (*.XTF). The column definition is also saved with this type of table file and is then available for repeated use.

Creating Charts

After selection and allocation comes the second step: in the *Chart* menu select the desired style of chart, e.g. *Bars…* A dialog box will then open up in which you can choose between further subtypes. At this point you can also decide in which document the chart is to be drawn. You can draw as many charts as you wish within one document. If no document is open, Xact opens a graphics window and draws the chart there according to the *default settings* (*File* menu).

The charts themselves consist of graphical elements, which are assembled into a series of **groups** – see the Figure "Chart Groups". To explain this, we have taken a chart apart here. In the center are the **graphs**: here you can find a single row of bars and a ribbon. You can then see three **axes**, as well as the **title groups** above the chart, the **legend groups** on the right-hand side and – on a 3D chart – the **walls** and the **base**, too.

Each of the named groups has its own **chart functions** to change the properties of that particular group – so for instance you can create "deeper" bars, broader ribbons, or change the colors, alter the labels on the axes, choose a
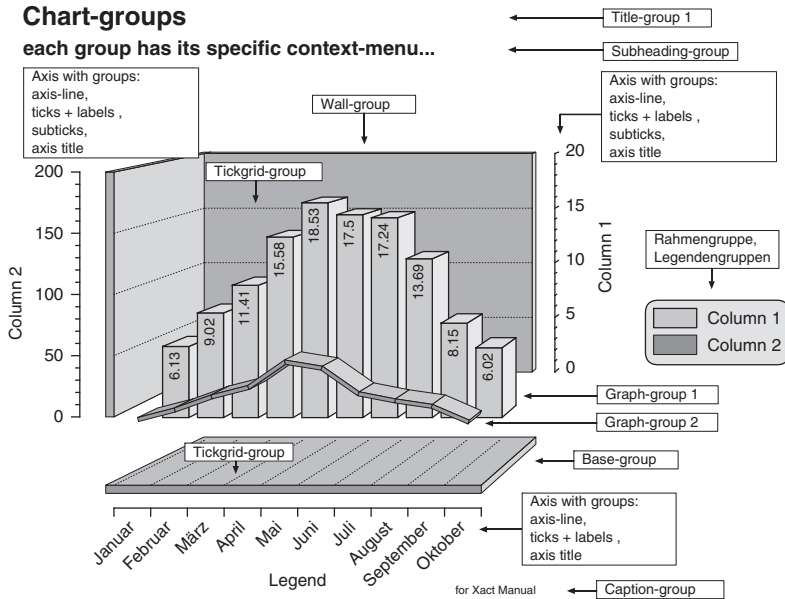
different perspective…. The chart functions range from relatively simple set-
tings, such as the length of the axes through the 3D rotation, to complex
mathematical calculations such as non-linear fits or filter functions.

The chart functions can be divided into three areas, which are discussed in the
corresponding sections of this manual:

- **Axes** – see *Overview: Axes*

- **Graphs** and **Labels** – see *Overview: Graphs* and *Overview: Captions in
  Charts*

- **Legends** – see *Overview: Legends*

To arrive at the chart functions: place the mouse pointer directly onto an
element of the chart component you want to change (e.g. an axis) and with a
context click, open up the context menu for the group in question. A context click
– depending on the mouse settings in the operating system – is usually a click
with the right-hand mouse button. You can see some examples of this in the
Figure "*Context menus for chart groups...*". Then use the mouse to choose an

Context-menus of chart-groups and graphic objects

Sample data
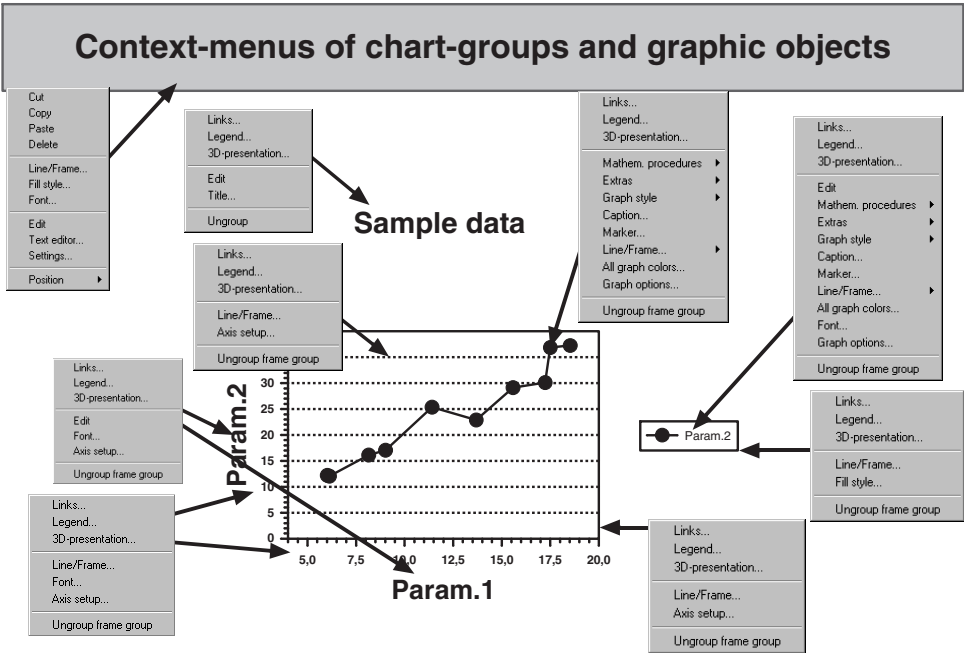
item in the context menu so that you can change the chart group selected. After any alteration the chart is recalculated.

Incidentally, you can also access the most important chart functions for each group by means of a *double-click* on an element in the group. Alternatively, you can select some of the general chart functions via the *Chart* menu.

Let us suppose for example that you want to change the initial and final values of an axis. To do this, click the right-hand mouse button on the axis and select *Axis setup…* . In the dialog that opens up (see illustration) enter the desired values for *From:* and *To:*. Leave the dialog with OK, and the changes you want will be carried out in the chart.
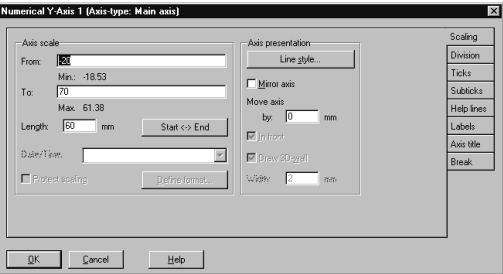
You can also alter the type of chart for graphs that have been changed in this way by selecting another type

from the *Chart* menu. During this process all the meaningful settings for the new type will be retained.

As the initial decision for a particular type rules out the possibility of converting the data into certain other types, these menu items are switched off. The affected menu items are recognizably grayed out. These *context-sensitive* user prompts are maintained throughout Xact. Functions that would not make sense in a particular context cannot be selected. In the same way, a context menu only contains those functions which serve a purpose for the object selected.

From chart to presentation – the graphics editor

If you want to make further changes to your graphics – with additional lettering, gradations, clip-arts, logos, etc. – you can use the *Graphics editor*. In the left-hand margin of a graphics window you will find the drawing tools you need for the purpose. Using the *context menus* of the graphics elements you have drawn, you can change features such as their appearance, position or other properties. You will find an introduction to this in the section *Drawing and Illustrating*. The section entitled *The Text Object* goes into special detail on how to work with text. The graphics editor is a complete drawing program that you can also use as a stand-alone program independently of any charts.

Graphical elements that have been added to charts can be changed in any way you want as the chart functions do not affect them. You could also dissect and alter charts down to the finest detail as these also consist of graphical elements from the graphics editor. However, charts that have been "dissected" in this way can no longer be recalculated.

At a glance…

… here you can see all the steps in a not entirely straightforward example - after all, you want to know what Xact can do! In the next figure you can see the Table editor window. The descriptions of the lines have been en-

Types:	0	1	2	3
0	Legend	Transaction 1	Column 1	Transaction 2
1	January	6.1287548304	1	20.153511715
2	February	9.0210840941	1	27.870704752
3	March	11.411110926	1	38.624099064
4	April	15.580839604	1	46.312433034

tered in column 0 under *Legend* – here they are the names of the months. Columns 1 and 3 contain the figures that are to be represented, column 2 is not to be shown in the chart.

In the line *Types*, the data columns are assigned to the axes of the chart. Transaction 1 has been **defined as L Y1**, which thus specifies that the data in this column are assigned to a **L**eft-hand **Y**-axis. Transaction 2 has been **defined as R Y2** and is thus allocated to a **R**ight-hand **Y**-axis. The numbering (Y1 and Y2) determines the sequence of the symbols in the chart. In this case Transaction 1 is drawn first and then Transaction 2.

One method of defining the columns in this way is to click in the right and left halves of a cell in the Types line. If a column is not explicitly defined, all the data columns present will be numbered consecutively from left to right as **L Y** columns.

In this example we shall plot numbers against categories, namely the names of the months. **As no column is defined as X**, the names of the rows will be used for labeling the X-axis and **we obtain an alphanumeric X-axis**.

In general, only **selected areas** of defined columns are shown. We could now select a particular area of the table with the mouse. However, as we want to show all the data in the defined columns, we do not need to do anything - Xact automatically selects the whole table. For more information, please read *The Table Editor* section.

In the *Chart* menu of the table under *Bars...*, the type *Rows 3D* is selected, thus generating the "raw chart" shown below. Many of the properties for this raw chart can be specified in the *File* menu under *Preferences*. You can read up on how to do this in the Help system under the heading *Preferences*!
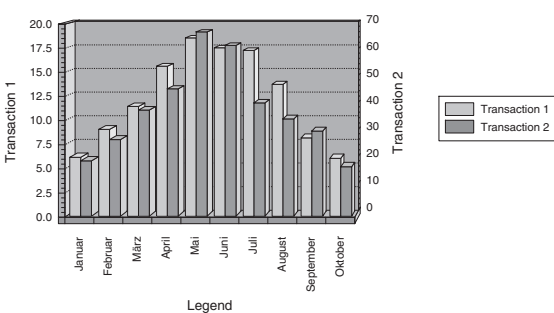
Now we're going to edit the chart with the chart functions mentioned previously. Here we shall systematically list the changes made - although in practice, the changes made to a chart are seldom planned...:

   Context menus for the **graphs** : Under *Graph style...*

in the Transaction 1 graph we select the entry *Ribbon 3D* and thus swap the bar graph for a ribbon graph. In Transaction 2 under *Caption…* we select the position *Bottom of chart* and leave *Insert row legend* as the *Formatting*. Under the entry *Fill style…* of the context menu we switch to *Gradation/2 colors* with the *Start*ing value of 53% gray and the *End* value 86% gray.

  *Context menu for the **left-hand Y-axis**:* We open *Axis setup…* . On the page *Scaling/Axis scale*, after *To:* we enter 35. On the page *Labels/General* for *Position at ticks* we enter *top*, under *Format…* in the dialog *Number format/Symbols* after *Behind*: we enter %.

  *Context menu for the **right-hand Y-axis:*** We open *Axis setup…* . On the page *Label Align:* is set to *align right*. On the *Axis title* page "in $" is added to the text taken from the table.

  *Context menu for the **X-axis:*** We open *Axis setup…* . On the *Ticks* page the *Grid lines* are checked, on the *Label* page, the *Show* box is unchecked.

  *Context menu for the **Legends*** : First the command entry *Ungroup frame* group is executed. In the context menu we then select the *Legend…* entry. On the *General* page *Just text* is checked as the legend type, under the *Frame* option *None* is selected, under the *Lettering* options the F*ill style…* is set to *Covering* and *White*.

The legends are then dragged with the mouse to the positions on the graphs shown in the illustration.

In the *Overview Charts:…* sections you will find out more about the settings we have listed here. And in the *Example* sections you can learn by doing.
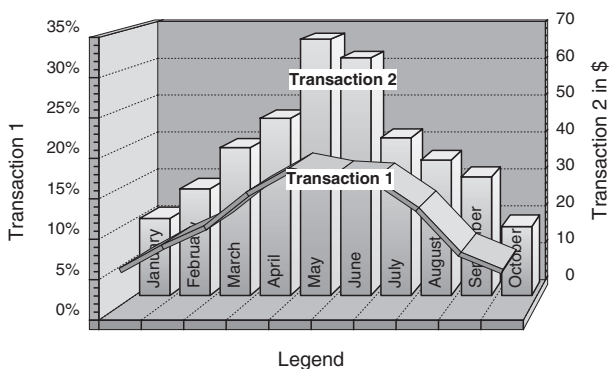
Connections to the outside world

  Suitable and complete import and export formats are important for professional publications. In the overview we have given you a list of the formats that you can select for a document in the *File* menu under *Import* and *Export*. Depending on the operating system you can of course also exchange graphics, text and numerical values via *Copy* and *Paste contents*. If you publish in

PostScript, we recommend the *EPS format* to ensure that graphics are exported correctly. The windows version of Xact provides you with several bitmap formats for import and export.

Exporting graphics with CMYK colors

Working with Xact Pro you can choose the colorspace CMYK. This is needed for the professional printing process where color definitions must be kept. Today you must export files created with CMYK as *EPS* or *PS*, as these are the only widly used vector formats that can use CMYK.

Import- and Export-filters in Xact:

- WMF
- GEM
- TIFF
- PCX, BMP
- OS/2 Metafile
- RTF
- Shapefiles (*.SHP),
    only in XactPro

Graphics

- WMF, GEM
- PostScript, EPS
- OS/2 Metafile
- Adobe Illustrator
- HPGL
- TIFF
- PCX, BMP

- Lotus
- Excel
- DIF, CSV
- ASCII...
- dBase

Tables

- L$_a$T$_e$X
- DIF
- ASCII
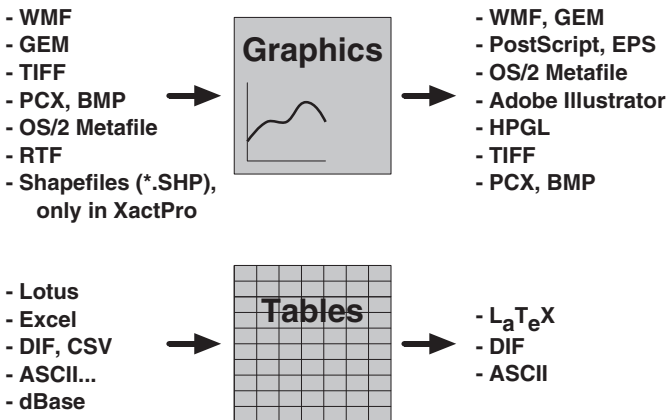
Mouse and Keyboard Commands

These command summaries for the Table and Graphics windows will make working with Xact easier for you. You will find them on your hard disk in the Xact folder under GRAPHICS as files named GRFSHORT.XGF and TABS-HORT.XGF. Print this file and keep the copy next to your keyboard!

Table windows

Editing:

Return	Down one line
Return **Ctrl**	Line break (when changing cell contents)
F2	Change cell contents
Arrow **Strg**	Adjacent cell + continue editing

Alt **Insert**	Get special characters box

Positioning:

Tab	One column to the right
Tab **Shift**	One column to the left
Home	To first column
End	To last column
Home **Ctrl**	To first cell
End **Ctrl**	To last cell
Page Up	Up one screen
Page Down	Down one screen
Arrow	Adjacent cell
Arrow **Ctrl**	Adjacent cell +continue editing

Selecting:

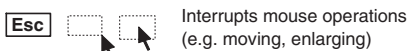|	
Esc	Deselect all
Shift **Arrow**	Extend selection
Home **Ctrl** **Shift**	Extend selection to first line
End **Ctrl** **Shift**	Extend selection to last line
Page Up **Shift**	Extend selection by one screen upwards
Page Down **Shift**	Extend selection by one screen downwards

Graphics windows

Explanation of the symbols:

       Button   Enlarging/reducing objects

     Click on objects   Moving objects

Esc   Interrupts mouse operations
(e.g. moving, enlarging)

Selecting objects:

Ctrl	**Arrow**		Select visible objects
Ctrl	**Arrow**	**Shift**	Select further visible objects
Ctrl			Select further objects
Esc			Deselects objects/points
Switches back to pointer mode

Enlarging objects:

Shift   Enlarge proportionally with corner handles
Enlarge in one direction with center handles

Moving objects:

Shift		Copy object while moving it
Arrow		Move objects/points (slowly)
Shift	**Arrow**	Move objects/points (quickly)
Alt		Move object horizontally only (OS/2 only)
Alt	**Shift**	Move objects vertically only (OS/2 only)

Tool bar:

Z	Magnifying glass (Zoom)
B	Rectangle (Bar)
C	Circle
V	Vertical line
H	Horizontal line
P	Polygon
T	Text
E	Empty pipette
F	Filled pipette
R	Rotate
+	Enlarge image section
-	Reduce image section

Space bar   Reuse tool last selected
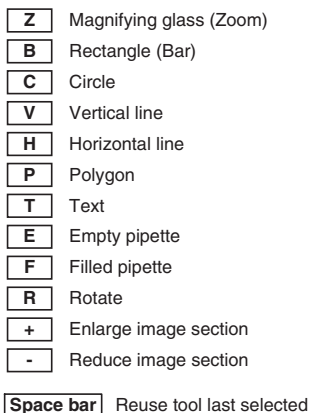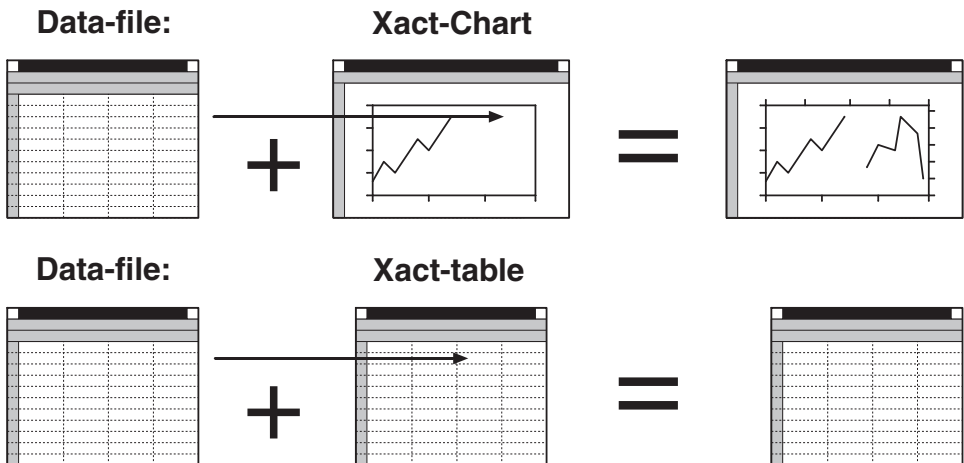
Drag & Drop for Data and Graphics

If data or graphics already exist as files, they can be dragged from the work surface using the mouse with the button depressed and then dropped onto an Xact document.

Drag & Drop with data-files
(e.g. from Explorer):

Data-file: **Xact-Chart**

Data-file: **Xact-table**

In the above case, data files (***.CSV, *.TXT** ...) can be **dragged** onto the **top right-hand corner** of an **Xact chart.** The data will be used dependent on where the mouse pointer is placed on the chart: here (top right) the data are assigned to a **right-hand Y-axis** and an **X-axis in the upper position**. The chart will thus have two Y and two X axes. With this type of "drag & drop" the position of the mouse determines how the new data are used. Depending on the quadrant (and chart type) targeted the following allocations are made:

- **left/right half** of chart gives a **left-hand or right-hand Y axis**

- **upper/lower half** of chart gives an **upper or lower X axis.**

How a chart responds when a table is added is determined in the *Add tables…* dialog. This specifies for example whether the existing column definition will be "passed on" to the new table or whether a specific predefined definition pattern is employed. The way in which the data are used can be adjusted in the context menu of each chart under *'Links…'.*

A similar thing happens when a data file is **dragged** onto an **Xact table:** here the **position of the cursor** determines the position at which the new data are added to the Xact table. The characteristics are specified in an analogous manner to the above case in the dialog *'Add tables…'.* If the cursor is in row 0 or 1 of a table, the new data will be examined for existing legends and then, if none exist, imported from column 0 onwards.
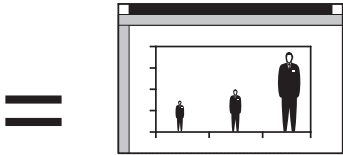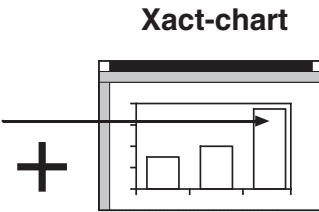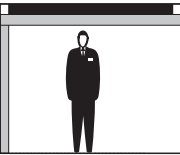
If a **graphics file,** e.g. ***.WMF** or a symbol from an *Xact symbol library* is **dragged** into a **graphics window,** its content will be displayed there. This also applies to text files.

Drag & Drop of graphics files
(e.g. from Explorer):

Graphics file, Xact-symbol   **Xact-graphics**
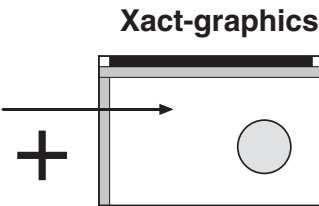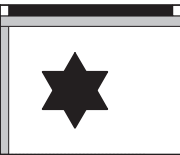
Graphics file, Xact-symbol   **Xact-chart**

If an **graphics file** is **dragged** onto an **Xact chart**, its content will be used in different ways according to the position of the **mouse pointer.**

- If there is a marker directly below the mouse pointer, all **markers** in this graph will be **replaced by the symbol**.

- If there is a bar of a bar chart directly below the mouse pointer, all **bars** in this graph will be **replaced by the symbol**.

- If there is a chart frame directly below the mouse pointer, the contents of this **frame** will be **replaced by the symbol**.

When these replacements are made, the **size** of the symbol is **adapted** to match the situation; further changes can then be made in the *Context menu* of the relevant graph.

One example of the use of this technique can be found in this manual under Examples: *A Simple Object Chart.*

Digitizing Drawings and Pictures

Often data only exist as a chart, but you want to have the underlying figures in table form as simply and quickly as possible.

The digitizing function is intended for this application. It can be used to digitize charts or maps which exist as raster or vector images.

First the image is loaded into a graphics window (*Open…* in the *File* menu). Then in the tool bar of the graphics window (at the left-hand edge of the frame) you select the *arrow* symbol. If you keep the mouse button pressed down, a context menu will open, and selecting the last symbol on the right will activate the *Digitization*. The mouse pointer changes into a hollow rectangle with cross-hairs.

For digitization you first have to define a system of **coordinates**. To do this, you set

(1) a horizontal axis (X) by clicking the mouse once to mark the starting point and once again for the end point

(2) do the same for a vertical axis (Y).

Shift these points as accurately as possible to the desired positions!

After you have set the total of four end points for the axes, open the context menu of one point or press the *Enter* key. Select *Define…*, and the *Scaling* dialog will appear. Here you can set the *Starting* and *Finishing points* for the Y and X axes and the type of *scaling*.
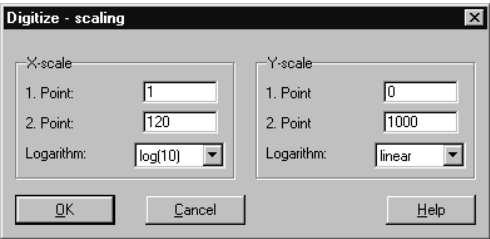
Leave the dialog by pressing *OK* and a new table is opened which already contains the column headings X and Y. Afterwards, all the points that are set by mouse click are converted to the preset axis scaling and are entered into this table according to the order in which they are clicked.

If you want to digitize **several curves at the same time,** open *New parameter* in the *context menu*. Afterwards two new X and Y columns will be entered in the table and points sets after this will be included in these columns. If you want to digitize more points for the first curve, first click on an existing point in the first curve and then continue in the usual way.

While digitizing, you can alter the position of the points that have already been set. For this you first need to select them with the mouse or with the combination Ctrl + arrow key. You can then shift these points with the mouse or with the arrow keys.

- The magnifying glass can also be used while you are digitizing and this enables you to work accurately at pixel level.

- You end the digitizing function by clicking on *End* in the *context menu*, by pressing the *ESC* button or by selecting a new tool (except the magnifying glass) from the tool bar.

The data table you have created can be used for creating charts, for exporting data or for calculations, to name but a few examples.
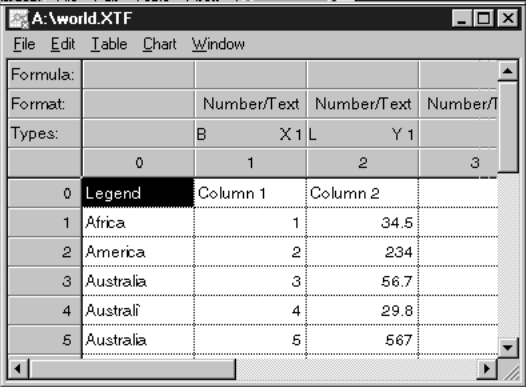
The Table Window

Xact displays data in rows and columns in table windows. You can import and enter data into these data windows and then edit and use them for calculations. All the charts in Xact are generated on the basis of the data in the table. For this you need to select the data that is to be presented: as a rule, each column in the editor corresponds to a series of data (curve, ribbon, bar) in the final chart.

First let us take a brief look at an Xact table: the above illustration shows you the structure of a table window. Monthly results measured over two years have been selected as specimen data. There is a series of data for each year, which is entered in a separate column – therefore the years have been selected as the column legends. As there is a reading for each month, we have chosen the names of the months for the rows legend.

Xact tables as files

Xact tables on the hard disk can be recognized by the ending *XTF* in the filename. In addition to the actual data, they also contain information on the column definition and data types as well as the formulas, titles and sub-headings that you have entered yourself.

Creating tables/Entering new data

If you want to enter your data directly into an Xact table, you first have to create a new table. To do this, select the command *New…* in the *File* menu.

The keyboard commands in the table editor correspond to those commonly used for spreadsheets. Newly entered characters will overwrite the content of the currently selected cell. In order to change the content of a cell, but not completely overwrite it, double-click the left-hand mouse button on the position that you want to change. You will find an introduction to working with the table editor, when you press the help key in a table window – see the section *Mouse and Keyboard Commands*.

If you want to enter a line break in a cell, press the key combination <ALT> <return>. Please note that you can use time and date formats in Xact tables – you will find more detail on this in the help system.

- You can type **any text you like** into the table, so – even apart from the legends – your input is not restricted to numbers. This has a number of important consequences: for instance, when creating table charts, you are not only able to create tables of values, you can choose any type you like. What is more, you can add units when typing in figures, for example "-1.3 cm". When charts are created, the unit is ignored, whereas the complete number with unit appears in a table chart.

- Internally, all entries are **saved as texts**. If, for example, you use the function *Shorten numbers* and thus remove figures after the decimal point, these figures really have been removed – they will no longer be used in calculations!

Entering the legend/Automatic legend

The legend texts are in the first row and column. They are taken from there for use in the charts, e.g. to label the axes. If you decide not to type in a legend, Xact will generate it automatically. The 5th column for example would have the text "Column 5". If required, you can switch off the automatic legend function in the *File* menu under *Preferences/Table*.

Opening table/Loading existing data

How you start your work in the table editor depends on the form your data take. For instance, you can **copy** data from a spreadsheet and then **paste** them into an Xact table. The data are then inserted at the cursor position. If the data already exist as a file, you can load the file directly with *Open…* in the *File* menu. Apart from tables in Xact format, several commonly used file formats are also available:

- ASCII or text files

- DIF (Data Interchange Format)

- CSV (with comma or semicolon as separator)

- WKS, WK1, WK3 (from Lotus 1-2-3 ® or Lotus Symphony ®)

- XLS (from Microsoft Excel ® '97 on)

- DBF (from DBase ® III, III+, IV)

You can generate text files in almost any program. This option is usually offered in the form of an export format or print to file. Xact is very flexible in interpreting text files and so you can load almost all data perfectly.

Importing data

In already opened table windows you can import data by using *drag & drop* (see previous section), the command *LINK* (see next section) or the command *Import…* (in the *File* menu). When you import files, the data you are loading is **inserted at the cursor position** in the table, without a new table being opened. In this way the import function can be used to compile a table from several sets of data. Always place the cursor at the desired position and select Import… in the File menu. The imported data will be placed in the table, downwards and to the right of the cursor. No new columns will be added during this step; instead the existing columns will either be filled or overwritten.

Several options let you control the way data is imported. Please read the online help for further information! A special option might be interesting for those working with large amounts of data:

Data reduction during import

Measuring devices often generate enormous quantities of data in a very short time. A graphic presentation generally requires no more than a few hundred values per data series. Therefore if required, Xact can reduce the data
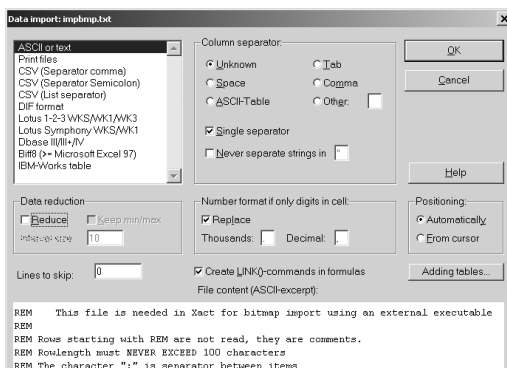
directly while loading them. If you activate the *Data reduction* switch on import and select, say, *10* as the *Interval size*, the program will only load every tenth value into the table.

• You should only use the *Data reductio*n option when you have a large number of approximately constant data; otherwise there will be a real loss of information. If the data are not approximately constant, we recommend that you either present all the data or restrict yourself to the interesting regions of data during the analysis.

