

SCREEN MAKER

**ICON Software
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INTRODUCTION

OVERVIEW

SCREEN MAKER is a BASIC utility program that allows you to write BASIC programs combining up to 15 different graphics modes on your screen simultaneously. If you need many different mixtures of graphics modes, SCREEN MAKER will let you make a package of many different screen layouts. You decide where on each screen you are going to want large text, small text, and any of the different graphics resolutions.

SCREEN MAKER generates a set of BASIC subroutines, and then prints them to disk so that you can append them to your program. You can successfully use these subroutines even if you have no understanding of Atari's display list feature or memory requirements. SCREEN MAKER manages all of the requirements for creating the display lists needed to mix different graphics modes on one screen. You can now use custom designed screens as easily as you use the currently built-in graphics modes. Your program simply retrieves a particular screen and either prints or plots using normal BASIC statements to a particular window on that screen.

REQUIRED ACCESSORIES

ATARI BASIC Language Cartridge
48K RAM
ATARI 810 Disk Drive

OPTIONAL ACCESSORIES

One ATARI Joystick Controller
ATARI 825 Printer

CONTACTING THE AUTHOR

Users wishing to contact the author about SCREEN MAKER may write to:

Wayne Harvey
925 Waverley St. #102
Palo Alto, CA. 94301

SPECIAL TERMS

SCREEN: This term refers to a mixture of graphics modes that you select to make up an entire screen display. For example, in one SCREEN you may have used Graphics 0 in the top quarter of the TV display, Graphics 7 in the next half, and Graphics 1 in the bottom quarter.

WINDOW: This term refers to any section of a particular SCREEN that consists of one uninterrupted graphics mode. The example SCREEN above has three WINDOWS: the first is Graphics 0, the second is Graphics 7, and the third is Graphics 1. WINDOWS can range in size from as small as one scan line (the size of one GRAPHICS 8 line) to as large as 192 scan lines (the entire TV screen).

screen. No information can be written to blank areas.

3. Move the arrow to point C and press "1".
4. Move the arrow to point D and press "B".
5. Move the arrow to point E and hit RETURN. No need to type a "7" here since "7" is the background mode.
6. Move the arrow to point F and press "1".
7. Move the arrow to point G and press RETURN.
8. Press ESC to exit editing session.

FEATURES OF THE SCREEN MAKER EDITOR

1. To define a window:
 - Position the arrow anywhere on the screen (including the bottom).
 - Press a graphics mode number or "B" for Blank.
 - Move the arrow anywhere else on the screen.
 - Press RETURN or type in a new mode number to define another window.

The area between the two locations of the arrows will now be a window of the given graphics mode.

2. The arrow wraps around the screen top or bottom, but windows are defined by the area between the arrow's starting point and ending point. Thus a window never wraps around the top or bottom of the screen.
3. To redefine a window:
 - Position the arrow within or at the edge of an already defined window.
 - Type in a new mode number.
 - Reposition the arrow where you want the edge of the newly defined window.
4. **IMPORTANT!** SCREEN MAKER does not let you define screens that would be impossible to construct (i.e., that violate scan line requirements). For example, when you define a window as being Graphics 2, you can only move the arrow in line widths that are the size of Graphics mode 2 lines. If you add a window of Graphics 8 on top of this, SCREEN MAKER will only let you replace multiples of a full Graphics mode 2 line (16 scan lines) with Graphics 8 so as not to leave a fraction of a mode line.

TESTING A SCREEN

SCREEN MAKER's test feature allows you to preview your display by typing characters into your text windows on your custom screen and drawing in your graphics windows using a joystick. SCREEN MAKER allows you to do this by setting up your custom display list and handling the transfer of data to screen RAM. Although SCREEN MAKER will not allow you to manipulate colors at this time, you can get a sense of the relative positioning and sizes of information displayed on your screen.

When typing information into your text windows, you may use the four keyboard arrow keys and the return key to move your cursor. You also may use the delete-backsp key for editing your text and the clear key to entirely clear any window on your screen. Use the ESC key to exit the testing mode.

