Low Resolution Graphics

From text to low resolution (lo-res) graphics might seem a big step (from letters to color blocks), but it's not. You're still "looking" at the same block of memory (text page), except that now each byte is displayed as two blocks of color stacked one on top of the other. The two blocks take up the same space on the screen as does one character, but because there are twice as many blocks as there are characters, the lo-res screen is an array of 40 across and 48 high. Each block can be any of 16 colors, depending upon the value of the two nybbles that make up the byte. The lower color is determined by the "high" nybble and the upper color by the "low" nybble.

Bottom Color = INT (BYTE/16)
Top Color = BYTE—BOTTOM COLOR * 16

Use the Color Code to discover the code for each color. You can avoid the mathematics involved in determining the high and low nybble by using the Low Resolution Color Character Chart. It gives both the top and bottom colors for all 256 different byte values, as well as the character that is displayed on the text screen. That's right . . . by switching to text, the lo-res colors are revealed as ASCII characters. The color character chart is most useful in determining the relationship of color to text. This knowledge comes in handy when using hybrid graphic commands, such as lo-res commands for text graphics. (See Shrinking and Enlarging Boxes.)

There are two low resolution display modes: full screen and mixed screen. With mixed screen the bottom four rows of text are displayed while the rest is in lo-res colors. Like text graphics, you can use page one and page two. However, most Applesoft programs begin on page two of text.

GR initiates lo-res graphics by displaying page one in the mixed screen mode. To switch from page one to page two, POKE -16299,0. To return to page one, POKE -16300,0. To initiate lo-res graphics without GR, POKE -16304,0 if you are on the text page or POKE -16298,0 if you are in high resolution. To switch to mixed screen, POKE -96301,0. For full screen, POKE -16302,0.

Once in lo-res, the following commands will put color on the screen:

COLOR = ?
PLOT X,Y
HLIN Y1,Y2 at X
VLIN X1,X2 at Y

Color is set to zero by the GR command. Other colors must be specified by setting color from zero to 255 because the value placed after COLOR = is always divided by 16 and the remainder used to select a color. Setting color to any other number is an ILLEGAL QUANTITY ERROR.

Once the color has been selected, the position must be given. The horizontal position (X) and its vertical block position (Y) must follow the PLOT command. X must be in the range of zero through 39, where zero is the far left edge. Y must be between zero and 47; zero is at the top of the screen. Any value outside these limits will be an ILLEGAL QUANTITY ERROR.

Using PLOT while in the TEXT mode will put a character on the text screen. For example:

COLOR = 1: PLOT 0,1

The result will be an inverse 'P' in the upper left part of the screen.

Low Resolution Color Character Chart (Hex and Decimal)

Mode: INVERSE
Bottom Color: 0

DEC	HEX	TOP	ASC
0	00	0	@
1	01	1	A
2	02	2	B
3	03	3	C
4	04	4	D
5	05	5	E
6	06	6	F
7	07	7	G
8	08	8	H
9	09	9	I
10	0A	10	J
11	0B	11	K
12	0C	12	L
13	0D	13	M
14	0E	14	N
15	0F	15	O

Mode: INVERSE
Bottom Color: 1

DEC	HEX	TOP	ASC
16	10	0	P
17	11	1	Q
18	12	2	R
19	13	3	S
20	14	4	T
21	15	5	U
22	16	6	V
23	17	7	W
24	18	8	X
25	19	9	Y
26	1A	10	Z
27	1B	11	[
28	1C	12	\
29	1D	13	]
30	1E	14	^
31	1F	15	_

Mode: INVERSE
Bottom Color: 2

DEC	HEX	TOP	ASC
32	20	0	
33	21	1	!
34	22	2	"
35	23	3	#
36	24	4	$
37	25	5	%
38	26	6	&
39	27	7	'
40	28	8	(
41	29	9	)
42	2A	10	*
43	2B	11	+
44	2C	12	,
45	2D	13	-
46	2E	14	.
47	2F	15	/

Mode: INVERSE
Bottom Color: 3

DEC	HEX	TOP	ASC
48	30	0	0
49	31	1	1
50	32	2	2
51	33	3	3
52	34	4	4
53	35	5	5
54	36	6	6
55	37	7	7
56	38	8	8
57	39	9	9
58	3A	10	:
59	3B	11	;
60	3C	12	<
61	3D	13	=
62	3E	14	>
63	3F	15	?