Exporting and export formats
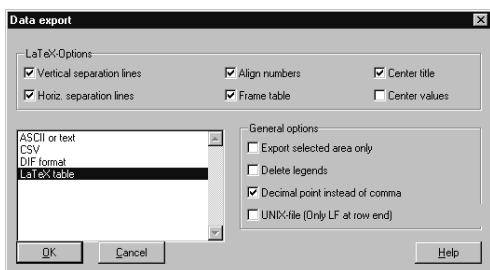
If you want to continue working in other programs with tables that have been loaded or entered in Xact, the export function gives you a choice of formats for the output. When exporting tables, we recommend that you use the very well-defined DIF format. Where possible, do not opt for different formats unless the program in question does not understand DIF. Xact tables – or parts thereof – can be saved in three external formats:

• *Text*: the standard format that almost always produces results.

• *CSV*: text format with a separator that varies according to the country settings on the operating system in use.

• *DIF*: the most reliable format. Use DIF whenever possible.

Sometimes you might only want to export certain section of the table. To do this, simply select the columns and rows that you want. Call up *Export* in the *File* menu and activate the option *Export selected areas only*.

Export as LATEX table

Xact offers TEX users the option of output as a fully-formatted LATEX table with a large number of possible configurations. A large range of formatting options, some of which would require a great deal of work if carried out manually, are available at the touch of a button. Once generated, the file can be copied or integrated into your LATEX document using an Include command.

Using Table Windows

The table windows can be used for editing and reading in data as well as for manipulating and automatically generating data. In the table window you can determine how the data are used in the charts by means of the *definition of columns* and *selection of ranges*.

Defining column types

You will often want to use all the columns of a table in the chart, and represent each column as a separate graph. For this purpose the columns in the table are defined as Y columns and are numbered from left to right. Xact selects this standard definition automatically if you have not defined any column types yourself. Values from Y columns are plotted on the Y axis in the chart: the greater the value, the higher the bar or line will be (depending on the type of chart).

As well as Y columns, Xact also has the following column types: *X* and *Z* columns (for 2D and 3D plots) and four types of deviations (for error bars, measuring tolerances, etc.). For Y columns there are options for deviations in both directions, only positive or only negative deviations(*Dev, Dev+, Dev-*) and for X columns a type for both directions, *DevX*. The column head displays the type and consecutive number of the co-lumn so that you do not lose track of where you are.

Defining columns – by mouse click

Every column has a column head consisting of two lines. The column heads are numbered consecutively in the table screen. If you click the type line of a column head with the left-hand mouse button, the column below will be allocated a new *Column type*. If the column has not yet been allocated a type, it will be allocated the first possibility, i.e. "Y". Clicking again will take you to the next possible type.
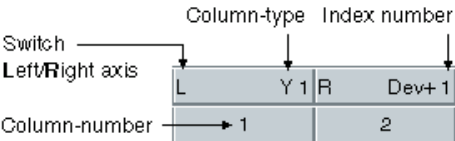
Let us assume you have created a new table and have clicked the *Type* field in column 1. The description "Y1" will then appear in the type field. The letter "Y" indicates that the values in this column will be plotted on the Y axis of the graph.

When you click on further columns, they will first be defined as Y columns and numbered consecutively according to the *Sequence of definition*. The index number "1" indicates that this column will be transferred to the Y axis first. This is particularly important for three-dimensional charts. The series of data are plotted back to front from high to small indices. "Y1" therefore always denotes the series of data represented at the very front. Hence the order in which you select the columns will determine the sequence of characters in charts!

- An **X axis is always needed**, too, in order **to display the data**. There is no constant X axis in the standard definition. The values (e.g. bars) are simply plotted from left to right with the same intervals. Xact then uses the consecutive row numbers as the X axis and describes these with the row legend. This type of X axis is known as ***alphanumeric***. If you want to plot data against a ***numeric* X axis,** you must define at least one column as X!

In the column head you can also determine whether the values in the column are to be assigned to the left or right axis (or top or bottom). Line charts, in particular, often use a display with two different Y axes. In the column head, the letter "L" stands for the left axis and "R" for the right. For X axes, "B" stands for a bottom axis and "T" for a top axis. By clicking on the letters, you can switch between left and right.
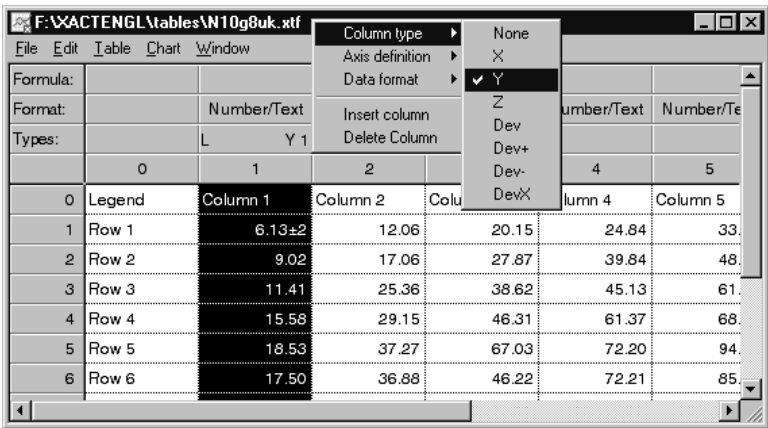
Defining columns – by context menu

Another way of changing the column type and axis allocation is to use the *context menu* for the column. Select the desired columns and then press the right-hand mouse button with the pointer over one of the column heads. In the context menu select a new column type or a different axis definition. Your choice then applies to all the columns selected.

Defining a number of columns - by dialog

If you use big tables with a large number of columns, you can have all the definitions performed automatically by selecting the entry *Column types…* in the *Table* menu. You can also select from a list of preset definitions in the dialog that appears. For example, if you select "X,Y", clicking OK in the box will define all the columns in the table alternately as X and Y types. Moreover, you can design your own definition settings in this dialog and insert these in the list. You will find more information in the Online Help under the heading "Dialog 'Define column types'"

The different column types

The first mouse-click in the *Types* field of the column head always produces Y columns. Further clicks will **change** the column type consecutively and the following types are obtained in sequence: **X**n, **Z**n, **Dev** n, **Dev+** n, **Dev-** n and **DevX** n.

Here, "n" always stands for the index of the column in question. In a table consisting only of Y columns the row legend will be used as the X column in charts. The data from this column will not be plotted on a numerical X axis until one column has been defined as X!

A simple way of defining column types for several columns is to use the *Column types…* entry in the *Table* menu. The definitions entered there are stored and can be called up time and again.

XY plots

If you have defined at least one column in the table as the X column, you will obtain XY plots with a numerical X axis for a large number of chart types. Instead of the row legend, the X axis will then consist of a scale for the range of values on the X column. In some chart types (e.g. most types of bar charts) a numerical X axis cannot be used.

The series of data are sorted according to the X values as the default and so the curves generated always run from left to right in the XY system of coordinates. To represent *loci* you can switch off the function that sorts the X values when selecting the chart.

XYZ plots

The same applies for the Z axis. If your data are in the form of 3D coordinates, you can have them displayed as portfolios, XYZ plots, 3D surfaces or contour plots, for example.

Deviations

If *Dev-n* appears in the head of a column, the values of this column will be assigned to the Y column with the same index as error bars. If a column *DevXn* appears in the head of a column, the values of this column will be assigned to the Y column with the same index as error bars parallel to the X axis. Options for displaying deviations include in line charts, two-dimensional bars, 3D lines, XYZ plots and profile charts.

You can allocate a Y column to any other column of the table as a deviation column; depending on the type of deviation your data contain, in both directions or as positive or negative deviations. By marking the columns as *Dev-* and *Dev+*, you can display positive and negative deviations independently of each other in Xact.

Normally you will import the data for presenting deviation or error bars at the same time as the table and then designate these columns in Xact accordingly. Calculation of the standard deviation is one of the statistics and formula functions in the table editor.

Selection and definition

In the meantime you will have noticed that there are some differences between working with a spreadsheet and the Xact table editor. In fact the large number of different column types means that this could not be done any other way. For you as the user, it is essential that you understand how *defining* column types and *selection* are connected.

The **definition** of a column (the type) determines how the data are plotted in the chart. If a column has no type, its data will not be used. **Selection** – when available – puts further restrictions on the area to be displayed.

• A cell within a table will not be used in a chart unless it is located within the selection and its column has a type. If no selection has been made when a chart type is called up, Xact automatically selects the whole table. If no column types have been defined, all the selected columns will be designated type "Y" columns.

Selecting and deselecting all columns

Calling up *Select all* in the *Edit* menu selects all the columns. *Deselect all* has the opposite function.

Activating and deactivating rows

Selected parts of rows can be activated or deactivated in the context menu (mouse click with the right mouse button at the head of the row). Deactivated rows are shown with a red line through them in the table, and are not used. Deactivating rows can be especially useful if a large table contains several invalid ranges of measurements that you do not want to depict.

Selecting ranges

Apart from individual rows and columns you can also select entire ranges. To do this, click the mouse key while it is in the cell that is to mark the start of the range and, keeping the mouse key depressed, mark the range by dragging the mouse. The simplest way to select ranges of columns and rows is to click on a column or row number and then drag the mouse in the desired direction while keeping the button pressed. A click with the Shift key pressed down does not begin a new selection but extends the existing one.

Selecting date types
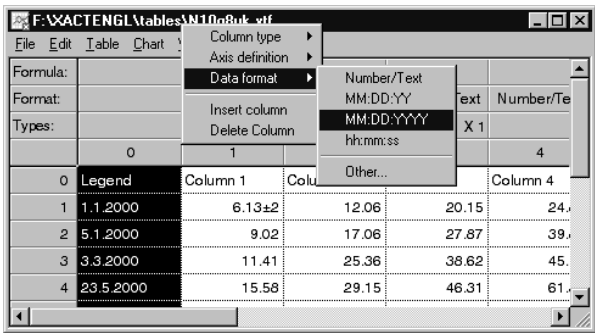
Apart from text and numerical values Xact can also process date formats. Select the *Date format* entry in the *columns context* menu (click with right-hand mouse button on the head of the column) to either choose one of the available date formats or define one to meet your own needs.

- Under the heading *Other...* you can define any date and time formats you require in the *Define data format* dialog. Click on *Help* in this window to find a complete list of the abbreviations for numbers of days, names of months and the like.

Swapping rows/columns

Depending on the application from which you have imported the data, you may find that the table has not been set up in columns but in rows. In such cases, as Xact works on the basis of columns, you will have to exchange the rows and columns. To do this, select *Swap lines/columns* in the Table menu.

- This swapping action enables Xact's column-based functions to be used on rows too, by calling up *Swap lines/columns* before and after the function. For instance, you can use the function *Create columns*, which is explained later in this section, to generate a new column legend that will in fact be located in row 0.

- When rows and columns are swapped, the column and row selection are retained together with any formulas that have been entered. Therefore the column formulas will **not** become row formulas.

Shortening numbers

The function *Shorten numbers…* in the *Table* menu enables you to adjust the number of figures after the decimal point to which numbers are rounded off or truncated for a selected range. If required, values with fewer figures after the decimal will be filled up with zeroes. The *Shorten numbers…* function only works on the selected ranges in the table. Areas not selected will not be changed.
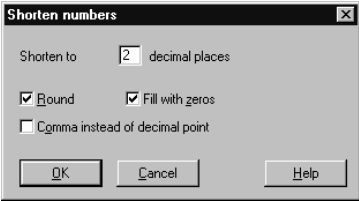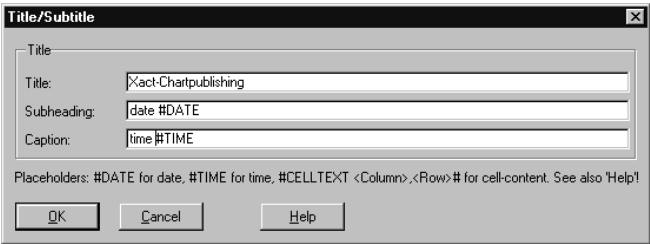
- In some cases – especially when automatically recorded data from measuring instruments are concerned – the data series will have decimal places that lie beyond the measuring accuracy or are not needed in the graphic presentation. Particularly when tables are being printed, a high number of decimal places can result in loss of clarity and very broad printouts.

Entering titles

In addition to the data, you can also specify a title or sub-heading for the chart in the table editor. To do this, select the command Title… in the Table menu.

The dialog shown then allows you to enter the first and second titles – they are positioned above the figure – as well as a sub-heading for copy-

rights, details of the data source, etc. below the figure. Details regarding the source is one example where it is especially practical to have the information permanently linked with the table. The next time you load the data set, you will again have all these details at your disposal.

Under *Preferences/Charts* in the *File* menu you can specify the standard font for the titles and sub-headings as well as the alignment (left, centered, right). You can also preselect title texts – so that for example the date and time are entered as sub-headings in all charts.

Create column contents...
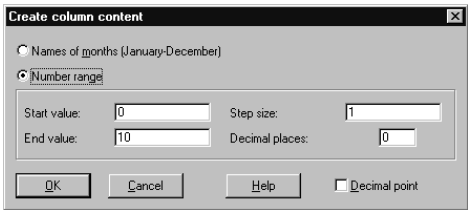
This item from the *Table* menu enables columns to be generated automatically. Apart from allowing you to create a month legend quickly, this function also generates a series of numbers with any start and end value in the column where the cursor was placed. The step size, by which the values increase from row to row, and the number of decimal places can be selected as required.

If the end value (dependent upon the start value and step size) is not reached with the available number of rows, the table is extended automatically to accommodate the number of rows needed.

Sorting by row...
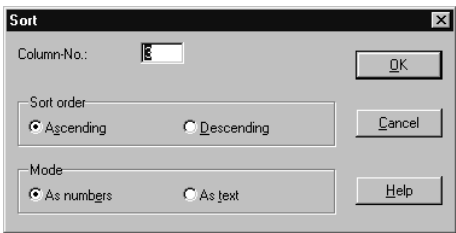
Select *Sort...* in the *Table* menu and en-ter a column number which you want to use as the basis for sorting the rows. You can then sort the rows in ascending or descending order according to the values in this column, and also alphabetically for text. The sorting process always in-cludes all the columns (not just those selected) so that the allocation of legends to the data is not lost.

Statistical values

In the *Table* menu the item *Statistics...* allows you to generate a table with the statistical parameters for the section of the table you have selected. These range from the mean via confidence intervals to the geometric mean – you can find a list in the *Online Help*.
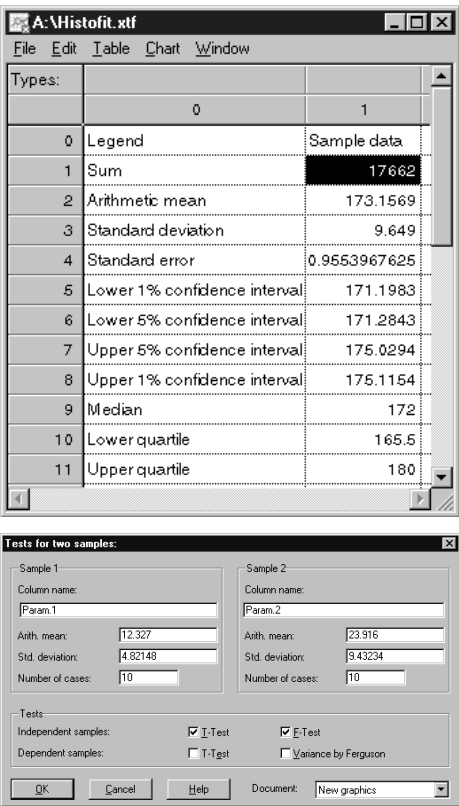
Statistical tests

Under *Tests...* in the *Table* menu you will find a dialog that enables you to perform some parametric tests for dependent and independent samples. These tests for differences between means and variances. The results appear in a graphics window.

Linking several tables

Sometimes it is useful to be able to link several tables with one another. Work groups that want to compile their results are one such example. Of course the values from the separate tables can also be copied by hand, but creating links can often have advantages, particularly if individual values frequently change.

Links between tables in Xact are created using formulas with the command LINK. *LINK* reads values from any required column of another table file, which may for example also be an ASCII file. For more information, read the following section called *Calculating in the Table* and the section on *Reusing & Automating Documents*.

Calculating in the Table

The column-based method of calculating in Xact is particularly useful for computing entire series of measurements – for example, if you want to subtract two series of data and then multiply them by a factor. For each column you can define a formula, which can then be called up at any time when the values change.

By and large the formulas in Xact are used as in a spreadsheet. However, Xact calculates on the basis of columns, whereas spreadsheets can contain a different formula for each individual cell.

Entering formulas

If you want to use formulas in a table, you should first switch on the Formula line (*Show formula* in the *Table* menu).

Then click with the left-hand mouse button on the formula field in the column where the result of the calculation is to be written. In the formula dialog that now appears you can enter a new formula or alter an existing one.

The usual mathematical rules apply when entering the formula. Contrary to mathematical shorthand, the multiplication sign has to be entered. Consequently, the expression *3ab* would be typed in as *3*a*b*. Spaces between expressions are not necessary but can be entered for clarity. You can also enter brackets as required. You refer to the values of existing columns by their column numbers, e.g. "S1" for the first column.
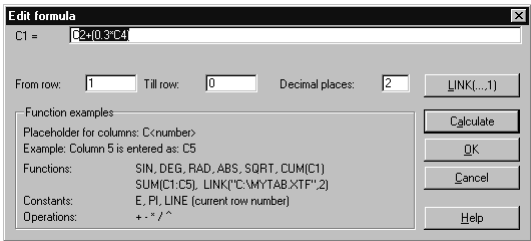
After *From row:* and *Till row:* you can specify the range of the column in which the results are shown. The field *LINK(…,1)* is for quickly selecting a file that is to be linked (see **Linking function** later on in this section).

• If a *0* has been entered after *Till row:* (the default when the dialog is called up), the results are always output from the initial row of the table **to its end**!

In the Decimal places box of the input dialog, you indicate the *number of decimal places* to be used for the output of the results from the calculation.

• Only the **decimal place**s that are **actually visibl**e in a cell are used for the calculation and in the output!

Leaving the dialog with *OK* means that only the altered formula will be saved. If you leave with *Calculate*, Xact saves and calculates the formula.

Dealing with errors

Errors in the formula, e.g. incorrectly placed brackets or incorrect notation, are indicated by Xact before the calculation is performed. The position in the formula is shown where the error or the ambiguity was found. Errors at computation time (e.g. logarithm of a number <= 0 or root of a negative number) are reported by Xact and the calculation is aborted.

Functions

• **SIN, COS, TAN, ASIN, ACOS, ATAN, SINH, COSH, ASINH, ACOSH, TANH, ATANH**

The trigonometric functions of Xact work in radian measure, i.e. SIN, COS and TAN are given values in radians, whereas ASIN, ACOS and ATAN deliver such values. An 'H' at the end of the name of a function indicates that this is a hyperbolic function. If you want to work in degree measure, you can use DEG and RAD for conversion.

- **DEG, RAD**

The function DEG converts a value from radian to degree measure, RAD has the opposite effect.

Example: C1 = SIN(RAD(90))

- **SQRT** takes the square root. The root of negative numbers is not defined.

- **LN, LOG**

LN yields the natural logarithm, i.e. to the base "e". LOG is the decimal logarithm. Logarithms of numbers <= 0 are not defined.

- **EXP** Tip: in Xact the constant "e" must not be used as this letter is reserved for the parameters in the non-linear fits. Instead, use EXP(1).

- **FAC** yields the factorial of a number. It is calculated from 1*2*3*…* number.

- **ABS** yields the absolute value of a number.

- **CUM**(Column number)

Cumulates the values of the column "Column number". Example: C2=CUM(C1) Taking C1=1,2,3 gives C2=1,3,6

- **DIF**(Column number) is the reverse function of CUM. Example: C2=DIF(C1) Taking C1=1,2,3 gives C2=1,-1,-4

- **dateToNumber**() creates numbers from date or time strings, for more information see the Online Help.

- **numberToDate**() calculates date or time from a number, for more information see the Online Help.

- **random**() creates random values in the range > 0 and < 1, for more information see the Online Help.

- **randomGauss**() creates Gauss distributed random numbers with mean = 0 and standard deviation = 1, for more information see the Online Help.

Linking function

- **LINK** ()

The function LINK enables values from other files to be used. These can be read into the selected Xact table. The *Import dialog* can automatically create LINK() functions in formula fields.

LINK () can have up to three parameters: the first parameter is always the file name (incl. path), the last one the column number of the file to be imported (column numbers always start with 0).

If the file name is of type XLS the second parameter can be the name of a worksheet in this file. If no second parameter is used, Xact imports data from the first found worksheet.

Examples:

- LINK("Test.XLS", "Table1", 0) imports from the file "Test.XLS" column "0" from worksheet "Table1".

- LINK("Test.XLS", "Table1", 0) imports from the file "Test.XLS" column "0" from the first worksheet in this file.

If the file type is not XLS the second parameter CAN contain a string to be used as column separator. (Xact always tries to convert imported numerical data to the Xact number format: no thousand separator, decimal sign is ".". The numerical data will be parsed for the characters given in Menu "*File/Preferences/Charts/Number format*".) The second parameter is used to determine the column separator and must be a not-number. Typically it could be ";" or ":", special cases (see dialog '*Import*') are:

- Tab character: type as "TAB"

- ASCII-Table: type as "ASC"

- Unknown: type as "ALL"

How it works in the not-XLS case: as said above the string is made of one character or - in the special cases - three characters and is referred to as "Separator Symbol".

Let us look for the behaviour using *ONE Separator Symbol*. After the occurence of the Separator Symbol in the file, Xact starts a new cell:

-LINK("Test.TXT", ",", 1) imports from the file "Test.TXT" column 1. A line from Test.TXT may look like this: "Cell 0,Cell 1,Cell 2". The cell of the Xact table window shows "Cell 1". After the first "," in each line of the file a new cell starts in the Xact table window until the next "," appears (or the line ends). That means also: if in a line of the file two Separator Symbol follow each other directly, it creates a empty cell. So "Cell 0,,Cell 2" creates a empty cell.

If *TWO identical Separator Symbols* are used as separator string, a cell ends with the first Separator Symbol. The next cell then begins with the first character in the line of the file being not a Separator Symbol:

-LINK("Test.TXT", " ", 3) contains as Separator Symbols two spaces and imports column 3 of Test.TXT: a line may be: "Cell0 Cell1   Cell2 Cell3", the result is "Cell2". In the Xact Table window "Cell2" appears. (Column 0 would contain "Cell0", column 1 would contain "Cell1", all following spaces are skipped until a non-space occurs, the "C" from "Cell2". In the Xact table window all following characters are written to this cell until the Separator Symbol (space) is found. Thus any number of Separator Symbols following eachother separate one column from the next. That means also: No empty cells are written to the Xact table window. In case of tab stop the separator string would be "TABTAB".

With CSV files strings between " are always completly written into one Xact cell, even if they contain Separator Symbols. Example:

-LINK("Test.CSV", ",", 1) imports from the file "Test.CSV" column 1. A line in Test.CSV may be: <Cell 0,"A cell with a Separator Symbol,",Cell 2> The Xact cell would be "A cell with a Separator Symbol,": The "," after "...Symbol" is NOT used as a separator.

If ALL is used as a Separator Symbol, the following characters are used as column separators:

all unprintable characters up to and including the space character and the characters !#$%&()*,;<=>

Expressed as ASCII-codes: 0-33, 35-38, 40-42, 44, 59-62

If only two parameters are used in LINK(), the first one is the filename, the second the column number to be imported. Example:

-S1 = LINK("MYTAB.XTF",2): if the directory is not entered, Xact assumes that the table is present in the same directory as the one that is being edited.

The linked file does not necessarily have to be an Xact table. However, Xact should be able to import the file format. For reasons of speed, it is advisable to us only one link function in a formula and perform further calculations in another column (see below).

One exception is when this function is the only entry in the formula. In this special case:

- Inserting data is much faster.

- The legend is used as column legend.

- The data are always read starting from row 1 in the source file.

- All rows from the source file are always read.

- The filename and – if present – the column legend of the source file are imported. This procedure is especially helpful for maintaining clarity in tables and charts where the various linked tables have identical column legends. The following example illustrates this:

-C3=LINK("\DATA\MEASDATA.TXT", 3) copies the fourth column from the file MEASDATA.TXT into C3. Suppose the original legend of the fourth column of MEASDATA.TXT were "Y". Hence the legend of column C3 will become:

"MEASDATA
Y"

Statistical functions

Statistical functions always use ranges of a table. For instance, the means of all the selected lines of columns 1 to 8 can be calculated. A range is designated with two columns separated by a colon.

Example: C9 = MEAN(C1:C8)

- **SUM** calculates the sum of all values within a range.

- **MEAN** calculates the arithmetic mean of all values within a range.·

- **STABW** calculates the standard deviation within a range.·

- **STERR** calculates standard errors for a range.·

- **MIN, MAX** yield the smallest and largest value within a range.

Constants·

- **PI** is a dummy variable for the mathematical constant pi.·

- **LINE** changes from line to line. In each row it has the value of the row number. When the formula is calculated for the first row, LINE therefore has the value of 1, in the second row 2, and so on.

There are many conceivable applications for this constant; however, if you want to create columns with a linear increase in the values, you will find the function *Create columns* in the Table menu is more straightforward to use.

Sample formulas

$C1 = 1.2$
$C2 = C1 + 5.3$
$C2 = 1.14 * C1$
$C3 = (C1 + C2)^2$
$C4 = SIN(RAD(C3)) + LOG(C2) + 2*C1$
$C5 = SQRT(((C1 + C2) * (C3 + C4))^3)$

Recalculating formulas

The formulas that have been entered are stored as in a spreadsheet and can be called up time and again. If you want to have the table recalculated, for example because the values have changed, simply call up the item *Recalculate now* in the Table menu.

During recalculation all the columns are calculated in order of the dependent functions and the links are updated. Therefore if the formula in column 2 refers to column 4, column 4 will be calculated first and then afterwards column 2, although Xact works from left to right.

Circular references

If the user has accidentally created a so-called circular reference, Xact will give a warning message. A simple example of a circular reference would be the following formula system:

C1 = 2 * C3

C2 = 3 * C1

C3 = 4 * C2

Without the check, Xact would enter an endless loop because the formulas are mutually dependent.

Reusing & Automating Documents

Xact offers several ways of simplifying recurring operations, which can also be combined:

- **Stylesheets** let you create your own chart types

- **Links** let you connect tables and charts with one another

- **Batch files**, **macros** (OS/2 only) or the **programming interface** (OS/2 or Windows > NT) let you automate complex operations.

To choose the best way you will need more information how Xact handles documents. As you already know Xact Graphics windows contain objects. These can be *graphic* or *chart* objects (they are in the end made of graphic objects, too). To reuse graphic objects, simply copy them to a new graphics window. While graphic objects are created (or imported) by you, chart objects are created by Xact.

Reusing Chart Objects

Chart objects are always made of data from a table window, so chart objects "know" from which table they are made from. In the diagram you can see how
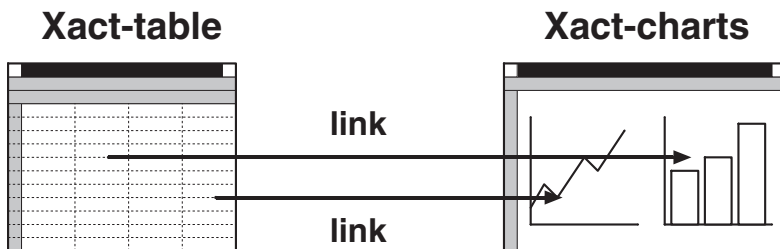
each chart of a graphics document is linked to different ranges in a table.

As a general rule, when charts are created they are always linked with the range of the table from which they have been generated, provided the table has already been saved. As a result, each chart "knows" from **which table** and **which selection** range it comes from. When a recalculation of a chart is performed (with a click on *Recalculate now* in the Chart menu or on printing or

opening a file), the chart then rereads "its" data range before displaying it. During this process, tables that have not been opened on the screen are read. In the File menu under *Preferences/Charts* you can specify in *On recalculation…* how charts should generally react when is selected. You will find more on this dialog later in this chapter.
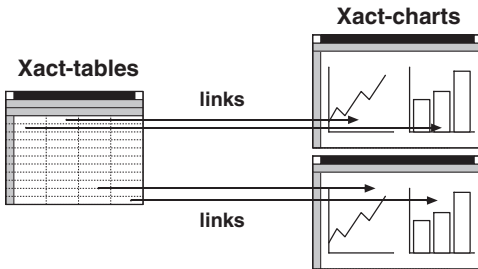
If you are using **several** charts in a graphics document, then **each** chart in the document is linked with the **underlying table range**. Here the table areas may come from **one** or **several tabular documents.**

As a result, **one table** can be linked with several graphics documents.

With so many possibilities available, it is important to maintain an overview. Xact offers you summarized infos on the whole document and more detailed infos on each chart:

- For the entire Graphics document, you'll find a list of charts and their links to tables in the File menu under Document info... In this dialog click on Linked tables... to get a list of all charts and their linked tables.

- For a single chart you will find all the necessary information and settings under Links…in the context menu of each chart. We will give more details in Managing links later in this chapter.

As shown chart objects in Xact are always linked to tables that provide the chart with its data. These links can be changed to reuse the chart. To do this you link a new table with the new data to the existing chart. The results:

- the data of the new table is shown in the chart
- the layout of the chart remains as before

Reusing charts

There are two ways to reuse a chart:

- if you want to reuse one single chart with one single table you can use the stylesheet method. First create a stylesheet by saving the graphics window "Save as stylesheet" (menu File).

- in any other case copy the chart(s) to a new graphics window and change their links by clicking on the entry "Links..." in the context menu of each chart.

Making your own chart types – Stylesheets

Stylesheets are used in all automation methods and help to simplify the creation of similar charts considerably. Stylesheets are graphics documents created with Xact, that contain one rescalable chart and any number of graphic objects such as texts and drawings. With stylesheets, you can make your own chart types and then use these instead of those that are permanently installed in Xact. You will find the menu item for calling up a stylesheet in the Chart menu under Use stylesheet…

Advantages of stylesheets

If you want to use a single chart with different data at a later stage, you should save it as a stylesheet. In this way you will avoid having to repeat the work; you obtain your individual chart at the touch of a button.