Warning! When you finish testing a screen, you will be unable to save any pictures you drew or text you typed.

SAMPLE APPLICATIONS

HOW TO USE YOUR SUBROUTINES

After SCREEN MAKER generates the subroutines needed to use your custom screens, it is a simple matter to integrate them into your own program. You communicate with the SCREEN MAKER subroutines through four special variables: SCREEN, WINDOW, CLEAR, and MYSCREEN. Your BASIC program should assign values to SCREEN, WINDOW, and CLEAR, and follow this with the statement "GOSUB MYSCREEN". Examples and explanations of how to do this are shown in the following demonstration program.

The value in variable SCREEN tells one subroutine which of your screens you want displayed. WINDOW tells the subroutine which window you will be printing on. If CLEAR has a value of zero when you call the subroutine, any text or graphics previously written to the window will remain untouched; otherwise the memory corresponding to the current window will be cleared.

Avoid using variable names that begin with XX in your BASIC program, because such names are used by the subroutine. Also, do not use line numbers greater than 30000 or line number 0. Once you have entered your program (or retrieved it by using the LOAD command), you must append the SCREEN MAKER subroutine to it. To do this, type the direct command (no line number) ENTER "D:filename.SRC" where "filename.SRC" is the file in which SCREEN MAKER stored your subroutine. You can now save your entire program including the subroutine by typing SAVE "D:filename". Then later you can load the entire program into memory with only one LOAD command.

The following is an example, with explanations, of a program that uses two custom screens. This program is stored in a file called DEMO. To see it run, load DOS from another diskette, then insert the SCREEN MAKER master diskette and type: RUN "D1:DEMO".

SCREEN #1

1	GRAPHICS 3
2	GRAPHICS 1
3	GRAPHICS 5
4	GRAPHICS 2
5	GRAPHICS 5
6	GRAPHICS 1
7	GRAPHICS 3

SCREEN #2

1	GRAPHICS 7
2	GRAPHICS 0
3	GRAPHICS 7
4	GRAPHICS 0
5	GRAPHICS 7

```

110 REM SCREEN MAKER Demo program.
112 REM By Wayne Harvey
114 REM (c) 1982
116 REM
120 OPEN #1,4,0,"K:":SETCOLOR 2,0,0:ESC=27:RTN=155:TRAP 300
130 REM
132 REM To print to our custom screens, we need
134 REM to tell our subroutine which screen and which
136 REM window we are going to use.
138 REM
140 REM *****
142 SCREEN=1:WINDOW=1:GOSUB MYSCREEN
144 REM *****
150 REM
152 REM The upper left corner of the window is considered
154 REM position 0,0. We can draw outside of the window,
156 REM as is done below, and our lines will show up in all
158 REM windows of the same mode. In this example our lines
160 REM show up in both window #1 and in window #7 at the
162 REM bottom of our screen. Both of these windows are
164 REM graphics mode 3.
166 REM
170 REM *****
172 COLOR 1:PLOT 0,0:DRAWTO 39,23
174 COLOR 2:PLOT 39,0:DRAWTO 0,23
176 REM *****
180 REM
182 REM We can change windows on the same screen and draw in
184 REM graphics mode 5. Our lines are drawn below window #3
186 REM and therefore also show through in window #5.
188 REM
190 REM *****
192 WINDOW=3:GOSUB MYSCREEN
194 COLOR 2:PLOT 2,5:DRAWTO 78,5
196 COLOR 1:DRAWTO 78,17
198 COLOR 2:DRAWTO 2,17
200 COLOR 1:DRAWTO 2,5
202 REM *****
210 REM
212 REM We now print text to our text windows. We define our
214 REM window as #2 and print two lines of text. Window #2
216 REM is only one line wide, so the second line is printed
218 REM to the next window of the same mode - window #6.
220 REM
230 REM *****
232 WINDOW=2:GOSUB MYSCREEN
234 PRINT #6;" TO CLEAR A WINDOW"
236 PRINT #6;" TYPE A 1 THRU 7"
238 REM *****

