

# High Resolution

Low resolution allows you to control the colors of a 40 by 47 block array. A single lo-res block is equivalent to 56 hi-res pixels. High resolution (hi-res) lets you control an array of 280 by 192 pixels, resulting in an obvious improvement in detail. That's the good news.

Now for the bad news. There are 16 lo-res colors, but only eight hi-res colors (that includes two whites and two blacks).

## HI-RES COLORS

Value	Description
0	black 1
1	green
2	blue
3	white 1
4	black 2
5	purple
6	orange
7	white 2

There are several problems with hi-res color, which are caused by both the way color is produced on the set (TV or monitor) and the way the hi-res screen buffer is formatted in memory. (See "Color".)

HGR initiates hi-res graphics by displaying hi-res page one, clearing it to black, and setting the mixed screen mode. HGR does this by activating a series of soft switches (addresses in memory that "switch" whenever they are POKEd or PEEKed). The screen soft switches let you switch between:

- A. Graphics and text.
- B. Full screen and mixed screen.
- C. Page one and two.
- D. Lo-res and hi-res.

(See table of screen soft switches.)

PEEKing or POKEing the following addresses will duplicate HGR soft switching: 49300, 49235, 49239, 49232.

To make certain that hi-res page one is used as well as displayed, POKE 230,32. To clear the screen to black, CALL 62450.

HGR2 initiates hi-res graphics on page two. It can be duplicated by PEEKing or POKEing these addresses: 49237, 49234, 49239, 49232. Be sure to POKE 230,64 so that drawing will also be done on page two. To clear it, CALL 62450.

Once graphics is initiated, it's time to draw.

Color is specified by HCOLOR = n, where "n" is any number from zero to seven (see hi-res colors above). Setting HCOLOR = to a number less than zero or greater than seven results in an error.

To plot on the hi-res screen, use HPLLOT. It can be used in various ways:

HPLLOT X,Y can draw a dot on the screen (if the HCOLOR is correct for that dot position).

HPLLOT TO X,Y can put a line beginning with the last point HPLLOTted and ending at the pixel whose position is X,Y.

HPLLOT X1,Y1 TO X2,Y2 can put a line on the screen beginning on the pixel at the position X1,Y1 and ending on the pixel at X2,Y2. (Again, whether a line is actually drawn may depend on the HCOLOR specified. For more information, see "Color".)

HPLLOT X1,Y1 TO X2,Y2 TO X3,Y3 TO ... Xn,Yn will plot one line after another, each beginning where the last line ended.

Because the screen positions are limited to 280 pixels across and 192 down, all values of X less than zero and greater than 279 are met with an error, and all Y values less than zero and greater than 191 are similarly met.

Other ways to place graphics on the hi-res screen include:

- A. Poking values into the memory used by the hi-res page buffers.  
 B. Using shape tables (vector graphics).

Graphics placed on the hi-res page can be saved as a binary

## Using Applesoft Hi-Res Routines from Machine Language

For those who enjoy working in assembly language, here are all the hi-res commands available from BASIC, as well as four additional ones. This section is geared for the advanced user who is already familiar with assembly language.

### Zero Page Locations

First here are some zero page locations used.

- \$1A,1B** Shape pointer used by DRAW and XDRAW.  
**\$1C** Last color used (HCOLOR converted to its color byte. See Color Byte Table).  
**\$26,27** Address of byte containing X,Y point.  
**\$30** The bit mask for the bit in the current byte.  
**\$E0,E1** X-coordinate (0-279) in hex (low, high).  
**\$E2** Y-coordinate (0-191) in hex.  
**\$E4** Color being used (converted, see Color Byte Chart).  
**\$E6** Current hi-res page being used (\$20: page one, \$40: page two).  
**\$E7** Current SCALE (0-256).  
**\$E8,E9** Location of shape table (low, high).  
**\$EA** Collision counter (used by XDRAW and DRAW).