- The chart contained in the stylesheet reacts according to the settings. For example, if you have switched off the axis automation, rescaling will no longer occur automatically.
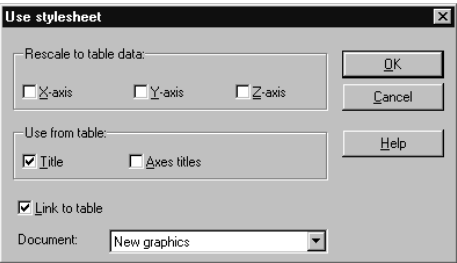
Creating stylesheets

A stylesheet is created by storing a graphics document with an active chart with Save as stylesheet… in the File menu.

Using stylesheets

Define and select the columns you want in the table window and choose the item Use stylesheet… in the Chart menu. The Select Stylesheet dialog that opens shows a miniature view of the stylesheets. This saves you compu-

ting time if you are still unsure of which stylesheet is the most appropriate (or simply cannot remember under which filename you saved the stylesheet that you are looking for).

After you have selected a stylesheet, the Use stylesheet dialog will appear. Here you can specify for example whether and, if so, which captions are to be taken over from the current table, and whether the axes need to be rescaled. In the field next to Document: you decide which of the opened graphics windows is to be used for drawing the stylesheet. In this way you can create a document that contains various stylesheets together with standard charts.

Making your own chart types - Changing Links

As said above, tables and charts are linked with one another. Links are an efficient tool for connecting several document with one another and thus form the basis for reusing complex tabular and graphics documents. Changing the link of a chart means linking it with a new table, filled with the data you want to show with this chart. Of course the organisation of data in the new table must fit to the possibilities of the existing chart.

Links - Usage and Managing
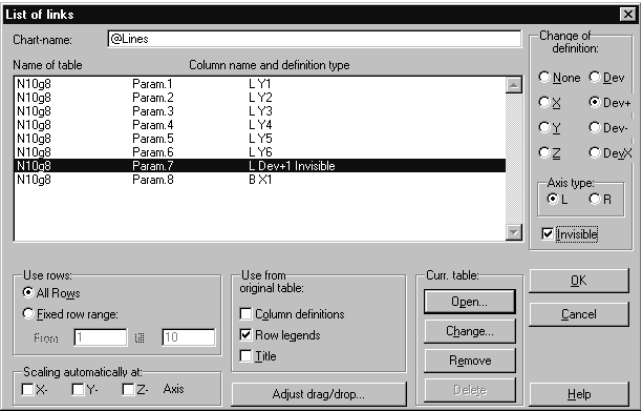
The context menu of every chart has a Links… entry which takes you to the dialog of the same name. This enables you to view and change the existing links from this chart to its tables within a dialog.

In the adjacent dialog you can see a List of all tables used in the chart and their column definitions.

Selecting (mouse click) a row in this list enables you to perform a number of operations with the selected table: clicking on Current Table, Open loads the table, Change replaces it with another table or Remove separates it from the chart. If a table is removed from the chart, the data are retained in the chart - but now there is no longer any link with the table. You can Delete a table if several tables are linked to one chart. The table is then deleted from the chart.

- If there is only one table used in chart and you will replace it by a new table, simply click on Change.

You can also change the column definitions of the rows selected in the list. You will find all the switches needed to do this under Change of Definition on the right-hand side of the dialog. If you want to remove a graph from the chart but retain its definition in the table, check the Invisible box.

The remaining settings in the dialog determine how the chart behaves when being recalculated.

If a chart has been newly created, these settings will be adopted from the current preferences on the Charts page, under On recalculation... . Here you can preset the link behaviour of all charts created later:
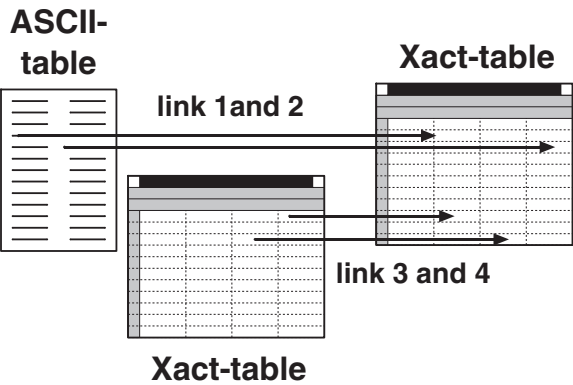
- Change scale automatically for: If this box is checked, the starting and finishing values of the axis affected will be reset each time recalculation is performed, depending on the figures in the table(s).

- Use rows/columns: Here you specify whether basically all rows are to be used or just a fixed row range from the linked table. Use column definitions of tables means that the currently defined columns of the linked table(s) are used. If this switch is active, the column legends have no effect, as the legends are always updated in this case.

- To use from table: the following characteristics can be adopted, and they then overwrite the characteristics already present in the chart: Column definitions, Column legends and the Title of the table concerned.
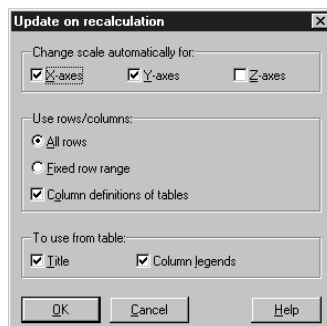
Linking a table with other tables

Every column within a table can be linked with a column in another table using the command LINK.

This linking of tables with each other not only applies to Xact tables but to all the tables that can be imported by Xact. Hence an Xact table (the target table) can be linked with any number of ASCII tables that contain data from measuring equipment or the various members of a working group. The target table can in turn be linked to one or more Xact charts. You can read up on details of the LINK function in the section entitled Calculating in the Table or in the Online Help (under LINK).

ASCII-table

Xact-table

link 1and 2

link 3 and 4

Xact-table

Graphics file lists for exporting and printing

If you want to print or export a large number of files, the File list dialog provides a convenient way of selecting and grouping them, before you process them as a batch.
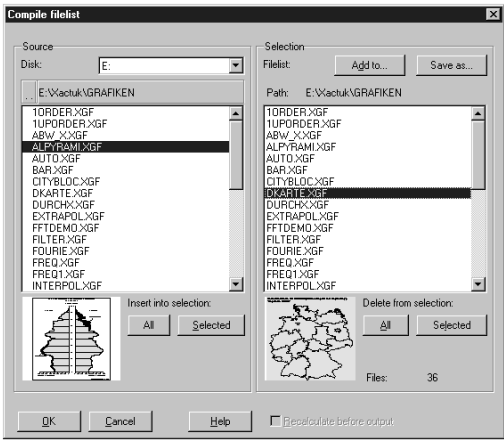
If you just want to print or export files from one common directory, it is easier to open a Graphics Explorer window in this directory, select the wanted files and give the wanted command in the context menu of the Grapics Explorer.

You access the dialog via the options Print... and Export... in the File menu. In both cases you can choose the Print or Export filelist only...

button. You can compile the files you want here from any directories by selecting files under Source and adding these to the Selection. The two preview images enable you to retain an overview of what is happening.

• In the XactPro version you can also save the selection you have compiled as a list or add it to an existing list.

More automation through programming

Frequently recurring tasks can be efficiently simplified using links; however, working operations can only be completely automated (i.e. without user intervention) with the Programmable Interface.

Xact offers several interfaces for various applications, and for those of you with programming knowledge, so that you can automate complex sequences of operations.

• Programming Interface (currently REXX and 'C' for OS/2 and MS Windows >= NT)

• Batch files (for MS Windows only)

• REXX macros (for OS/2 only)

The programming interface (Windows >= NT and OS/2)

For optimum integration of Xact into your applications or solutions, a programming interface is provided for REXX and 'C'. Please read the separate documentation on this in the Xact Programming Toolkit. The programming toolkit and the accompanying documentation were written on to your hard disk under the name XACTRPC when Xact was installed.

Batch files (Windows version only)

Batch files allow you to completely automate many tasks, e.g. the regular processing of measurement data, or the printing and export of all the files within a directory. For details, see "Batch processing" in the Online Help.

Batch processing is based on those Xact documents that are processed with the batch commands.

Batch files are written in a similar style to a C or Pascal program text: they consist of a sequence of single function calls separated from each other by a semicolon. The parameters of the functions are placed in round brackets after the function name.

You can document your batch files by inserting comments in the text at any position you like. A comment is introduced with a double slash ("//") – the remainder of the line is ignored by the program.

Creating and executing batch files

Batch files are normal text files (ASCII) that can be created with any conventional text editor. The batch files are given the ending XBT and are passed to Xact when the program is started.

There are two ways of starting Xact with a batch file. If you want to start Xact from a DOS prompt, instead of entering "XACT" as usual, simply enter "XACT TEST.XBT", where "TEST.XBT" is naturally just an example and can be replaced by any other batch file name.

From the Windows File Manager you start Xact batch files by double-clicking on the name of the desired batch file. The necessary file allocation is carried out by the Xact installation program. If you often need to call up specific batch files, you can also create an Xact program object for each file and enter the name of the batch file in the Properties dialog in the command line.

Sample batch files

//

```
// This batch file imports the file MEAS.TXT,
// sets a title and a sub-heading, calculates a
// chart using the stylesheet MEAS.STL and prints
// it out.
//
TE_OpenTable("MEAS.TXT");
TE_SetTitle("Measuring site Hamburg");
TE_SetCaption("measured on #DATE um #TIME");
GE_UseStylesheet("MEAS.STL");
```

```
PR_Print(1);
SH_Exit();
//
// This batch file prints all XGF files within directory on the
// standard printer.
//
PR_Print("E:\XACT\PROJEKT\*.XGF");
// Prints out all charts from the directory E:\XACT\PROJEKT on the
// standard printer. See following description of PR_Print()!
SH_Exit();
// Exits Xact; this also completes the execution of the batch file.
```

Summary of functions

TE_OpenTable("Filename");

Opens the table with the name given. The import function is called up automatically for foreign formats and ASCII files.

TE_SetTitle("Text");

Sets the title of the active table. If no table has been opened, the function has no effect. To insert the date and time automatically, you can use?"#DATE" and?"#TIME" as dummy variables in the text. Each time the batch file is executed, the dummy variables are replaced by the current values.

TE_SetSubTitle("Text");

As for TE_SetTitle, but for the sub-heading.

TE_SetCaption("Text");

As for TE_SetTitle, but for the caption.

TE_SelectAll();

Selects and defines all columns in the table from left to right as Y columns.

TE_Select(Column number,Column type);

Selects a column and defines the column type desired. Column type options are:

COL_NONE   No column

COL_X   X column

COL_Y   Y column

COL_Z   Z column

COL_DEV   Deviation column

COL_DEVPLUS   Column for positive deviations

COL_DEVMINUS Column for negative deviations

COL_DEVX   Column for deviations parallel to X axis

Similarly, if a column is to be assigned to the right axis, use the column types COL_OX, COL_RY, COL_RZ, COL_RABW, COL_RABWPLUS, COL_RAB-WMINUS and COL_OABWX.

- ·If you want to mark almost all columns as Y columns and only a few in a different way, you should first use the function "TE_SelectAll". Afterwards you can mark individual columns as X or Z columns with TE_Select.

GE_UseStylesheet("Filename");

Calculates a chart from the table opened with TE_OpenTable and the named stylesheet.

GE_OpenGraph("Filename");

Opens the graphics document Filename.

GE_Recalc();

All the charts within a graphics document are recalculated. All links to tables and their own links are updated beforehand.

GE_ChgText("New Text", "Object name");

Replaces the contents of an already existing text called Object name by the text New text. This presupposes that the text object in the graphics window has the name indicated (entry in the context menu under Position/Properties).

GE_Export(Parameter list);

Exports one or more graphics windows. Wildcards such as '*' or '?' can be used when naming the source file. One application of this, for example, would be to export all the graphics documents (*.XGF) of a directory. Please read the section Batch Export graphs in the Online Help for more information on the parameter list.

PR_Print("Filename");

Prints out one or more graphics windows on the standard printer. If no filename is entered, Xact prints the content of the uppermost window. The filename may contain wildcards such as '*' or '?'

SH_Exit();

Exits Xact; this also ends the execution of the batch file.

Refining batch files

If you have any requests or suggestions concerning the batch files, please get in contact with us. However, for sophisticated automation requirements we recommend either the C or REXX interface. An interface to Microsoft Visual Basic is being prepared.

REXX macros

Macros generally consist of a sequence of commands that either fully or partially replace manual work with a program.

They are used in particular for automating frequently recurring applications or for tasks that would be difficult or impossible to manage by hand.

With OS/2 the obvious tool for this purpose is the REXX programming language. The advantages are as follows:·

REXX is supplied as part of the OS/2 package. After the installation of OS/2 an online reference can be found in the Information folder on the user interface.·

REXX is easy to learn and can be used for many purposes. Many users therefore already have a basic knowledge.·

REXX procedures can be entered with the system editor and do not need a compiler – they are therefore directly executable.·

Using REXX as the macro language not only enables a macro to be run sequentially, but also allows conditional statements, loops and subroutines.

In addition to the normal language content of REXX, Xact also provides functions for processing tables as well as for creating and printing out graphics. On example of using this would be to read data from a test record, enter them into a table and then create a chart by means of a stylesheet. On the other hand, there is also the option of reading data from a table, performing various calculations and then entering the results in a new table. The individual functions are described in the Online Help.

To start a macro, call it up from Xact with the REXX macro function in the File menu. Here an identification code is transferred for the window from which the macro was started. This identification is needed if you want to work with this window, i.e. write and read data or inquire about and set definitions and selections.

Working with REXX macros can best be explained with the aid of a short example: the following procedure is intended to open a table, select and define several columns and then create a chart using a stylesheet.

```
/*************************************************
* Xact Macro
*************************************************/
Parse Arg window
   tHandle = XR_OpenTab("TABELLEN\N10G8.XTF")
  Call delDefinitions tHandle
  Call XR_Select tHandle, 1, 10, 1, 5
  Call XR_SetColTyp tHandle, 1, "DEVL"
  Call XR_SetColTyp tHandle, 2, "XL"
  Call XR_SetColTyp tHandle, 5, "YL"
   gHandle = XR_UseStyleSheet(tHandle, "STYLES\LINE1.STL", 1)
Return
/*************************************************
*  delDefinitions
* deletes all column definitions within a table
*************************************************/
delDefinitions:  procedure
```

```
  Parse Arg tHandle
   numOfCols = XR_NumOfColumns(tHandle)
  Do i = 1 To numOfCols-1
     Call XR_SetColTyp tHandle, i, "NONE"
  End
Return
```

The first 3 lines contain a comment. It gives a signal to OS/2 that a REXX procedure is involved. The contents are of no significance.

In the fourth line a parameter is imported. In this case it is the identification of the window from which the procedure is called up.

In the fifth line, an existing table is opened. The result of this function is returned as the identification of the new table window.

Line 6 calls up a REXX function that deletes any existing column definitions.

Line 7 selects lines 1 to 10 and columns 1 to 5. The three following instruction lines define 3 columns as deviation, X, and Y.

In line 11 a chart is created with the aid of a stylesheet. The result of this function is returned as the identification of the new graphics window.

The following line ends the procedure.

After this comes the function that deletes any existing column definitions.

The first line defines the function.

In the second line, the identification of the table window is imported in which the definitions are to be deleted.

The third line requests the number of columns which contain at least one value.

The following three lines form a loop in which the definition of each individual column is deleted, the last column ends the function.

In the MAKROS subdirectory you will find more examples that explain how to work with REXX.

The REXX instructions SAY and PULL are processed in the form of dialogs. Xact gives error messages from the REXX interpreter as an output in the form of a dialog.

Axes

In this section we want to give you a general view of the various options available for displaying axes. The legibility of charts depends to a large extent on a suitable method of display for the axes. Certain conventions have become established for the presentation of axes, which vary according to the application concerned, and you as the user both ought to and have to be aware of these.

For each chart, Xact can generate up to two automatically drawn Y axes and two X axes. The position of the axes to the chart is already specified in the table via the columns definitions (see also the section on "The Table Editor"). Here you can use the column definition to select whether you want the Y axes to be drawn on the left and/or right, and the X axes to be positioned at the top and/or bottom. If you have selected one of the 3-D chart types, the axes appear with an adjustable wall.

If you want to show extra axes for a chart, there are two methods available for 2D charts:

- **You can superimpose additional charts on top of an existing one**. And this is how it works: select an existing chart. Choose the *Copy* command in the *Edit* menu. Xact will then ask you a question, which you should answer with *Copy entire chart*. If you then enter *Paste* in the *Edit* menu, a **duplicate of the existing chart will be placed directly on top of the original**. Further steps: change the name of the upper chart in *Links...* (to prevent any confusion) and the column definitions, as necessary. Delete the title of the upper chart in its *Title dialog*, which is no longer needed, by emptying the contents of the text fields. Push the *legend* to a suitable position. In *Axis setup*, move the axes by the desired amount on the *Scaling* page.

- **Duplicate the existing axes and position them as required.** To do this, you will the find entry *Clone axis...* in the context menu for any axis. **Cloned axes can be scaled as required** without affecting the graphs. You can then remove them again with the *Delete axis* option in the context menu of a clone.

Changing axes

The graphic elements that belong to an axis are summarized in groups, as shown in the adjacent figure. (The groups for *grid lines* also belong to *ticks* or *subticks*).

Axis are made of maximum four groups:
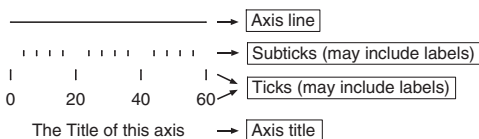
After you click the right-hand mouse button on an element of the group concerned, the relevant **context menu** will open up. In the middle group of this menu you will find the available settings. If, for example, you change the *line style* in the *ticks* group, this change will affect all the ticks on the axis. Using *Axis setup…* you can open the *Axis dialog*, which enables you to make changes to all the axis groups.

The large number of possible settings for axes may prove to be annoying – they are there because a lot of adjustments have to be made before the layout of an axis exactly matches your needs. The **pipette tool** in the left-hand toolbar provides additional help with these. You can use the pipette to transfer all the parameters for one axis (length, scale, optical features…) to another axis **of the same type**. For example, in this way you can only transfer the features of a Y-axis to another Y axis, and those of an X-axis only to another X-axis. You will find more information on the pipette tool in the section *Overview: Help functions for charts* and of course in the Online Help, too.

The best solution is to prepare some charts with the desired axis settings for your own personal layout. If you then have to prepare a new chart, you simply "pipette" the desired layout onto the new axes!

The **position of the axes to the chart** may change according to the method used:

- **Numeric**: In the *Axis dialog* under *Axis presentation* on the *Scaling* page, you can enter an appropriate – positive or negative – value for *Move axis:*.

- **Manual**: In the *context menu* for the chart, first unlock the *Frame group,* select the group for one axis and move this with your mouse or the arrow keys (see also the "*Quick Start*" section). The following tip may help when using the mouse to move the axis: before moving the axis, select the *Grid options…*

in the *Page* menu and check the *Relative grid* option. Then check *Show grid* in the lower control bar of the window. All objects can then only be moved relative to their starting position by the set interval!

As a general principle, you can make all adjustments for the actual axis display in the axis dialog. You access this dialog via the *context menu* entry *Axis setup…* or with a *double click* (see also the *Quick Start…* section).

The number of possible settings in the axes dialog is very extensive. **Please read the section entitled *Axis dialog* in the Online Help for more detailed information!**

The Axis dialog is divided into several pages, each with their own subheadings:

- *Scaling*: Here you will find settings for the numerical and optical scaling.

- *Division*: Here you can determine the numerical divisions and hence the position of ticks and subticks on the axis. You can select logarithmic scales or completely free divisions: you decide for yourself where the ticks and labels should appear on the axis.

- *Ticks*: You will find all the setting for the long graduation lines on an axis as well as the settings for grid lines originating from the ticks.

- *Subticks*: In analogy to Ticks, this page contains the settings for the short graduation lines.

- *Help lines*: Here it is possible to select three freely definable lines (with labels) per axis.

- *Labels*: Under General you will find the settings that apply jointly to ticks and subticks. Under Settings for: you will find various parameters that have an effect on the lettering for ticks and subticks separately.

- *Axis title*: Each axis can be given its own title. You can enter and design the text in this window – the text field has its own context menu for this purpose. You can also adjust the position of the text to the axis from here.
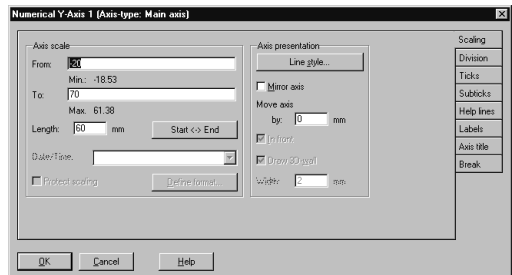
- *Axis break:* In most 2D charts you can insert a break into an axis. The **partial axes** produced can also be further **scaled as required**. The newly created partial axes can in turn be broken, so that they too generate partial axes.
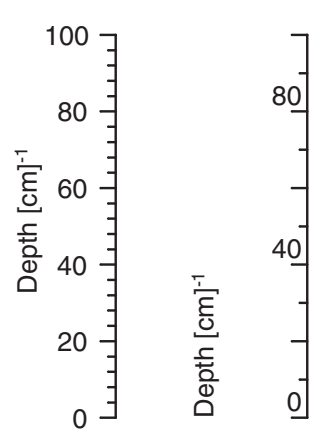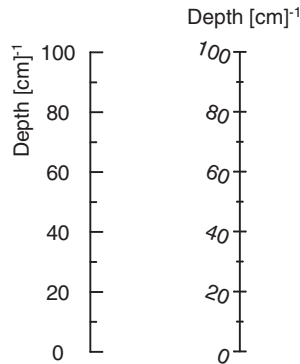

Fig. 1   **Fig. 2**

We would now like to show you a set of examples for typical axis displays with some tips on how to achieve them in Xact. We have deliberately not varied the font and line styles used so that you can recognize the main differences more easily.

Let us first look at **Figure 1**. You see the actual axis (consisting of the axis line, the graduation lines and sub-divisions, the labels (the numbers on the axis) and the title (in this case: Depth…). In the Axis dialog you can adjust the properties of the axis line on the *Scaling* page, and the length of the graduations on the *Ticks* page. On the *Labels* page you can set the properties of the numbers, on the *Axis title* page any extra lettering. Among the properties you can set on the Scaling page are the *length* and the *starting* and *finishing* values, on the *Division* page there are the number of subticks and the type of scaling for the axis.

In Figures **1** to **4** the axes have a linear scale, starting at a value of 0 and finishing at a value of 100. The individual settings of the original drawings (standard setting is a tick length of 2mm, ticks outside):

Fig. 3   **Fig. 4**

- Fig.**1:** subticks: 5, Labels: right aligned with 2 mm spacing, angle 0 degrees, Axis title centered parallel to axis

- **Fig.2**: subticks: 2, Labels: top position, caption after 2 ticks right aligned with 1.5mm spacing, angle 0 degrees, Axis title parallel to axis at bottom

- **Fig.3**: subticks: 2, labels with 2mm spacing, angle 0 degrees, Axis title parallel to axis at top

- **Fig**.4: tick length: -2mm, subticks: 2, Labels: flush with axis at a spacing of 1mm, angle - 20 degrees, Axis title centered at right angles to the axis

Figures 5 to 7 have logarithmic scales, starting at the value of 0.1 and finishing at 100. The individual settings of the original drawings:

- **Fig.5**: logarithm to the base 10, subticks: 2, Labels: aligned right with 1mm spacing, angle 0 degrees, comma as decimal separator, Axis title at right angles to axis with left alignment

- **Fig**.6: logarithm to the base 10, subticks: 1, Labels: left alignment with 1mm spacing, angle 0 degrees, scientific presentation activated, no Axis title

- **Fig**.7: logarithm to the base e, tick length: - 2 mm, subticks: 1, Labels: label after 2 ticks, left alignment with 1mm spacing, angle 0 degrees, scientific presentation activated, no Axis title

- **Fig**.8: logarithm to the base 2, tick length: - 2 mm, ticks outside, subticks: 1, Labels: left alignment with 1mm spacing, angle 0 degrees, scientific presentation activated, no Axis title

- **Fig**.9: logarithm to the base 10, *Free division* activated, list of the division: "0.1 1{one} 10{ten} 27.3 100{hundred}", tick length 1mm, ticks outside, subticks 1, Labels: right alignment with 2mm spacing, angle 0 degrees, comma as decimal separator, no Axis title.
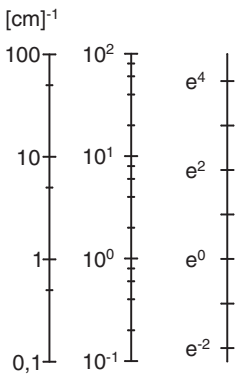
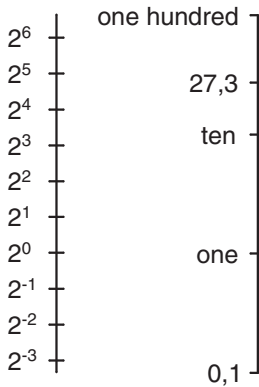**Fig. 5   Fig. 6   Fig. 7**

Fig. 8   Fig. 9

With *Free division*, as used here, you can insert Labels and ticks at any desired points of the axis. To do this, you simply enter them in the above-mentioned list. You can read more about this in the help system if you click on *Help* on the *Scaling* page!
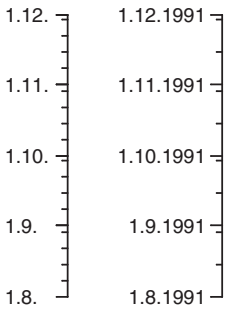
1.12.	1.12.1991
1.11.	1.11.1991
1.10.	1.10.1991
1.9.	1.9.1991
1.8.	1.8.1991
Fig. 10	**Fig. 11**

Thursday, Dec. 1.

Tuesday, Nov. 1.

Saturday, Oct. 1.

Thursday, Sep. 1.

Monday, Aug. 1.

Fig. 12

Figures **10** to **13** have date scales, starting at the value of 1.8.1991 and finishing at 1.12.1991. The individual settings are as follows:

- **Fig**.**10**: date format "DD.MM.", tick length: 2mm, ticks outside, subticks: 7 (days), labels aligned away from the axis with 1mm spacing, angle 0 degrees, no Axis title

- **Fig**.**11**: date format "DD.MM.YYYY", tick length: 2 mm, ticks outside, subticks: 14 (days), Labels: flush with axis at 2mm spacing, angle 0 degrees, no Axis title

- **Fig**.**12**: date format "DDDD, MMM. DD", tick length: 2mm, ticks outside, subticks: 14 (days), Labels: flush with axis at 2mm spacing, angle 0 degrees, no Axis title

Date and time scales can be selected for each axis from a formatting list. You can extend this list with your own formats – see Fig. 12 – and it may contain any characters you choose. The smallest time unit is one hundredth of a second. You will find more details in the *Online Help* under *Axis dialog 'Scaling'* and under *Define date/time presentation*.

Broken axes

In most 2D charts you can insert a break into an axis on the *Break* page of the *Axis setup* dialog. The features that you can adjust include the *position* and the *symbol* used for the break, as well as the *distance* from the next axis. The partial axes produced can also be further scaled as required. The newly created partial axes can in turn be broken, so that they too generate several partial axes.

0,01	0,10	1,00	10,00	**15**	**20**	**25**	100	1.000	10.000
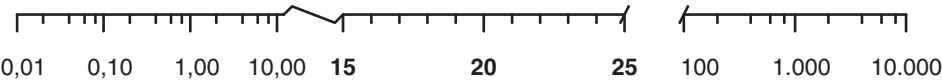
2 breaks

Alphanumeric axes

When alphanumeric axes are shown, descriptions (rather than numerical values) are used as the basis for the axis display. These are taken from the legend column 0 of a table and designated as the row legends.

• This type of axis is only generated if no column has been defined as X!

As a general principle the identifiers present will be drawn on the axis in the order in which they appear in the table. If the identifiers in the table extend over several lines, then they will also be written on the axis in this manner. In the figure "**Multiple-line axis labeling**" we have deactivated the entry *Angle automatically* in the axis dialog on the *Labels* page under *General*, in *Settings for:* under *Ticks* we have set the *Angle* to *45 degrees* and under *Align* we have selected align *right*.
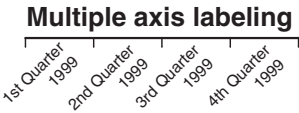
In order to maintain the maximum clarity in axis labels with long identifiers, it may be help to form **categories**. In this case the vertically positioned identifiers in "**Initial state**" have been entered in the table. The numbers "1996" and "1997" are always repeated. We can make use of this fact to create the division of the axis shown in the lower right-hand figure.
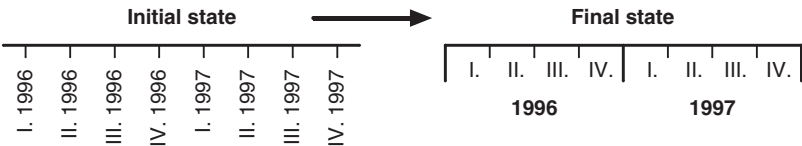
To do this, we have altered the following settings in the *Axis dialog*: on the *Ticks* page, the *Ticks/subticks between values* box has been checked and 8mm has been selected for *Length* of the ticks. On the *Subticks* page L*ength = ½ tick length* and *Line style as tick* have both been deactivated. Under *General* on the *Labels* page, a space has been entered in the field *Split at:* and *Angle automatically* has been deactivated. Under *Settings for:* the *Text spacing* for Subticks
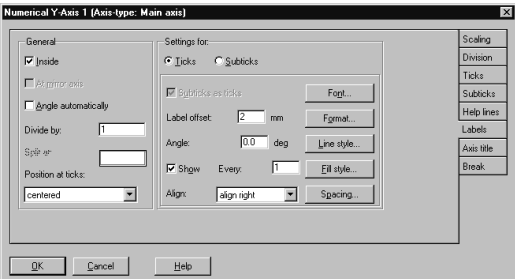
has been set to 0 and the *Show* box checked. A bold type face has been chosen for Ticks in the *Font...* dialog. The *Angle* of 0 degrees has been set for *Subticks* and *Ticks.*

At this point it is worth mentioning the effect brought about by entering a character in the *Split at*: field: every identifier on the axis is split at the last occurrence of this character. The identifier components that occur **before** the character (in this case: I., II., III. and IV.) are drawn on the axis as **Subtick labels**. Identifier components that occur **after** the character are drawn under the axis as **Tick labels**. All the **equal remainders** (in this case 1996 and 1997) are **written once only and centred** under the subtick labels. To separate the identifiers "1996" and "1997" from each other tick marks are drawn between them on the axis.