```

```

240 REM
242 REM Next we print to our other text window.
244 REM
250 REM *****
252 WINDOW=4:GOSUB MYSCREEN
254 PRINT #6;"esc for other screen"
256 REM *****
258 TRAP 300
300 GET #1,KEY
302 IF KEY=ESC THEN 400
310 REM
312 REM To clear a window, set CLEAR=1, store the window
314 REM number and call the subroutine. Only that one window
316 REM gets cleared. Windows continue to be cleared until
318 REM CLEAR is set to 0.
320 REM
330 REM *****
332 CLEAR=1:WINDOW=VAL(CHR$(KEY)):GOSUB MYSCREEN
334 REM *****
340 GOTO 300
400 REM
402 REM Next we call up our second screen. When we do this,
404 REM all of our first screen memory disappears. As before,
406 REM our plotting shows in all windows of the same mode.
408 REM
410 REM *****
412 CLEAR=1:SCREEN=2:WINDOW=1:GOSUB MYSCREEN
414 COLOR 2:PLOT 0,0:DRAWTO 159,95
416 COLOR 1:PLOT 159,0:DRAWTO 0,95
418 REM *****
420 REM
422 REM And we can write to our text windows individually.
424 REM
430 REM *****
432 WINDOW=2:GOSUB MYSCREEN
434 PRINT "      Press ESC for other screen."
436 WINDOW=4:GOSUB MYSCREEN:FIRST=1
438 PRINT "      Press RETURN to switch text."
440 REM *****
450 GET #1,KEY
452 IF KEY=ESC THEN 140
454 IF KEY<>RTN THEN 450
456 IF NOT FIRST THEN 436
460 REM
462 REM We can reuse a selected screen very simply.
464 REM
470 REM *****
472 WINDOW=4:GOSUB MYSCREEN:FIRST=0
474 PRINT " Replacing text is easy. Press RETURN."
476 REM *****
480 GOTO 450

```

ERROR MESSAGES

Cannot save screen or Cannot open "filename" for printing on this disk: Your diskette or file is probably write protected or there are no free sectors. You may have sectors with bad data. The best cure is to change diskettes and try again. Be sure the diskette you use is formatted.

Illegal name: File names must have no extension and be 8 letters or fewer.

You have no screens: You tried to save, modify, or test a screen, but none have been created yet.

No screen to save: You tried to save a screen, but you have not created one or recalled and modified one.

Screen #n is not retrievable: A previously created screen contains bad data or cannot be found on the disk. You probably will have to recreate the screen

Illegal screen num: The screen number you specified does not exist.

Reached maximum number of screens: You tried to create another screen, but there are already 10, the maximum number.

You must first save your screen: You tried to generate the subroutine before you saved any screens. To correct this, save your screen by choosing menu item #4.

Cannot open directory on drive n: The directory cannot be found on the disk drive you specified. Your drive may be turned off or it may have a different drive number than the one you provided.

Cannot write to printer: You asked for a paper copy of your display, but an I/O error occurred. You probably forgot to turn on the printer or the interface.

Insufficient memory to test display without overwriting program space: WARNING! Do not test display after receiving this message unless you have saved your last screen. If you proceed, you will be able to test your display, but you will not be able to return to the menu and therefore you will not be able to save any of the work you did after your last save. You will have to reload SCREEN MAKER to do anything more.

SCREEN MAKER

(c) 1982

WAYNE HARVEY

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INTRODUCTION

OVERVIEW

SCREEN MAKER is a BASIC utility program which enables you to combine up to 15 different graphics modes on the screen simultaneously. Additionally, SCREEN MAKER allows you to define up to ten different screen mixtures in which you decide where on each screen you wish to place different size text and/or different graphics windows.

