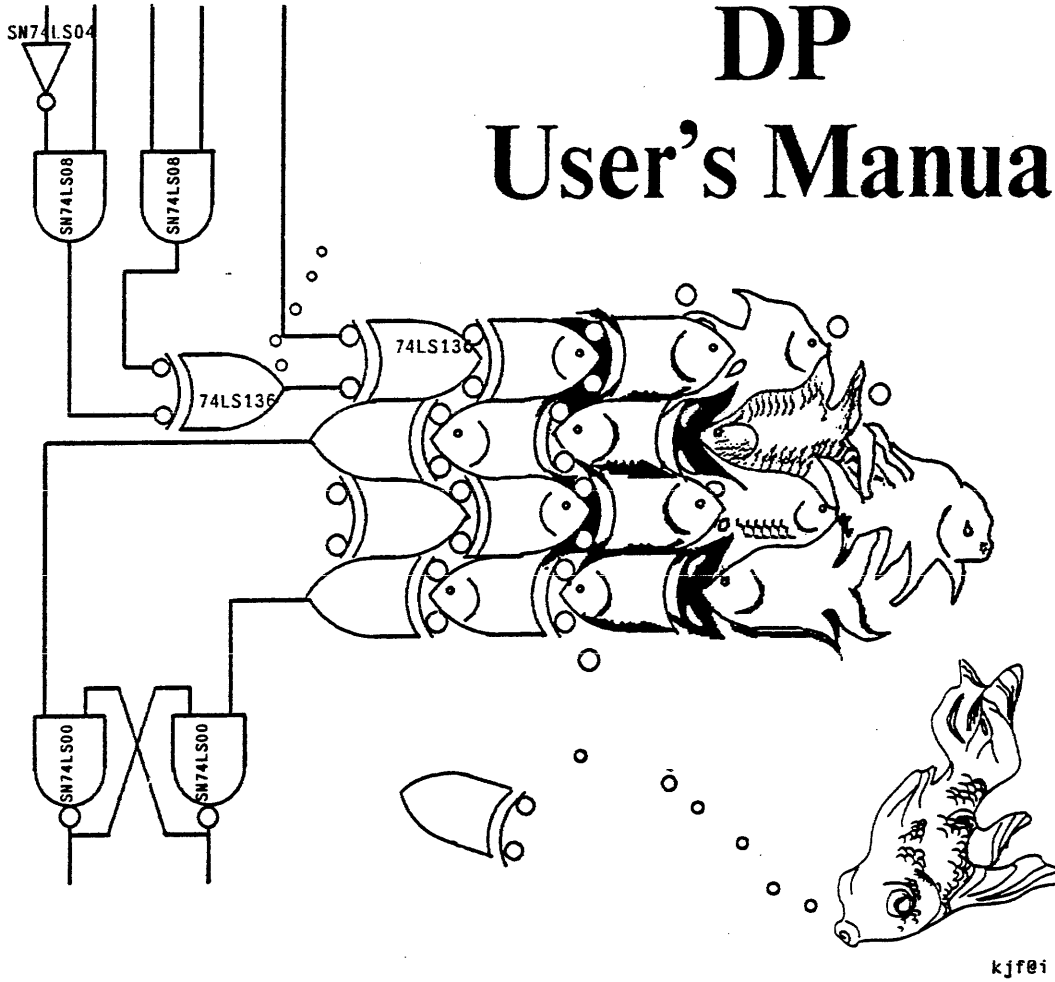


DP User's Manual



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DP was developed as part of the Spice Project in the Computer Science Department at Carnegie-Mellon University. The program author is Dario Giuse of Carnegie-Mellon. This document was produced by PERQ Systems Corporation.

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1. INTRODUCTION

DP (Drawing Program) is a highly interactive graphics editor which runs on the PERQ computer. It is a general purpose graphics editor containing powerful features such as multiple layers, hierarchically nested symbols, and multiple windows. Drawings produced with DP may be inserted into documents produced by the Mint or Scribe text formatting programs.

Some typical drawings produced with DP are diagrams, flow charts, graphs, architectural layouts, organizational charts, forms, and circuit designs. In creating drawings, you can copy parts of other drawings from DP files or you can place a hard-copy of a drawing on the tablet or bitpad and trace it.

DP was developed by Dario Giuse of the Robotics Institute at Carnegie-Mellon University, as part of a circuit design system to reduce the turnaround time between the conception and the implementation of prototype electronic circuits.

When used as an electronic circuit drawing tool, DP allows a designer to create the description of an electronic circuit in a graphical form that corresponds to the way circuits are normally represented in logic diagrams. Although DP has several features that are especially useful for this purpose, DP is purely a graphic editor; it does not try to understand the drawing. However, its output may be used as input to post-processors that are able to extract electrical information, perform error checking, and generate a set of lists, such as a wire list, a stuffing list, and a wrap list for wire-wrapping a board.

DP is written entirely in Pascal. It runs under the POS and Spice operating systems with at least 1 Mbyte memory. Landscape monitor support is provided.

This manual is a complete user's manual, covering all of the features of DP as implemented at CMU.¹ It is written both for those who will use DP for circuit design and for those who will use it for general purposes. The only prior knowledge assumed is an understanding of the basic features of the PERQ. Section 2 explains the basic features of DP. Sections 3 through 6 explain how to enter, exit, get help, and work with DP. Section 7 covers the creating and editing of basic elements, and Section 8 tells how to combine basic elements into sets and symbols. Section 9 explains the functions you can perform on items, such as moving them or copying them. Section 10 tells how to write a drawing to a file or to read in other files. The rest of the manual explains features that you will find useful as you gain experience with DP (such as creating a drawing in layers and working with more than one drawing). Appendix A is a summary of all commands.

¹The editor thanks Dario Giuse of CMU and Ellen Colwell, John Godfrey, and Jeff Pepper of PERQ Systems for reviewing drafts of this document.

The following conventions have been used in this manual:

- < > - information to be supplied by the user, such as a filename
- [] - an optional item, such as a command switch
- | - a choice between the items on each side of this mark

2. OVERALL VIEW

In order to give you an overall picture of DP, the following paragraphs briefly explain the features around which DP is built. Details on using these features are given in the referenced sections.

2.1. Basic Elements

In DP, drawings are composed of six basic elements, shown in Figure 2-1:

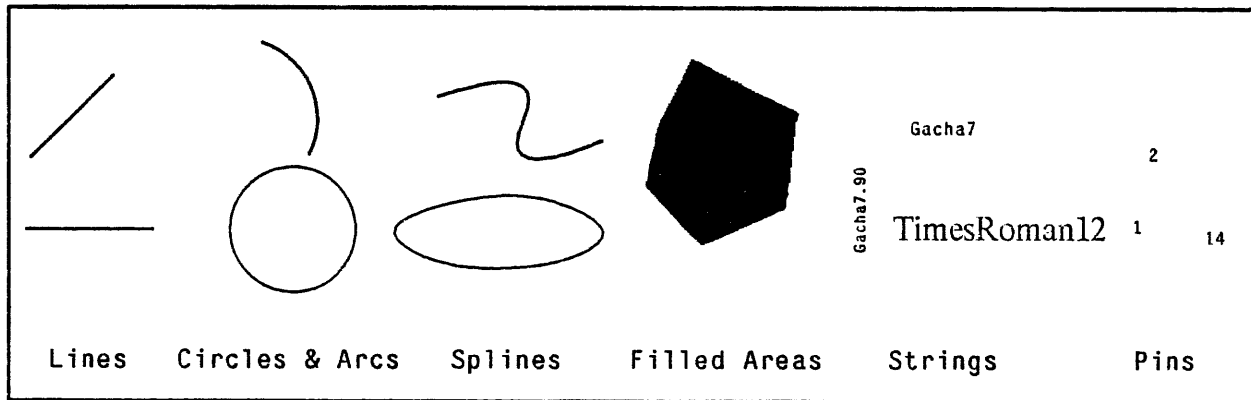


Figure 1: Elements

1. lines (finite length) with any slope--the endpoints have gravity, explained later;
2. strings (sequences of printing ASCII characters);
3. circles and arcs;
4. splines (generic curves, with the shape determined by a set of control points);
5. filled areas (polygons, with the shape determined by a set of control points, and filled with a color level from 1-black to 17-white); and
6. pins (connection points with gravity, used mostly on electronic circuits). Each pin has a number associated with it.

Elements can be edited, deleted, and formed into larger units called sets and symbols. Elements also can be moved and copied, either within a drawing or from one drawing to another.

Details on creating and editing elements are given in Section 7, and details on working with elements are given in Section 9.

2.2. Sets, Symbols, and Instances

A set is a group of items which have been designated with the **Select** function. The set is formed so that the same function (for example, delete) can be performed on all the items with one command. There can be only one set per window. The set is temporary, that is, the set will be broken up when you exit DP (or sooner if you choose).

A symbol is a permanent unit consisting of one or more basic elements or other symbols. Each symbol is identified with a unique name, assigned by you or the program. Instances (copies) of the symbol can be easily produced as often as needed on the same or another drawing. Because symbols may be nested inside other symbols, drawings may be created in a hierarchical manner. A symbol instance can be transformed (rotated, mirrored, or scaled), unpacked into its component parts, or deleted--all without affecting the symbol definition.

Like basic elements, the selected set and symbols can be moved and copied, either within a drawing or from one drawing to another.

Details on forming sets, symbols, and instances are given in Section 8, and details on working with these items are given in Section 9.

2.3. Layers

Drawings can be divided into layers. This feature provides the same effect as multiple transparencies containing parts of a drawing. Just as transparencies may be added or removed, modifying the drawing itself, each layer can be turned on (displayed) or off (made invisible). When displayed, a layer can be defined as read-only so that it will not interfere with other layers and cannot be changed unintentionally. Two typical applications are 1) putting construction lines into a separate, read-only layer which can be made visible as needed, and 2) grouping items in a very complex drawing onto different layers so that you can choose to display only certain items at one time. Details on layers are given in Section 13.

2.4. Windows

You may have two or more DP windows open on your screen at the same time, each containing a different drawing. Each window has a separate coordinate space and is comparable to a sheet of paper. Only the sheet corresponding to the current window (the window in which the cursor is located) may be written on, changed, or manipulated in any way. For example, a *Select All* operation selects all the objects associated only with the window in which the cursor is located. **Move** and **Copy** are the only commands which allow interaction between windows; these commands erase the object from the source window and write it into the destination window.

Details on windows are given in Section 14.