Mode: FLASH
Bottom Color: 4

DEC	HEX	TOP	ASC
64	40	0	@
65	41	1	A
66	42	2	B
67	43	3	C
68	44	4	D
69	45	5	E
70	46	6	F
71	47	7	G
72	48	8	H
73	49	9	I
74	4A	10	J
75	4B	11	K
76	4C	12	L
77	4D	13	M
78	4E	14	N
79	4F	15	O

Mode: FLASH
Bottom Color: 5

DEC	HEX	TOP	ASC
80	50	0	P
81	51	1	Q
82	52	2	R
83	53	3	S
84	54	4	T
85	55	5	U
86	56	6	V
87	57	7	W
88	58	8	X
89	59	9	Y
90	5A	10	Z
91	5B	11	[
92	5C	12	\
93	5D	13	]
94	5E	14	^
95	5F	15	_

Mode: FLASH
Bottom Color: 6

DEC	HEX	TOP	ASC
96	60	0	
97	61	1	!
98	62	2	"
99	63	3	#
100	64	4	$
101	65	5	%
102	66	6	&
103	67	7	'
104	68	8	(
105	69	9	)
106	6A	10	*
107	6B	11	+
108	6C	12	,
109	6D	13	-
110	6E	14	.
111	6F	15	/

Mode: FLASH
Bottom Color: 7

DEC	HEX	TOP	ASC
112	70	0	0
113	71	1	1
114	72	2	2
115	73	3	3
116	74	4	4
117	75	5	5
118	76	6	6
119	77	7	7
120	78	8	8
121	79	9	9
122	7A	10	:
123	7B	11	;
124	7C	12	<
125	7D	13	=
126	7E	14	>
127	7F	15	?

Mode: CONTROL
Bottom Color: 8

DEC	HEX	TOP	ASC
128	80	0	@
129	81	1	A
130	82	2	B
131	83	3	C
132	84	4	D
133	85	5	E
134	86	6	F
135	87	7	G
136	88	8	H
137	89	9	I
138	8A	10	J
139	8B	11	K
140	8C	12	L
141	8D	13	M
142	8E	14	N
143	8F	15	O

Mode: CONTROL
Bottom Color: 9

DEC	HEX	TOP	ASC
144	90	0	P
145	91	1	Q
146	92	2	R
147	93	3	S
148	94	4	T
149	95	5	U
150	96	6	V
151	97	7	W
152	98	8	X
153	99	9	Y
154	9A	10	Z
155	9B	11	[
156	9C	12	\
157	9D	13	]
158	9E	14	^
159	9F	15	_

Mode: NORMAL
Bottom Color: 10

DEC	HEX	TOP	ASC
160	A0	0	
161	A1	1	!
162	A2	2	"
163	A3	3	#
164	A4	4	$
165	A5	5	%
166	A6	6	&
167	A7	7	'
168	A8	8	(
169	A9	9	)
170	AA	10	*
171	AB	11	+
172	AC	12	,
173	AD	13	-
174	AE	14	.
175	AF	15	/

Mode: NORMAL
Bottom Color: 11

DEC	HEX	TOP	ASC
176	B0	0	0
177	B1	1	1
178	B2	2	2
179	B3	3	3
180	B4	4	4
181	B5	5	5
182	B6	6	6
183	B7	7	7
184	B8	8	8
185	B9	9	9
186	BA	10	:
187	BB	11	;
188	BC	12	<
189	BD	13	=
190	BE	14	>
191	BF	15	?