SCREEN MAKER generates a BASIC subroutine which you enter into your own program. You do not need any knowledge of the workings of Atari's display list feature or memory requirements to successfully utilize the power of this program. The design and implementation of the custom display lists needed to have access to mixed graphics modes on the Atari, and the necessary hooks for your program to use them, are totally handled by SCREEN MAKER and made invisible to you, the user. Thus, using your custom designed screens is as easy as using the current built-in graphics modes. Your program simply calls a particular screen and either prints or plots using normal BASIC statements to a particular window on that screen. Windows can be cleared and reused, as can screens.

REQUIRED ACCESSORIES

ATARI BASIC Language Cartridge
48K RAM
ATARI 810 Disk Drive

OPTIONAL ACCESSORIES

One ATARI Joystick Controller
ATARI 825 Printer

CONTACTING THE AUTHOR

Users wishing to contact the author about SCREEN MAKER may write to:

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ATARI Special Projects
1196 Borregas Ave.
PO Box 427
Sunnyvale, CA. 94086

or call him at:

(408) 745-4991

SPECIAL TERMS

SCREEN: This term refers to a mixture of graphics modes that you select to make up an entire screen display. For example, in one SCREEN you may have used Graphics 0 in the top quarter of the TV display, Graphics 7 in the next half, and Graphics 1 in the bottom quarter.

WINDOW: This term refers to any section of a particular SCREEN that consists of one uninterrupted graphics mode. The example SCREEN above has three WINDOWS: the first is Graphics 0, the second is Graphics 7, and the third is Graphics 1. WINDOWS can range in size from as small as one scan line (the size of one GRAPHICS 8 line) to as large as 192 scan lines (the entire TV screen).

GETTING STARTED

LOADING SCREEN MAKER INTO MEMORY

1. Be sure a BASIC Language Cartridge is in the left cartridge slot of your computer console and that you have 48K of RAM.
2. Have your computer turned off.
3. Turn on your disk drive.
4. When the busy light goes out, open the disk drive door and insert the SCREEN MAKER diskette with the label in the lower right-hand corner nearest you. (Use disk drive one if you have more than one drive.)
5. Turn on your computer and your TV set. The program will load into computer memory and start automatically.
6. It is advisable to remove the SCREEN MAKER master diskette once it is loaded and insert into your disk drive a blank formatted diskette for storing files you create with this program.

THE FIRST DISPLAY SCREEN

If you properly loaded SCREEN MAKER you will see:

```
-----  
| SCREEN MAKER |  
| (c) 1982 |  
| WAYNE HARVEY |  
| PLEASE WAIT A MOMENT |  
|-----|
```

After a minute, a selection of eight commands will appear on a menu.

USING SCREEN MAKER

THE SCREEN MAKER MENU

```

      MENU
1  Establish/Switch screen file
2  Create new screen
3  Modify/Test a screen
4  Save screen
5  Generate subroutine
6  Instructions: creating screen
7  Instructions: testing screen
8  End program

Choose 1 - 8 ?

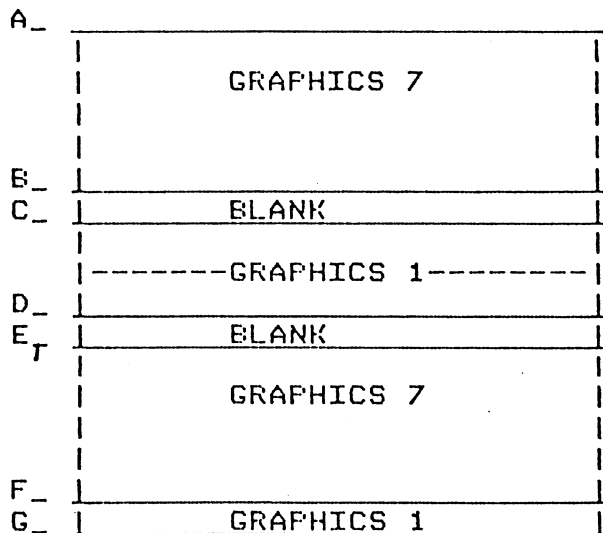
```