### Black and Blue

Here's an example of how to use some of the routines from assembly language.

- ```
JSR HGR      INITIALIZE THE SCREEN
LDX #S2     SET THE COLOR TO BLUE
JSR SETHCOL
JSR BKGND   MAKE THE ENTIRE SCREEN
            BLUE
            USE BLACK TO DRAW LINES
LDX #S0
JSR SETHCOL
LDA #S0     PLOT THE FIRST POINT AT 0,0
LDX #S0
LDY #S0
JSR HPLLOT
LDX #S00    DRAW A LINE FROM LAST
            POINT TO 50,128
LDA #S32
LDY #S80    Y-COORDINATE
JSR HLIN
RTS        EXIT TO CALLER
```

Remember, to use DRAW and XDRAW, point (X,Y) to the actual shape, not to the beginning of the shape table. This means that all calculations must be done by the user, to index into the shape table.

file. To save page one on disk, type

**BSAVE name, A52000, L52000**

or in decimal

**BSAVE name, A8192, L8192**

By changing the address (A) to \$4000, you can save the picture on page two. There are also other hi-res "pages" that, though they cannot be directly displayed, can be saved.

**Page Three A56000**

**Page Four A58000**

**Page Five A510000**

DOS normally occupies hi-res page five.

## Basic Hi-Res Commands

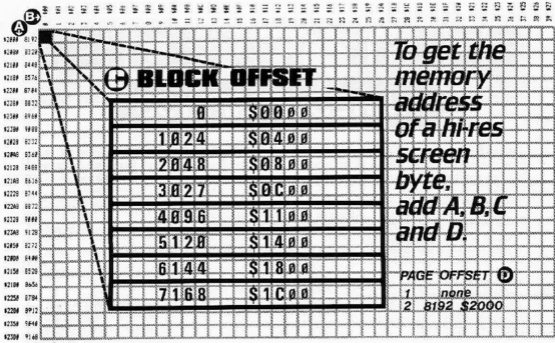
The following are the routines available for hi-res graphics.

- HGR \$F3E2** Initialize and clear hi-res page one.  
**HGR2 \$F3D8** Initialize and clear hi-res page two.  
**HPLLOT \$F457** Positions the cursor and plots a point. Enter with the Accum (A) = Y coordinate and the X register and Y register containing the X coordinate (low, high).  
**HLIN \$F53A** Draws a line from the last plotted or positioned point to (A,X) = X coordinate (low, high), (Y) = Y coordinate.  
**DRAW \$F601** Draws a shape. Enter with (X,Y) pointer to the actual shape to be drawn, not to the shape table itself. The accumulator should contain the ROTation factor. Uses current color and scale.  
**XDRAW \$F65D** Performs the XDRAW command, same entry as DRAW.  
**SETHCOL \$F6EC** Performs the HCOLOR command where the X register contains a color 0-7.  
**SCALE SE7** Simply place scale factor here (STA).  
**ROT** See the DRAW command.

## Additional Commands

The following commands are not available from BASIC.

- HPOSN \$F411** Moves the hi-res cursor without plotting a point. Enter same as HPLLOT.  
**HFIND \$F5CB** Converts the current hi-res cursor's position to X and Y coordinates. Can be used to find where you are left after drawing a shape. After calling this routine, \$E0,E1 is the X position (low,high) and \$E2 is the Y position.  
**HCLR \$F3F2** Clears the current hi-res page to black.  
**BKGND \$F3F6** Clears the current hi-res screen to the last color plotted.

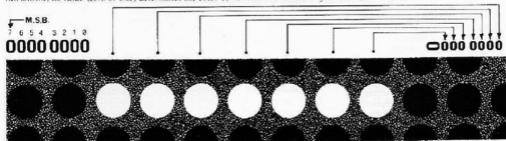


## HI-RES SCREEN FORMATTING

1. Horizontally, the hi-res screen consists of only 40 bytes. In this illustration, one byte is illuminated and enlarged.



2. As can be seen, only seven bits are "lit". The eighth bit (also known as the MSB, Most Significant Bit) is the Color Bit. Although not shown, its value (zero or one) determines the color combination. For more information, see "Color".



3. When displayed on screen, the "dots" correspond to actual bit positions, but the positions are reversed. The last dot of the displayed byte is actually the first bit of the byte in memory. To be technically correct, the bit numbers are from zero to seven, rather than from one to eight. That means that the MSB (eighth bit) is bit seven.