Mode: NORMAL
Bottom Color: 12

DEC	HEX	TOP	ASC
192	C0	0	@
193	C1	1	A
194	C2	2	B
195	C3	3	C
196	C4	4	D
197	C5	5	E
198	C6	6	F
199	C7	7	G
200	C8	8	H
201	C9	9	I
202	CA	10	J
203	CB	11	K
204	CC	12	L
205	CD	13	M
206	CE	14	N
207	CF	15	O

Mode: NORMAL
Bottom Color: 13

DEC	HEX	TOP	ASC
208	D0	0	P
209	D1	1	Q
210	D2	2	R
211	D3	3	S
212	D4	4	T
213	D5	5	U
214	D6	6	V
215	D7	7	W
216	D8	8	X
217	D9	9	Y
218	DA	10	Z
219	DB	11	[
220	DC	12	\
221	DD	13	]
222	DE	14	^
223	DF	15	_

Mode: L. CASE
Bottom Color: 14

DEC	HEX	TOP	ASC
224	E0	0	
225	E1	1	!
226	E2	2	"
227	E3	3	#
228	E4	4	$
229	E5	5	%
230	E6	6	&
231	E7	7	'
232	E8	8	(
233	E9	9	)
234	EA	10	*
235	EB	11	+
236	EC	12	,
237	ED	13	-
238	EE	14	.
239	EF	15	/

Mode: L. CASE
Bottom Color: 15

DEC	HEX	TOP	ASC
240	F0	0	0
241	F1	1	1
242	F2	2	2
243	F3	3	3
244	F4	4	4
245	F5	5	5
246	F6	6	6
247	F7	7	7
248	F8	8	8
249	F9	9	9
250	FA	10	:
251	FB	11	;
252	FC	12	<
253	FD	13	=
254	FE	14	>
255	FF	15	?

There are also commands that let you draw horizontal and vertical lines. Once the color is specified, HLIN draws horizontal lines. You must specify the column to begin drawing (Y1) and the column to stop drawing (Y2), followed by the horizontal row (X) on which to draw this line. The format of the command is:

HLIN Y1, Y2 AT X

(The comma separating the start and end columns is necessary, as well as the word "at" which indicates the proper row.)

VLIN works just like HLIN, except the beginning (X1) and end (X2) rows must be specified along with the column (Y) upon which the line will be drawn. In other words:

VLIN X1, X2 AT Y

If X is set less than zero or greater than 39, or if Y is less than zero or greater than 47, you will get an ILLEGAL QUANTITY ERROR.

Like PLOT, both HLIN and VLIN will put characters on the text page.

The color of any block on the lo-res screen can be determined by using the SCRN (X,Y) command. A number from zero to 15 will be returned. Use the lo-res color chart to get the color for that number. The values for X and Y must be between zero and 47. Values greater than 47 but less than 255 will still work, but the numbers returned are not related to the lo-res screen.

COLOR CODE

Ø	Black	8	Brown
1	Magenta	9	Orange
2	Dark Blue	1Ø	Grey 2
3	Purple	11	Pink
4	Dark Green	12	Light Green
5	Grey 1	13	Yellow
6	Medium Blue	14	Aquamarine
7	Light Blue	15	White

What Characters are also Solid Lo-Res Colors?

(Top and bottom colors the same.)

DEC	HEX	ASC	MODE	COLOR
Ø	$ØØ	@	Inverse	Black
17	$11	Q	Inverse	Magenta
34	$22	"	Inverse	Dark Blue
51	$33	3	Inverse	Purple
68	$44	D	Flash	Dark Green
85	$55	U	Flash	Grey 1
1Ø3	$66	'	Flash	Medium Blue
119	$77	7	Flash	Light Blue
136	$88	H	Control	Brown
153	$99	Y	Control	Orange
17Ø	$AA	*	Normal	Grey 2
184	$BB	8	Normal	Pink
2Ø4	$CC	L	Normal	Light Green
221	$DD	]	Normal	Yello
238	$EE	.	L. Case	Aquamarine
255	$FF	?	L. Case	White