1. Establish/Switch screen file: Always begin your SCREEN MAKER session with this item. You must provide a filename with no extension (disk drive number is optional). SCREEN MAKER creates three files: "filename.CTL", "filename.DAT", and "filename.SRC". The first two files are used to store information about your custom-designed screens for later retrieval and modification by SCREEN MAKER. "filename.SRC" is used to store the subroutines generated by SCREEN MAKER for later incorporation into your programs.
2. Create new screen: Use this command when you wish to make a new screen -- whether it is the first screen you are creating or a new screen you are adding to an existing series. (See "Using The SCREEN MAKER Editor".)
3. Modify/Test a screen: A previously saved screen can be recalled by this command. You may make modifications to your screen design and resave it, or you may simply see how things look using SCREEN MAKER's test feature.
4. Save screen: Whenever you create a new screen or modify an old one, you must save it using this command. If you do not save a new screen, you will lose it; if you do not save a modified screen, you will retain the old version before modification.

5. Generate subroutine: This command should not be used until you have created all the screens that you will want to incorporate into your program. You can end a session with SCREEN MAKER without generating your subroutine and come back at a later date to finish designing your screens. The command allows you to include only those screens you want in your subroutine (usually all that you created), numbered in any order you wish.
6. Instructions for creating screen: This command provides helpful reminders for first-time users.
7. Instructions for testing screen: SCREEN MAKER's test feature allows you to type characters into your text windows on your custom screen and to draw in your graphics windows using a joystick to preview your display. SCREEN MAKER allows you to do this by setting up your custom display list and handling the transfer of data to screen RAM. Although SCREEN MAKER will not allow you to manipulate colors at this time, you can get a sense of the relative positioning and sizes of information displayed on your screen.
8. End program: Always exit the program with this command. Failure to do so may result in loss of some or all of your work.

USING THE SCREEN MAKER EDITOR

Use the editor to tell SCREEN MAKER the layout of the graphics modes you want on one screen. The following example shows how to define the screen layout below:



SCREEN MAKER will ask:

What is the predominant mode --
BASIC modes 0 - 8, or Blank?

1. One begins with the entire screen in one mode. Which mode you choose is fairly arbitrary, but in this example, since most of the screen is Graphics 7, one would type a "7". An arrow will show up at the top of the screen (point A).
2. Move the arrow down to point B using the keyboard arrow keys and press "B" for Blank.
3. Move the arrow to point C and press "1".
4. Move the arrow to point D and press "B".
5. Move the arrow to point E and hit RETURN. No need to type a "7" here since "7" is the background mode.
6. Move the arrow to point F and press "1".
7. Move the arrow to point G and hit RETURN.
8. Hit ESC to exit editing session.

FEATURES OF THE SCREEN MAKER EDITOR

1. You can define windows by placing the arrow anywhere on the screen (including the bottom), pressing a graphics mode number, and moving the arrow anywhere else on the screen. When you hit RETURN, the space between the two locations of the arrow will be a window of the given graphics mode.
2. The arrow wraps around the screen top or bottom, but windows are defined by the area between the arrow's starting point and ending point. Thus a window never wraps around the top or bottom of the screen.
3. To redefine a window:
 - position the arrow within or at the edge of an already defined window.
 - type in a new mode number.
 - reposition the arrow where you want the edge of the newly defined window.
4. **IMPORTANT!** SCREEN MAKER does not let you try to define screens that are impossible to construct (i.e., that violate scan line requirements). For example, when you define a window as being Graphics 2, you can only move the arrow in line widths that are the size of Graphics mode 2 lines. If you add a window of Graphics 8 on top of this, SCREEN MAKER will only let you replace multiples of a full Graphics mode 2 line (16 scan lines) with Graphics 8 so as not to leave a fraction of a mode line.

