

appears on your screen it is because the shell couldn't find the Magic program. The most stable version of Magic is the directory `~cad/bin`, and the newest public version is in `~cad/new`. You should make sure that both these directories are in your shell path. Normally, `~cad/new` should appear before `~cad/bin`. If this sounds like gibberish, find a Unix hacker and have him or her explain to you about paths. If worst comes to worst, you can invoke Magic by typing its full name:

```
~cad/bin/magic tut1
```

Another possible problem is that Magic might not know what kind of display you are using. To solve this, use magic's `-d` flag:

```
magic -d display tut1
```

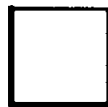
Display is usually the model number of the workstation you are using or the name of your window system. Look in the manual page for a list of valid names, or just guess something. Magic will print out the list of valid names if you guess wrong.

If you are using a graphics terminal (not a workstation), it is possible that Magic doesn't know which serial line to use. To learn how to fix this, read about the `-g` switch in the `magic(1)` manual page. Also read the `displays(5)` manual page.

5. The Box and the Cursor

Two things, called the *box* and the *cursor*, are used to select things on the color display. As you move the mouse, the cursor moves on the screen. The cursor starts out with a crosshair shape, but you'll see later that its shape changes as you work to provide feedback about what you're doing. The left and right mouse buttons are used to position the box. If you press the left mouse button and then release it, the box will move so that its lower left corner is at the cursor position. If you press and release the right mouse button, the upper right corner of the box will move to the cursor position, but the lower left corner will not change. These two buttons are enough to position the box anywhere on the screen. Try using the buttons to place the box around each of the colored rectangles on the screen.

Sometimes it is convenient to move the box by a corner other than the lower left. To do this, press the left mouse button and *hold it down*. The cursor shape changes to show you that you are moving the box by its lower left corner:



While holding the button down, move the cursor near the lower right corner of the box, and now click the right mouse button (i.e. press and release it, while still holding down the left button). The cursor's shape will change to indicate that you are now moving the box by its lower right corner. Move the cursor to a different place on the screen and release the left button. The box should move so that its lower right corner is at the cursor position. Try using this feature to move the box so that it is almost entirely off-screen to the left. Try moving the box by each of its corners.

You can also reshape the box by corners other than the upper right. To do this, press the right mouse button and hold it down. The cursor shape shows you that you are

reshaping the box by its upper right corner:



Now move the cursor near some other corner of the box and click the left button, all the while holding the right button down. The cursor shape will change to show you that now you are reshaping the box by a different corner. When you release the right button, the box will reshape so that the selected corner is at the cursor position but the diagonally opposite corner is unchanged. Try reshaping the box by each of its corners.

6. Invoking Commands

Commands can be invoked in Magic in three ways: by pressing buttons on the mouse; by typing single keystrokes on the text keyboard (these are called *macros*); or by typing longer commands on the text keyboard (these are called *long commands*). Many of the commands use the box and cursor to help guide the command.

To see how commands can be invoked from the buttons, first position the box over a small blank area in the middle of the screen. Then move the cursor over the red rectangle and press the middle mouse button. At this point, the area of the box should get painted red. Now move the cursor over empty space and press the middle button again. The red paint should go away. Note how this command uses both the cursor and box locations to control what happens.

As an example of a macro, type the **g** key on the text keyboard. A grid will appear on the color display, along with a small black box marking the origin of the cell. If you type **g** again, the grid will go away. You may have noticed earlier that the box corners didn't move to the exact cursor position: you can see now that the box is forced to fall on grid points.

Long commands are invoked by typing a colon (":") or semi-colon (";"). After you type the colon or semi-colon, the ">" prompt on the text screen will be replaced by a ":" prompt. This indicates that Magic is waiting for a long command. At this point you should type a line of text, followed by a return. When the long command has been processed, the ">" prompt reappears on the text display. Try typing semi-colon followed by return to see how this works. Occasionally a "]" (right bracket) prompt will appear. This means that the design-rule checker is reverifying part of your design. For now you can just ignore this and treat "]" like ">".

Each long command consists of the name of the command followed by arguments, if any are needed by that command. The command name can be abbreviated, just as long as you type enough characters to distinguish it from all other long commands. For example, **:h** and **:he** may be used as abbreviations for **:help**. On the other hand, **:u** may not be used as an abbreviation for **:undo** because there is another command, **:upsidedown**, that has the same abbreviation. Try typing **:u**.

As an example of a long command, put the box over empty space on the color display, then invoke the long command