2.5. Gravity

The endpoints of lines, splines and arcs, pins nested within symbols, circles, and splines all have gravity--that is, they attract the endpoints of lines close to them if those lines are drawn with the gravity option. Gravity serves two purposes: to aid in circuit design and to make lines meet intersecting elements neatly without gaps. The strength of gravity can be controlled, and gravity can be turned off. Details on using gravity with Lines are given in Section 7.1.1, and details on changing the gravity strength or turning off gravity are given in Section 11.

2.6. Scale

The image on the current window can be *zoomed* so that it appears larger or smaller. Changing the scale does not affect the true size of the items, and it does not affect the scale of other windows on the screen. A scale of 1 is the real size of the drawing. It is useful to use a large scale when creating and editing items and a small scale to view large chunks of the drawing or the whole drawing at once.

Details on changing the scale are given in Section 6.8.

2.7. The Coordinate System

DP uses a standard-oriented, cartesian coordinate system to represent the objects in a drawing. Sixteen-bit integer arithmetic is used throughout, and therefore the integers in the range -32767...32767 are valid coordinates. DP initially places point 0,0 at the center of the window and uses a scale of 1. Both the window and the drawing may be moved and the scale changed. You can return the drawing to scale 1 and its initial position by specifying the special case scale of 0. The display grid is used as an aid in drawing. You can have the grid visible or invisible, and you can alter the distance between the dots in the grid.

Details on making the grid visible or invisible are given in Section 6.8, and details on changing the grid are given in Section 11.

2.8. Mouse Grid

Cursor movements with the mouse lie on an imaginary grid. When you move the mouse on the tablet or bitpad, DP moves the cursor to the closest grid point. The setting for the mouse grid determines the distance between points. DP will keep several mouse grids in memory for each drawing and allow you to switch among them.

Details on switching among settings are given in Section 6.2. Details on changing the list of settings are given in Section 11.

2.9. Size of the Drawing

You may create drawings that are about 64 x 96 times the size of the PERQ screen. This means that a drawing can be as big as 6,000 sheets of paper. Large drawings should be printed on a large-page output device such as a plotter. If the whole drawing is to be printed on a device such as the Dover, the drawing must be switched to a small scale or printed in several parts.

See Section 10.2 for details on printing a drawing.

2.10. Files

A drawing can be stored in a DP file which can be edited in subsequent sessions. In order to get a hard-copy of your drawing, you must create a press file from within DP. You may access other files to read in a symbol, text, an entire drawing, or DP commands.

Details on input and output files are given in Section 10.

3. ENTERING DP

Before you enter DP, you may wish to path to the desired directory (the directory containing an existing DP file you want to access or the directory where you want to create a DP file). However, this is not necessary because you can specify a pathname when you read or write a file within DP. Typing the command *dp* starts DP, using default values for all the variables and switches. If you have not set default values in your profile, as explained in Section 15, the program supplies the defaults listed below. These variables are explained in detail later.

```

current function = line
mouse grid = 3
display grid = 6
gravity field = 5
display scale = 1
current thickness = 1
current font = 1 (Gacha7)
current layer = "STANDARD"
color = 1 (black)
pin display = OFF

```

You may specify the name of an existing file when you enter DP by typing *dp <filename>*. The extension *.DP* may be omitted. Alternately, after you enter DP you may access an existing file by typing *I*. To create a new file, enter DP, create the drawing, and then write it to a file (explained in Section 10.1). Likewise, DP transcripts (explained in Section 12) can be invoked either when you first enter DP, by typing *dp <filename>*, or after you are within DP.

You may add switches to the command line. At present, only two switches are recognized:

`/profile=<name>` The profile may be used to completely set the initial status of DP (number and position of windows, font sets, default options, grid, etc.) Profile files are covered in detail in Section 15.

`/help` prints a short help message about DP and returns you to the Shell.

4. EXITING DP

To exit DP, type *q* (for quit) or get the Top-Level menu as explained in Section 6.5 and select quit. DP will ask for confirmation that you wish to exit. Type *y* (for yes) to exit or any other character to stay in the program.

DP keeps track of whether changes have been made to the file(s) on your screen since the last output command. If a window has been modified since the last output command, this is indicated by a modified flag: an asterisk (*) appended to the filename. When you give the quit command, DP checks this flag for all existing windows and issues a warning if any window is marked as modified. The algorithm for determining if a window has been modified is conservative, so a window may be flagged even if its contents have not actually been changed. The following rules determine the status of the window:

- the output command (to write the changes to a file) clears the Modified flag;
- input commands (to read in a file) do not alter the status of the flag;
- all non-immediate functions (those that require further action from you, such as **Copy**) set the Modified flag after the function has been completed;
- immediate functions (those that require no further action after you've given the command) do not alter the flag, except **Delete** and **Undelete**.

If you have more than one window open and want to remove a window but stay in DP, do not type *quit*. Instead, remove the window as explained in Section 14. Only an empty window can be removed.

5. GETTING HELP

To obtain help, either type *h* or press the HELP key. A menu of DP help topics appears. Select the desired help message by pressing any button. If the help message is more than one page long, press any button or key to get the next page. After you have read the message, press any button or key.

6. WORKING WITH DP

The following sections give overall procedural information, such as what the display screen looks like in DP, how to use the mouse, keyboard commands, and pop-up menus, and how to edit text that is typed in response to commands or as input to the drawing.

6.1. The Display

Figure 6-1 shows a display screen in DP. The screen in this example contains only one window. The lower right corner of the window contains the status line, which shows the following information:

- command character of the current function (l for Line);
- name of the current function (Line); and
- the actions associated with the mouse buttons for the current function (Generic | Hor/Ver | No grav. -- explained in the next section)

The area above the status line shows the current mouse grid and the name of the current layer. The filename is shown in the lower left corner of each window. An asterisk (*) is appended to the filename if the window has been modified since the last output. The cursor is an arrow pointing northwest. The position of the cursor (arrow) is controlled by the mouse. The current window is the window in which the cursor is located. (If the cursor is not located within a window, you cannot issue most commands.) The white rectangles in the border are used to invoke the Top-Level Commands menu, and the corners of the border and the border itself are used to create, delete, move, or change a window (as shown on Figure 6-1 and explained in detail in Section 14). Items within a window can be moved with the "w" command explained in Section 6.9. Warning and error messages will be given at the bottom of the screen and erased when a new command is given. Section 6.9 explains ways in which the display can be changed without affecting the drawing.

6.2. Using the mouse and mouse grids

In most functions DP assigns different meanings to each mouse button. DP uses only three buttons; if you have a four-button mouse with different colored buttons, the blue button is ignored. The status line at the lower right of the screen always shows how the buttons perform in the current function (for example, in Figure 6-1, the actions for Line function are *Generic* for the left or white button, *Hor/Ver* for the middle or yellow button, and *No grav.* for the right or green button). Details on the mouse actions for each function are given in this manual; however, after you have worked with DP a short time you'll probably find that the descriptions at the bottom of the screen will be sufficient.

Many of the functions use the buttons as follows:

- left (white) - Rectangle (to choose a group of items identified by forming a rectangle around them). Position the cursor to the left or right of the group of items you want to manipulate. Press

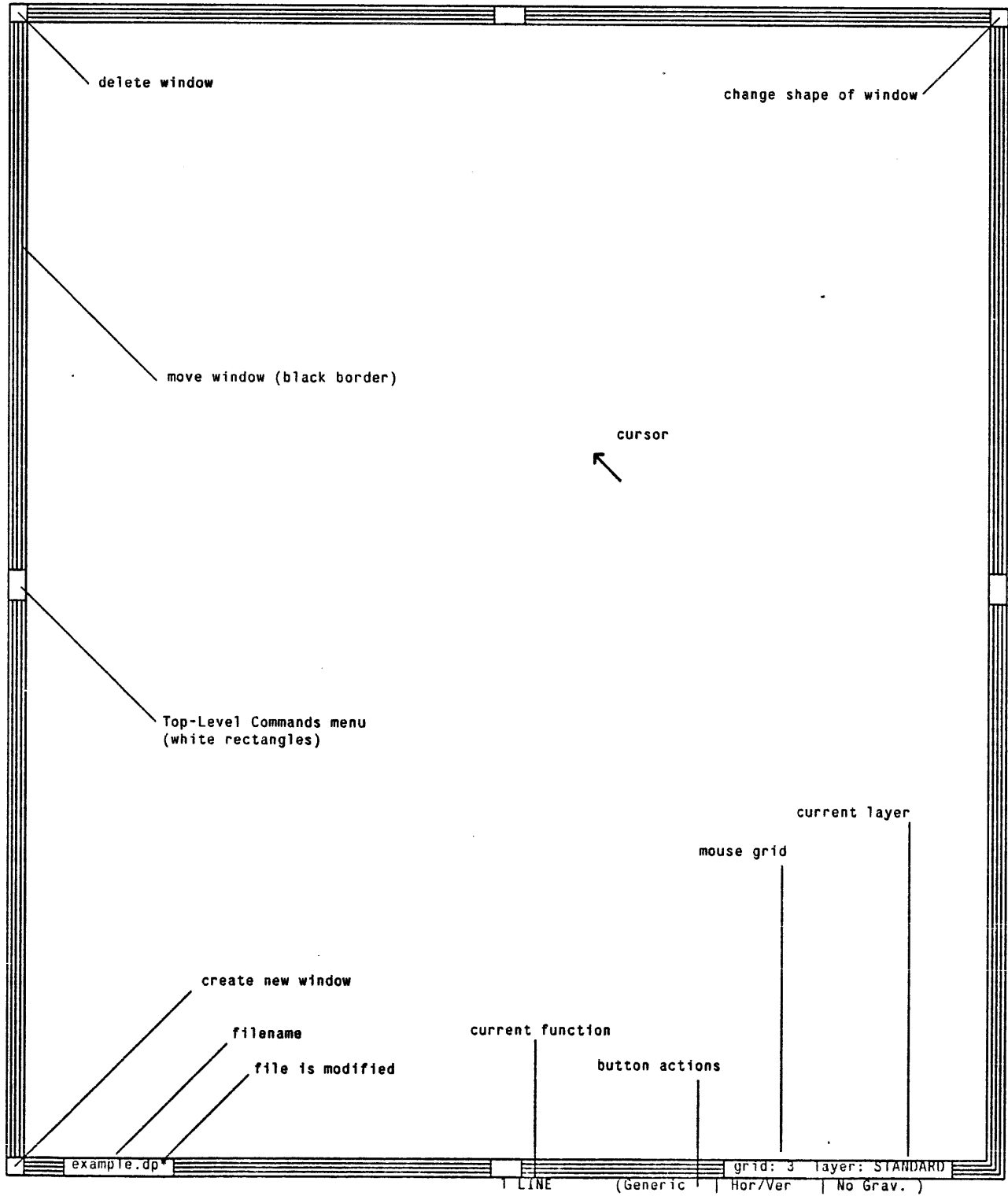


Figure 2: Display screen

the button, and while holding the button, move the cursor in any direction to extend the rectangle until it encompasses all the items in their entirety. To freeze the rectangle, release the button. (If an item was not completely contained within the rectangle, the item will not be affected by the function you are performing.)