3-D axis systems

In three-dimensional charts you can assign a wall (or a base) to each axis. For left and right Y axes, the Scaling page of the *Axis dialog* has the switch *Draw 3D-wall* which enables to you to decide whether or not a wall is to be drawn (and if so, with what dimensions). Furthermore, the switch *In front* allows you to determine the position of the axes. An example with a left and right Y axis with activated wall and base is shown below.
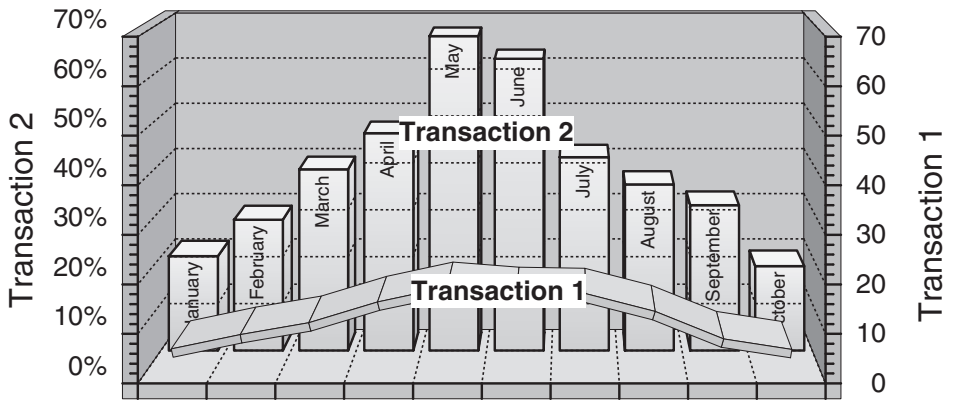
Graphs

In Xact the Y columns defined in the table are depicted as different **graphs** - depending on the choice of chart type. For instance a set of continuous lines or bars is called a graph. Graphs may also be formed from several columns: for example in an XY plot with error bars, the graph is formed from a Y, an X and a Dev column, a set of bars in a Gantt chart, for instance, is formed from two Y columns.

For most chart types you can gain a rough idea of what the graphs will look like later when making the initial selection from the chart types on offer. The available settings are of major importance when working with graphs professionally. In Xact these settings are changed by means of *context menus* (see the *Quick Start* section) and then apply to the graphs in question.

The figure below shows the *context menu* of a line graph as an example. The three entries in the upper group apply to the entire chart, as does the entry in the lower group, and these are discussed in additional sections within this handbook. The entries in the center group apply specifically to this graph and alter its properties:

The **Mathem. Procedure->** entry of the context menu opens up further settings, such as *Regression/Fits, Interpolation, Approximation, Extrapolation* and *Filters*. If you are interested in this topic, please read the section in this manual entitled *Mathematical Procedures*. You can also find information on this topic in the Online Help.

Using the entry **Extras->**, you can determine the position of each measuring point manually with *Move data points*, and you can also add or delete such points. The altered data are simultaneously entered into a new table. You can find out more on this topic in the section entitled *Help Functions for Charts*. *Show data* displays the data in this graph in the form of a table.

Line/Frame... allows you to adjust the line style, and **Marker...** the type of marker. In the case of markers, the border line and fill colors can be adjusted separately and

even the color of the line style can be adjusted. With ***All graph colors…*** you can alter these three colors simultaneously. ***Graph options…*** takes you to the Options dialog specific for this grap-type.

The ***Caption…*** entry in the context menu for the graph leads to the *Caption dialog* that enables you, for example, to write measured values on the graphs.

In the section *Overview: Captions in Charts* we provide you with more precise information on the options for lettering in Xact.

Ribbon 3D
Block 3D
Bar 3D
Line
Filled line
Bar
Step
Filled step

The list shown below appears when you select ***Graph style->*** in the context menu. Here you can exchange the current type of graph for another one from the list displayed. The list contains different options, which vary according to the initial graph. For example, this list is for a 3D chart and so both 3D and 2D charts are offered as replacements.

Graph and chart options

Similar graphs have a common options dialog, in which specific adjustments can be made. The **settings** within the context menus are only **valid for the graph selected** in each particular case.

In the *Chart* menu you will find the entry *Chart options*. Settings made here affect **all graphs** within a chart and therefore overwrite any settings made in the individual graph options.

Replacing graphs by symbols

In many frequently used graphs, e.g. those with bars or markers, a symbol from the **symbol library** can replace the graph. Symbols can be graphic elements of any complexity - you will find a practical example in the section *A Simple Object Chart*.

Line graphs

Linear graphs characteristically contain filled or unfilled, continuous or stepped curves and may be fitted with markers. Linear graphs have a common options dialog (see figure). Apart from the settings in the dialog, you can also use those within the context menu - you will then have a very large number of presentation options. We show a selection of these in the figure below.

- **a)** The scatter plot uses markers, the curve is a regression (context menu *Mathem. Procedures / Regression*) Additional columns are defined in the table as Dev+ and Dev-, as well as DevX for the error bar.

- **b)** Only every second data point is shown by a marker - hence when there are a lot of points, markers can be used to depict sets of data, without the graph being made illegible by too many markers (Settings in *Chart options*)

- **c)** Markers can be replaced by any symbol you wish (see section "*A Simple Object Chart*"), the curve is a spline (context menu *Mathem. Procedures / Interpolation...*)

- **d**) The graph here is distinguished by the line style, the markers have been deactivated (context menu *Line / Frame...*)

- **e**) If any measuring values are missing, the lines can be set so as not to show between the measurements concerned (setting in *Graph options...*)

- **f**) Data points can also be represented by perpendicular lines (setting in *Graph options...*)
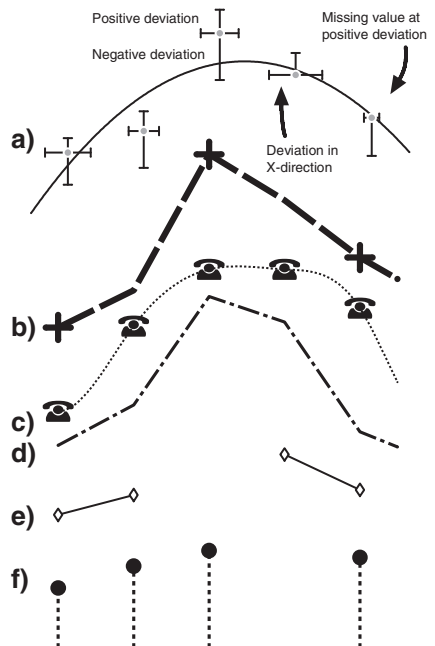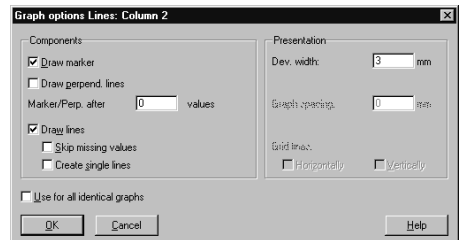
In the Marker selection (context menu *Marker...* , see figure on next page) you have a choice of eighteen different basic types in any desired size, which you can vary with *Fill style...* and *Line style...* . Nevertheless – sometimes special markers are needed that are not included in the standard selection. In such cases you can use the mouse to drag a symbol of
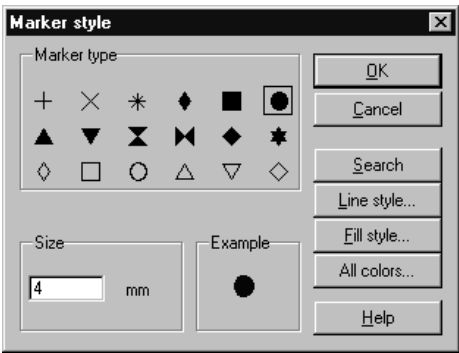
your choice from an opened *Symbol window* (open by selecting *Symbols...* in the *Object* menu) onto a graph. The graph concerned is indicated by a frame on the screen. Release the mouse button and the markers on the graph are replaced by the symbol selected. In the *Marker* dialog you can then adjust the size of the symbol, instead of that of the marker. You can also read up on this in the section entitled *A Simple Object Chart* later on in this manual.

Bar graphs

Bar type graphs are used in the chart category *Bars...* and in some of the types included under *Special...* . **Error bars** can also be presented in bar graphs. Bar-type graphs have a common options dialog. Bar graphs can also be displayed as triangles in the 2D variants, and as columns, pyramids or hollow bodies with up to 64 angles in the 3D variants. This dialog enables you to adjust the breadth in all bar graphs (for 3D charts the depth, and the distance of a graph from its predecessor, too). Further settings on 2D graphs make it possible to *offset* the graph concerned and provide a visual indication that the graph "*overshoots*", i.e. continues beyond the range displayed.
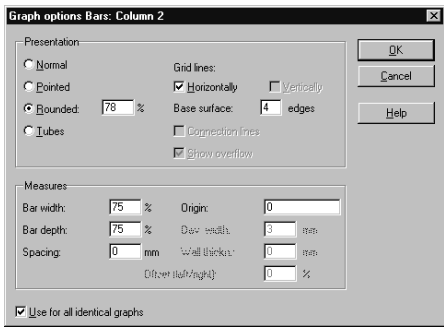
The effects of some of these settings are shown in the illustration overleaf. We have restricted ourselves here to the more unusual displays as your are no doubt familiar with standard bars. Each of the graphs in the figure represent 3 numbers in relation to one another. Each of the 3D displays is illuminated.

The upper four figures show stacked bars in 3D and 2D displays, **d)** is a pointed column display with a hexagonal base. In **g)** every graph (each bar series) has a

different width, **c)** consists of tubular column with a 64-sided base and a wall thickness set to 1mm.

b) and **f)** are both based on the *From average* chart type. The fill styles used in **f)** are a mixture of Hatches and Covering, whereas **b)** consists of pentagonal columns. In **e)** - from *2D rows* - the graphs have been given color gradations with different angles. Different widths have also been set for the graphs, and they have been pushed together using different *offsets*.

Figure **a)** - chart type *City Block* - consists of hexagonal illuminated columns, where the breadth and depth of the graphs increases from front to back.

In Figure i) the Indicate overshoot switch in the Graph options has been activated. The corresponding Y axis has a break.
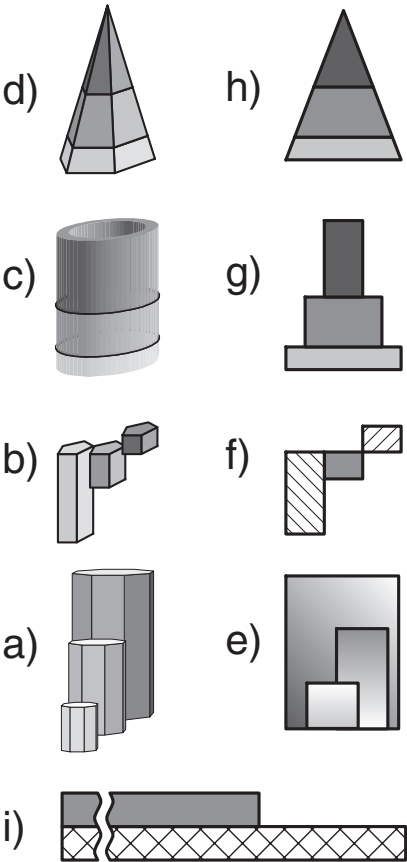
Apart from the settings presented in the options dialog, you can also use the settings in the context menu for designing your graphs.

Legends in Charts

Legends help to uniquely identify graphs and thus make charts easier to read. You will find the entry Legend… in both the *Context menu* for the chart and in the *Chart* menu. A multi-page dialog is available for adjusting the position and appearance of the legend.

General

On this page you can make basic decisions on the appearance and font style of the legends.

If you have selected *None* for *Frame* and then *Ungroup frame group* in the *Context menu* for the legend, you can position the individual legend entries freely.

Incidentally, the line and fill styles for a legend frame are defined via the entries in the context menu for that frame!
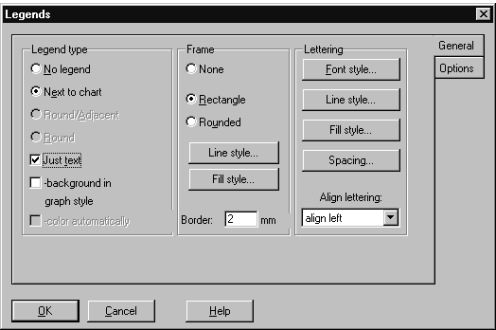
Options

Under *Placement* you can determine the type of distribution for the individual legend entries within the legend frame.

In the case of *Circular charts* you specify the diameter of the circle on the edge of which the legends are drawn. This presupposes that you have also selected a circular legend in the options for circular charts. If you have used fits or regression in a chart, you specify under *As additional legend* whether a numerical output should appear next to the chart. In this case you adjust the *number of Decimal places* to be displayed at this position.
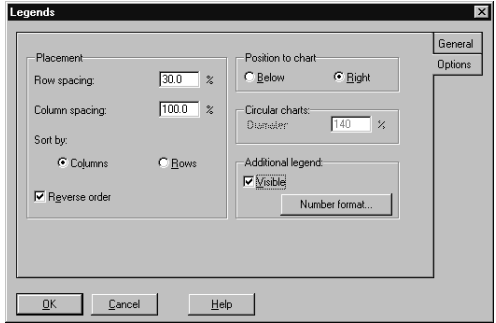
Color legend

If colors have been allocated to the values in certain chart types - e.g. Lines/Markers with the marker colors switched on according to Z values - this page will be added to the legend dialog.
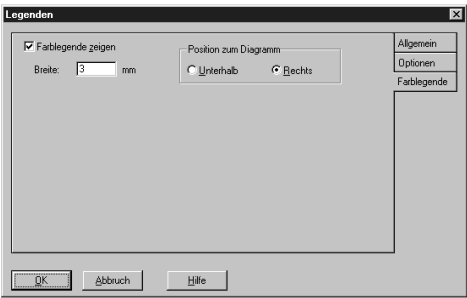
The features that can be selected include the position, the color legend for the diagram, its width and not least the type of presentation. The legend object created will be of the legend axis type and can be scaled in just the same way as an axis. The colors can be altered via the Fill style. option in the context menu for the object.
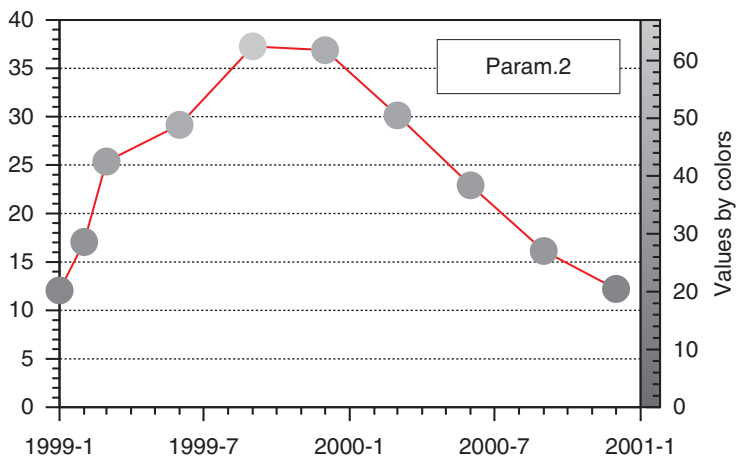
Lettering in Charts

In this section we aim to give you an overview of the captions used in charts. Captions in charts are either created automatically by Xact or – if a chart is being recalculated – are taken from the table editor.

Lettering from tables

Captions that originate from an Xact table (i.e. table texts) contain information on font styles and formatting. A cell in a table may for example contain superscripts or special characters, may have multiple line spacing or a variety of colors. If the text from a table cell is used in a chart, the features named above will also be used in the following chart groups, **with the exception of the font size and colors:**

- **Alphanumeric axes** (usually X axes)**:** these adopt the contents of the row legend - if no X column has been defined. The font is adjusted in the *Axis setup* dialog on the *Labels* page, using *Font…*

- **Legend letterings:** these generally adopt the contents of the column legend for the Y columns. The font is adjusted in the *Legend* dialog on the *General* page, using *Font style…*

- **Captions on graphs**: if the *Insert row legend* switch in the *Caption* dialog has been checked, the content of the respective row legend will be written onto the graph. The font is adjusted in the dialog, using *Font style… .*

Axis titles, however, are always reproduced in the original size and color of the table after the recalculation operation! The font is adjusted on the *Axis title* page of the *Axis setup* dialog in the *text entry box* - here you can determine the appearance of each individual character.

If you alter captions in charts via the *Font type and style* dialog shown overleaf, pay particular attention to the two switches *Change font* and *Size.* After
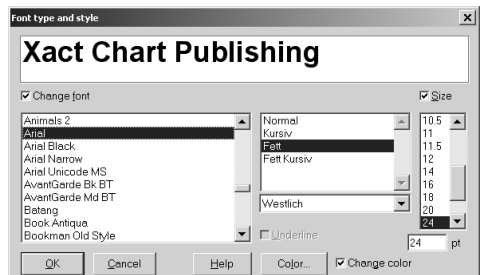
you exit the dialog with *OK*, the fonts will be affected according to the position of these switches:

- *Size*: if this is checked, the size of all characters in the affected text will be altered to the selected size.

- *Change font*: if this is checked, all the characters of the text concerned will be changed into the font type selected – characters from other font types (e.g. from the symbol characters sets) will converted into the selected font type! If this switch is not checked, the font does not change.

Automatic captions

In the following chart groups Xact generates captions automatically from the figures in a table:

- **Numerical axes**: the font is adjusted in the *Axis setup* dialog on the *Labels* page, using *Font…* .

- **Captions on graphs**: the font is adjusted in the *Caption* dialog, using *Font style…* .
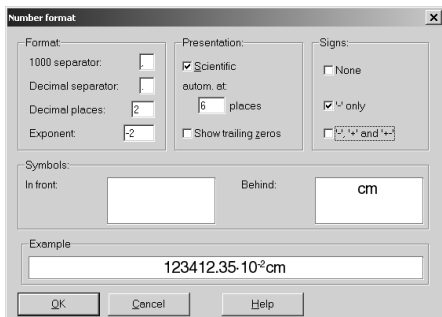
The desired number format in automatic captions can always be adjusted via *For-matting*. In the *Number format* dialog you can set the *separators* for thousands and decimals, the *decimal places*, etc. You can also enter the symbols placed *before* and *after* the figure concerned and set their *font types* and *sizes*. These are displayed in *Example* in the actual size with which they will be inserted into the chart.

If at a later stage you decide to change the caption you have created with *Font style…*, do not forget the above-mentioned effects caused by the switches *Change font/Size* in the *Font type* and style dialog. In the case of more complex symbols with different font sizes, colors and styles, it is therefore advisable to specify the automatically generated font style and then you should define the symbols.

The **Table chart** type is a special case. It does not contain any automatic captions, only text and formatting from tables.

Captions and spacing.

In almost all the dialogs that are concerned with captions in charts you will find a button labeled *Spacing...* . It opens up the adjacent *Text-frame setup* dialog.

Under *Margins* you can set the *distance* between the text and the surrounding frame (if you have made this visible by checking *Draw line* under *Line/Frame...*). The *Line spacing* can be altered here, but only **affects texts containing several lines**. Under **Text frame** you can choose whether this length of text should be kept constant or adapted. This option is not always available.
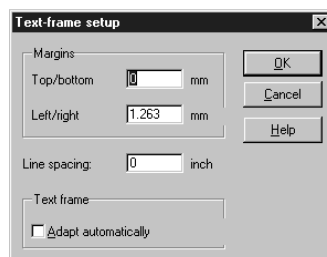
Captions on graphs

Captions may differ greatly in character according to the type of graph. The options and settings available in the *Caption* dialog are therefore dependent upon the chart type and graph. If this dialog is called up via the context menu of a chart, the settings only apply for that graph. However, if the dialog is called up from the Chart menu, the settings apply to all graphs in the chart – and will overwrite any previous caption options that may have been set for individual graphs! Please refer to Dialog '*Caption*' in the *Online Help* for further details of the dialog.

Under *Placement* you can select the *position* at which the caption is to be entered. Here *object* is used as a general term for a measured value on the graph. Hence, in a line graph, object means the position of a marker, whereas in bar charts it means the end of a bar.

Under *Formatting* you can select what is to be used as the caption, *Font* allows you to set the details of the font used.
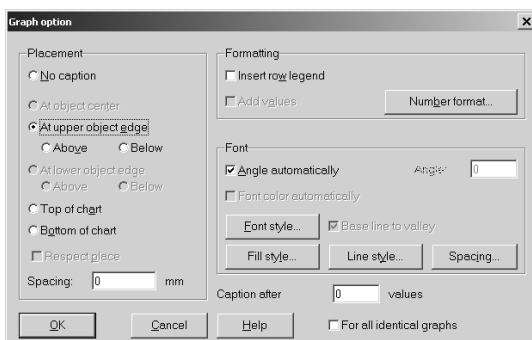
Mathematical Procedures

The *context menu* of a line graph for example includes the entry *'Mathematical procedures->'*. If you highlight this entry, the adjacent context menu will appear. From here you can access a range of important methods for analyzing and altering graphs. After you have selected one of the entries, the appropriate operation will be performed. (Where the entry is followed by three dots (…), a dialog is called up.) **You can look up more precise information about the given functions and procedures in the Online Help!** The following section gives an outline of the entries and their functions:
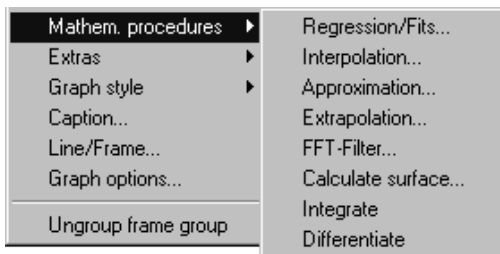
Regression/Fits

Basically the fit uses all the data points of a graph that lie within a definable *range of the X axis.* Apart from the fit procedures listed under *Methods* in the box below – and depending on which of them is selected – the following methods are also available in the *Regression/Fits* dialog:

- **Minimize by:** -least square (sum of the squares of the deviations), -absolute deviation (sum of the absolute values of the deviations), -Lorentz distribution (sum of the deviations evaluated according to the Lorentz distribution) are the methods that can be used.

- **Use weighting:** the Y value of a data point can be given an individual weighting. The weightings are entered into a column defined
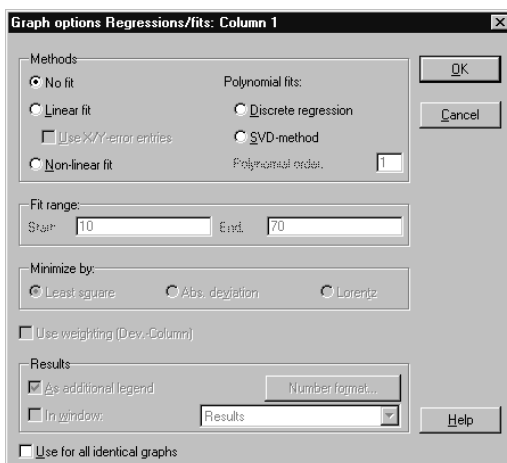
as the Dev. Column. A factor of 1 weights the deviation by 1, a factor of 10 would only affect the value of the Y measurement by 1/10.

- **Results:**

The numerical output of the fits can be written *As additional legend* or cumulatively in a *Results* window. The output includes the quality of the fit, the coefficients calculated with errors, variances and standard deviations of the residuals, correlation coefficients with level of significance and degrees of freedom.

If *Show data* is activated in the *Extras->* entry of the *context menu* or in the *Chart* menu, the residuals and the equations of fit containing numerical details, among other information, are displayed in a table.

The following methods are available:

- **Linear fit**

Linear fit is also known as "forecast", "linear regression" or "polynomial regression of the 1st degree" and corresponds to the regression equation f(x)= a + bx. It involves trying to draw the best possible straight line through the measured values. Using *X/Y-error entries* you can determine whether you wish to make an error entry in the X and Y direction for every data point. The error entries are expected in DevX and DevY columns.

- **Polynomial fits**

Non-linear relationships can for example be approximated via polynomial regression of a higher degree. In polynomial regression of the third degree, for example, the Y values of the readings are estimated with the following equation: f(x) = a + bx + cx^2 + dx^3. Xact can be used for calculating polynomial regression analyses up to the 26th degree. The following algorithms for calculating the polynomial parameters are available:

   - *Discrete regression*: This algorithm (full name: discrete polynomial regression) is characterized by the fact that it is particularly stable with high degree polynomials and has very small coefficients.

   - *SVD method*: This algorithm (full name: singular value decomposition), in addition to its high stability, also enables the standard deviations to be output as single parameters.

- **Non-linear fit**s

A large number of more complex relationships cannot be described with polyno-
mials. With Xact you can either select from a list of predefined fit formulas (with
automatic determination of the *Start values*) or perform the fit to your own
formulas. Up to ten parameters
can be fitted at the same time. Se-
lection of the *Formulas* and *Start
values* as well as the *abort criteria*
and algorithms *(Simplex* or *Leven-
berg-Marquadt)* takes place in the
adjacent dialog.

  We go into these complex proce-
dures in some detail in the section
on *Regression*, later in this manu-
al.

Interpolations

Interpolation methods are use on line charts and can be selected in the context
menu of, say, a line graph under '*Mathematical procedures->*'. This involves the
initially straight connecting lines between the individual data points being
replaced by 'round' curves. In addi-
tion, Xact offers a choice of *Cubic
spline* and *Akima spline* interpola-
tion methods. It is also possible to
indicate the range of the X axis
within which the interpolated cur-
ve will be drawn.
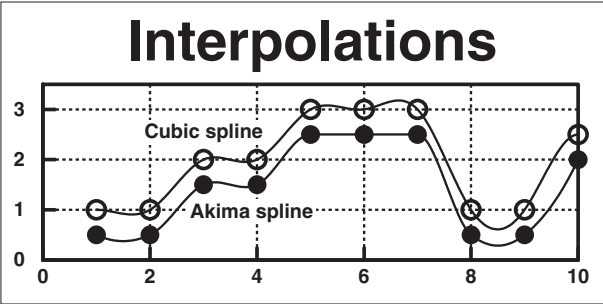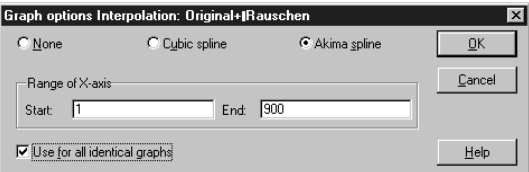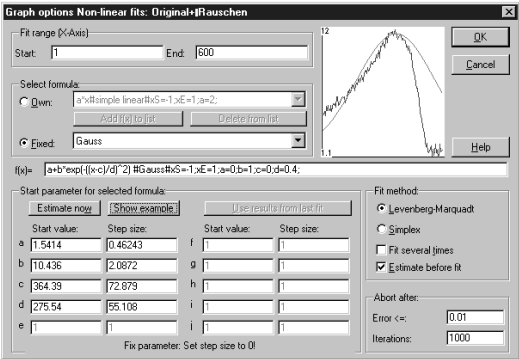
Approximations

The purpose of approximations is to match a set of data to a curve. They can be selected under '*Mathematical procedures->*'in the *context menu* of a line graph, for example. Generally the
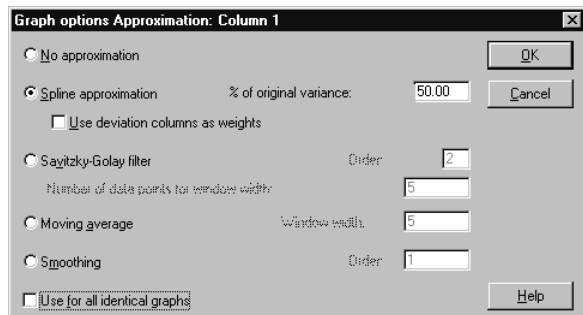
aim is to draw a curve between the measured values that is "pleasing to the eye". Often approximations are used to optically compensate for disruptive random fluctuations. The *FFT filter methods* discussed in more detail below are usually also well-suited to this task.

- **Spline approximation**

Here, a *cubic spline* is fitted by means of nodes previously calculated from the measured values. You can adjust the margin of fluctuation of the curve drawn with % of original variance. At 100% the calculated nodes lie on the data points, at 0% the nodes lie on a straight line. You can also assign an individual weighting to each data point: if a Dev column has been defined and selected for a Y data column, the figures contained there will be used as a weighting factor. In this case, the values in the Dev column will no longer be drawn on the graph as deviations. A factor of 1 weights the Y data point by 1, a factor of 10 would only affect the value of the Y measurement by 1/10. If no measured value is present, or the value in the Dev column is 0, the weighting is set to 1.

- **Savitzky-Golay Filter**

This method of approximation is used particularly in spectroscopy. It is also known by the name "DISPO" (digital smoothing polynomial) filter or "least squares filter". It removes random fluctuations from measured values, while still retaining very good local minima/maxima for the data.