SAMPLE APPLICATIONS

HOW TO USE YOUR SUBROUTINE

After SCREEN MAKER generates the subroutine needed to use your custom screens, it is a simple matter to integrate it into your own program. You communicate with the SCREEN MAKER subroutine through four special variables: SCREEN, WINDOW, CLEAR, and MYSCREEN. Your BASIC program should assign values to SCREEN, WINDOW, and CLEAR, and follow this with the statement "GOSUB MYSCREEN". Examples and explanations of how to do this are shown in the following demonstration program.

The value in variable SCREEN tells the subroutine which of your screens you want displayed. WINDOW tells the subroutine which window you will be printing on. If CLEAR has a value of zero when you call the subroutine, any text or graphics previously written to the window will remain untouched; otherwise memory corresponding to the current window will be cleared.

Avoid using variable names which begin with XX in your BASIC program since such names are used by the subroutine. Also, do not use line numbers above 30000 or line number 0. Once you have typed in your program (or retrieved it using the LOAD command), you must merge the SCREEN MAKER subroutine to it. To do this, type the direct command (no line number) ENTER "D:filename" where "filename" is the file in which SCREEN MAKER stored your subroutine. You can now resave your entire program including the subroutine by typing SAVE "D:filename". Then at a later date you can load the entire program into memory with only one LOAD command.

The following is an example, with explanations, of a program which uses two custom screens. This program, along with the subroutines generated by SCREEN MAKER, is stored in a file called DEMO. To see it run, type: RUN "D1:DEMO".

SCREEN #1

1	GRAPHICS 3
2	GRAPHICS 1
3	GRAPHICS 5
4	GRAPHICS 2
5	GRAPHICS 5
6	GRAPHICS 1
7	GRAPHICS 3

SCREEN #2

1	GRAPHICS 7
2	GRAPHICS 0
3	GRAPHICS 7
4	GRAPHICS 0
5	GRAPHICS 7


```

110 REM SCREEN MAKER Demo program.
112 REM By Wayne Harvey
114 REM (c) 1982
116 REM
120 OPEN #1,4,0,"K:":SETCOLOR 2,0,0:ESC=27:RTN=155:TRAP 300
130 REM
132 REM To print to our custom screens, we need
134 REM to tell our subroutine which screen and which
136 REM window we are going to use.
138 REM
140 REM *****
142 SCREEN=1:WINDOW=1:GOSUB MYSCREEN
144 REM *****
150 REM
152 REM The upper left corner of the window is considered
154 REM position 0,0. We can draw outside of the window,
156 REM as is done below, and our lines will show up in all
158 REM windows of the same mode. In this example our lines
160 REM show up in both window #1 and in window #7 at the
162 REM bottom of our screen. Both of these windows are
164 REM graphics mode 3.
166 REM
170 REM *****
172 COLOR 1:PLOT 0,0:DRAWTO 39,23
174 COLOR 2:PLOT 39,0:DRAWTO 0,23
176 REM *****
180 REM
182 REM We can change windows on the same screen and draw_in
184 REM graphics mode 5. Our lines are drawn below window #3
186 REM and therefore also show through in window #5.
188 REM
190 REM *****
192 WINDOW=3:GOSUB MYSCREEN
194 COLOR 2:PLOT 2,5:DRAWTO 78,5
196 COLOR 1:DRAWTO 78,17
198 COLOR 2:DRAWTO 2,17
200 COLOR 1:DRAWTO 2,5
202 REM *****
210 REM
212 REM We now print text to our text windows. We define our
214 REM window as #2 and print two lines of text. Window #2
216 REM is only one line wide, so the second line is printed
218 REM to the next window of the same mode - window #6.
220 REM
230 REM *****
232 WINDOW=2:GOSUB MYSCREEN
234 PRINT #6;" TO CLEAR A WINDOW"
236 PRINT #6;" TYPE A 1 THRU 7"
238 REM *****
240 REM
242 REM Next we print to our other text window.
244 REM