- middle (yellow) - One item (to choose one item at a time). Press the button and point the cursor at the item.
- right (green) - Selected (to choose all the selected items in the current window). Section 8.1 tells how to select and deselect items with the "s" command. Selected items are displayed with a black square in the center or, if the item is text, highlighted. You do not need to point to the items with the cursor; pressing the right (green) button automatically performs the function on all Selected items.

As an example of the above, Figures 6-2, 6-3, 6-4 show the effect of a Move command on the same drawing when the three different buttons are used. The small black arrow pointing NW represents the cursor.

Cursor movements with the mouse lie on an imaginary grid. When you move the mouse on the tablet or bitpad, DP moves the cursor to the closest grid point. A small grid allows you to draw fine details easily. A large grid (such as 6) makes it easier to line up items. For each drawing DP keeps several grid settings in memory in a circular list. The list can be changed, as explained in Section 11. The current grid is shown at the lower right of the screen. To switch to the next grid on the list, type *g* (for grid). If you have difficulty in pinpointing items to be moved, deleted, etc.-- return to the grid that was current when the item was created.

6.3. Issuing Keyboard Commands

All keyboard commands are single letters or special keys. You do not have to hold CTRL or any other key while you give the command. Upper and lower case command letters are considered different.

Some commands (such as **Redraw**) are Immediate; that is, they are immediately executed when the command is typed and then you are returned to the previous function. Non-immediate commands (such as **Line** and **Copy**) do not change the drawing without some further action from you, and after the procedure has been completed, you are left in the new function.

6.4. Aborting Commands

Commands that result in the display of a prompt or a pop-up menu (both explained below) can be cancelled by pressing a mouse button outside the prompt or menu area. However, commands that are executed immediately, such as a change in function from **Line** to **Circle**, or commands involved in drawing or editing cannot be aborted. (Instead you would have to switch back to the previous function, or in the second case, edit or delete the item.)

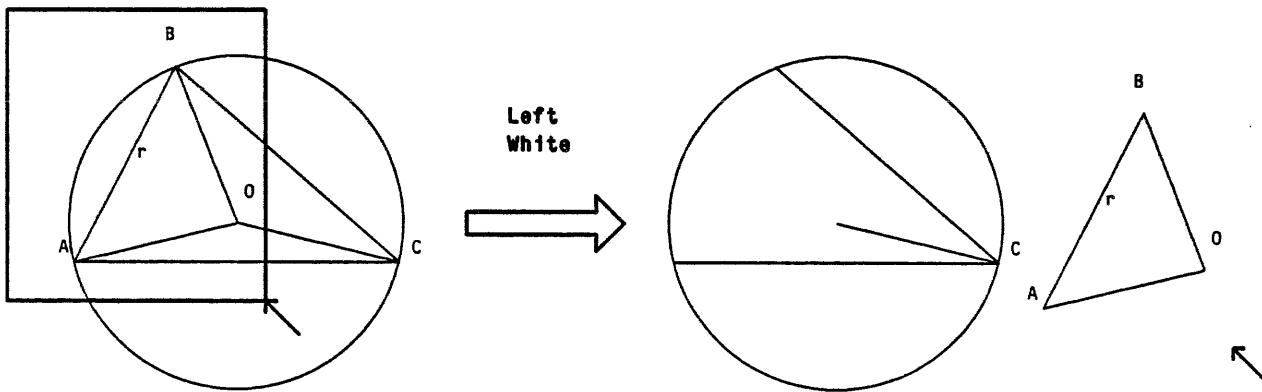


Figure 3: Figure 6.2 left (white) button: Moving the items within a rectangle

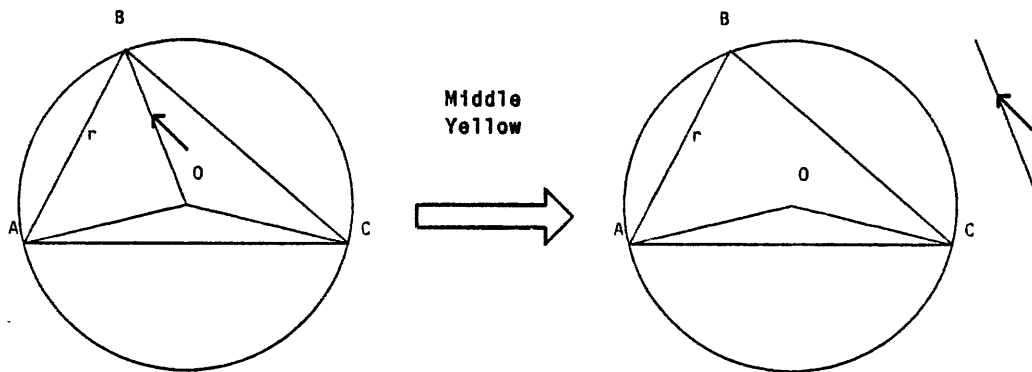


Figure 4: Middle (yellow) button: Moving one item at a time.

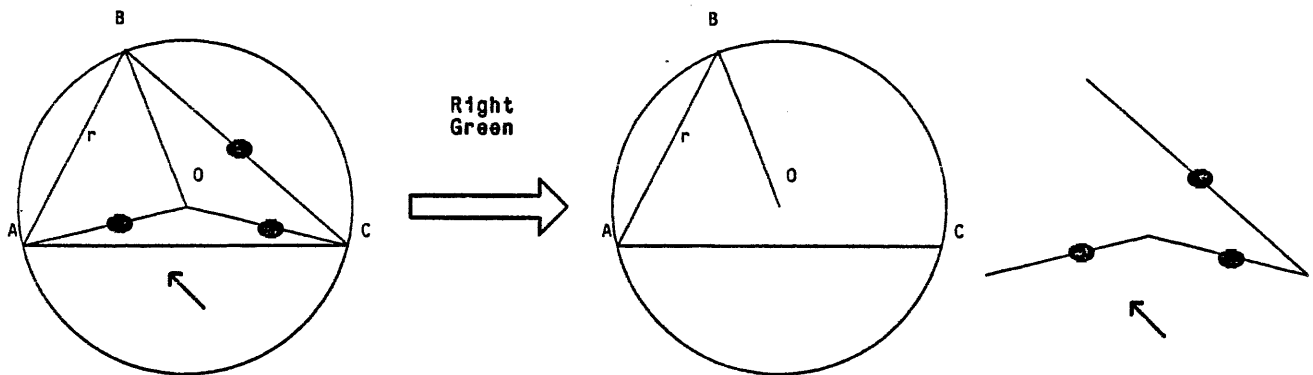


Figure 5: Right (green) button: Moving the selected items

6.5. Using Menus

A pop-up menu is a rectangular area which appears on the screen when requested or in response to certain commands. The menu will be centered at the location of the cursor and will contain several commands. A command on the menu can be executed by pointing to it with the cursor and pressing any button. The menu does not interfere with the underlying area--when the menu is exited, the previous contents of the area reappear.

The most frequently used menu is the Top-Level menu, which gives you the option of invoking Top-Level Commands from the menu rather than typing them. To get the Top-Level menu, either press the space bar or point the cursor at a white rectangle in the border of the window and press any button. Some menus disappear after you have made a choice, whereas others return to allow you to make another choice. In DP any menu can be aborted by pressing outside the menu rectangle.

6.5.1. Changing the Top-Level Menu

This section is only for advanced users.

You may change the Top-Level menu. You may either delete commands from the Top-Level menu or change the descriptions of the commands. To do either of these, you must create a file which contains the contents of the menu as you want it to be presented. Do the following:

Create a file and type the commands, one per line, as follows:

```
character text-string-describing-command
```

For example:

```
k Unusual Commands
```

You must type each command you want to appear on the menu. You may use upper or lower case letters. Regardless of the order in which you type the commands, DP will present the menu in alphabetical order by the command characters. Commands with no character listed will precede other commands. Use the `commands-file` option in your profile to point to this file (see Section 15).

6.6. Responding to Prompts

Commands that require you to provide input use a Prompt Buffer, a small rectangular area which will appear in the middle of your screen. The buffer will contain a header which tells what type of information is required (such as `Filename:`) and perhaps a default, shown either in square brackets following the header or on the next line. To accept the default, press RETURN or the right (green) button. If you type in a reply, note that the Prompt Buffer contains a pencil cursor (a thin line to the right of the text as you are typing or between two

characters if you move it back within the string). You can use any of the same characters as the Spice Intra-line editor to edit your reply (see the [Introduction to the Spice User's Manual](#) for more information on the Intra-line editor). Terminate the reply by pressing RETURN. To abort the command without replying to the prompt, position the cursor outside the Prompt Buffer and press any button.

6.7. Editing Commands and Text Strings

If you need to make corrections as you type a reply to a command or as you enter text for the drawing, use the following keys and mouse buttons to position the pencil cursor and to make the change:

left(white) button position the pencil cursor before the character you are pointing to with the arrow cursor.

middle (yellow) button

Same as left(white) button.

right (green) button

terminate the editing (same function as the RETURN key)

RETURN

terminate the editing (close the string)

All of the characters of the Spice Intra-line editor may be used with the exception of CTRL ? (see the [Introduction to the Spice User's Manual](#) for more information). After you use the arrow cursor to position the pencil cursor, you may move the arrow cursor out of the way.

6.8. Changing the Display

The commands listed below affect only the way the drawing is displayed on the screen; they do not change the internal representation of the drawing itself. If a command is listed below as immediate, the command is executed as soon as you type it and then you are returned to the current function.

Redraw the screen

Type *R*

Immediate. This is helpful if the display contains an error message you've taken care of or some other extraneous material.

Redraw the current window only

Type *r*

Immediate. (This is also referred to as *refreshing* the window.)

Change the scale

Type =

Immediate. You will be prompted for a number. The default (actual size) is 1; a scale of 0.5 displays the objects half size, 0.25 quarter size, etc., and a scale of 2 doubles the size, 3 triples it,

etc. A special case is a scale of 0, which returns a drawing to scale 1 and to its original position (point 0,0 at the center of the window).