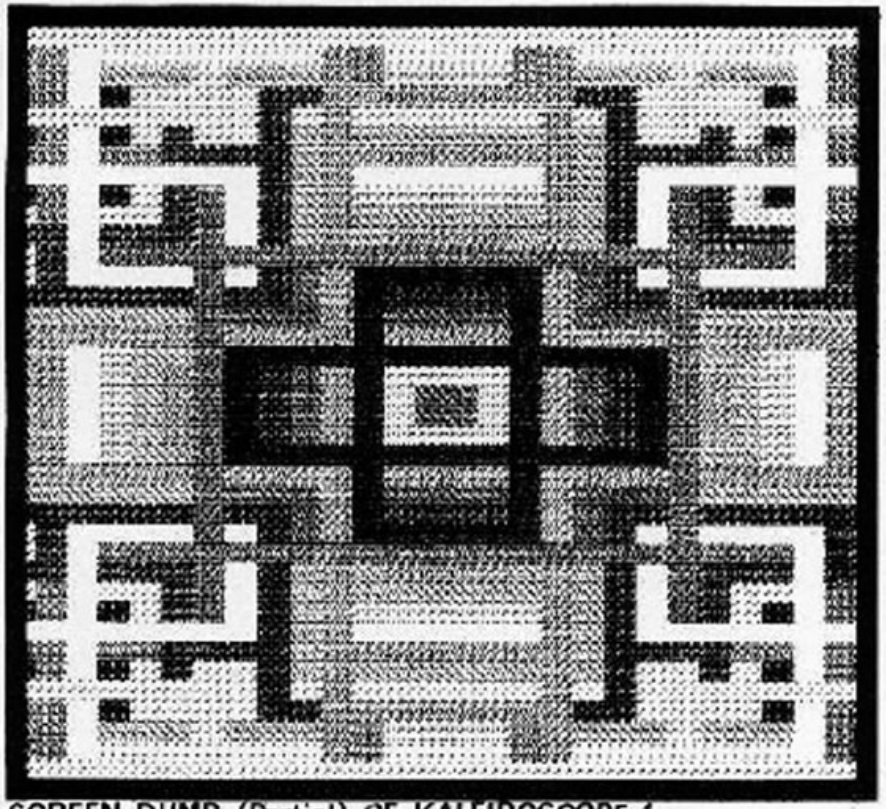
Lo-Res Graphics

Lo-res color is simple and useful for really colorful displays. Programs directed toward children often use the lo-res screen, but some very interesting arcade games also use lo-res.

```
0  REM LO-RES KALEIDOSCOPE 1
100  GR
200 R1 =  RND (1) * 19
210 R2 =  RND (1) * 19
220 RC =  RND (1) * 16
300  COLOR= RC
310  VLIN 20 - R1,20 + R1 AT 20 - R2
320  VLIN 20 - R1,20 + R1 AT 20 + R2
330  HLIN 20 - R1,20 + R1 AT 20 - R2
340  HLIN 20 - R1,20 + R1 AT 20 + R2
360  VLIN 20 - R2,20 + R2 AT 20 - R1
370  VLIN 20 - R2,20 + R2 AT 20 + R1
380  HLIN 20 - R2,20 + R2 AT 20 - R1
390  HLIN 20 - R2,20 + R2 AT 20 + R1
990  GOTO 200
```

```
0  REM LO-RES KALEIDOSCOPE 2
10  GR
20  FOR A = 3 TO 50: FOR B = 1 TO 19: FOR C = 0 TO 19

30 D = B + C: COLOR= C * 3 / (B + 3) + B * A / 12
40  PLOT B,D: PLOT D,B: PLOT 40 - B,40 - D: PLOT 40 -
    D,40 - B: PLOT D,40 - B: PLOT 40 - B,D: PLOT B,4
    0 - D: PLOT 40 - D,B
50  NEXT : NEXT : NEXT : GOTO 20
```



SCREEN DUMP (Partial) OF KALEIDOSCOPE 1