The parameter *Number of data points for window width* enables you to set the range from which measured values will be gathered for approximation. If for example a value of "13" has been entered here, the six values to either side will be used for each node to be calculated. Therefore the number of data points

must always be uneven. Correspondingly fewer values are employed at the extremes of the range of measured values. The width of the window should also vary according to the details to be represented in the data material. To do this, you will need to determine the breadth of the peak of the curve which is to be displayed (in data points), at approximately half the peak height. Then as a rule of thumb, for a 4th order filter (see below), the width of the window should be between 1 and 2 times this width.

The parameter *Order* determines the weighting with which the surrounding data points are used for the node. The weighting uses a polynomial, the order of which is adjusted here. It makes sense here to use values =2. Providing suitable window widths have been selected, the best results are generally obtained using an order of 2, 4 or 6. As is the case with a polynomial, both higher orders and odd-number entries often result in overshooting and hence to imprecise filtering.

If regression or non-linear fits are used, these are calculated using the smoothed data!

- **Moving average**

In this case the Y data points within the window width (see above) are used in calculating each of the nodes for the approximation curve. The arithmetic mean of these values is calculated in the process. Here too, the space after *Window width* is used for the (odd!) number of the values used. Correspondingly fewer values are used for the calculations at the left and right edges of the distribution. If regression or non-linear fits are used, these are calculated using the smoothed data!

- **Smoothing**

Here the weighted harmonic mean (so-called 1-2-1 smoothing) is calculated for X and Y from three measured values in each case. Higher orders of smoothing can be entered after *Order*.

The algorithm for the smoothing is: 1st order: (value 1 + 2*value 2 + value 3) / 4 = new node. 2nd order: the nodes smoothed by the 1st order are again smoothed according to the same algorithm, etc. One node is lost at both the beginning and end of the graph for each smoothing step. If regression or non-linear fits are used, these are calculated using the smoothed data!

Extrapolation

Extrapolation is the name given to methods that analyze the existing data and use it to calculate additional figures. They can be selected in the *context menu* of a line graph for example under the *Mathematical procedures->* option.

With the *Regression* and *Non-linear fits* in Xact you will find methods that you can use for this purpose. However, they do presuppose a knowledge of the mathematical principles for fluctuations within a set of data, and this condition is often not satisfied. *Linear prediction* is a method offered by Xact that is particularly suitable for extrapolating steadily changing sets of data which have distinct periodicity. Examples include all data that are subject to time fluctuations – from economic activity through seasonally fluctuating data (sales, temperatures) to high and low tides. You can find more information on extrapolation in the Online Help under the headword *Extrapolation.*

Fig. 1

Fig. 2
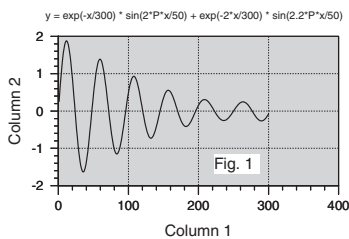
To demonstrate the procedure, we shall use the data set shown in Figure 1, which was calculated for 300 X values.

Select the *Extrapolation…* entry under *Mathematical procedures->* in the context menu of the graph. In the *Extrapolation* dialog check the *Create data* option. In the *Source range* indicate which data range you wish to use for future estimates - in this case 0 to 200. In the *Target range* you specify the final X coordinate up to which you wish to calculate figures - incidentally, the first figure calculated follows on from the end of the target range. Enter 300 here. You will obtain what you see in **Figure 2** as a result. The estimated values between 200 and 300 are shown as a white curve.
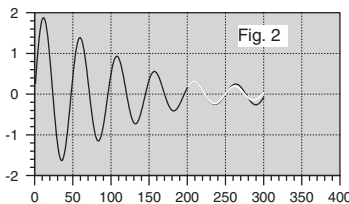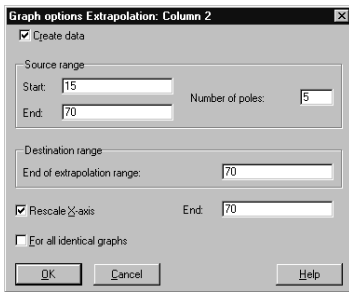
As you see, the estimated values (the white curve) deviate more and more from the actual function as x increases. The estimation is based on a function that aims for the best possible fit with the source values, the values of which can be

adjusted in the *Extrapolation* dialog with the parameter *Number of poles*. The following applies to this number – it is dependent upon the quantity and complexity of the data: the greater it is, the more numerically unstable the prediction will be, but the greater its accuracy. Overall, the stability of the prediction falls with increasing amounts of data. There it is wise to vary this parameter experimentally for each data set and thus achieve an optimum fit at the end of the range.

On the basis of the experience mentioned above, we opted for 24 poles in **Figure 3**, so as to predict in a target range up to 400 from a source range of 0-300.

You can obtain the numerical results of the extrapolation as a table for further processing if you click on the entry *Extras-> Show data* in the *context menu* of the extrapolated graph.
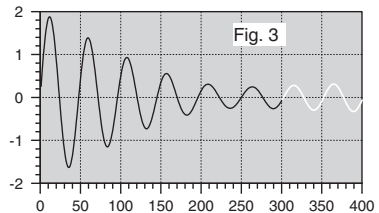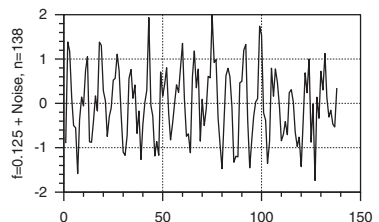
- **Using extrapolated data**

As you have seen from this simple example, a "good eye" can be very helpful for obtaining a meaningful estimate. Of course the validity of the estimated data will have to be assessed very carefully. However, if they are relatively small in number in relation to the source data, and if plausible results are obtained when they are used, then missing data can be easily estimated and meaningful prognoses produced.

FFT filters

FFT filter methods are used in data sets for highlighting and suppressing information, or for separating individual items from one another. They can be selected in the *context menu* of a line graph for example under the *Mathematical procedures->* option. For instance, they can be used for removing the noise (measuring errors) from a set of data or separating overlapping signals from one another. Xact offers high-pass, low-pass and band-pass filters as well as band-

stop filters, which can all be combined with one another as required. Filters work in a similar way to an equalizer or the bass and treble controls of a stereo system.

The filters in Xact are based on fast Fourier transformations (FFT). These methods determine the frequencies and amplitudes that occur in a set of data and present the results in Xact as a periodogram (Fourier analysis). The set of data itself can then be recalculated from the frequencies and amplitudes (Fourier synthesis). If the amplitudes found are altered before the synthesis, then the data set will change as well. This process is known as filtering.

We would like to give an example to illustrate what has been said above. On the previous page you will find the original set of data used. It consists of a sinusoidal oscillation and some added random values. Now if you want to filter a set of data less subjectively than by using your "eye", you should first take a look at what the frequency chart looks like. It shows the distribution of the amplitudes at the various frequencies.

- **Creating and analyzing a periodogram**
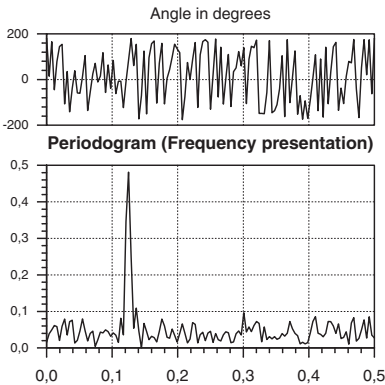
First we create the periodogram shown below by selecting the chart type *Fourier analysis* (*Special* entry in the *Chart* menu).

The lower part of this chart shows the amplitudes of the frequencies that occur in the set of data, and the upper section the phase angles for the amplitudes. In this case the phase angles are of no further interest to us. There are a large number of low amplitudes (approx. 0.1 Herz) in the chart, which are spread over the entire frequency range. This type of roughly uniform amplitude distribution is often an indication of noise - it consists of many different frequencies. There is a distinct amplitude peak at the frequency of 0.125. Precise knowledge of the frequency is important in this case because we want to try and isolate this frequency as accurately as possible from the remaining signal.

To do this, we will rescale the X axis of the chart: after a *context click* on an element of the X axis, we can set the starting value for *From*: to 0.1 and the end value at *To*: as 0.2. In addition, we also check the box for *Draw perpendicular lines* in the *Graph* options menu for this chart and can thus easily read off the frequency with the highest amplitude from the X axis. Here we are presuming that the hidden signal is located in the noise and we will use this value for the filtering.

- **Using the band-pass**

We return to the chart for the original set of data and select the *FFT-Filter* from *Mathematical procedures->* entry in the context menu. We can then choose from various types of filter in the *Filter* dia-log. As we now want to show the frequency with the highest amplitude, we reduce the amplitudes as far as possible before and after the desired frequency (to the left and right of 0.125 Hertz). We therefore select the *Band pass* page and check the first band pass under *No.*. As the amplitude is not to be altered, we retain the number 1 under *Factor*, and the preset value is also retained under *Slope*; as this is the maximum achievable edge slope. For *Start* and *End* we type in 0.125. You can see the result in the adjacent figure. The sine-wave signal has been almost entirely cleared of noise.

- **Using the band stop**

Another important application is the suppression of certain frequencies of the original signal if they cause inter-ference. In order to obtain the noise signal, without the useful signal, we
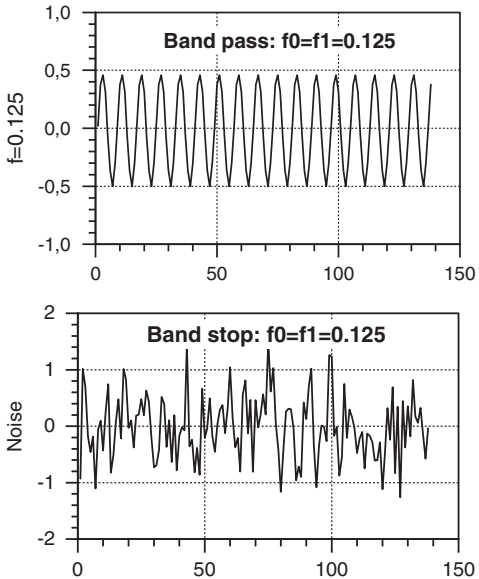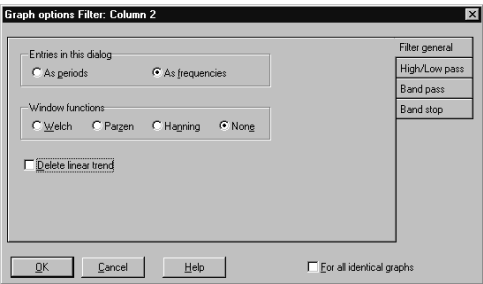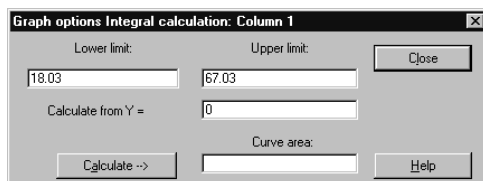
use a *band stop* as the filter. This is what might be called the "inversion" of the band pass: all amplitudes within the selected frequency range are reduced, lower and higher frequencies are allowed to pass unhindered. In the previous figure you can see the extremely satisfactory result.

- **Low and high passes**

Xact also allows high and low passes, that can be used in an analogous manner. Low passes are often very useful as a tool for smoothing sets of data and are far superior to other smoothing techniques due to their rationally justifiable selection of cut-off frequency.

Calculating areas

Here the area beneath a graph is calculated. In order to do this, the interval limits (with respect to the X values of the graph) are entered, and one Y value, which is deducted when the area is calculated. Linear interpolation between the adjacent data points is carried out for calculation purposes.

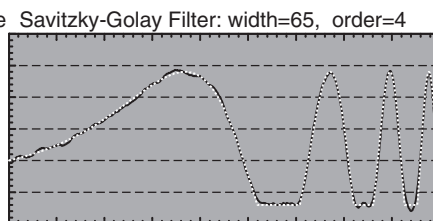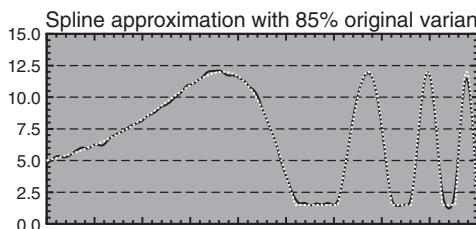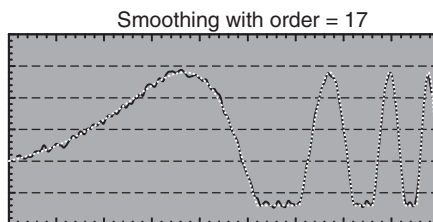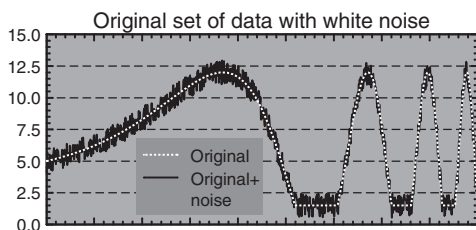| Graph options Integral calculation: Column 1		
Lower limit:	Upper limit:	Close
18.03	67.03	
Calculate from Y =	0	
	Curve area:	
Calculate -->		Help

Integrating

This forms and draws the cumulative curve of the graph. In this process, the entire selected column from which the graph is formed is taken into consideration. Fits, approximations, interpolations, extrapolations and filter are calculated for the integrated curve if the integrating option is activated.
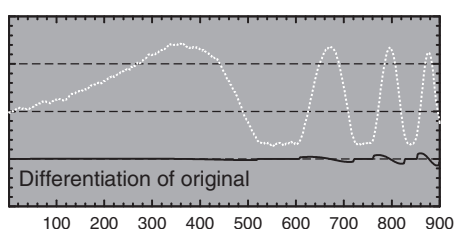
Differentiating

This command differentiates a graph according to the geometric center rule. In this way the gradient of the graph is calculated for each data point. The gradient is then plotted on the Y axis. A gradient cannot be calculated for the first and last data points of a graph because the preceding / following point necessary for such a calculation simply does not exist. Fits, approximations, interpolations, extrapolations and filters are calculated for the integrated curve if the integrating option is activated!
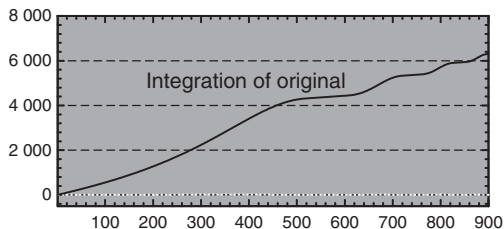
Mathematical Procedures in Xact:
Removing noise from a set of N=900 data

Original set of data with white noise

Smoothing with order = 17

Original
Original+
noise

Spline approximation with 85% original variance

Savitzky-Golay Filter: width=65, order=4

Moving average with window width = 17

FFT-filter:no window, low pass start=0.03
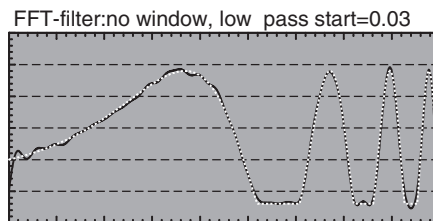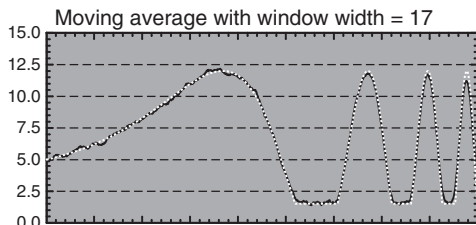
Integrating & Differentiating:

Integration of original

Differentiation of original

Help Functions for Charts

In this section we would like to show you some useful help functions that will simplify your work with charts.

Displaying chart coordinates

The lower control bar in a graphics window gives you a constant display of the current mouse coordinates (x= ,y=) with **respect to the page size**. If the mouse pointer is located within the frame bounded by the axes of a 2D chart, the current mouse coordinates will be shown in **relation to the axis system** of the chart when you press the Shift key.

The data lens for scaling with the mouse

This function saves you the time-consuming procedure of entering the start and end values of axes in the axis dialog boxes. In the toolbar of a graphics window (at the left-hand edge) you will find the symbol for the *magnifying glass*. If you keep the mouse button pressed, a fold-out menu will open, and if you select the last symbol on the right, the *data lens* is activated. First the mouse pointer will appear as a magnifying glass. If you then trace a rectangle which contains parts of the axis frame of a 2D chart, the axes of the chart will be rescaled to fit the selected area when you release the mouse button.

Pipette for copying attributes

The pipette is used as a simple way of transferring attributes from one item to another. It "sucks up" all the attributes (e.g. line and fill style) from an object and passes them on to any other object. If you click on an object within a group when the pipette is full, only the object in question will be changed, provided it is not an automatically generated component of a chart. Once a pipette has been filled, it remains so until emptied and can be used repeatedly. Filled pipettes retain their contents even when you change from one graphics window to another.

In the tool bar of a graphics window (at the left-hand edge) you will find the empty *pipette symbol*. When you click on it, the mouse pointer also changes into an empty pipette symbol. When you click the mouse pointer on an item, the pipette is filled with all the attributes of this item. Each click with the filled pipette on an item will then transfer **all the attributes** in the pipette to that object. However, if you open the *context menu* of the filled pipette on an object, you can select the property you want to transfer and if necessary *empty* the pipette.

| Line/Frame |
| Fill pattern |
| Font |
| Marker |
| Axis style |
| Empty |

Graphics attributes are transferred to the **Charts** by the pipette, according to the chart group. Almost all the groups use fill, line and text styles, and **Axis styles** can also be pipetted and transferred for axes of the same type.

Axis styles contain all the settings for an axis - from the line style through the length of the axis to the lettering. Hence pipetting an axis enables all its characteristics to be transferred to another axis. This saves you carrying out the numerous individual settings in the axis dialog that would otherwise be necessary!

Moving data points

This functions lets you change the position of the data points interactively for every graph in a 2D chart. You will find the entry *Move data points* under *Extras-* in the *context menu* for a graph. When you select this, all the data points will be displayed in a frame.

At the same time the current data of the reference points are displayed in a new table. Data points selected in the graph are shown as filled and are also selected in the table accordingly.

And this is how it works: after the option has been selected, the reference points of the graph are shown as squares, which are drawn on the graph. One of the squares is filled – this is the data point that is currently selected. A click with the right-hand mouse button will take you to a *context menu* with the following functions:

- *Insert* adds an extra data point.

- *Delete* removes a selected data point. Delete can only be selected if the context menu for an active data point is being used!

- *End* terminates this function.

Data points can be **selected** in a variety of ways. Clicking the mouse on **one** data point selects that point, as does the key combination Ctrl + arrow right/left. You can select **several** data points by drawing a frame with the mouse. All the data points positioned within it will be selected and shown as filled.

- The selection frame can be enlarged or reduced with the mouse horizontally or vertically. The data points contained will move accordingly. You can use this feature to stretch or compress measuring ranges in either the X or Y direction!

You can **move data points freely** if there is a numerical X column in the graph. If you only have alphanumeric labels of the X axis, you can only move the data point in the direction of the Y axis.
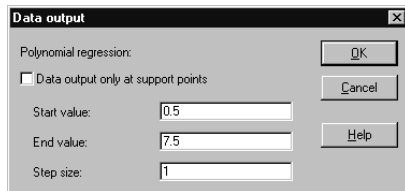
You can **move selected data points** with the mouse button pressed or with the left/right arrow keys. In the latter case, the step size of the movement can be increased by pressing the Shift key at the same time.

- **Please note**: while executing this function you can make enlargements almost at will using the **magnifying glass**. You can thus specify the numerical accuracy of the final version!

Showing data

This function can be selected in the *Chart* menu and causes the data from **all graphs** to be shown. In the *context menu* for a graph found under **Extras->** , only the **data of the graph** selected will be shown.

If a graph has been **calculated** by Xact (regression, fits, filters, Fourier analyses, interpolations, approximations, extrapolations…), these **calculated data** will also be shown. To allow you to make the settings, a *Show*

data dialog opens for every graph, in which you can specify the *Starting value*, *Step width* and *End value* of interpolated values as required. You can then use the data shown in a new table in any way you want.

Quick color changes in charts

In the *File* menu under *Preferences/Charts* you will find the option *Replace with present styles on recalculation.* These switches enable you to change the colors of finished charts, such as when you want to create a black and white chart from a colored original as a master template.
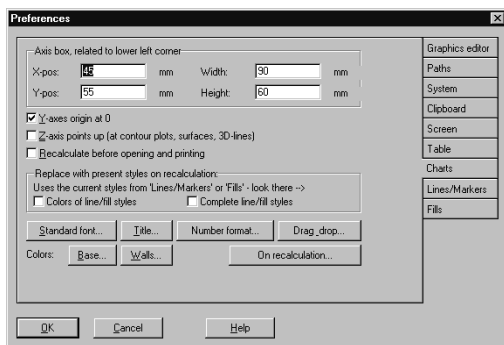
If you check one of the two boxes, Xact will in future use the line styles and colors currently set in *Preferences/Charts* under *Lines/Markers* and *Fills* when recalculating. If you have chosen a black and white model there for example (or your own special setting) with *Load...*, a click on *Recalc* in the *Chart* menu will cause the graphs in all the charts of a graphics document to take on the preset characteristics. This will overwrite any previous manual settings on the graphs. **In any case, texts, axis lines and legends will be shown in black and white** – this is the basic setting when charts are first created. If you just want to change the colors **temporarily**, you can restore the previous settings with a click on **Undo** in the **Edit** menu. The way in which the graph styles are altered depends on the switch:

- *Colors of line/fill style*s only changes the colors of the graphs. Any existing marker types and line styles will be retained. This function can therefore be particularly useful for changing a color chart quickly for a black and white printout or vice versa.

- *Complete line/fill style*s, on the other hand, changes all the attributes from lines/fills and thus changes the graphic features of all graphs so as to precisely match the current settings.

Drawing & Illustrating

Xact creates charts from your data automatically. However, most charts and publications require explanations, logos and images and thus have to be designed individually. To do this, Xact provides you with a complete vector graphics drawing program – in the following we will call this the *Graphics editor*.

Here, with the aid of various drawing tools, you can insert extra lettering or draw graphics objects such as circles, rectangles, shapes or curves. All the objects within a chart, and that also includes the tables that are created automatically by Xact, can have their shape, color, frame or text style altered at a later stage. Useful functions such as grids, rulers or copying functions are there to help make your work easier.

Vector graphics and bitmap graphics

Vector and bitmap graphics are two terms that users of graphics programs often encounter. However, they are also terms that create a very indistinct impression for non-programmers. Nevertheless, as their meaning is very important when working with Xact and in exchanging data with other programs, we would like to shed some light on the matter.

Bitmap and vector graphics differ in the way an image is saved, whether it be within the program itself or as a graphics file, and in turn this method of saving gives rise to all the other differences. This can explained most simply by using a line.

Bitmap graphics

In a bitmap graphics program, a line is saved as a row of points, each of which has a certain color – in the simplest case black and white. However, the program is no longer able to distinguish whether this sequence of points is a line or not. To put it another way, this program notices the color of each point within a grid, where for example the grid could be the image dots on a monitor.

Consequently, bitmap graphics is a suitable for an image that consists of complex shapes and a multitude of colors, e.g. digitized photos. The fact that each image dot is saved also means that its color can be changed at any time and this opens up a wide range of special options for subsequent processing. These might include, for example, an eraser, with which all colored pixels in the vicinity of the mouse turn white, or a spray can with which a few random pixels within a certain area can be colored.

Vector graphics

In the simplest case, a vector program saves a line in the form of four numbers, the x and y coordinates of the starting and end points. Added to this, there is generally information on color, thickness and the style of line as well as some identifier to show that the object is a line. However, the program does not know whether a particular point on the screen or the printer is black or white.

Avector graphics image therefore consists of a collection of clearly defined basic geometric objects such as lines, ellipses, curves, formatted text, etc. This has the advantage that we can not only change the color and thickness of our line but we can also edit the coordinates at a later stage.

Afurther advantage is the so-called *independence of resolution*. This means that every output device, whether it be a screen or a laser printer, displays the line between starting and finishing points as accurately as possible.

Vector graphics are therefore particularly useful for displays that consist of geometric shapes, a term which also includes curves (sometimes called paths). This is for example the case with technical drawings, organigrams and graphics for presentations.

A brief outline: Graphics windows

In Xact all graphics objects are managed in one or more **graphics windows**. The entry *New…* in the *File* menu of a window lets you open up a new graphics window. Start Xact

and take a look at a graphics window: it consists of several *menus*, the *toolbar* in the left-hand frame of the window and the *status line* in the lower frame. You will also see a dotted rectangle against the white background of the window. This marks the limits of the print area, which depends on the printer that has been selected *(File* Menu, *Printer preferences...* option). The following is a summary of the basic menu functions:

File:

Here you will find the functions *Open*, *Save*, *Import*, *Export* and *Print*. Under *Document info...* you can edit comments on the current document, and in *Preferences* you can specify the *paths* and the basic operating characteristics of Xact.

Edit:

Here you can access the functions *Undo* and *Restore*, you can *Cut*, *Copy*, *Paste* and *Delete* objects as well as *edit* objects with the special functions of *Clone*, *Multiple cloning* and *Exchange*.

Page:

The options in this menu affect the entire graphics window. *Format...* is where you specify the *size* and *units* of the page. The options from *Full page* to *Custom size...* determine the appearance of the graphics objects on the screen. The remaining help functions assist you in working efficiently.

Arrange:

The entries in this menu refer to the position of the selected objects. The entries between *Foreground* and *Send backward* enable you to change the order in which they are drawn. *Group* joins objects together so as to make one unit, *Ungroup* has the opposite effect. *Align...* and *Position and size...* change the location of objects as do *Rotate* and *Flip*.

Object:

Symbols… gives you access to the symbol libraries, which help you to manage and easily select graphics objects. The entries *Font style…* down to *Marker…* allow you to specify the optical properties of objects. *Convert to curves* and *Connect curves* are functions for changing the way in which selected graphics objects are constructed. *Combine*, *Cut* and *Round objects* let you manipulate existing objects.

The *status bar* shows the current mouse position within the selected coordinate system. *Show grid* and *Outlines only* give you rapid access to the frequently used page-specific functions. *Recalculate automatically* lets you decide whether charts should be recalculated immediately after each change in the chart functions.

The *toolbar* in the **left-hand frame of the graphics window** directs you to frequently used functions, without your having to search in the menus. The function that is active at any point in time is displayed in inverted colors.

The toolbar provides rapid access to the page display (*magnifying glass*), contains functions for creating objects (symbols from *rectangle* to *text*), functions for *shearing* and *rotating* symbols (the two bottom symbols) as well as for *editing* polygons and curves (the second symbol from the top). If none of these functions is active, the *arrow* symbol will be displayed in inverted colors. It indicates that objects may be selected.

Creating objects

You can create a variety of different graphics objects in Xact. The so-called *drawing tools* are there to help you do this. You can drag standard graphics items from one of the *symbol libraries* directly into the graphics window or import them into the window using the *Import…* option in the *File* menu.

When you open a graphics window you will initially find yourself in selection mode, in which you can move and edit objects. The drawing tools are located at the left-hand margin of each graphics window. By clicking on the individual symbols, you determine the type of object that is to be drawn.

- Open a graphics window with the option *New…* in the *File* menu.

- ·Click on the *ellipse* symbol in the *toolbar*. It will be shown in inverted colors to indicate that you can now draw an ellipse. If you keep the mouse button depressed on the ellipse symbol, further symbols will appear for *circle*, *segment* and *arc*, which you can select as alternatives for drawing.

- Now move the mouse pointer to any location within the window. To show that your are in a drawing mode, the mouse pointer appears as a small *cross-hair*.

- ·Now press the left-hand mouse button to mark the upper left-hand corner of the ellipse and, with the button depressed, move the mouse across the screen to create the ellipse.

- ·As soon as you release the button, the ellipse will be drawn in its finished form.
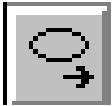
All other objects are produced in basically the same way!
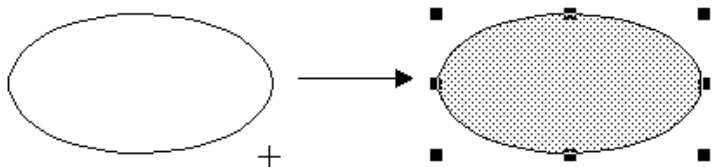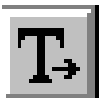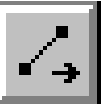
The *rectangle* symbol also offers you a choice of the symbols for drawing a *square*, *rounded rectangle, triangle* and *polygon*.

For the *line* symbol you have a choice of the symbols for drawing *vertical*, *horizontal* and *freehand* lines.

You will notice that eight black rectangles are drawn around each object. These so-called *sizing handles* indicate that the shape and appearance of this object can now be changed. We shall not touch on these for the time being as they will be dealt with later in the section entitled *Selecting and Moving Objects*.

In the next exercise we shall draw an irregular triangle using the *polygon* function. Equilateral triangles are best drawn with the above-mentioned triangle drawing function!

- Activate the polygon symbol.
- Now mark the starting point of the polygon with a brief click
- Now set the next corner points by clicking the mouse on the desired position for the lower left and then for the lower right-hand corner of the figure.
- The finishing point of the polygon is marked by a double click.

While you are drawing, the last corner point you set can be erased again by pressing the backspace key.

Please read the next section on *Creating a Text Object* to find out about the *text tool* and its derivative functions.
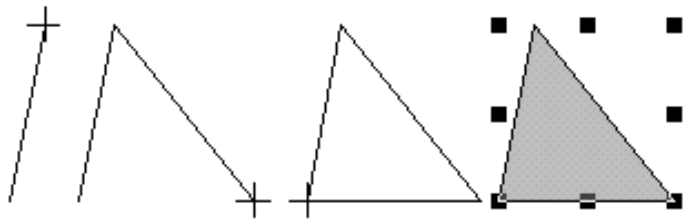
Creating a Text Object

In this section we aim to give you an overview of writing in Xact. The so-called *text object* is available to help you do this. A text object is just as much a graphic element as is for example a rectangle or a line. It is also treated in the same way by the graphics editor – it can be moved, reduced, enlarged or arranged with other items in exactly the same manner as for other graphics items.