It is useful to use a large scale (3 or 4) when creating or editing items and a small scale when viewing a large drawing. After you have switched to a large scale, you can bring the desired items into view with the *w* command described below.

Be aware that the scale on the screen may not correspond exactly to that of the printing device (see Section 10.2).

Turn the display grid on or off

Type `'` (back quote)

The display grid will be toggled to ON or OFF. Having the grid on is useful for aligning items. Immediate. (To alter the distance between the dots, see the Unusual Commands in Section 11.)

Move (scroll) the whole image in the current window

Type *w*

Then hold down any button and move the cursor. The image follows the cursor. Release the button when the image is where you want it. Although any button will work, the right (green) button uses a faster the drawing off- screen and then bring them back, which allows you to work on parts of large drawings.

Insert a mark at the center of the current window

Press the INS (or ESC) key

Immediate. Each window has a circular buffer of marks that can be used to remember positions in the drawing. When you start a drawing, the buffer is empty. Move the desired item to approximately the center of the screen and press INS. There is no limit to the number of marks you can insert. To use the marks, see the *G* command below.

Go to the next mark.

Type *G*

Immediate. The next mark moves to the center of the window; thus this command allows you to jump between between specified points in a drawing. (Marks are inserted with the INS key, described above.)

Delete the previous mark

Press the DEL key

Immediate.

6.9. Automatic Saves

Since typical DP sessions tend to be fairly long, DP automatically saves your drawing periodically. Each window has a counter associated with it, which is incremented every time a new function is entered while the window is active. After a given number on the counter, the contents of the window are written out to a *checkpoint* file and the counter is reset. This ensures that a recent copy of the drawing is always available, even if the system crashes. The checkpoint filename is formed by appending *.CKP* to the filename associated with the window (for example, the file *latch.dp* is checkpointed to *latch.dp.CKP*). The default for the number of commands between check points is 100. The number may be modified with the Unusual Commands menu (see Section 11).

Also you may write out the changes to the original file or to any other file at any time by typing *o* (for output). This is explained further in Section 10.1.

7. BASIC ELEMENTS

As explained previously, all drawings in DP are composed of six basic elements--lines, circles and arcs, splines, filled areas, strings of text, and pins. In addition, you may create rectangles--which are not considered basic elements but merely four lines.

Items are drawn in Invert mode, and therefore overlapping items erase each other

You may find it helpful to use a large scale (3 or 4) while you are creating elements (see Section 6.9).

7.1. Creating Elements

7.1.1. Line

Lines can be drawn with or without gravity, depending on the gravity field you set and which button you use to draw the line. All lines (as well as pins nested in symbols, circles, and splines), regardless of how they are drawn, have gravity--the ability to attract other lines. But the gravity field and buttons determine whether lines are affected by gravity as they are drawn. If the gravity field is strong (for example, 10), the endpoint of a line as it is being drawn is attracted to nearby elements unless the line is drawn with the right (green) button. The first endpoint is attracted when the button is pressed, and the second endpoint is attracted when the button is released. This attraction allows you to close corners and other intersections neatly. If the gravity field is 0 (off), none of the lines you draw will be attracted to other items, regardless of the button used.

Section 11 explains how to set the gravity field. If you normally do not want to use gravity, put a statement *gravity 0* in your profile, as explained in Section 15.

To create a line, do the following:

1. Type the letter *l* to enter Line mode.
2. Position the cursor where you want the line to begin; then press and hold one of the buttons:
 - a. left (white) - Generic: a line which can go in any direction
 - b. middle (yellow) - Hor/Ver: a line which DP adjusts to a true horizontal, vertical, or diagonal position--0, 90, or 45 degrees
 - c. right (green) - No grav.: a generic line without gravity. The line will not be attracted to other elements, regardless of the current gravity field.
3. Move the cursor to the position where you want the line to end and release the button.

The current thickness (see Section 9.6.1) is used for the line.

If two lines are drawn exactly on top of each other, they become invisible. They can be displayed with the Black mode option in the Unusual Commands menu (Section 11).

7.1.2. Rectangle

To create a rectangle, do the following:

1. Type *L* to enter Rectangle mode (the letter L was chosen because rectangles are just a special case of lines).
2. Position the cursor where you want the upper left corner of the rectangle. Press any button and hold it down. As soon as you start to move the cursor, a rectangle will appear.
3. Move the cursor up or down to change the length, left or right to change the width.
4. Release the button to freeze the rectangle.

7.1.3. String of Text

To create an ASCII string of text, do the following:

1. Type *a* to enter ASCII String mode.
2. Position the cursor where you want the text to begin; then press and release one of the buttons:
 - a. left (white) or middle (yellow) - Single (to enter a single line of text). Terminate the string by pressing RETURN.
 - b. right (green) - Automatic (to enter a sequence of strings which will be aligned below the first string). Position the cursor where you want the first string to begin. Type each string, terminating each by pressing RETURN. The sequence must be single spaced; pressing RETURN twice terminates the action.

You may use upper and lower case characters. If you need to make changes, use the keys and buttons explained in Section 7.2.2. Strings cannot exceed 80 characters.

The current font is used for all characters in the string (see Section 9.6.2).

7.1.4. Circle or Arc

To create a circle or an arc, do the following:

1. Type 0 (zero) to enter Circle mode.
2. To make a circle, position the cursor where you want the center of the circle. Press and hold the left (white) or middle (yellow) button. Move the cursor away from the center of the circle to where you want the circumference; the circle will grow as you move the cursor. Release the button to freeze the circle. This is shown in the Status Line as *Center,r*--indicating a circle with the center and radius determined by pressing and releasing the button.
3. To make an arc, press the right (green) button at the beginning point of the arc. Going in a counterclockwise direction, press the right (green) button again at the end point; and finally press it again in the approximate area of the center of the arc. This is shown in the Status Line as *1,2,center*.

The circumference of the circle or the arc is drawn in the current thickness (see Section 9.6.1).

7.1.5. Spline

To create a spline, do the following:

1. Type 9 to enter Spline mode.
2. Position the cursor where you want the first control point and press any button except the right (green) one. A black rectangle will temporarily mark the location of the control point. (Each control point will not necessarily be located exactly on the completed spline; a smooth curve will be calculated which will run close to each point.)
3. Repeat Action 2 for each control point. You must specify at least two control points; the endpoints will be the first and last control points you specify.
4. Press the right (green) button to create a curve connecting all of the control points.

The current thickness (see Section 9.6.1) will be used.

7.1.6. Filled Areas

To create a filled area (closed polygon), do the following:

1. Type 8 to enter filled area mode
2. Position the cursor where you want the first control point and press any button except the right (green) one. A black rectangle will temporarily mark the location of the control point.
3. Repeat Action 2 for each control point.
4. Press the right (green button) to create a filled area defined by all of the control points.

The default for closed polygons is filled with color 1 (black). The filled area function can be toggled from the k menu. If filled area is NO, only the edges of the polygon are shown.

7.1.7. Pin

A pin is a connection point, used mostly within symbols as a gravity point. Each pin has a number assigned to it.

Pins that are nested within symbols have gravity unless the gravity field is set to 0 (see the discussion of gravity under Lines in Section 7.1.1).

To create a pin, do the following:

1. Type *p* to enter Pin mode.
2. Position the cursor where you want the pin.
3. Press one of the buttons:
 - a. right (green) - to insert a pin with no prompting for the number (the program will assign the pin number, incrementing the previous pin number by 1 regardless of whether the previous number was assigned by the program or you).
 - b. any other button - to insert a pin and to be prompted for the pin number

Pin numbers may range from 0 to 4095. If you supply an incorrect number, you will receive an error message.

7.2. Editing Elements

Edit mode is used to change the shape and size of any existing basic element. (To move, copy, delete, change the parameters, or perform other functions on elements, see Section 9.)

Regardless of the element you are editing, you must first enter Edit mode by typing *e*. Then you must *open* the desired item by pointing at it with the cursor and pressing any button. Circles and splines are opened by pointing at one of their endpoints; lines, strings, pins, and symbols are sensitive over the entire item. The exact procedure then depends on the type of element being edited. The descriptions of the actions associated with each button displayed in the Status Line in Edit mode are meaningful only when editing lines. As you edit, the new shape is redisplayed dynamically.

It is helpful to use a large scale (3 or 4) while you are editing elements (see Section 6.9 for instructions on changing scale).

7.2.1. Line or Rectangle

To edit a line or rectangle, do the following:

1. Type *e* to enter Edit mode.
2. Position the cursor precisely on the line, near the endpoint you want to change; then press and hold one of the buttons. (The whole line is sensitive--that is, you can choose the line by pointing at any part of it. However, the endpoint nearest the cursor is the end that will follow the cursor.) Each line of a rectangle is considered a separate item.

- a. left (white) - Generic (to lengthen or shorten a line or move it in any direction)
 - b. middle (yellow) - Hor/Ver (to lengthen or shorten a vertical, horizontal, or diagonal line)
 - c. right (green) - No grav. (to lengthen or shorten a line in any direction, with no effects from gravity)
3. Move the cursor to the desired new location of the endpoint. The line is dynamically adjusted and appears to follow the cursor in a rubberband fashion. Release the button when the endpoint is at the desired location.

7.2.2. String of Text

To edit one or more strings of text, do the following:

1. Type *e* to enter Edit mode.
2. Identify the string of text you wish to edit by positioning the arrow cursor within the string and pressing any button except right (green). A pencil cursor (a straight line) will appear within the string.
3. Position the pencil cursor where you want to insert or delete characters, as follows:
 - a. left (white) button - position the pencil cursor before the character you are pointing to with the arrow cursor
 - b. middle (yellow) button - position the pencil cursor before the character you are pointing to with the arrow cursor and delete the character following the pencil cursor. Holding the button down deletes several characters.
4. To insert text, just type the text using the Spice Intra line editor (see the [Introduction to the User's Manual](#) for more information).
5. Terminate the editing by pressing RETURN or the right (green) button.

To edit another string, repeat the procedure.

Note that a string cannot be entirely deleted this way. If you delete all of the characters, the original string returns when you press RETURN or the right (green) button. To delete an entire string, use the procedure explained in Section 9.5.

7.2.3. Circle or Arc

To edit a circle or an arc, do the following:

1. Type *e* to enter Edit mode.
2. Press one of the buttons as follows:
 - middle (yellow) button - to change the radius. Open the circle or arc by moving the cursor near one of the endpoints and then pressing and holding the button. (The endpoints of a circle are located at the rightmost point of the circumference.) Move the cursor to the desired new location of the circumference and release the button.