```

```

250 REM *****
252 WINDOW=4:GOSUB MYSCREEN
254 PRINT #6;"esc for other screen"
256 REM *****
300 GET #1,KEY
302 IF KEY=ESC THEN 400
310 REM
312 REM To clear a window, set CLEAR=1, store the window
314 REM number and call the subroutine. Only that one window
316 REM gets cleared. Windows continue to be cleared until
318 REM CLEAR is set to 0.
320 REM
330 REM *****
332 CLEAR=1:WINDOW=VAL(CHR$(KEY)):GOSUB MYSCREEN
334 REM *****
340 GOTO 300
400 REM
402 REM Next we call up our second screen. When we do this,
404 REM all of our first screen memory disappears. As before,
406 REM our plotting shows in all windows of the same mode.
408 REM
410 REM *****
412 SCREEN=2:WINDOW=1:GOSUB MYSCREEN
414 COLOR 2:PLOT 0,0:DRAWTO 159,95
416 COLOR 1:PLOT 159,0:DRAWTO 0,95
418 REM *****
420 REM
422 REM And we can write to our text windows individually.
424 REM
430 REM *****
432 WINDOW=2:GOSUB MYSCREEN
434 PRINT " Hit ESC for other screen."
436 WINDOW=4:GOSUB MYSCREEN:FIRST=1
438 PRINT " Hit RETURN to switch text."
440 REM *****
450 GET #1,KEY
452 IF KEY=ESC THEN 140
454 IF KEY<>RTN THEN 450
456 IF NOT FIRST THEN 436
460 REM
462 REM We can reuse a selected screen very simply.
464 REM
470 REM *****
472 WINDOW=4:GOSUB MYSCREEN:FIRST=0
474 PRINT " Replacing text is easy. Hit RETURN."
476 REM *****
480 GOTO 450

```

ERROR MESSAGES

SCREEN MAKER always checks any conditions necessary to carry out a command before it proceeds. The following are explanations of the error situations it might find:

1. You must establish a screen file: You tried to use SCREEN MAKER before giving it a working file name (menu option #1).
2. Illegal name: File names must have no extension and be 6 letters or less.
3. You have no screens: You tried to save, modify, or test a screen, but none have been created yet.
4. No screen to save: You tried to save a screen, but you have not created one or recalled and modified one.
5. Screen #n is not retrievable: A previously created screen contains bad data or cannot be found on the disk. It could result from having copied a file from one disk to another because SCREEN MAKER keeps pointers to sectors on the disk in order to locate data. In any case, you probably will have to recreate the screen.
6. Illegal screen num: The screen number you specified does not exist.
7. Reached maximum number of screens: You tried to create another screen, but there are already 10, the maximum number.
8. Cannot write to printer: You asked for a paper copy of your display, but an I/O error occurred. You probably forgot to turn on the printer or the interface.
9. Insufficient memory to test display without overwriting program space: WARNING! Do not test display after receiving this message unless you have saved everything. If you proceed, you will be able to test your display, but you will not be able to return to the menu and therefore you will not be able to save any of the work you did after your last save. You will have to reload SCREEN MAKER to do anything more.

ADVANCED TECHNICAL INFORMATION

SCREEN MAKER handles all of the memory boundary conditions necessary for making custom display lists and user-defined screen RAM. The display list for each screen is copied by an assembly routine from a string array (XXDL\$) to page 159 in memory. Screen RAM is placed below this, and RAMTOP is reassigned so that uses of other graphics modes do not interfere with your custom display list or associated screen RAM. The display list handles places where screen RAM crosses 4K boundaries. RAM is also allocated so that BASIC's graphics statements can be used as if the entire screen were in one mode while the user only sees what shows through the windows defined in that mode (see program in "Sample Applications").

Memory is not organized by the order of the windows. The low end of screen RAM is used for Graphics mode 0 lines with Graphics 1 next, then Graphics 2, on up to the high end of screen RAM for Graphics 8 memory. Display list instructions then point to the appropriate places in screen RAM. Of course, if no window were defined for a particular graphics mode, then no memory is allocated for that mode.