Setting the attributes of a text object

Like every other graphics object, a text object has its own specific context menu. You can set the attributes of a text frame with *Line/frame…* and *Fill style…* . Using *Font…,* you can set the font for the entire text within the object. *Edit* opens up the text object and displays a cursor (a double click has the same effect). *Text editor…* provides a convenient way of entering text in a separate window without having to worry about formatting and text angle.

Using *Settings…*, you can determine how the text frame reacts when changes are made, as well as the distance between the frame and the text.

If the text frame *adjusts automatically*, the size of the frame varies according to the quantity of text; otherwise the frame remains fixed. However, it can be changed at any time by pulling one of the **non-diagonal sizing handles** with the mouse.

Pulling the **diagonal sizing handles** with the mouse changes the content of the text object (the text itself) proportionally.

How to create a text object

A text object is created by clicking the adjacent symbol in the left-hand frame of the graphics window. If you keep the mouse button pressed on the symbol for a moment, further symbols will appear with the following functions: with the left-hand symbol

you create a **variable text block**, which adapts to the text typed in. The middle symbol enables you to draw a **fixed text block** – which you can then adjust with the mouse as required, at a later stage. The right-hand symbol lets you specify a **fixed and framed text block**.

In the case of variable text frames, the mouse pointer has the form of a cursor; otherwise it is displayed as a right-angle with a cursor. A mouse click then positions the text object within the graphics window. At the same time a dotted frame shows the current outline of the text object. The cursor flashes within the frame and you can start typing in the text. If you make a mistake, you can used the arrow keys to move the cursor within the text, to insert letters, or delete them using the backspace or Del keys.

The text entry mode is terminated as soon as you click on the page outside of the text object, activate a new tool or select an option from the menu.
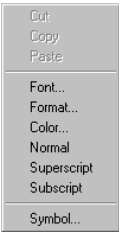
If you click on the right-hand mouse button **while editing**, you can change the text using the adjacent *context* menu. If nothing has been selected within the text object, the changes made with the central group will affect the entire text. However, *Format…* only affects the paragraph in which the cursor is positioned. If you have selected parts of the text with the mouse, the changes will only affect the area selected:

- *Superscript* and *Subscript* raise or lower the text,

- *Normal* restores superscripts and subscripts to normal text,

- *Color* changes the color of the text,

- *Font…* opens the dialog for *Font type and style.* Note here the two switches, **Change font** and **Size**. After you exit the dialog with *OK*, the fonts will be affected according to the position of the switches:
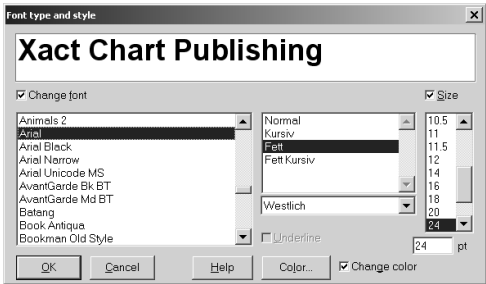
Change font: if this is checked, all the characters of the text concerned will be changed into the font type selected – characters from other font types (e.g.

from the symbol characters sets) will be converted into the selected font type! If this switch is not checked, the font will not change.

***Size*:** if this is checked, the size of all characters in the affected text will be altered to the selected size.

The adjacent figure gives an example of how to change the font attributes via the options in the context menu. If you do not select a section of text with the mouse, the entire text will be auto-matically displayed as selected and changed accordingly.

- **Format**… opens the adjacent *Para-graph format* dialog. In this window you can set the *line spacing*, *inden-tation*, *tabulator stops* and formats such as left or right *alignment*. The settings made here always apply to the paragraph in which the selected text is located.

- **Symbol…** opens the *Symbol selecti-on* dialog. The *Font* field allows you to select a font of your choice so that its character set will be displayed. If you click on a character from the field below, this will be inserted in the text at the cursor position. You can also access *Symbol selection* by simultaneously pressing the **Alt** and **Ins** keys while you are editing the text.
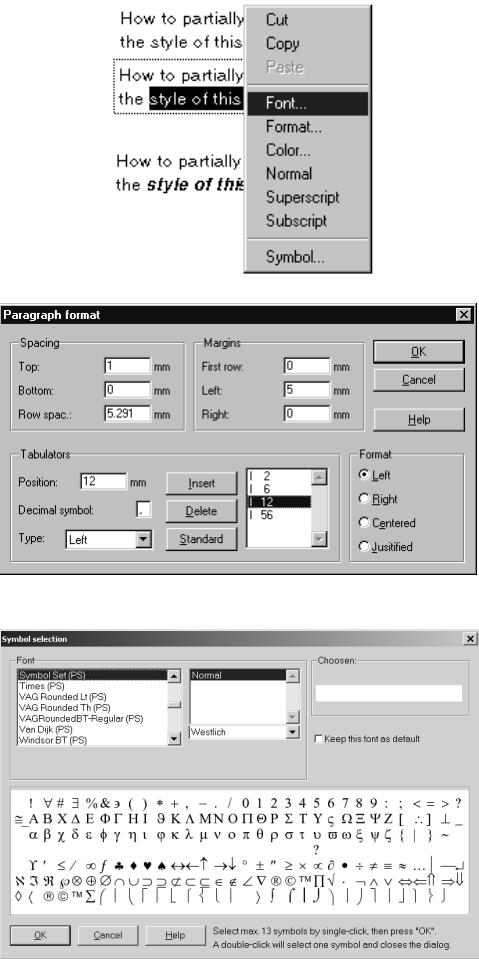
Copying and inserting text

You do not have to type in every text – in many cases the texts will already exist and can be inserted in Xact. If you select *Import…* from the *File* menu, you can select and import texts in RTF and ASCII formats. Xact creates a text object and fills the frame with the imported text. Texts can also be inserted into existing text objects at the cursor position by using the functions *Copy* and *Paste*.

Selecting and Moving Objects

Objects that are already present in Xact have to be *selected* before they can be edited. In the following you will find various methods of selecting objects.

First of all, make sure that you are actually able to select an object. An active (inverted) arrow symbol in the toolbar shows that you are in *selection mode*. Graphics objects can be selected by clicking on a component of the object. The selected objects are then displayed with a selection frame.

Mouse click

The simplest method of selection involves clicking on an object – e.g. an ellipse.
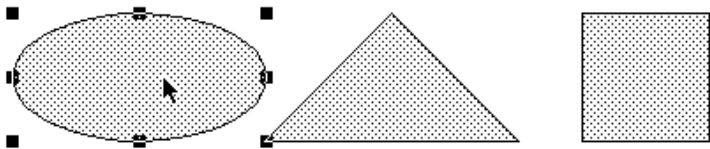
- ·*Please note that objects that are shown without a filling can only be selected by* **clicking on their outline**.
- ·**General rule: objects can only be clicked where they actually *cover* some space.**

Selection mouse pointer The shape of the mouse pointer changes as you move it over objects. If there is no object under the current mouse position, the mouse pointer is shaped like an arrow. However, if there is an object beneath the mouse pointer, it will change:

Therefore you can tell from the shape of the mouse pointer whether it is over an object, and at what position. Incidentally, the mouse pointer also changes

Shapes of the mouse pointer

On the filling   On a line or frame   On a vertex
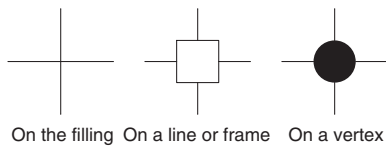
when it is in the immediate vicinity of an object. The distance does not depend upon the zoom factor of the screen. The shape of the mouse pointer when you select objects is of great importance when moving them – we shall discuss this later!

Multiple selection　　　You will often want to select several – or a large number – of objects at once so as to group the objects, or set one attribute for several objects at once, or even move the objects together. Xact offers different methods for selecting **several objects:**

… with Ctrl mouse click Keep the Ctrl key pressed and click consecutively on the objects you want to select. This methods is recommended for a small number of objects – or if one of the other methods has selected too many or too few objects. Ctrl + click on a selected object will deselect it.

... by drawing

a frame　　　　　If the objects are positioned adjacent to each other and are isolated from the others, then they can be jointly selected by drawing a frame. Note that a **frame** started from the **left** only selects the objects that are fully included in the frame. A **frame** started from the **right** selects all the objects it touches.

.

..
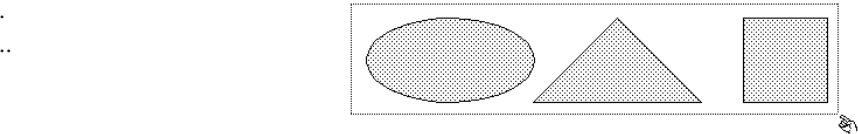
with Search　　　　Sometimes you will want to alter objects of a certain type – perhaps "all lines with a thickness of 0.1 mm" or all markers of a certain type. In the Object menu you can use the *Search* function in the dialog boxes for the *line*, *fill style*, *marker* and *text* attributes to search for and select objects with specific properties. To do this, first select one of these objects with a mouse click and then choose Search in the appropriate dialog.

... with the arrow keys　　Another way of selecting is to use the arrow keys in conjunction with the Control key. The objects in a chart are arranged internally in a list. You can scroll up and down this list from a selected object using Control + Up or Control + Down. (This is also makes it possible to select objects that are

completely hidden.) If you also keep one of the Shift keys
pressed down, all the objects you scroll through remain selec-
ted.

Deselecting objects   A mouse click on a vacant position on the graphics page
deselects all the objects. If such a position cannot be found, you
can either choose Deselect all in the Edit menu or press the
ESC key.

Finding lost/hidden

objects...   You will sometimes find that an object gets "lost" behind
larger objects in the foreground. You can easily check whether
other objects are "hiding" behind another if you activate *Outli-
nes only* in the *control bar* of the graphics window! Completely
covered objects can be accessed in several ways if you know
their approximate position.

in Outline mode   First activate the *Outline mode* in the *lower bar* of the
window. In this mode you can select objects only by their edges
(outlines). In this way you can click 'through' individual ob-
jects.

with Ctrl and arrows   You can also use the Ctrl and arrow keys to select hidden
objects. Select any object in the vicinity of the one you are
looking for. Now you can "flick through" the objects in the
order you have drawn them using "Ctrl + Up" and "Control +
Down" until you have selected the object you want. In both
cases you will only be able to recognize from the selection
frame whether the object you have "found" is the one you are
seeking.

With relative grid   Another method of selecting hidden objects is to push the
objects obscuring them to the side – and this requires both
Magnetic grid and *Relative grid* to be activated. If you have
selected coarse grid spacing, the relative grid will help you to
reposition the upper objects exactly in their original places –
this is because Relative grid accurately maintains the diffe-
rence between the position of the object and the next grid
point. When you have exposed the object you are looking for,
select it and bring it to the front with the Foreground function.

Moving objects

...with the mouse   Everything that is drawn by hand, or that is automatically drawn by Xact, can be moved freely on the screen at a later stage. If *Show grid* is checked (lower window bar), objects can only be moved in intervals of the grid spacing and "snap" into the nearest grid point when you let them go. If you have checked the *Relative grid* option (*Page* menu under *Grid options*), objects will be moved from the starting position according to the preset grid spacing.

- Draw a rectangle
- Click on the rectangle and move the mouse while keeping the left-hand button pressed. To help you, the outline of the rectangle is shown while you are moving it.
- After you have released the key, the rectangle is drawn in its new position.
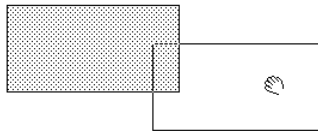
- **If objects are not filled, you have to click on their perimeter to move them!**

...multiple objects   If you intend to move several objects, you have to select them beforehand. Moving one of these objects will then cause all the others to be moved at the same time. To help you do this, you will see the outline of the object you have clicked, together with a frame around all the other objects, while you are moving the objects.

- **If you notice that you have started moving the wrong object, you can abort the process by pressing the ESC key.**

... with Clone   If you press the Shift key during the moving operation, the objects will be cloned and only the clone will be moved!

...with arrow keys   Selected objects can also be moved with the arrow keys. Here every press of the key causes the object to be moved by one pixel. If you keep the Shift key pressed at the same time, the objects will move ten pixels at a time.

...with the capture
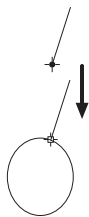
function   We showed you above that the shape of the mouse pointer changes when it moves over another object. If for example you select a line at one of its end points with a mouse click and then move this line to the edge of an ellipse, the mouse pointer will change shape in the immediate vicinity of the ellipse perimeter. It thus shows that there is a line underneath. If you then let the line "go" at this point, the end point of the line fits exactly onto the perimeter of the ellipse: the line "slots" into the outline of the ellipse.

...with a reference point You will find an important tool for moving objects accurately if you keep the *selection arrow* depressed on the *toolbar*. If you click on the *central symbol*, you can set the first reference point on an object. You set the second reference point on another object. Afterwards a dotted line appears, the tip of which points to the second reference point (the target point). Press the *Enter* key : the first reference point (and with it the object) is moved exactly onto the second reference point.

...return key
pressed...
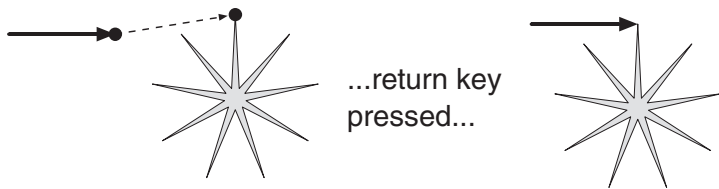
    You can **control the position of the reference points** in the *context menu* for reference points. The context menus have various, different options – depending on the starting and end points and the type of object. Here is an example:
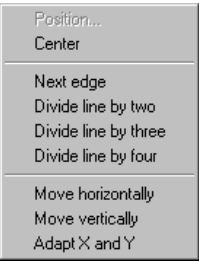
- *Center* places the point in the middle of the object

- *Next edge* places the point on the nearest node of the object

- *Divide line by two, three, four* places the point precisely on the selected divisor for the line on which the point is currently located. This makes it easy to divide line segments without any calculating.

- *Move horizontally or vertically* causes the point to be aligned accordingly and executes the move

- *Adapt X and Y* has the same effect as the Enter key and executes the move
- *Position…* enables you to set the *target point* numerically. When dealing with complex graphics it is particularly useful to be able to indicate the target point. For example, the origin of a chart can be set quickly and accurately to a defined position!

Before:

Moving objects using the reference points eases many tasks:

After:

Moving objects using the reference points eases many tasks:

In the example **Before: After:** the starting point was set at the end of an arrow, the target point was set to approx. ¼ of the lower edge of the rectangle and *Divide line by four* was selected from the context menu. The target point thus jumps to the nearest ¼ point on the perimeter, executes the move. Repeating this twice resulted in the precisely positioned arrows seen in **After:**

Objects and Groups

In Xact you can draw graphics objects as *vector objects* or have them created automatically. Xact also manages *bitmap objects*, in which you can change the size and color resolution. All objects have their own *context menu* with frequently used functions. If the object is part of a chart, a chart context menu is opened. Here we shall discuss the context menus of graphics objects.

Context menus for graphics objects

A context menu appears when you click the right-hand mouse button over a graphics object. It consists of up to four groups:

In the **upper group** you will find functions to *Copy*, *Cut*, and *Delete*. This group is always available and affects all the objects selected.

The **second group** offers attribute settings such as *font, fill and line style*. These functions also affect all the selected objects.

The **third group** is intended for functions that refer especially to the object that has been clicked, such as *Edit* for example.

At the end of the context menu you will find the grouping functions, provided you have selected several objects, and the option *Position*, which, in essence, corresponds to the Arrange option in the menu bar of the graphics window. The function *Properties* is an exception. Please refer to the Online Help for further information

- **Incidentally, a right-hand mouse click brings you back to the selection mode in most cases. It is only when editing objects that this is not possible, since this mode generally uses its own context menus.**
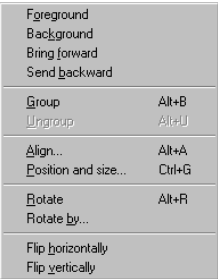
Properties of objects

You will find the option *Properties...* in the context menu of a selected object (and a group of objects too) under *Position->*. Using a vector object, we now want to show you the dialog that enables you to adjust the following properties:
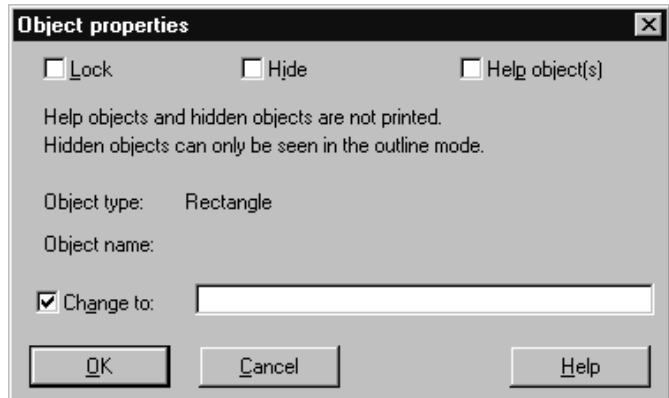
|			
Locking		Locked objects are protected against changes of any kind. They are identified by transparent sizing handles at the top left and bottom right. If you have specified in the Page menu that locked objects are not to be shown, you will see a frame containing a cross instead of the locked object.
Hiding		Hidden objects are not printed and can only be seen in the outline mode. This also means that you can only cancel this attribute in outline mode.
Help object(s)		They help to align other objects, and are only displayed as dotted outlines and are not printed.
Object name		Every object can be assigned a name here. The purpose of this name is to identify the object in connection with the programming interface.

Combining groups – objects

Your charts will often consist of very many objects. Working with such charts would be very tedious if there were no way of combining several objects into a group.

- Draw an ellipse, a polygon and a rectangle.
- Select all three objects and select the function *Group* in the *context menu* or in the Arrange menu.
- The selection frame now encloses all three objects.
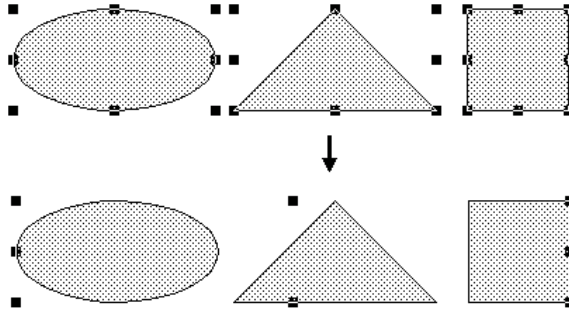
In principle this group may be regarded as one object. This means that all changes in shape, position and appearance (apart from changes with the pipette) will always affect all the objects of this group. It also means that several groups may in turn be combined, with there being no restriction on the depth of nesting.

- **When a chart is saved, the grouping information is saved too. You should therefore not shy away from making frequent use of this function.**

A group can of course also be dismantled back into its constituent parts.

- Select the group by clicking on one of the objects and choosing the function Ungroup in the context menu or in the Arrange menu.
- Each individual object will now have its own selection frame again.

internal and free groups Xact distinguishes between internal and free groups. **Internal groups** are formed automatically when calculating charts; you can call up diagram functions such as axis scaling in the context menu. You may choose to separate groups and work with the individual objects as if you had drawn them by hand. However, the chart can no longer be resized afterwards. **Free groups** are those you create yourself.

The drawing sequence is not changed when the objects are grouped. For example, you first draw a rectangle, then an ellipse on top of it and another rectangle on top of that. After you have combined the two rectangles to form one group, the ellipse still covers the rectangle that was drawn first.

- **Tip: if you want to alter an object in a group, first separate the group, deselect the object in question and recombine the group. After the change, you carry out the same procedure as before except that this time you add the object to those selected with *Control + mouse click*. In this way you can avoid the trouble of having to completely rebuild the group.**

Changing Objects

Selected objects can be changed in Xact in a variety of ways – both in terms of their optical properties and their size and shape. Let us start with the optical changes:

Changing optical properties

Most object types have several, independently adjustable properties. On a rectangle, for instance, you can not only adjust the color and type of filling, but also the color and thickness of the edge. However, some object types (e.g. bitmap graphics) have their own properties dialog.

You can find the properties common to most objects in the *Attributes* dialogs. You can access these:

- via the *Object* menu
- via the *context menu* for the object (press the right-hand mouse button)

It does not matter which method you use to call up the attribute dialogs, although the context menus are often more convenient as they allow you to alter the properties "*on the spot*" as it were – without having to move the mouse pointer all the way to the menu.

If you have selected **just one object**, the attribute settings relating to this object will be shown in all the dialogs. If, for example, you have selected a rectangle with a line thickness of 0.3 mm for the frame, this figure will also be shown in the dialog for setting the line attributes. If **several objects** have been selected, the dialog shows the properties for the object positioned furthest in the background.

The values you set in the dialog then apply to all the objects selected when you call it up.

If no object has been selected while you call up the attribute dialog, the values for newly created graphics objects will apply.

Changing line properties

You will presumably change these properties very frequently. We will therefore use a rectangle as an example in the following paragraph to show you some of the available options. Remember though that the rectangle must be selected before it can be changed.

- Draw a rectangle.
- Now open the context menu with the right-hand mouse button and select the option *Line/Frame...* . You can select the line styles in this dialog and/or adjust the thickness and color of the line.
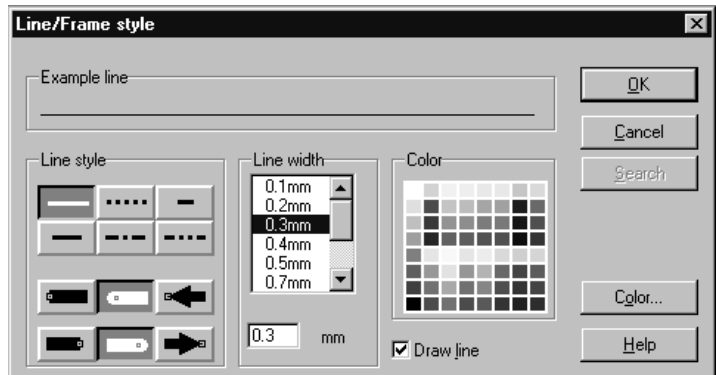
- Now select a line thickness of 2 mm and confirm with OK.
- The rectangle will now be redrawn with the newly selected line style.
- Select *Fill style...* in the context menu, check the covering switch and set a different Color for the rectangle. If you wish, you can also set a precise number for the color: to do this, click on *Setup...* and select the color of your choice from the dialog that opens. Leave the dialog with OK or by double clicking on the desired color.
- The rectangle will now be redrawn with the newly selected color.
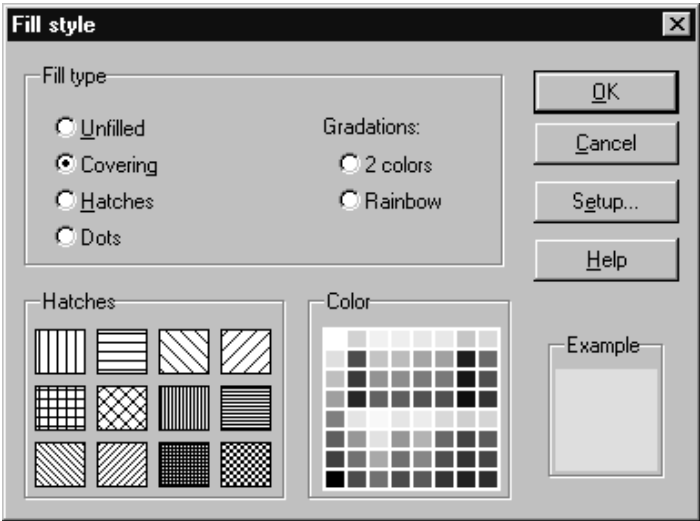
- Under *Fill type* you can also select *Unfilled*, *Gradation*, *Hatches* or *Dots*. The dialog that appears after *Setup…* also varies according to the type of filling.
- The color and style of the object frame are adjusted in the *Line/frame…* dialog. In this way, for example, you can create a green/red checked filling at 45 degrees with two different line styles and 4 mm spacing, framed by a 2 mm thick, blue dotted line.

Gradations and shading

Xact offers you various vectorial hatches and color gradations as fill styles. You can choose between the different fill types in the *Fill style* dialog.

Under *Fill style* you can choose from *Unfilled*, *Covering*, *Hatches* and *Gradations*. The S*etup…* button you will take you

to different setup dialogs according to which switch you check. In the figure you can see the dialog for *Hatches*. Here you can compose hatches and freely define their Angles, Line styles, Spacing and Background.
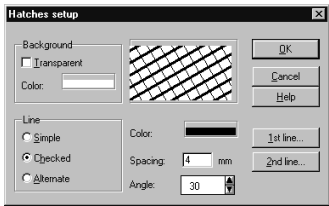
If you select a *Gradation* as the fill type, *Setup…* will take you to the *Color Gradation* dialog. Here you can select the starting color under *From* and the final color with *To*, the *Angle* and the *Method.*
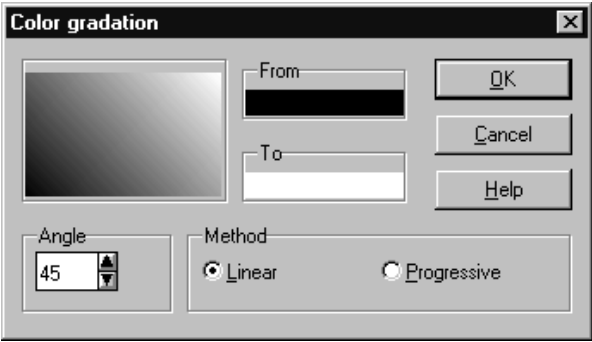
Marker types and sizes

Markers for indicating the nodes in line graphs are used as independent graphics objects by Xact. Firstly this has the advantage that the markers always retain their proportions, regardless of whether the entire chart is stretched or compressed; secondly a circular marker, for example, can be easily transformed into a triangular marker. The only difference between it and the other object types is that there is no drawing tool for markers.

You will only rarely have to call up the Marker settings in the *Object* menu because these are usually accessed via the context menu for a graph. You will only need to use this dialog when a chart can no longer be resized.
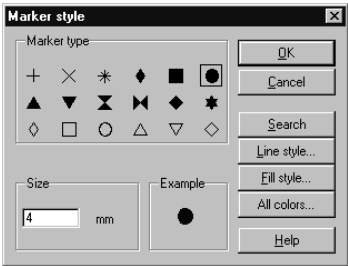
- Open a table, select the *Chart* menu, then the *Line…* option and then the type *Scatter* before leaving the dialog with OK.
- In the *context men*u of a graph select the entry *Marker …*. Select a round marker and enter a 2 after *Size*, assuming you are currently using millimeters as a measuring unit. After you have clicked on OK, the markers in the chart will be changed accordingly.

The pipette tool

This tool enables you to transfer all the optical properties of an object to another in one operation. Select the empty pipette symbol in the toolbar (or press the e key) and click on an object with the mouse. The pipette is now filled with all the optical properties of this object. Optical properties are transferred within **charts** according to the chart group, and even axis styles can be pipetted and transferred.

If you click on an item within a group when the pipette is full, only the item in question will be changed, provided it is not an automatically created component of a chart. Once a pipette has been filled, it remains so until emptied and can be used repeatedly. Filled pipettes retain their contents even when you change from one graphics window to another.

If you open the context menu of the filled pipette on an item, you can select the property you want to transfer and if necessary empty the pipette.

If you click and hold the mouse pointer a little longer on the *pipette tool*, you can use the filled pipette shown on the far left – it contains all the properties last pipetted. (You can achieve the same result with the f key). The other symbols have the same function as the options shown in the context menu for the pipette.

Changing shape attributes

In this section you will learn how to alter the shape attributes of objects. The term used for this in Xact is **editing.**

Transforming objects with straight segments into curves

Many objects contain straight segments, e.g. polygons, rectangles, squares, stars or lines. The straight segments can be changed into curves using the function *Round objects* (*Object* menu). In this process, continuous transitions between the individual curve segments are generated so that after rounding, a square will look like a circle. The objects are thus
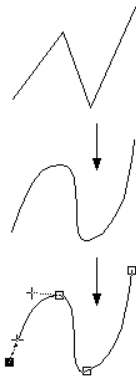
changed into polygons, i.e. they change their object type and can then be edited like other polygons. **This function has no effect on text objects!**

Editing objects

The various objects each have their own special editing functions. You can access these for a selected object by

- selecting *Edit* in the *context menu* or
- *double-clicking* on the object.

If you click on the *curve editing* symbol in the *toolbar,* you can then select the object you wish to edit – if in fact it can be edited.

Some object types have an additional *Settings…* entry in the *context menu*. Rectangles and squares have no editing function.

Now try the following example:

- Draw a **polygon**
- Select *Edit* in the context menu
- Every vertex will now be marked by a button.
- Click on a button and move the mouse while keeping the left-hand button pressed.
- After you have released the key, the vertex will be drawn under the button at its new position.
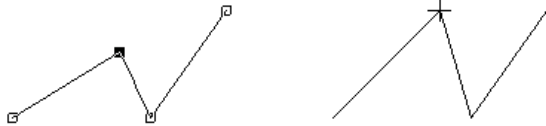
- You can **move vertices** either with the *mouse* or the *arrow keys* (pressing the *Shift* key at the same time will increase the step width).

- You can also move several vertices at once in the curve editing mode of a polygon. To do this, select the points one after another with the Control key pressed, or draw a selection frame around the points you want. If you then move
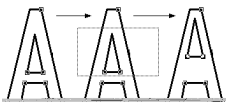
one of the vertices selected while keeping the mouse key pressed, all the points selected will follow the mouse movement.

You will find important functions for editing individual vertices in the context menu for each point of the curve.