- left (white) or right (green) button - to move the endpoint, changing the subtended angle but keeping the radius constant. (A circle can be shortened to an arc in this manner.) Open the circle or arc as explained above; then move the cursor to the desired location for the endpoint and release the button.

The endpoints must be pinpointed precisely in order for these procedures to work. If the order of the two endpoints is swapped, the circle changes abruptly, for example, from a short arc to an almost full circle or vice versa. If the circle is embedded in a symbol and that symbol is rotated or mirrored, the endpoints of the circle are also transformed. Therefore, when the symbol is unpacked (see Section 8.5), the endpoints of a full circle may no longer be at (Radius,0); they may be at (0,Radius).

7.2.4. Spline

To edit a spline, do the following:

1. Type *e* to enter Edit mode.
2. Position the cursor over one of the endpoints and press any button except right (green). The control points will become visible (displayed as black rectangles).
3. Position the cursor over the endpoint you want to move; then press and hold the left (white) or middle (yellow) button. Move the cursor to the desired location for the point; release the button.
4. Repeat #3 for any other points you want to move.
5. Press the right (green) button to close the spline and erase the control points.

7.2.5. Filled Areas

To edit a filled area, do the following:

1. Type *e* to enter Edit mode.
2. Position the cursor over one of the control points and press any button except right (green). The control points will become visible (displayed as black rectangles).
3. Position the cursor over the control point you want to move; then press and hold the left (white) or middle (yellow) button. Move the cursor to the desired location for the point; release the button.
4. Repeat #3 for any other points you want to move.
5. Press the right (green) button to erase the black rectangles on the control points.

To change the color of the filled area,

1. enter the new parameters menu by either typing *n* or selecting new parameters from the top level menu
2. Select *new color:* and enter the number of the shade that you want, the range is from 1(black) to 17(white).
3. Use the mouse buttons to change the color in the following way:

- left(white) - to change the color of all filled areas enclosed in a rectangle.
- middle(yellow) - to change the color of one filled area.
- right(green) - to change the color of all selected filled areas

7.2.6. Pin

Editing allows you to change the position of a pin number, as follows:

1. Pin Numbers Display should be ON. (If not, invoke the Unusual Commands menu explained in Section 11 and change the display setting.)
2. Type *e* to enter Edit mode.
3. Position the cursor precisely over the pin itself (the two small lines). Press and hold any button.
4. Move the cursor to the desired location for the pin number (it can be located in any of the four quadrants around the pin); release the button.

The display position of new pins is computed automatically when they are used in a symbol.

8. SETS, SYMBOLS, AND INSTANCES

Basic elements can be combined either into a set or into symbols. A set is a group of items (basic elements or symbols) that you temporarily want to handle as a unit so that you can perform the same function on all of the items with one command. A set is formed by using the Select function to designate the desired items. There can be only one set per window. The set will be disbanded when you leave DP (or sooner, if you choose). A symbol is one or more items to which you assign a name and which will be treated as a unit permanently. A symbol consists of a definition (that is, a template) and one or more instances (occurrences) of that symbol. A symbol definition is created with the Pack function.

The advantages of a symbol over a set are:

1. If the symbol is composed of several items, the group will not be broken up when you leave DP.
2. Because a symbol is treated as a unit, it can be moved, etc. without affecting intersecting items.
3. A symbol can be copied very easily within the same drawing or from another drawing on your screen.
4. The symbol is identified with a name and therefore you can copy a symbol from another drawing without bringing up the whole drawing on your screen.
5. Because symbols can contain other symbols, drawings can be created in a hierarchical manner.
6. Symbols may be transformed: rotated, scaled and mirrored.

To make maximum use of DP's power, make into a symbol any item or group of items that is repeated on the same drawing or on more than one drawing. An instance of a symbol can be transformed for parameters such

as rotation and scale, and an instance can also be broken down into its components, edited, and defined as a new symbol. Therefore it is useful to make a symbol even when creating items that are similar. Symbols are the basic mechanism that allows you to create hierarchically structured drawings. They provide a powerful grouping operation for logically related items.

8.1. Forming Sets (Selecting)

A set is a unit consisting of all the *selected* items in a window. Combining basic elements into sets is useful for tasks in which you want to perform the same operation on more than one item, such as deleting several items or moving a group of items that are located near each other. Items that are selected as explained below can be treated as a group for the functions transform, pack, unpack, move, copy, stretch, delete, and set new parameters. However, remember that sets are temporary designations. If the items should always be handled as a unit, make them into a symbol.

To form a set, do the following:

1. Enter Select mode and identify the items to be included by doing one of the following:
 - a. Type *S* to select all of the items on the current window.²
 - b. Type *s* to select certain items. Then press one of the buttons:
 - i. left (white) - Rectangle (to identify the items by enclosing them in a rectangle)
 - ii. middle (yellow) - One item (to choose the items for the set, one at a time)
 - iii. right (green) - Selected (to select all of the items on the current window). This action is the same as typing *S*.

Strings of text that have been selected are inverted on the display (that is, if your screen background is white, the selected string will be displayed as white text on a black background). Other items which have been selected are displayed with a small square near the center of the visible portion of the item.

Items remain selected until you deselect them or exit DP. To deselect all of the items on the current window, type *Z*. To deselect certain items, type *z* and then press the appropriate button. The buttons perform as they do in Select mode.

²Note: If you want to select a large number of items, it is faster to select all items (*s*) and then deselect certain ones (*z*), than it is to select the items one at a time.

8.2. Forming Symbols (Packing)

A symbol is a unit containing one or more basic elements or other symbols. The symbol consists of a definition (that is, a template that specifies how to draw a graphical entity); a unique name assigned by you or DP; and one or more instances (occurrences) of the symbol. If all instances are deleted, the definition is deleted.

You can get a list of the symbol names and the number of times each appears on the current drawing by typing ?. Section 8.3 tells how to find out the name of a particular symbol or to change a name.

8.2.1. Symbol Definition

Creating a new symbol definition from a set of items is called *packing* a symbol.

To pack a symbol, do the following:

1. Draw the components of the symbol. When you are creating a symbol, we recommend a mouse grid of 3 or 6 and a high scale (3 or 4), especially when drawing lines for a shape (Mouse-grid is an Unusual Command, explained in Section 11. Scale is a display command, explained in Section 6.9.)

You will find it useful to copy an existing symbol that is similar, unpack it, edit the components, and then repack it into a new symbol.

2. Type *b*.

3. Press one of the buttons:

- left (white) - Rectangle (to identify all of the items to be included by enclosing them in a rectangle)
- middle (yellow) - One item (to make a symbol with a single item)
- right (green) - Selected (to include all of the items that are Selected on the current drawing)

4. Reply to DP's prompt for a symbol name. You may give the symbol a name or you can let the system generate a name. The advantage of giving a name is that you can then use that name to retrieve the symbol.

5. To name a symbol, type the name (up to 80 characters). If you type the name of an existing symbol, DP asks whether the old definition should be deleted. If you reply no, DP will again prompt for a name. If you reply yes, the old symbol is redefined, as explained in Section 8.6.

To have DP generate a name, press RETURN. DP will assign a name such as \$\$12:28:32 (denoting the time that the symbol was created). Symbols with automatic names should be used inside other symbols. In an integrated circuit symbol, for example, pins are usually complex items consisting of a pin, a string (the visible pin name), and possibly other items. Automatic names are very handy for symbols like this.

To change a symbol name, see Section 8.3. To change a symbol definition, see Section 8.6. You cannot explicitly delete a symbol definition; it is automatically deleted when all instances of the symbol have been deleted.

8.2.2. Symbol Instances

You may use a symbol as many times as you wish, by creating instances of it. To create an instance, copy the symbol as explained in Section 9.2. Because the Copy command works across windows, you may copy a symbol from any drawing on the screen.

If you wish to copy a symbol from another drawing without bringing the whole drawing to the screen, use the *i* (input symbol) command explained in Section 10.4.

8.3. Displaying or Changing a Symbol Name

To display or change the name of a symbol, do the following:

1. Type *e* to enter Edit Mode.
2. Point to the symbol and press one of the buttons:
 - right (green) - to change the name
 - any other button - to display the name in the lower left corner of the screen

If you pressed the right (green) button, DP will display the current name in the prompt area. Edit the name as desired.

If you change the name, all of the instances of that symbol will be renamed. It is illegal to rename a symbol to a name already in use.

8.4. Transforming Instances

Symbol instances may be rotated, mirrored, or changed to a new scale without affecting the original symbol definition. Do the following:

1. Type *t* to enter Transformation mode. A pop-up menu will appear with the following items:
 - Rotate 90
 - Rotate counter-clockwise
 - Rotate clockwise
 - Mirror X(-) (mirror the item around the X axis)
 - Mirror Y() (mirror the item around the Y axis)
 - Scale (scale an item along both axes, relative to the current size. For example, if you specify 0.5, pointing to an item (#4 below) will reduce that item in half. Pointing to it again will reduce it in half again.)
 - Scale X (same as Scale, except it works only on the horizontal axis. To scale along the Y axis only, rotate the item, scale X, and rotate the item back to its original position.)
 - Strip transformations (remove previous transformations and return a symbol to its original parameters)
2. Pick one option from the menu.

3. Read parameters (display in the lower left of the window the current parameters on chosen symbols) Move the cursor to the desired transformation and press any button.
4. Reply to DP's prompt for information, if any (such as angle of rotation).
5. Indicate the instance(s) to which the transformation is to be applied, by pressing a button as follows:
 - left (white) - Rectangle (to identify the instances by enclosing them in a rectangle)
 - middle (yellow) - One item (to identify one instance at a time)
 - right (green) - Selected (to transform all the instances that have been selected on the current window)

8.5. Unpacking an Instance

Unpacking an instance of a symbol refers to breaking it up into its components. The item will no longer exist as an instance; in its place will be the elements and nested symbols that made up the symbol. The symbol definition is not affected (unless this was the only instance, in which case the definition is deleted). To unpack a symbol instance, type *B* and then identify the instance you wish to unpack by pressing the appropriate button: left (white) - Rectangle; middle (yellow) - One item; right (green) - Selected. To unpack a nested symbol, repeat the procedure at each level of nesting.

8.6. Redefining a Symbol

To redefine a symbol, do the following:

1. Draw the symbol with its new configuration,
2. Pack the new symbol definition (as explained in Steps 2 and 3 in Section 8.2.1, type *b* and then use the buttons to identify the elements to be included in the symbol).
3. When DP prompts for the symbol name, type the old name. DP will warn that the name is in use and ask if you want to delete the old definition. Reply yes.

All instances on the current drawing and on any other drawing on the screen are changed to the new definition. However, other drawings that contain instances of the old symbol, but which are not on the screen, are not affected.

9. MANIPULATING ITEMS

The following sections describe all the operations that can be performed on elements, sets, or symbol instances. In all cases, the selected set or a symbol instance is treated as one item. Items on write-protected layers are not affected by any of the commands.

9.1. Moving

You may move one or more items within a window or from one window to another. (Move and Copy are the only commands that work across window boundaries.)

To move one or more items, do the following:

1. Type *m* (for Move).
2. Press and hold one of the buttons:
 - left (white) - Rectangle (to enclose in a rectangle and move a group of items)
 - middle (yellow) - One item (to move one item at a time)
 - right (green) - Selected (to move as a group all the selected items)
3. Move the cursor to the desired new location for the item(s) and release the button.

9.2. Copying

You may copy one or more items within a window or from one window to another. The procedure is the same as that explained above for the Move function, except in Step 1 type *c* for Copy.

9.3. Stretching

The Stretch function (also called the Sticky Move function) resembles the Move function, but it is especially adapted for circuit design--lines, strings of text, and symbols can be moved along with connecting lines. Strings and symbols can be moved in any direction; vertical lines can be moved only horizontally and horizontal lines can be moved only vertically. When vertical lines are moved, connecting lines are stretched to the new location. A line is considered to be connected to a symbol if the line ends exactly over a pin of the symbol. If possible, all existing connections are preserved and no new connections are created.

To stretch an item, do the following:

1. Type *x*.
2. Use one of the buttons to identify the item(s) to be stretched:
 - left (white) - Rectangle (enclose the items to be stretched in a rectangle)
 - middle (yellow) - One item (to stretch one item at a time)
 - right (green) - Selected (to move all Selected items in the direction of the cursor movement; however, connecting lines are not stretched)
3. Move the cursor to the desired new location and release the button.

9.4. Rotating

Symbol instances can be rotated in Transformation mode, as explained in Section 8.4. Strings of text can be rotated as they are typed or afterward, by specifying the font as one that contains the desired rotation angle. Details are given in Sections 9.6.2 and 9.6.3.

9.5. Deleting and Undeleting

To erase one or more items, do the following:

1. Type *d* to enter Delete mode
2. Press one of the buttons, as follows:
 - left (white) - Rectangle (to delete a group of items identified by forming a rectangle around them)
 - middle (yellow) - One item (to delete one item at a time) A circle or arc can be deleted by pointing to the line or any area inside. If you delete within overlapping items, all of those items are deleted.
 - right (green) - Selected (to delete all Selected items in the current window)
3. Typing D results in the same action as pressing the right (green) button.

If you have trouble deleting an item, it may be because you are not using the same mouse grid used to create the item. Type the *g* command to switch grids, as explained in Section 6.2.

As a safety feature in case you unintentionally delete one or more elements, deleted items are not physically removed from memory until you re-enter Delete mode. (The items are deleted immediately upon re-entry, even before you delete any additional items.) To see what deleted items are being held, type *?* Each item will be listed with its coordinates and name (circle, line, etc.). To undelete an item, type *u* (for undelete). Deleted items are returned to the drawing in their original positions and are selected. The fact that they are selected is useful in case you want to keep only one of them--deselect the desired item; then delete the selected items. If you want to intentionally erase the latest deleted items to save memory space, type another *d* (to in effect re-enter Delete mode) immediately after you have finished deleting. However, remember that if you do this you can no longer retrieve those items.

9.6. Specifying Parameters

You can control the following parameters for each item:

- thickness (of lines, circles, and splines) - see Section 9.6.1 below
- font (for strings of text) - see Section 9.6.2 below
- the layer on which the item appears - see Section 13
- color (applies to all items except symbol instances). In a black and white system, this parameter is meaningless (a default of 1 is used). However, the program has allowed for systems that use color.

As explained in the following sections, you can change the default thickness or font before you create a new item and you can change any of the parameters on existing items. To see what parameters have been used on an existing item, type *t* to enter Transformation mode, as explained in Section 8.4.

9.6.1. Thickness

To change the current thickness (the one in effect as you create new items), do the following:

1. Type a minus sign (-).
2. Type a number in the range 1 to 7 (1 is a very thin line, and 7 is very thick). If you type a number higher than 7, No. 7 thickness will be used.

The new value will be used for all new lines, splines, and circles. To change the thickness of existing items, see Section 9.6.3.

9.6.2. Fonts

DP supports multiple fonts and maintains a menu of fonts for each drawing. The font specification is device-independent (it describes an *abstract* font such as Helvetica8 or TimesRoman12, which is approximated as closely as possible on output devices).

For each font, the description (which appears on the font menu) consists of five items:

family	the name of the family. A family is a set of fonts with similar characteristics, such as Helvetica, Gacha, TimesRoman, etc.
size	an integer indicating the size of the font, usually in the range 6 to 16 (small numbers mean small fonts).
face	one or two characters that describe the particular face used. Valid characters are r (Roman, the standard face), b (boldface), i (italics), and bi (boldface italics).
rotation	an integer indicating the rotation of the font, expressed in degrees from the positive X axis (0 for standard fonts like the printing on this page, 90 for fonts running vertically up the page). In converting the rotation, DP may round off the number (for example, to 89.999992370605).
PERQ font	the name of the file containing the font that will be used to display the string on the screen. Such files usually have the extension .KST. If the font file is not in the directory in which you will be using DP, you must add the directory containing the font to your search list before you enter DP.

The PERQ font ~~does not have~~ to match the above specifications which will be used when the drawing is printed. You can use the same PERQ font for more than one DP font; although the items will appear on your screen in the same font, the specified font for each item will be used when printed.

If you want to rotate a string of text 90 degrees, you must have two fonts of the same family and size. One should have a rotation of 0 degrees and the other 90 degrees.

To change the current font (the one in effect as you create new strings), to enter a new font, or to delete an existing font, do the following:

1. Type *f* (for font). A menu will be displayed, showing all of the active fonts plus options to add or delete fonts.
2. Point the cursor to the desired font or option and press any button.
3. If you selected a font, no further action is necessary. All new strings you create will be in the selected font. If you chose to delete a font, another menu appears showing the current fonts. Position the cursor over the font and press any button. An error message is generated if the font is still in use.

If you chose to add a font, a prompt buffer appears with a default font which you may edit. You must specify the five pieces of information shown above. In some cases you can define a new font merely by specifying a different size, face, and rotation and using the same family and PERQ font file used for an existing font; but in some cases you must specify a different font file which precisely defines the font you are adding. When you add a new font, it is automatically chosen as the current font. If you specify a PERQ font that doesn't exist, DP will not accept it. DP will list a font that is on file, and you must start over.

Section 10.5 explains a method for accessing from within DP a file containing the names of font files. If all of your font files are in one directory and if all have the extension .KST, you can create such a file at the command level by pathing to the appropriate directory and typing `dir *.kst <filename>`.

9.6.3. Setting New Parameters on Existing Items

Changing parameters on existing items is a three-step process. First enter the New Parameters mode by typing *n*. A menu appears with two items for each of the four parameters (thickness, font, layer, color). The second step is to specify a new parameter. The first block in each set on the menu is the last value specified in New Parameters (it is not the current parameter). Thus DP keeps a parameter in memory, which is useful if you are switching between two parameters frequently. Pressing any of the first blocks sets the parameter as shown. If you wish to change the parameter, select the second block of the set and DP will prompt for a new value. After you reply, the prompt area will disappear.

After you have set a new parameter, the third step is to indicate which items you wish to change to the new parameter. Point the cursor to the item; then press one of the buttons:

- left (white) - Rectangle (to identify the items to be changed by enclosing them in a rectangle)
- middle (yellow) - One item (to choose one item at a time)
- right (green) - Selected (to change all the selected items on the current drawing)

The New Parameters mode does not affect the current parameters. That is, if the current thickness is 2 and you enter New Parameters and change some lines to a thickness of 6, new lines which are drawn subsequently will have a thickness of 2. Note: To find out the current parameters on any item, type *t* to enter Transformation mode, as explained in Section 8.4.

10. INPUT AND OUTPUT FILES

You can write out all of the items to a DP file which can be used in subsequent DP sessions. You can read in another drawing in its entirety, a symbol definition or text from another drawing, or commands contained in a separate file. When a file is being read or written, a message telling what action is being taken appears at the lower left corner of the screen.

10.1. Writing to a DP File

A DP file stores the drawing along with instructions to DP so that the drawing can be edited in subsequent DP sessions. As you are working, DP automatically saves the drawing periodically in a checkpoint file (which is a DP file), but you may write to the original file (or any other file) at any time. Before you leave DP, you should write the drawing to a DP file of your choice if you wish to keep any items created and any changes made in the current session.

To write all of the items in the current window to a file, do the following:

1. Type *o* (for output).
2. Either type a filename (the program will assign the extension .DP) or press RETURN to use the default name shown in brackets. (Include the pathname if you do not want to put the file in the current directory.)
3. If a file of that name already exists (a previous version of the drawing), the previous file will be saved with a \$ appended to the name. This follows the usual practice on a PERQ of making a backup copy before overwriting a file.

10.2. Creating a File from Which to Print a Hard-Copy

If you want to print a hard-copy of the drawing, you must create a press file. A press file consists of a single page containing either the whole drawing or the portion that is visible on the screen (depending on the Clip option you have set, as explained in Section 11). You can change the amount of the drawing that appears on the screen with the = command, explained in Section 6.9.

To create the file, do the following:

1. Type *H* (for hard-copy).
2. Type a filename.

The press file is added to your current directory, and you may request a print of it by running the Dover program (for more information see the Spice Commands and Utilities manual).

If you want the drawing reproduced on a plotter, use the *Send to plotter* command (see the Unusual Commands in Section 11).

The scale of the drawing on the screen may not correspond exactly to the scale of the copy produced on the printing device. You may wish to develop a ruler or grid which shows the relationship and incorporate it as a layer on each drawing.

10.3. Reading in Another Drawing in Its Entirety

To read in another drawing file and merge it with the items in the current window, do the following:

1. Type *I* (for input).
2. Reply to the prompt by typing a filename. If the file does not exist, DP will generate an error message.

Depending on which *Center files* option you've chosen (see Section 11), the items from the other drawing will be either centered in the window (intermingled with the items, if any, on the current drawing) or entered in the same position they occupied on the original drawing. As explained in Section 15, your profile can determine whether the mouse grids from the other drawing are imported.