Insert edge
Delete edge

To line
To curve

Cut
Join
Close

Edge on/off
Position and size...

- *Insert edge* adds a new point midway between the point selected and the following point, *Delete edge* removes the point selected.

- *To line* changes the segment following the point into a line, *To curve* changes the segment following the point into a curve. For a curved segment you will see **additional alignment points** at the vertices. You can use these to **alter the shape** of the curve.

- *Cut* changes the line following the vertex into an invisible line, *Join* has the reverse effect. In this way you can display hollow shapes with a single object, e.g. a filled "A" or "O".

- *Close* links the vertex to the next point on the polygon.

- *Edge on/off* eaffects the two segments adjacent to the vertex if at least one of them is a curve. If Edge is *on*, there will be a smooth (continuous) transition between the two segments and adjacent alignment points will be moved together. Otherwise, there are no restrictions to the movement of the alignment points.

Enlarging and reducing

You have no doubt been asking yourself why Xact marks selected objects with eight buttons. The reason is that these buttons or handles are not only used for identification purposes but are also used for **enlarging and reducing** objects.

- Draw an ellipse
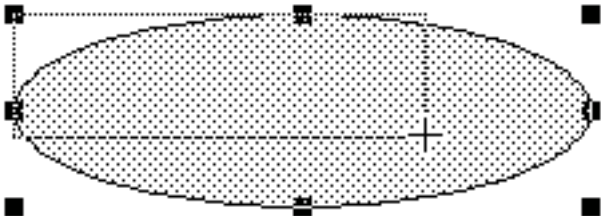
- Select the ellipse. Click on the *lower right-hand handle* and move the mouse upwards to the left.
- After this method has been used to reduce the ellipse proportionally in width and height, move the *lower central handle* downwards.
- The **height** of the ellipse is changed.
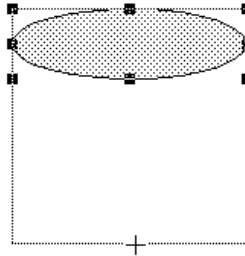
- When **charts** are changed in this manner, the **lengths of the axes** in the chart alter.
- When **text objects** are changed in this way the **height and breadth** of the **corresponding text frame** changes.

Proportional?   In general the **corner handles** change the size of the object **proportionally** . If you press the *Shift* key while you are changing the size, the size of the object can be altered at will. The **central handles** are used for changing either the height or the width.

- If **charts** are changed proportionally, both the **lengths of the axes** and the **font sizes** used will be altered.
- When **text objects** are changed in this way, the **height and breadth** of the **corresponding text frame** change, as do the **font sizes** used.

With the keyboard   Resizing with the mouse is often too inaccurate. In such cases it can help to enter position and size numerically in the unit of measurement selected. To do this, select the function *Position and size...* under *Position->* in the object's context menu.

Multiple objects   If you are going to enlarge the entire chart or parts of it, you first have to combine them into one group as it is not only the dimensions of the individual objects that can change but also their position.·

- **Pressing the ESC key when enlarging will cancel the operation in exactly the same way as for moving objects.**

Rotating and distorting objects
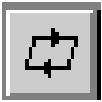
The *warp tool* in the *tool bar* is used for **distorting** objects and can thus be used for giving the impression of perspective. When you select an object after selecting the warp symbol, the sizing handles are shown as hollow rectangles. You can change the position of the handles with the mouse or the arrow keys and thus distort objects as required.

The *rotation tool* in the *toolbar* is used for **rotating** objects manually. When you select an object after activating the rotation symbol, you will only see four sizing handles and crosshairs within a circle to show the center of rotation. You can move the sizing handles with the mouse and thus rotate the object around its center point. You can also move the center of rotation with the mouse (or arrow keys).

In the *Arrange* menu the option *Rotate by…* allows you to specify the *Rotation point* and the *Steps* for the rotation angle under *Rotate manually*. **These settings apply when using the rotation tool!**

Locking objects – better safe than sorry

When a chart starts to get very complicated, you may soon find that the wrong objects are changed. To prevent this happening, you can **lock** individual objects or groups (but not, however, automatically generated chart objects). Locked objects cannot be changed. You can recognize locked objects by the fact that they only have two transparent sizing handles!

Under *Position->* in the context menu of a selected object you will find the option *Properties...* . Here you can protect an object against any changes with the function *Lock*. You can find more on *Properties...* in the section on *Object types*.

You can also decide in the *Page* menu whether **locked objects** are to be **displayed** or not. Locked objects or groups of objects will then be shown as a **frame containing a cross**. This function speeds up the display, in a similar manner to the outline mode and saves considerable time, particularly when you are carrying out detailed work at various zoom settings.

Arranging Objects

In practice you will want to create an attractive layout with the objects in graphics and charts. You will find the functions available in Xact for arranging objects of great assistance in this task.

Foreground or background

When working, you will notice that the last objects you draw cover those drawn earlier. You can alter this sequence of drawings provided you are not dealing with chart objects. To do this, open the *context menu* of a selected object. There, under *Position->*, you will find four functions for changing the order of the drawings (these can also be accessed via the *Arrange* menu):

- *Foreground* and *Background* bring an object to the very first or last place in the order of drawings.
- *Bring forward* and *Send backward* take an object one place forwards or backwards in the order of drawings.
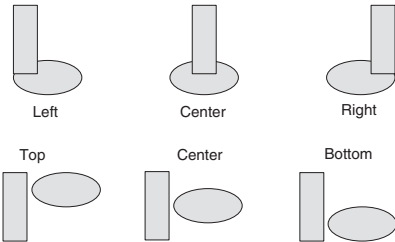
Positioning

You are no doubt familiar with the options available for arranging and aligning text from experience with word-processing. A comparable function – except that it relates to graphics items – can be found under *Align…* in the context menu of objects (or in *Arrange* in the main menu). Here you can specify
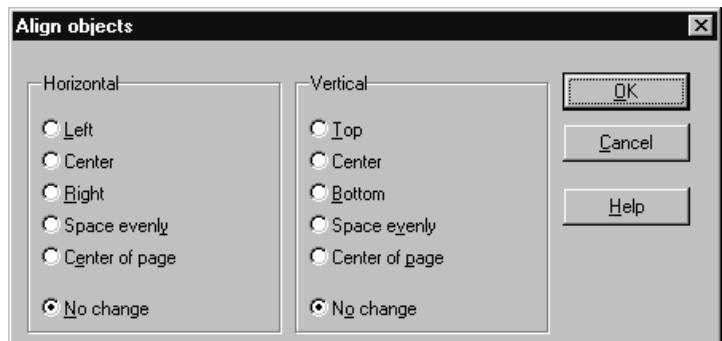
the position of selected objects or groups relative to one another. The following passage deals with the *Align* dialog and later on you will find some examples of different ways of aligning. The functions *Space evenly* horizontally and vertically refer to the centers of the objects, whereas *Center of page* horizontally and vertically refer to the middle of the page.

When creating the figure below, we used the function Lock (in the context menu under Position/Properties… to prevent movement of the objects with which the others were to be aligned.


Further positioning aids

In complex charts the aligning function shown above will often not be enough. In many cases it is more convenient to use the functions shown in the *Moving objects* section in order to *lock* objects or make *help objects* out of them. Help objects are shown on the screen and are saved but not printed. You will find the latter two functions under *Position->* and then *Properties* in the context menu for the objects. Read the section on *Object types* to find out more.

Only in Xact Pro...

A range of special functions are included in the Xact Pro version:

CMYK - color space

You can select the CMYK - color space in the **File** menu under *Preferences/Graphics editor/Color space...* . Imported vector graphics will then be automatically converted into the CMYK color model, but not, however, bitmap graphics!
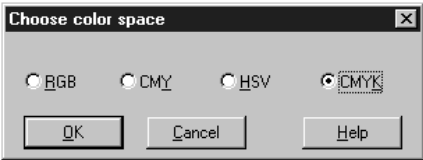
Copying XGF files...

If you often have to use Xact graphics files with charts on different computers or want to copy or move them to other directories, you will find the function Copy files. in the File menu of great use. It copies or moves Xact graphics files together with their accompanying linked tables, and at the same time changes the paths in the links for the chart. Therefore when copying, you do not need to know which tables are linked to which charts. To monitor this, a logfile is written in the accompanying dialog Copy XGF files with linked tables.

The Select Graphics files button in this dialog calls up the easy-to-use selection box for graphic files described in the section entitled Reusing and Automating Documents. Xact Pro enables you to save the data selected in lists and reuse them for repeated copying, printing or export actions whenever you need them.

Import filter for SHP files
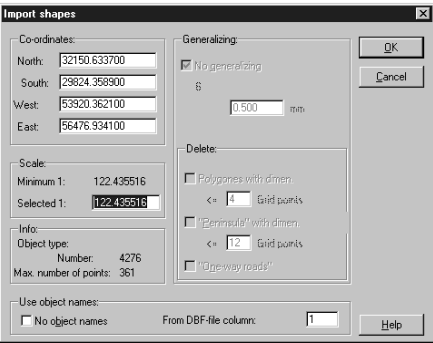
This import filter allows you to read in and process map material that has been stored in the SHP format from the ESRI company. To do this, select Shape File Format as the File type under Import. .

If present, the accompanying object names, which are usually stored together with the Shape Files, will also be read in and allocated. This function is used especially in combination with the Change object styles option in the Chart menu.

Example: Chart Type "Change Object Styles"

This chart type changes the optical properties (fill color or shading density, color or thickness of lines) of vector graphics objects according to numbers. Here the entire contents of an Xact graphics window are imported into any other Xact window. Graphics objects with names will not be changed optically unless the names are also in the corresponding Xact table. All other graphics objects will be copied at the same time without any changes.

Using the import function (*File* menu) or the clipboard, you can copy foreign graphics objects, for example maps, into an Xact window and name them. The import function is also able to read so-called shape files (*.SHP).

Let us demonstrate this procedure using a simple example – a map. The graphics file used GERMAP.XGF and the accompanying table GERMAP.XTF can be found in the directories that are created during the installation procedure: GRAPHICS and TABLES.

Step 1: Naming graphics objects

The graphics objects to be changed first have to be given names. This requires opening the *context menu* by clicking the right-hand mouse button on an object. Here you select the entry for the object properties dialog under the *Position->* option. In this dialog you can give the object a name in the field after *Change to*.

You can also give **several objects the same name** – these will then be treated in the same way in the chart. Similarly, you can give **groups of objects a name** – all objects belonging to the group will then be treated in the same way within the chart.

Step 2: Writing names and figures in tables

The names of the objects have to be entered in column 0 (Legend) of an Xact table from row 1. Every row that is named in this way can then have a numerical value in an adjacent column. If no value has been entered, the object will not be changed. The appearance of the object will be changed at a later stage regardless of this value. The column with the numerical values has to be defined as type L Y1.
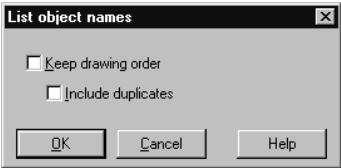
The simplest way is to let the objects be named automatically. To do this, select the option *List object names* in the *Object* menu. You will obtain a table which lists the names of all the objects found in column 0. This list is arranged in alphabetical order and does not contain any duplicates, even if several objects in the graphics file have the same name. For other purposes you can switch off both the *Keep drawing order* and *Include duplicates* function.

We have had the names, as described previously, printed to the table in the adjacent figure from a graphics file GERMAP.XGF (in the GRAPHICS directory). You will find the table with the names, GERMAP.XTF, in the TABLES directory. It con-

tains the current boundaries of the German Federal states. We have then allocated figures randomly to each state.

In the next step we selected the option *Change object styles...* in the *Chart* menu. This opens up the *Change object style* dialog shown below:

Selecting a file with named objects...

After clicking on this field, select the graphics file which contains the objects with names matching the table. In this case the file GERMAP.XGF is selected. Afterwards further settings can be selected in the dialog:
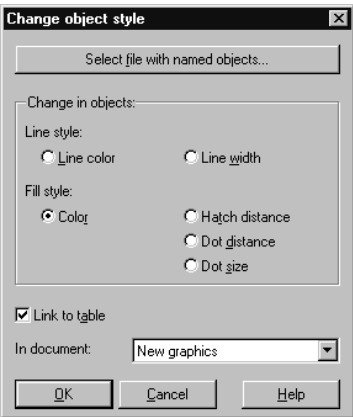

- ● ***Change in objects:*** *Line styles:* Depending on the numerical values in column L Y1 of the table, you can change the *Line width* or *Line color* of objects. *Fill styles:* You can change the *Fill colors*, *Hatch distances* or characteristics of the *Dot* matrix in objects according to the numerical values in column L Y1 of the table.

We have chosen the setting *Change fill styles*. After we have entered OK, our map chart appears in the document selected, New graphics. As we had selected a dull gray in Preferences/Fills, Xact has also proposed that the areas should be shaded gray.

The objects are retained in the chart, with their names. In contrast to other chart types, you cannot therefore call up the graph options via the context menu of the shaded graphics objects. Instead, select the *Chart options...* entry from the *Chart* menu or the *Graph options...* entry in the context menu of a *legend object*.

Changes to these options made in this way always affect all the listed object-names for the chart. We would now like to familiarize you
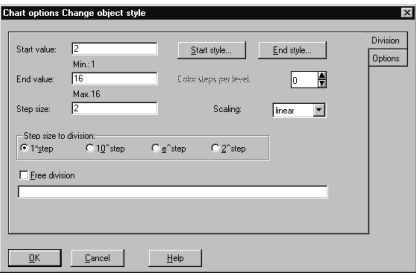
with some additional settings on this 'raw chart'. To do this, click the right-hand mouse button on a legend object to open the *context menu* for the chart. Select Graph options... , and the adjacent dialog will appear. It consists of two pages, here only the first page, Division, is shown.

The settings that can be made are the numerical limits for the chart, including the *Step size* and the *Scaling* (linear or logarithmic). The divisions of the accompanying legend also vary according to these settings. Under *Start style...* you can set the color that is allocated to the lowest numerical value- the starting value, and under *End style...* the style allocated to the final value. The intermediate styles (here: colors) are generated automatically by Xact.

On the second page *Options:* you can specify whether the style of the objects is

to be grouped in classes (the class width is determined by the preset step width). In this way all objects with numerical values between two steps receive the same style, hence in this case the same color. If *Style setup as gradation* is checked, all objects with numbers between the starting and finishing values will automatically be given a corresponding intermediate style. If this switch is not checked, any style can be used for each step of the legend. This allows you to choose any color you like to highlight a particular step.

The style would then be set in the *context menu* of the corresponding *legend object* via the *Fill style...* option. That is precisely what we have done for the fol-

lowing chart – in step "6" under *Fill style…* we have selected *checked hatching* with a *45° angle.*

In the *Chart* menu, under *Caption…,* we selected *At object center* under *Placement* and under *Font* we checked *Font color automatically.*

OK causes all the object names to be written in the center of the respective objects. As in some positions the white text overlapped the edge of the objects and could therefore not be seen properly, we ungrouped the frame group in the context menu of a descriptive object and shifted the lettering into place.

The completed chart is linked with the accompanying table. Hence any changes in the values will result in corresponding style changes for the map objects.

Showing a further dimension…

In order to display a further numerical dimension within the same map, several maps could be superimposed on one another, for example by allocating a numerical value to the thickness of the outline. However, this depends on your not yet having moved the first chart.

Here is an example of this technique: you want to have two different numerical features displayed on a map. Basically this involves creating two different charts, which are exactly superimposed. The lower chart, for example and as shown previously, is given a covering fill color and the upper chart transparent hatching. **Here it is important the objects in the two charts have different names.** For instance, if an object in the lower chart is called "Bavaria" and is displayed as a covering color, the upper shaded object must not be called "Bavaria" as well. Objects with the same name are treated in the same way and when the shaded object is created, the filled object that was already present would also be shown as shaded. For this purpose you therefore have to use two different graphics files with identical objects but different names, e.g. "BavariaF" and "BavariaS". Naturally the accompanying tables also have to have different names.

Further ideas

There is a great variety of applications for this type of chart because, in principle, every graphics object can be changed. By far the most familiar application is the **shading or coloring of maps**, i.e. polygonal objects.

Each of these object style charts can be used as the background for other conventional charts, such as pie charts, bar charts and the like. To do this, when you select from the Chart menu, simply click on a window with the object style chart for *In document*, and then push the chart to the desired position.

Similarly it is also possible to change the thickness or color of lines. Another example might be providing a clear presentation of quantities and sites of substances moving within a system, such as a group of companies or an ecological system. Here, for example arrows could be drawn at the various sites with their direction indicating input or withdrawal, their color the category, and their thickness the quantity. This would require drawing and naming colored arrows. In the accompanying list of names (see oben) the quantities would then be entered as numbers.

You have probably already realized that this type of chart offers quite **extraordinary opportunities** for **presenting complex relationships**. Incidentally, there is nothing to prevent you using Xact to place further charts on these objects.

	Wall St.
	Madison Ave.
	52nd St.

No. 1   No. 2   No. 3   No. 4

Legend
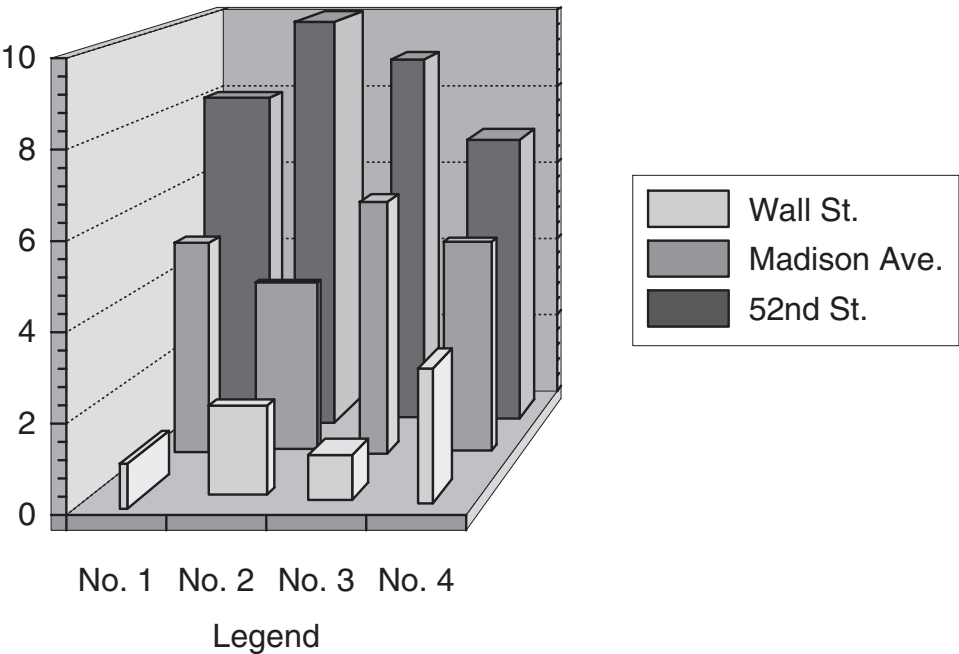
City Block Charts

In some cases extremely complicated relationships can only be made comprehensible for the reader by using a graphic representation. Frequently the data are divided into different charts because there is no suitable form for presenting all the data together. With this type of chart you can display up to 5 different grades of characteristic on any number of objects. The underlying metaphor will be easily understood by most people.

Each object is represented by a "**block of houses**" in an imaginary town. The position of the block is determined by its "**street**" and "**house number**". Every block has a specific and comparable "appearance" because its shape is

determined by the **height**, **depth** and **width**. How is a chart like this created? We have prepared a sample table for you with the name CITYBLOC.XTF in the GRAPHICS directory. In analogy to what was said above, it contains appropria-

		L	Y 1	B	DevX 1	L	Z 1	L	Y 2	B	DevX 2	L	Z 2	L	Y 3	B	DevX 3	L
	0	1		2		3		4		5		6		7		8		9
0	Legend	Wall St.		Width		Depth		Madison Ave.	Width			Depth		52nd St.		Breite		Tiefe
1	No. 1	1		.1		1		5		.5		.3		8		1		
2	No. 2	2		.8		.2		4		.9		.1		10		.6		
3	No. 3	1		.6		.5		6		.4		.4		9		.5		
4	No. 4	3		.2		.7		5		.7		.2		7		.8		

te column names and four "house numbers". The columns have already been suitably defined by clicks in the *Types* line. Under *Bars...* in the *Chart* menu we then selected the type *City-Block*.

 The results we obtained are displayed below. We shall now show you how to proceed from this chart to the display at the beginning of this section:
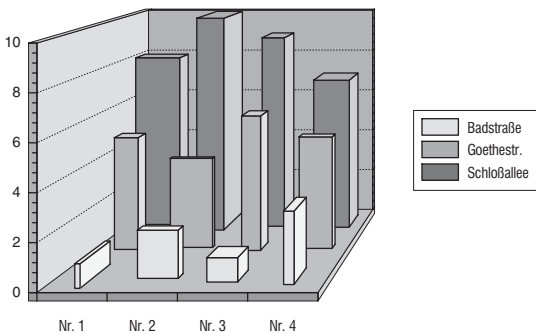
In the context menu of the "Wall Street" graph we selected *Caption*, and *Above the object* for *Placement* and set the *Spacing* to 4mm. Under *Font* in *Fill style...* we checked *covering* as the *Fill type* and selected white as the *Color*.

We then set the *Fill styles...* to suitable gray values in the *context menus* of the graphs, the *base* and the *rear wall*.

In the *context menu* for the chart we chose *Just text* as the *type* under *Legend...* , for *Frame* we checked *None* and under *Font style...* we set the *Size* to 14 pt. After clicking on *OK* in the dialog, we ungrouped the *frame group* for the legend in the *context menu* of the *Legend* and moved the lettering to appropriate positions with the mouse.

After this, we went to the *context menu* of the "Madison Avenue" graph and under *Graph options...* we checked *Horizontally* for *Grid lines:* and *Use for all identical graphs.*

We then changed the presentation mode of the vertical axis. To do this, we opened the *Axis setup...* dialog in the *context menu* for this axis and unchecked *Mirror axis* and *In front* on the *Scaling* page. On the *Ticks* page we set the *Style...* for *Grid lines* to continuous.

Finally, we wanted to demonstrate the options for changing the spatial arrangement of the chart. To achieve this effect, we selected *3D-presentation...* in the *context menu* of the chart and entered the settings for *Rotation*, *Vanishing point* and *Light source* shown in the figure.

To *Export* the chart *(File* menu) as an *EPS with preview* we checked *Embed fonts* (you can never be sure that the print setter will have the fonts to hand...). In the DTP software we loaded the image into a frame – and that is how it reached you.
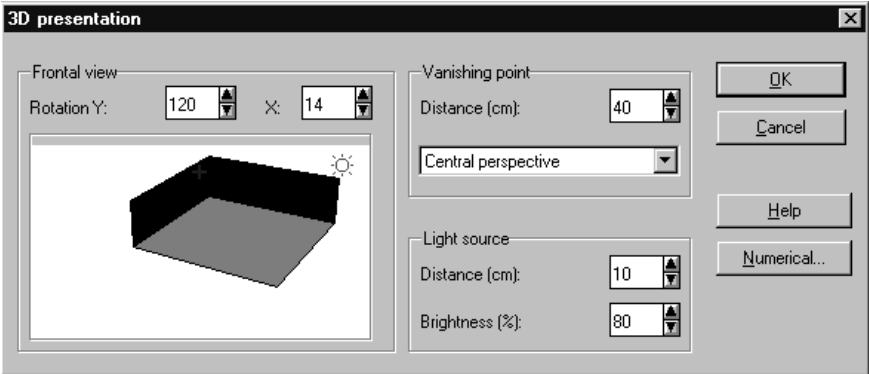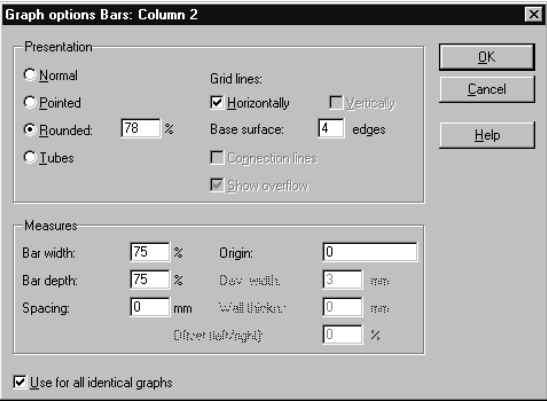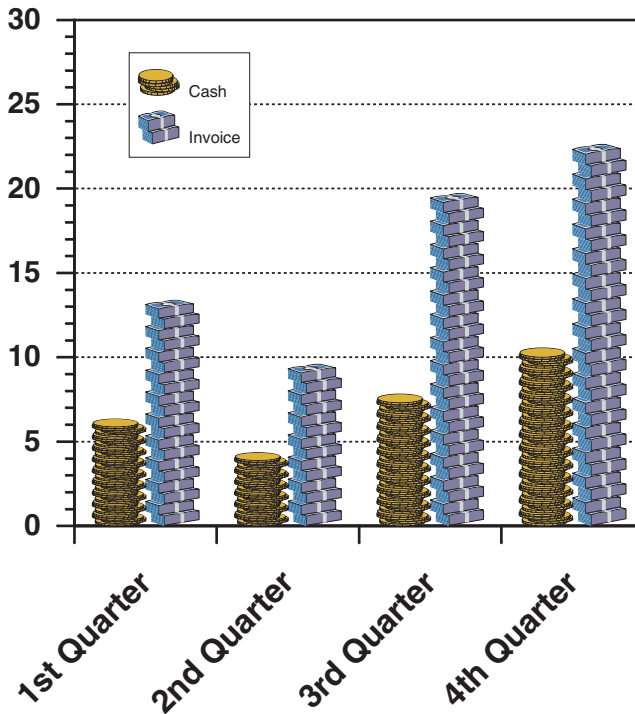
A Simple Object Chart

In this exercise we want to show you how to create a highly informative and appealing chart. We want to depict the quarterly turnover figures for a service provider, divided into cash turnover (till receipts) and invoices.

We shall use an object chart for this in which stacks of coins will represent the cash receipts, and wads of banknotes the invoiced receipts. A bar chart will form the basis for this object chart. The bars can then be replaced later by the required symbols. At this stage you can decide whether the height and/or width of the symbols should be adjusted or whether they should be stacked instead. In this case we are going to try stacking.

Generally you can either fit symbols into the background of a 2D chart or replace the markers of a line graph with symbols.
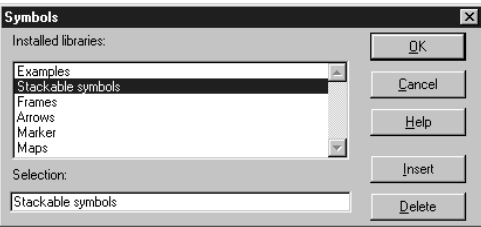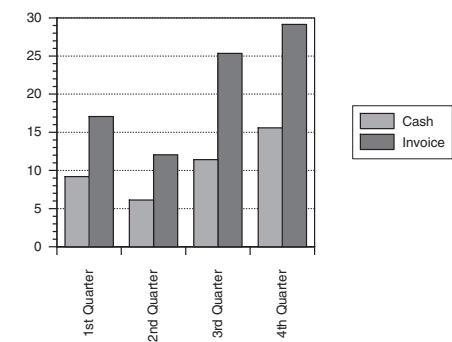
First open the table file MONEY.XTF from the GRAPHICS directory. Do this by selecting *Open table...* from the *File* menu and then choosing the file you want from the list.

To create a bar chart from the file you have loaded, select the *Bars...* option from the *Chart* menu. Click on the chart type *Rows 2D* and exit the dialog with *OK*. The adjacent chart serves as the basis for the object chart.

The next step is to replace the bars by symbols. The symbols that we want to use, a coin and a wad of banknotes, are already present in the symbol library supplied. Please open the list of installed symbol libraries in the *Object* menu under the *Symbols...* option. Now choose *Stackable symbols* and exit the dialog with *OK*.

Select the banknote symbol from the window with the mouse and, keeping the left-hand button pressed, drag it onto the legend for *Invoice* . As an orientation aid, Xact places a frame around the chart group on which the mouse is currently located. As soon as you let go of the mouse button, Xact will recalculate the chart.

After recalculation the chart will in fact contain the wads of notes selected, but they are much too large and look strangely distorted. The reason for this is that Xact assumes you want to *fit* the symbol yourself. However, the coin and banknote symbols are better suited to vertical stacking.

To switch to *Stacking*, move the mouse onto the wad of notes in the legend and open the context menu by pressing the right-hand mouse button. Selecting the

Symbol option opens up the corresponding dialog. Check the option *Stack vertically* and enter 76 % for *Offset* as the wads should overlap a little.

This offset, which is intended for 3D symbols, depends on the shape of the symbol. The offset causes an optical illusion which only works for symbols drawn with perspective. For two-dimensional symbols it is therefore better to have an offset of 0%. OK in the dialog will give you the desired piles of banknotes.

We notice the frame around the wads still exists, as we hah framed bars in the beginning. Open the *context menu* for the *wads graph*, select *Line/Frame...* and *All Graphs* and uncheck *Draw line* in the dialog.