If the incoming drawing contains a symbol with the same name as a symbol on the current drawing, the symbol on the current drawing will be either replaced or simply renamed, depending on the *rename-symbols* commands in your profile (see Section 15) and the *rename redefined* command on the Unusual Commands menu (see Section 11).

10.4. Reading in a Symbol from Another Drawing

To create an instance of a symbol which has been defined in another drawing, do the following:

1. Position the cursor where you want the instance to be located.
2. Type *i* (for input symbol).
3. Reply to the prompt for the symbol name. (If the name is the same as the name of a symbol in the current drawing, you will receive an error message.)
4. Reply to the prompt by typing a filename. DP supplies as a default filename the name of the symbol, which you can edit (helpful if you have given symbols and files similar names). If the file does not exist or the symbol is not defined in that file, you will receive an error message. If the symbol is found, an instance of that symbol will be created, centered around the cursor position.

You can specify that a menu of symbol names appear when the *i* command is given. Use either the read

symbols file command on the Unusual Commands menu (see Section 11) or the profile option parts-file (see Section 15).

10.5. Reading in Text from A File

Sometimes it is useful to be able to read in a text file (usually to a window which you have opened for just that purpose). For example, you might want to look up the specifications for a design, or you might want to look at a file you have created previously which contains the names of all of the font files on your PERQ. You might also want to read in text to be included as part of the drawing you're working on.

To read in text from a file and have it displayed as ASCII strings in the current window, do the following:

- Position the cursor where you want the text to begin.
- Type *j*.
- Type the filename, including the extension.

The text will begin at the cursor position, in the current font. Each line of the file will be considered a separate text string.

10.6. Reading in Commands

You can store commands to set various options in a DP profile file, as explained in Section 15. The commands will take effect automatically when you enter DP.

You can store any of the commands that set options, as well as commands to actually create a drawing, by creating a transcript of a DP session as explained in Section 12. To read in the transcript, type @ and then reply to DP's prompt for the filename. DP will take control, executing the commands contained in the file. (Transcripts are not officially supported and are not guaranteed to work for different versions of DP.)

11. UNUSUAL COMMANDS

A group of commands which most users will need infrequently have been designated as Unusual Commands and combined in a special pop-up menu. To use these commands, do the following:

1. Type *k* to obtain the menu.
2. Choose the desired option by pointing the cursor at it and pressing any button. (The options are described below.)
3. Reply to DP's prompt for information, if any. If information is required, a default (the previous value) is shown. The default can be selected by pressing RETURN or it can be edited. If the command requires a Yes or No argument, pressing any button will reverse the argument.
4. To remove the menu, either move the cursor outside the menu and press any button or press any key.

Many of these commands with the desired values can be placed in your profile (see Section 15).

Here are the options that are available:

- checkpoint** Specify the number of commands between automatic saves. After the specified number of commands has been type *d* to a window, the contents are written to a checkpoint file.
- display grid** Alter the distance between dots in the Display Grid, simulating graph paper. This is useful for aligning items. Grid 2 provides dots that are extremely close together; Grid 200 provides dots far apart. In Grid 1 the dots are so close that the result is a black back-ground. (The grid is made visible or invisible with the ' command.)
- mouse grids** Add, delete, or change grids on the circular list of mouse grids. The use of mouse grids is discussed in Section 6.2. If you choose to add a grid to the list, DP will prompt for the grid after which the new grid should be placed. Therefore you can arrange the circular list to your liking.
- gravity** Specify the size of the gravity field, in screen units. Smaller fields have weaker gravity; a value of 0 means that gravity is not used. A setting of 10 is strong. On very crowded drawings, 0 gravity greatly increases the speed with which things are handled.
- center files** Specify whether items read in from another drawing will be centered on the current drawing (YES) or located in the same position they occupy on the other drawing (NO).
- rename redefined** If YES, a symbol in the current drawing is renamed if a symbol with the same name is read in with the I command (a \$ is appended to the symbol name on the current drawing). If NO, the symbol on the current drawing is replaced by the incoming symbol. (This also can be set with the *rename-symbols* command in your profile, as explained in Section 15.) Note: This does not apply to the i command because that command will not permit you to read in a symbol with the same name as an existing symbol.
- read symbols file** Read a parts file and list the symbol names on a menu when the i command is given.
- display diamonds** Specify that a black diamond be displayed on the screen at the *T* connections of two lines, butting connections of two lines, and connections of three or more lines.
- outline press strings**
Default is OFF. If ON, draw outline around all ascii strings.
- display in black mode**
Display in black those items that are normally inverted (such as the intersection where lines overlap or two lines drawn on top of each other). When you give this command, only existing items are affected, not the items drawn subsequently.
- fill areas** If YES, fills polygon areas with color indicated in the new parameter menu. If NO, draws only the borders of polygons.
- pin numbers** Enable or disable the displaying of pin numbers. The screen is redrawn when this command is given.

- pins** Enable or disable the displaying of pins. The screen is also redrawn when this command is given.
- send to plotter** Print the drawing on a plotter (requires that your PERQ be connected to a plotter)
- clip (Press)** If YES, a press file will include only the portion of the drawing that is visible in the window (it is cut off at the window boundaries). If NO, the whole drawing is printed.
- diamonds (Press)** If YES, a press file will include diamonds (whether or not the diamonds are displayed on the screen).

12. TRANSCRIPTS

If you would like to create a transcript of a DP session (to use, for example, in a demonstration), within DP type `§`. Execute the desired commands and then close the file by typing another `§`. All of the commands you type between opening and closing the file will be saved in a file called `DpScript`. To play back the file, enter DP and type `@`; DP will prompt for the filename. After you type the filename, DP will execute all of the commands in that file.

A transcript may be stopped during replay by pressing and holding any mouse button; release the button to resume the replay. You may specify a few seconds delay between commands. When you type the filename, follow it with a number from 1 to 32767. The default is 0 (no delay). If you want to keep more than one transcript on file, rename the transcript after you leave DP. Otherwise, it will be written over the next time you create a transcript. Transcripts are not supported in all versions of DP.

13. LAYERS

In DP a drawing may be divided into layers, providing the same effect as multiple transparencies. Each layer is independent and can be made visible or invisible. A layer can also be set to read-only, so that changes are not made to it accidentally while you are working on another layer. You can control whether or not a layer appears in output files.

The layer mechanism is especially useful for complex drawings that contain logically separated parts. For example, when one is working on a printed circuit board, only one layer at a time is usually worked on, but it is essential that all of the layers be visible. Another common use of layers is to having a layer which contains only construction lines which can be made visible as needed. Construction lines may be kept even after the drawing is finished so that they can be reused if modifications to the drawing are made later. The layer mechanism is also used by circuit post-processors to quickly discard useless information, such as items in a Comment layer.

Invisible layers result in faster operations, since various algorithms that search DP items (such as the Gravity algorithm and the One-item-at-a-time algorithm associated with the middle or yellow button) scan only visible items.

A symbol can be made from items on different layers. Layers and symbols interact in the following way:

- If the symbol is on an invisible layer, all of the items that make up the symbol are invisible (even if some of them are on visible layers).
- If the symbol is on a visible layer, the visibility of the parts depends on the layer on which each is located.

The following sections explain how to change the settings on existing layers, how to switch from one layer to another, and how to create, delete, or rename a layer.

13.1. Changing Settings or Changing to Another Layer

To change the settings on existing layers or to switch to working on a different layer, do the following:

1. Type `v` to get the Layers menu. The top portion of the menu displays all the layers and the settings of the parameters for each. If the box is black, the parameter is ON. The parameters are:
 - Display - If ON, the items in the layer are visible. If OFF, the items in the layer are invisible, do not have gravity.
 - Alter - If ON, the items are affected by DP operations. If OFF, the items are write-protected.
 - Output - If ON, items are written to a file when the `o` command is given. If OFF, you will receive a message that some items have not been written out.
 - Current - If ON, this is the layer that will be current when you leave the menu.

To change a parameter of any level, point to the appropriate box in the menu and press any button. The parameter will be switched from its previous setting.

2. To change the current layer (the layer into which new items will be placed), point to the Current rectangle of the desired layer and press any button.

Like regular pop-up menus, the Layer menu can be terminated by positioning the cursor outside the menu and pressing any button.

13.2. Creating, Deleting, or Renaming a Layer

To create a new layer, rename an existing layer, or delete a layer, do the following:

1. Type `v` to get the Layers menu.
2. Point the cursor to the desired option at the bottom of the menu (New Layer, Rename, Delete) and press any button.
 - To create a new layer, reply to the prompt by typing a name (up to 80 characters). (All layers

must have unique names; if you specify the name of an existing layer, you will receive an error message.)

- To rename a layer, choose the layer from the next menu DP provides; then reply to the prompt for a new name. (The default name for the first layer created in a drawing is Standard, which you may change if you wish.)
- To delete a layer, reply to DP's prompt by typing the layer's name.

14. MULTIPLE WINDOWS

You may work on several drawings at a time by opening a window for each one. You may also find it useful occasionally to open a scratch window on which to try out things which can be moved to the good drawing if desired. To switch from working in one window to another window, just move the cursor. The only commands that work across windows are Move and Copy.

A region of the border near the lower left corner is used to display the filename associated with each window. If no filename is given when DP is invoked or when the window is opened, DP assigns a default name. Windows are opened, closed, and manipulated by positioning the cursor over the border of the window in a particular spot and pressing any button. Different areas of the border have different functions, as listed below and shown on Figure 6-1.

Change the shape or size of the window - square at upper right corner (icon showing a reduced window within the screen). The corner follows the cursor until you release the button. See Figure 14.1.

Create a new window, using one half of the area of the current window - square at lower left corner (icon showing two windows). The current window is divided in half, and the new window appears above the current window. The new window is empty initially. The original window is unaffected but, because it is smaller now, not all of the items may be visible (use the w command to scroll the window or the = command to change the scale).

Delete the window - square at upper left corner (icon showing an X). The space that had been occupied by the window will be empty after you delete the window. In order to delete a window, it must be empty (type *SDD* if you have not made any changes you wish to keep). The last window cannot be deleted; you must exit DP in the regular manner by typing *q*.

Move the window in the screen, without changing its size or shape - black border.

There is only one status line regardless of how many windows you have opened. Changing the current function (from circle to line, for example) changes the current function for all windows. Many commands

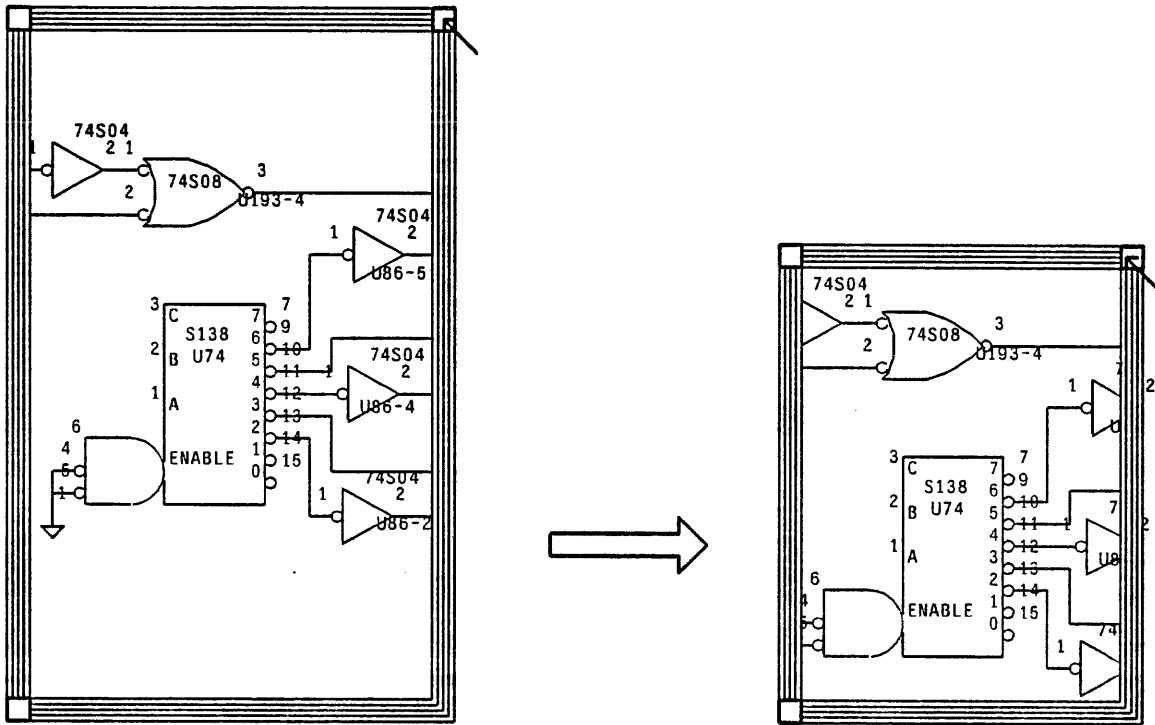


Figure 6: Reducing a Window

cannot be invoked if the cursor is outside a window. In that case, the Status Line will not show the new command and the PERQ will beep. Changes made in a drawing are not written to a file until you give the o command (see Section 10.1). If you bring in a file but do not make any changes you wish to keep, you can remove the drawing from your screen by a) typing SDD to select, delete, and erase from memory all items and then b) deleting the window itself, as explained above. The original file will remain unchanged. You cannot work on different parts of the same drawing by opening multiple windows. Although a drawing can be displayed in more than one window, only the changes made in one window will be kept.

15. PROFILE FILES

A DP profile file contains defaults which are put into effect each time you enter DP. You may override the defaults after you are within DP if you wish. Adapting a profile to the tasks you perform most often will greatly enhance your efficiency. You can access the DP profile when you enter DP, as explained in Section 3. (You might want to do this if your profile contains options that you want to be in effect for only certain tasks.)

Throughout this manual *profile* refers to the DP profile file.

The profile file is a text file. Case is ignored, and one or more blanks may be used to separate items on a line.

Comments may be inserted by beginning the line with an exclamation point (!); everything after ! is discarded. The commands may be entered in any order. The general format of a line is a keyword (which must be spelled out completely), usually followed by one or more values. Options that have a Boolean value are listed as ON or OFF (ON, of course, corresponds to true). You may specify that more than one window be opened, by including begin-window and end-window statements. Between those statements you may insert only certain commands that pertain to windows, as explained in Section 15.2. If errors are encountered in the profile, DP will print a warning and ask for permission to continue. New values override old ones. Therefore if you put a command into the profile more than once, the last value is retained until you change it within DP. The following sections give the keyword, description of the values, and an example for each command which may be placed in the profile. Unless stated otherwise the example shows the default value that DP will use if you do not put the command in your profile. Although ON and OFF are capitalized in the following sections, you do not have to capitalize them in your profile.

15.1. General Commands

The following commands are recognized:

pin-numbers	If ON, pin numbers are displayed. Default: pin-numbers OFF
pin-positions	If ON, pin positions are displayed. Default: pin-positions OFF
center-files	If ON, a file which is read in will be centered in the current file. If OFF, items will appear in the same location as on the original drawing. Default: center-files ON
rename-symbols	If ON, a symbol is renamed if a file containing a symbol with the same name is read in with the I command (a \$ is appended to the name of the symbol in the current file). If OFF, the symbol on the current drawing is replaced by the incoming symbol with the same name. (This is the same as the rename redefined command on the Unusual Commands menu.) Note: This does not apply to the i command because that command will not permit you to read in a symbol with the same name as an existing symbol. Default: rename-symbols ON
parts-file	When the i command is given to input a symbol, the names of the symbols in the specified file are displayed on a menu. Example: parts-file :user>SLparts
font	DP will append the specified font to the font table on each new drawing. The argument should be in the same format as that required for the f command. Example: cmss 8 r 0 cmss8r10.kst
def-font	This statement performs the same function as font explained above, except that the specified font is then used as the default font. Default: def-font gacha 7 r 0 gacha7.
layer	DP will append the specified layer to the layer table on each new drawing. The argument is a layer name followed by the attributes--a maximum of three

	characters from the set [r w o] meaning Readable, Writable, Output-able. If the letter is present, the attribute is ON. Default: layer Standard rwo
def-layer	This statement performs the same function as layer explained above, except that the specified layer is then used as the default layer. Default: def-layer Standard rwo
def-thickness	DP will use the specified thickness as the default for lines, circles, and splines. Default: def-thickness 1
def-color	DP will use the specified color as the default. Only 1 is meaningful on a black and white system. Default: def-color 1
checkpoint	After the specified number of keystrokes in a window, DP will write the window to a checkpoint file. Default: checkpoint 100
gravity	DP will use the specified gravity as the default. Higher numbers mean stronger gravity. A setting of 0 means do not apply gravity at all. Default: gravity 5
commands-file	The argument is a file containing a list of the commands which are to be displayed in the Top-Level Commands menu. See Section 6.5.1 for details on how to set up the file. If you do not have this command in your profile, DP uses its own default menu. Example: commands-file Dpcmds.txt
clip-press-on-window	If ON, only the portion of the drawing that is visible in the window will be written out when you create a press file. Default: clip-press-on-window OFF
diamonds-in-press	If ON, print diamonds in press files.
begin-window	DP will create a new window. The argument consists of four numbers which represent the coordinates of the lower left and the upper right corners. Coordinates are x,y pairs. The default is a full-size window--(0,0) at the bottom left of the screen and (767,1023) at the top right. Between this statement and the end-window statement, you may place only the commands shown in Section 15.2. Default: begin-window 0 0 767 1023
end-window	This statement ends the special window mode invoked with the above statement. Example: end-window

15.2. Window Commands

Between a begin-window and an end-window statement, you may place the following commands. Other commands will not be recognized. Each command will apply only to that window.

scale	DP will use the specified scale for the new window. A real number must be used. Default: scale 1.0
mouse-grid	DP will use the specified mouse grid for the new window. Default: mouse-grid 3
alternate-grid	Insert a new grid at the top of the circular list.
display-grid	use the specified display grid in the new window. Default: display-grid 6

show-grid If ON, the display grid will be visible in the new window. Default: show-grid
OFF

Appendix A

Summary of DP Commands

A.1. General commands

Top-Level menu: rectangles in border or press space bar (Section 6.5)

Window (Section 14): Change shape--upper right square
 New window--lower left square
 Delete window--upper left square
 Move window--gray border

A.2. Keyboard commands

<i>a</i>	enter ASCII String mode
<i>b</i>	create (pack) a symbol definition
<i>B</i>	unpack a symbol instance into its components
<i>c</i>	copy items and move them
<i>d</i>	enter Delete mode
<i>D</i>	delete all Selected items
<i>e</i>	enter Edit mode
<i>f</i>	change the current font
<i>g</i>	go to the next mouse grid
<i>G</i>	go to the next mark in the circular buffer
<i>h</i>	(or press HELP) type a Help file
<i>H</i>	create a press file for printing
<i>i</i>	read a symbol from a file and put it at the current position
<i>I</i>	read a drawing from a file, merging it with the current window
<i>j</i>	read a text file
<i>k</i>	present Unusual Commands menu (see section 11)
<i>l</i>	enter Line mode
<i>L</i>	enter Rectangle mode
<i>m</i>	move items
<i>n</i>	set new parameters for existing items
<i>o</i>	write out contents of window
<i>p</i>	enter Pin mode
<i>q</i>	quit
<i>r</i>	refresh the current window
<i>R</i>	redraw whole screen
<i>s</i>	enter Select mode
<i>S</i>	select all items in current window
<i>t</i>	transform symbol instances
<i>u</i>	undelete items
<i>v</i>	layers menu
<i>w</i>	move the image inside the current window
<i>z</i>	enter Deselect mode
<i>Z</i>	deselect all items in current window

<i>0</i>	enter Circle mode
<i>9</i>	enter Spline mode
<i>8</i>	enter fill areas mode
<i>-</i>	change current thickness
<i>=</i>	change current scale
<i>'</i>	toggle display grid
<i>?</i>	info
<i>INS</i>	insert mark at center of the current window
<i>DEL</i>	delete last mark
<i>@</i>	alt. input
<i>Space</i>	top-level menu
<i>\$</i>	transcript

A.3. Unusual commands (in the 'k' menu)

set no. of commands between checkpoint saves

alter distance between dots in display grid

change list of mouse grids

specify strength of gravity

center incoming files, Y/N

rename symbol if same name as symbol on incoming dwg--YES = rename; NO = replace

display a menu of symbol names when the i command is given

outline press strings

display in black mode the marks at overlapping existing items (non-permanent)

display diamonds at intersections of lines, Y/N

fill areas, Y/N

display pin numbers, Y/N

display pins, Y/N

send to plotter

clip the drawing to the size of the window when printed on Dover printer, Y/N

print diamonds when drawing is printed, Y/N