Now insert the coins from the symbol library into the second row of data, with an offset of 65%. For the crowning glory, open the *Axis setup* for the X axis and uncheck the *Angle automatically* box on the *Labels* page and set the *Angle* to 45 degrees. You will obtain the chart at the beginning of this section.
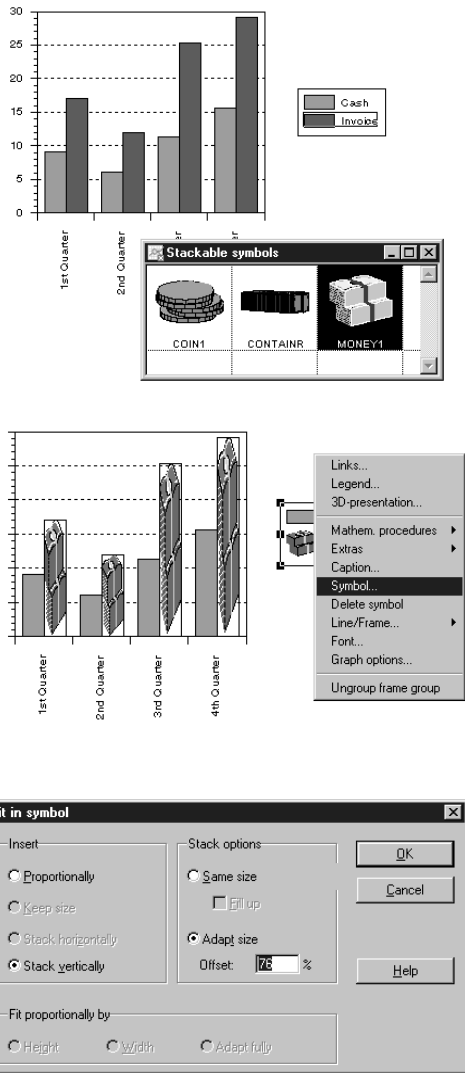
Economic indicators 1985

in the 6 major western
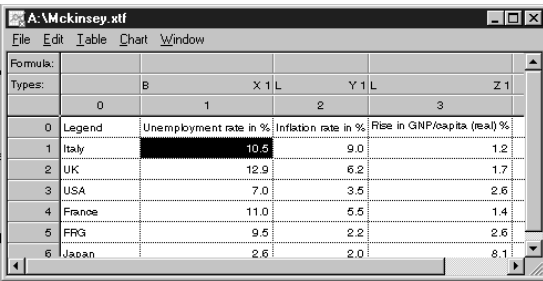industrialized countries
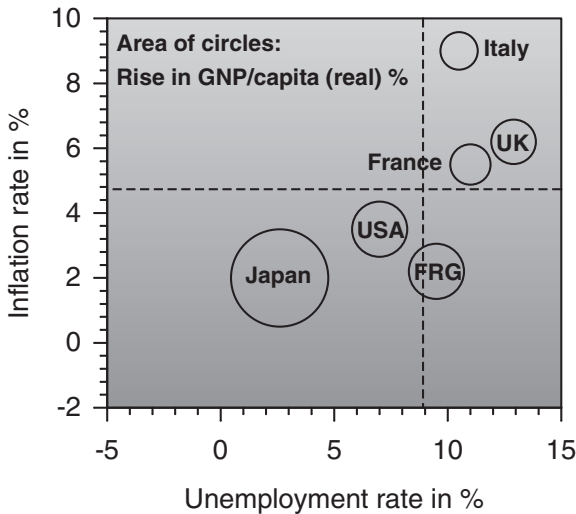
Example for portfolios

Creating Portfolios

The *portfolio* chart type is an established part of data presentation in the economic sciences, market research and in general commercial applications. Business consultants introduced this form of graphic representation in the seventies, as a strategic method of analysis. Today portfolios have largely established themselves in this field.

All portfolios are based on processed data, which have been evaluated and compiled according to type. This data processing is decisive for the validity and reliability of the portfolio. A key feature of modern portfolio methods are variables compiled from a large number of weighted characteristics: e.g. a "costs" variable which is made up of a wide range of weighted cost factors. A distinction is made between Boston, ADL and McKinsey portfolios. These methods of calculation will not be further elaborated upon at this stage. The necessary mathematical operations can be carried out in the Xact table editor.

The data that have been properly prepared and compressed produce a table with three columns (an X, Y and Z column) and at least 2 rows. The X and Y columns – as is familiar from the other chart types – are plotted on the X and Y axes and so they determine the position of the circles displayed in the portfolio. The values of the Z column determine the diameter or the area of the circles.

Here, with the aid of a set of data calculated according to McKinsey, we want to show how a chart evolves from the table. To do this, open the table MK-KINSEY.XTF by clicking on *Open table* in the *File* menu and selecting this file from the TABLES directory. You will see the following image on the screen:

We are concerned here with displaying important economic indicators. To be precise, six industrialized countries are being compared in terms of three characteristics. The columns have already been selected in the table: the "unemployment rate" in column 1 has been assigned to the X axis (marked *X1* in the type line), the "inflation rate" is plotted on the Y axis and the characteristic "rise in GNP per capita" as the Z column will determine the areas of the circles.

		B	X 1 L	Y 1 L	Z 1
	0	1	2	3	
0	Legend	Unemployment rate in %	Inflation rate in %	Rise in GNP/capita (real) %	
1	Italy	10.5	9.0	1.2	
2	UK	12.9	6.2	1.7	
3	USA	7.0	3.5	2.6	
4	France	11.0	5.5	1.4	
5	FRG	9.5	2.2	2.6	
6	Japan	2.6	2.0	8.1	

• Portfolio charts always need an X, a Y and a Z column!

Please select the option *Special…* from the *Chart* menu and then *Portfolio* from the *Special charts* dialog. The result – regardless of your preferences – will look something like the following figure. In the *context menu* of one of the objects on the X axis we have adapted its *length* to that of the Y axis, moved the automatically generated lettering "Area of the circles" into the chart with mouse and set the *Font size* in their context menus.

The dotted lines show the arithmetic means of the X and Y columns calculated by Xact. You can specify the *Position* and *Line style* of these lines, for example, on the *Help lines* page in the dialogs of the X and Y axes as required. You can also switch off these help lines or use additional help lines in this dialog.

Economic indicators 1985

in the 6 major western
industrialized countries

Example for portfolios
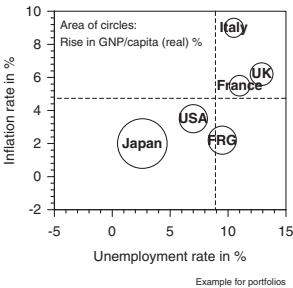
Changing the chart

First set the lengths of the X and Y axes to 55 mm. A double-click on any object in the axis concerned will bring up the axes dialog. Please set the appropriate length here and exit the dialog with OK.

Now call up the *Chart options* dialog. Click the mouse on the number after *Maximum diameter* and enter "15 mm". As we only want to see the outlines of the circles, deactivate *Filled circles* by clicking on the box. To use these settings for all graphs, check *For all symbols*. Confirm the settings with *OK* and exit the dialog.

- Each individual circle in a portfolio can be replaced by any symbol from one of the *symbol libraries*. To do this, drag a symbol from out of the symbol library onto one of the circles. The replaced symbol adapts to the size of the circle. You can also read up on this in the section entitled *A Simple Object Chart*.

If you wish, you can now alter the fonts for the title and sub-headings. A double click on the title opens the title dialog box where you can select the text, font and alignment in the context menu.
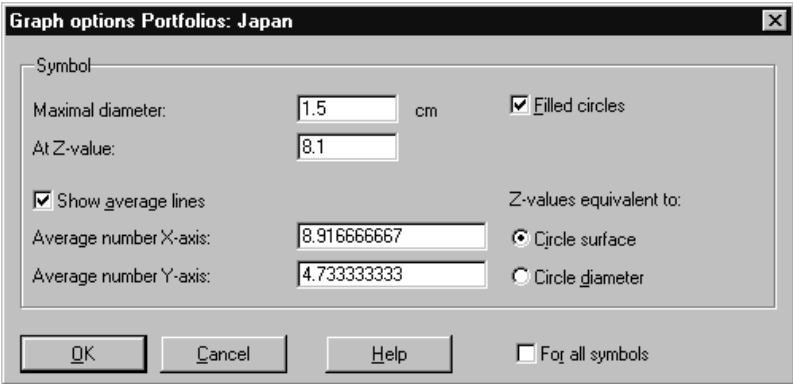
Changing the lettering

We notice that automatically created lettering protrudes beyond the edges of the smaller circles. It would look better if the lettering were above or below the circles, depending on the available space.

In the *Captions (chart* context menu) you will see many options for automatically positioning the lettering. In many cases the options in this dialog will suffice. However, the captions created cannot be moved individually by hand unless the groups with the captions have been unlocked. But then afterwards the chart can no longer be changed with the chart functions.

Therefore we will opt for another solution: we shall first check *No caption* under *Placement*. Then we open the *Legend options* in the chart context menu and select *Next to chart* as the *Legend type* and check *Just text*. For *Frame* we select *None*. After *OK* has been entered, the legend letterings are lined up next to the chart. In the context menu, for the *legends* we click on *Ungroup frame group* and can now select the lettering we wish to move, and position it at will by keeping the mouse button pressed.

Depending on the application and target group, you can still refine the design of the chart with the tools of the graphics editor, by importing logos and other external images. But we are going to leave that to you! You will find our version at the start of this section.
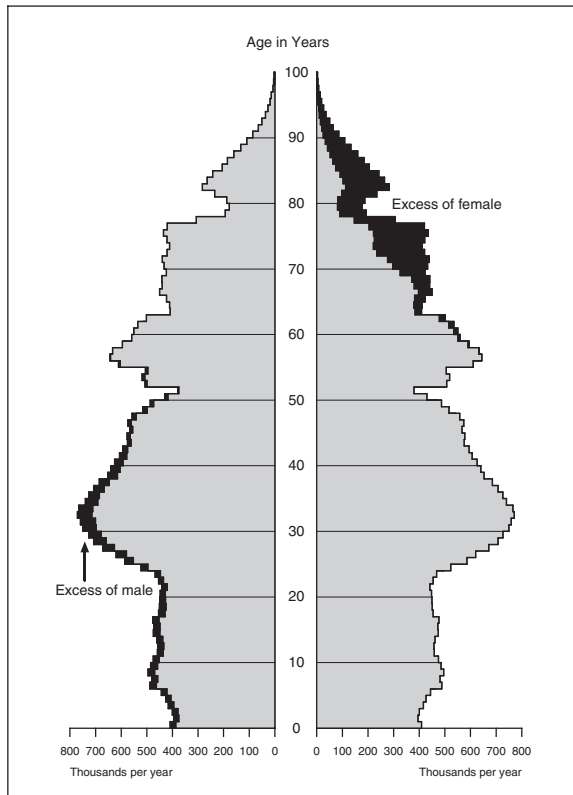
Creating a Population Pyramid

We would now like to take you through creating a so-called population pyramid. Basically this figure consists of two charts drawn 'back to back'. They therefore have a common vertical X axis and two mirror-image horizontal Y axes. Each chart contains two graphs (here "men" and "women"), the order of drawing the graphs in the two charts is reversed. The graphs themselves have a step-like curve.

Xact offers you two chart types for performing this task: you can choose between *Lines/Stepped areas* (rectangles placed next to each other with a

common frame) or *Bars/Histograms* or *Bars/Rows* (each bar has its own frame).

The data table

Let us first consider the data so that we can make the correct choice of chart type. The data supplied (see GERPOPLN.XTF in the GRAPHICS directory, original data from the German Federal Statistical Office) consist of counts (frequencies) per year of age (class) for each sex. It is therefore stipulated that precisely one figure has been gathered for each year of age. As far as the graphic representation is concerned, this means that the same frequency is present from the start to the finish of one year of age, and so the graph created must remain constant from beginning to end. Then at the beginning of the next year, the frequency (usually) changes – at this point there is a "jump" in the graph. The graph style selected must therefore accurately depict these features. To achieve this aim, Xact offers the chart styles already named above, and, of these, we shall choose the chart type *Lines/Steps area.*

We have already prepared the accompanying data as a table. Open the file GERPOPLN.XTF in the GRAPHICS directory. The table is read as follows: column 1 (age in years) records each age class. In columns 2 (male) and 3 (female) you will see the corresponding frequencies in thousands.

Values are available for the ages from 1 to 99. The last step begins at the age of 99 and continues to the age of 100. There are no more data at the age of 100 and the stepped curve should stop here, too. To make sure that the steps can be drawn at the correct height, we enter the frequency of 0 for the age of 100 in both columns 2 and 3.

		0	1	2	3
			Number/Text	Number/Text	Number/Text
Types:		B X 1	L Y 1	L Y 2	
	0		1	2	3
0	Legend	Age in years	Male	Female	
1	Row 1	0	409.150	387.111	
2	Row 2	1	395.214	375.300	
3	Row 3	2	400.465	378.888	
4	Row 4	3	416.542	394.973	
5	Row 5	4	426.288	405.791	
6	Row 6	5	443.743	421.312	
7	Row 7	6	488.013	462.848	
8	Row 8	7	480.995	457.504	

The population pyramid has a common axis in the middle for the two sub-charts from which the age can be read. This is the X axis of the two charts – in this particular case it is positioned vertically as a horizontal display is selected. We therefore define the column **Age in years** as *X1* with a mouse-click in the *Types* row. We begin the figure with the

chart overleaf, and here the graph for the **Female** column is covered by the **Male** column. Consequently, we first define (as before) the **Male** column as **Y1** because the column with the lowest number is drawn last, and covers the previous column. Then the **Female** columns is defined as **Y2**.

Creating the charts

The table is now fully prepared. We then select *Lines…* in the *Chart* menu, and there the type *Steps area*. We check *horizontal* and deactivate *Frame*. After *OK*, Xact draws a step diagram in accordance with our Preferences in a newly opened graphics window. Push the diagram, with the mouse button depressed, into the right-hand half of the graphics window – because we still need room for the second step diagram, which we plan to place next to it! Push the legend onto the diagram too.

To create the second chart, first bring the table window back into the foreground. In the left-hand chart (see figure at the start of this section) the step diagram for Female is in the foreground and covers the graph for the Male column. We therefore reverse the order of definition for the two columns. **Female** is defined as **Y1**, **Male** as **Y2**. First we have to delete the previous column definitions (the chart created previously has memorized its own definitions) and redefine them. You can do this in two ways:

- To delete the previous columns definitions keep clicking on them until they are no longer defined.

- You click the right-hand mouse button on the definition and choose *None* under *Column type* in the *context menu*.

Next open the option *Lines…* in the *Chart* menu. Xact has remembered your previous settings. As we want to draw this chart in the same window as the previous, we now select the name of this window in the drop-down list that appears next to *In document*. After you have left the dialog with *OK*, the window **New graphics 1** will appear in the foreground and the mouse-pointer will now have the shape of a right angle. This indicates the upper left-hand corner of the future chart frame. Place the mouse pointer to the left of the existing chart and give a brief click on the left-hand mouse button. The chart will be then be drawn at this position.

The first chart...

Fig. 2

Male
Female
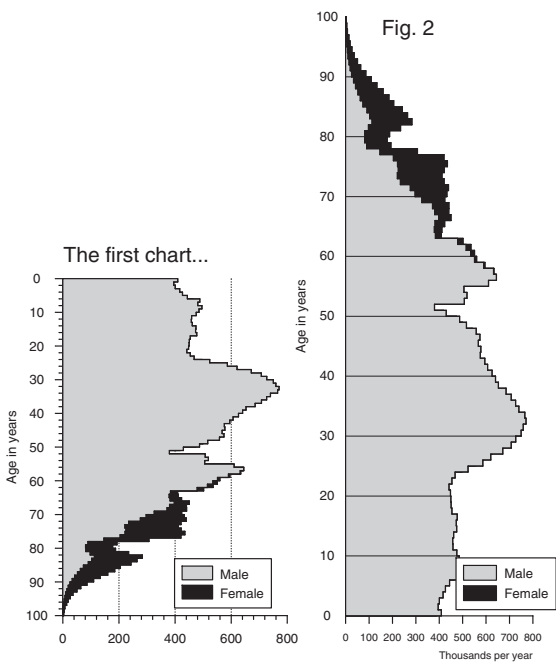
Our results so far can be seen besides. However, we have already changed some of the settings in the right-hand chart so that the appearance matches our original conception: we want to see grid lines actually lying on the graph at the points where the axes of the step diagrams are labeled (and not the long dashes, called **ticks** in Xact).

For this we select *Graph options…* in the *context menu*. In the dialog (see figure below) we check *Vertically* under *Grid lines* (as the chart was drawn horizontally, these lines will then be horizontal). By checking *Use for all identical graphs*, we ensure that these lines are drawn on both step curves. After pressing OK, we see in the figure that the lines are dotted – but we want continuous lines. These lines follow the grid lines of the vertical X axis in style, therefore we have to change the style in the Axis dialog. The style of the vertical axis has to be changed in any case.
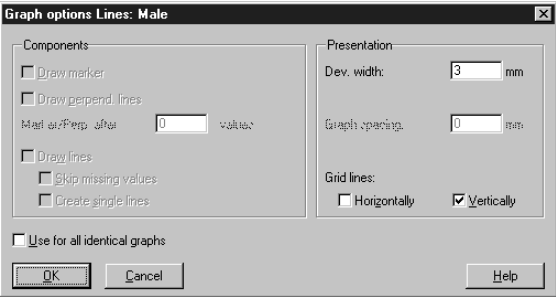
Therefore we first open the *Axis setup…* in the *context menu* for the *vertical axis* of the right-hand chart (Fig. 2).

On the *Scaling* page we reverse the counting sequence of the axis with a click on *Start<->End* and enter the *length* as 160 mm. On the *Division* page, we enter a 0 for *Number of subticks between ticks*. On the *Ticks* page (see figure on this

page) we set the *length* to 0 mm, under *Grid lines/Style...* we select a continuous Line type. On the *Labels* page we set the *Settings for: Ticks* to *Align:* centered.

We also need to deal with the horizontal axis: under *Axis setup.../Scaling* we enter a *Length* of 50 mm, on the *Division* page we deactivate *Start/division automatically* and specify a *Step size* of 100. On the *Ticks page* we deactivate the *On* box for the *Grid lines*. On the *Axis title* page we have changed the *Position* of the text, on the *Labels* page under *Font...* we have selected the *Size* as 8 pt.

In the *context menu* of each graph we have set the *Fill style...* black and 20% gray.

In the next step we are now going to apply these same characteristics to the left-hand chart. We are going to use the **pipette tool** for this, which is in the *toolbar* on the left of the graphics window. This enables us to transfer **all the characteristics from one axis to another** of the same type. Click on the *pipette* icon and the mouse pointer will change to an empty pipette. Point it to an object on the Y axis (e.g. a number) and give a short click. The pipette is now full, point to an object on the Y axis of the left-hand chart. With one mouse click you now transform this axis.

Do the same with the vertical axis! Then change the counting sequence for the lower left Y axis, as described previously.

The two charts (Fig. 3) now look fairly reasonable. However, the right-hand vertical axis is superfluous, so we shall make it invisible. On the *Scaling* page of the
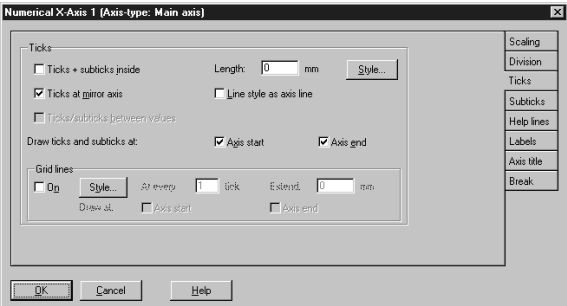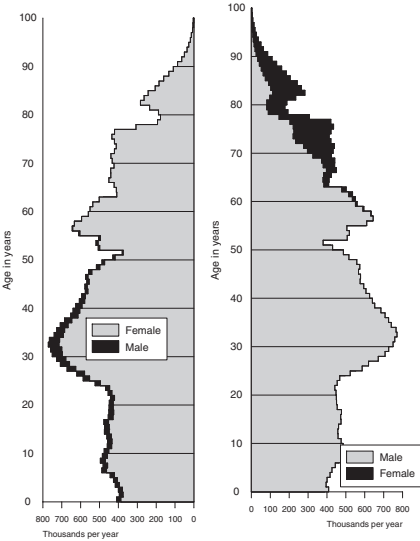

Fig. 3

axis dialog, deactivate the box for *Draw line* under *Axis presentation/Line style…* . On the *Labels* page, under *Settings for: Ticks*, click off *Show.* Finally, delete the text entry on the *Axis title* page.

All of the previously visible items on the X axis have now become invisible. The axis line is still there, but no longer visible. (If you click on *Outlines only* in the lower control bar of the window, you can render all the objects that are present visible!)

Now we transfer the fill style of the graphs in the right-hand chart to the left – just as for the axes, using the *Pipette* switch on the vertical grid lines of the graphs.

Assembling the charts

   The two charts now have to be mounted on a common baseline. Click for a moment on the *line tool* in the *toolbar* on the left (sixth from the top, see also the section on *Creating objects*). Three symbols fan out to the right, choose the middle one for a horizontal line and draw a line near the horizontal axes. Place the line at the background of the chart using *Background* in the *Arrange* menu. Now move the mouse pointer to the lower left-hand corner of the right-hand chart. The mouse pointer changes into a solid circle and thus shows that the vertex of an object is located beneath it. With the mouse button depressed, move the chart onto the horizontal line. The mouse pointer will change to a hollow circle, showing that a line lies beneath it. Release the mouse button and the corner of the chart will be sitting exactly on the line.

Use the same procedure to move the left-hand chart onto the line. Correct the horizontal position of this chart by shifting it with the arrow keys and –, so that the numbers on the vertical axis are positioned centrally. Read up the section on *Selecting and Moving Objects* to find

Fig. 4
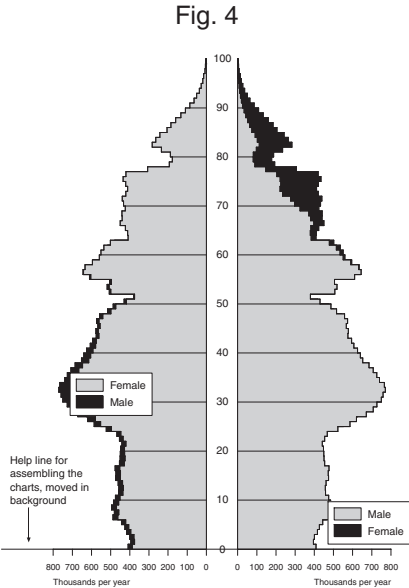
further facilities for mounting graphics objects!

In the meantime the Axis title of the vertical axis has become invisible because the left-hand chart is lying on top of it. Open the *Axis title* page in the *Axis setup* and change the *Position* to perpendicular centered. The text is still not positioned correctly, we shall push it into the appropriate position with the mouse. The text is part of the *Frame group* of the chart which we can *Ungroup* in the context menu. When ungrouped, all the group components are selected. However, we only want to select the text. If you click the mouse to the side of the chart, all the selections will disappear, and you can then click on the text and push it into the desired position with the mouse or the arrow keys.

The legends are superfluous. Check the *No legend* box under *Legends…* in the *context menu* of **each chart**. Some labels are still missing: use the text tool to write these (the *T* in the *toolbar* on the left). Alter the size of the selected text as required in the *context menu* of an object under *Font…* .

Finally, draw a rectangular frame around the figure using the *rectangle* from the *toolbar* on the left of the window. It will hide all the objects so set the *Fill style…* in the *context menu* of the object to *Unfilled*. Our result is at the beginning of this section.

And if the figures change ?

Each of the two charts is linked with the original table. Therefore every time a chart is recalculated, the data will be loaded from this table and used for the chart. You can find a summary of the links for each chart in the context menu under *Links…* .

If you change a figure in the table, you can click on *Recalculate* in the *Chart* menu for the pyramid diagram. The figures in the table will then be used according to the original column definitions and selection. You can read up on this in the section *Reusing and Automating Documents!*

Regression and Fits

Apart from descriptive functions, Xact also provides you with analytical tools, which can be accessed in the *context menu* for a graph under *Mathem. procedures->*. If you select the *Regression/Fits* option, the following dialog will open with its numerous possible settings. After you have pressed *OK*, the corresponding curve will be drawn. You can then change the appearance of the curve in the *context menu*. In the following, the word fit will be used as a synonym for regression. Here is a brief summary of the functions of this dialog:

- *Methods:* Here you can set the type of fit. *Linear*, *Polynomial fit* or *Non-linear fit* are the options available. Selection of the latter is discussed later in the *Non-linear fit Dialog*.

- *Fit range*: Here you can specify the range of the X values from which values are to be used for the fit. The curve calculated will then be drawn in this range.

- *Minimize by*: All of the methods attempt to place an "optimum" curve through the measured values. Three types of calculation are available for determining the optimum, depending on the method you choose. In *Least square* the **sum of the squares** of the **deviations** is minimized, all the data values are entered into the optimum with the same weighting. In contrast, *Absolute deviation* minimizes the **sum of the absolute deviations** – so that

more distant values are weighted less strongly. This applies to an even greater extent in the *Lorentz method*: here the distances of the values are evaluated in a non-linear procedure according to the **Lorentz transformation**. The two latter methods are therefore suited to lessening the influence of so-called "outliers" on the optimum.

- *Use weighting*: If **weightings** exist for the measured value (e.g. known errors), they can be employed in most methods. The weightings must then be placed in a column defined as the ***Dev*** column.

- *Results*: Here you decide where the numerical results are to be displayed. For *In window* the results are displayed **cumulatively** in a specially opened graphics window so that when several fits have been attempted, these can be assessed at leisure, edited and then used for further purposes. For As additional legend a legend with the results is created next to the chart.

- *Use for all identical graphs:* Normally a fit is only **calculated for the selected graph**. If this switch is active, the fit is calculated consecutively for all graphs in the chart.

For the *Show data* option of a fitted graph (*context menu* under *Extras->* or in the *Chart* menu), the residues and fitting formulas with the parameters used will be among the figures printed in a table for further processing. Refer also to the Online Help under the heading *Statistical characteristic values for fits*.

You can find detailed information in the Online Help under the heading *Regression*.

Non-linear fits

If you have selected *Non-linear fits* in the *Regression/Fits* dialog and entered *OK*, the *Non-linear fits* dialog shown on the next page will open up. It is divided into the following sections:

Fit range (X-Axis):

Here you can specify the **range of the X-axis** from which values are to be used for the fit. This range will also be used if you check the Show example box.

Select formula:

Here you can select your *Own*: or *Fixed*: formulas from the drop-down lists. The selected formula is displayed in the line *f(x)=* . If the formula (as do all fixed formulas) contains **display parameters,** a graph of it is shown in the *sample* image of the dialog. You can also use the parameters for the display in your own formulas (see below). You will find further details in the Online Help under the heading *Sample image for fit formulas*. If you enter a new formula in the line *f(x)=* (up to 10 parameters), you will be able to import these into your own list with the switch *Add f(x) to list* . *Delete from list* removes the selected formula from the list.

Start parameters for selected formula

Here you enter the *start parameters* necessary for a non-linear fit as well as any *step sizes* for the selected formula. A suitable starting value must be entered after the corresponding letter (a,b,c…) for each parameter (a,b,c…) of the selec-

ted formula. For non-linear fits, suitable starting values are nearly always necessary in order to achieve a useful match for the values. **If the value 0 has been entered as *Step size*, the *Start value* of the parameter will not be altered by the fit and will be used directly in the formula.** Even if the switch *Estimate before fit* is active, the start value entered will not be altered by an estimate!

- *Estimate now:* If you have chosen a fixed formula, you can have suggestions made for the start values (see above) of the fit for the selected graph by checking this box.

- *Show example*: Clicking on this box will cause a sample image with the currently selected start values to be displayed. In addition the graph of the current set of data will be shown as a blue curve in the image. This is particularly useful if you either want or have to specify the start values manually with difficult fit problems and a large number of parameters! You will find further details in the Online Help under the heading Sample image for fit formulas.

- *Use results from last fit*: Unfortunately not every fit with the selected start parameters and abort criterion is successful straight away. If you can already see an approximation to your graph in the last fit, it may be helpful (particularly in the case of the simplex fit) to use the determined parameters as start values for the next attempted fit.

Fit method:

- *Levenberg-Marquadt*: This very fast algorithm is only suitable for the Least squares method of minimization.

- *Simplex*: This relatively slow algorithm is very easy to manage. If you have selected either Absolute deviation or Lorentz distribution under Minimize by:, this will be the only algorithm open to you.

- *Fit several times*: To obtain a meaningful result, it is sometimes better to restart a fit once more with the values found after reaching the abort criterion. This box activates the appropriate mode.

- *Estimate before fit*: If you have chosen a fixed formula, you can have suggestions generated for the start values (see above) of the fit for every graph by checking this box.

Abort after:

Here you specify the abort criterion for the fit. If one of the two following criteria is met, the fit procedure will be terminated.

- *Error:* The fit procedure terminates if the minimization of the deviations from the data to the curve only changes by an amount smaller than the value set. Numbers smaller than 10^-11 would serve no purpose here because the computing accuracy is approximately 10^11!

- *Iterations:* Here you can specify how many iterations are required before the fit definitely terminates – after all, you do not want to sit in front of the computer for an eternity if the algorithm does not find an end point.

How fitting works

Non-linear fitting is an iterative process and hence the start value and step size are important parameters for controlling the iteration. Consequently, both values are needed for each of the parameters sought. The start values lay down the values of the parameters (a, b, c, …) at the beginning of the "trial".

In *simplex fits* the initial step sizes indicate the amount by which the start values are to be changed at the start of the iterations. In *Levenberg-Marquadt* fits this is not necessary.

The following applies to both methods: If *step size*=0, the preset start value will be adopted without change by the fit method and thus used directly in the formula.

At the beginning of the fitting procedure, the figures entered for *Start values* are employed for every X value in the selected formula. Xact records the deviation of the calculated values from the original values as the result. (In simplex fits the start values of the parameters are changed by the preset step sizes in the next iteration and the formula is recalculated.)

The new result is compared with the previous one and, according to whether there has been an improvement or deterioration, the parameters are altered further.

This process is continued so as to achieve an improvement in the result. If a change in the parameters leads to no further improvement (the change is then smaller than the Error entered), the fit will be aborted.

While the curve is being fitted, a small dialog box provides a continuous display of the iterations and the result (chi-squared).

If during computation the number entered after Iterations is reached, the calculation will in any case be terminated.

You can find detailed information in the Online Help under the heading Dialog '*Non-linear fit*'.