

MINNEAPOLIS APPLE II USERS GROUP NEWSLETTER.

AUGUST 1978

Please address all correspondence to

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HI- APPLE USERS

Welcome to the first edition of our newsletter.
We hope you find it useful. If you do, please let us know. But more, please make some contributions to it. Ideas; technical inf; reviews; short program listings; etc.

or

MINI'APP'LES
C/O Computerland
8070 Morgan Ave S
Bloomington

I would like to take this opportunity to thank Rob Wentworth for his technical assistance with respect to the workings of the HIRES software.

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The following are known Apple User's in the Twin Cities area- However they did not attend the July Users meeting.

Dr C.H. Walter	12924 So. Nicollet #202, Burnsville, 55337	894-1003
George Parker	4917 Ridge Road, Edina, Mn, 55436	938-0807
John Luther	428 E Main St., P.O. Box 16, Waterville, Mn, 56096	362-4682
Steve Davies	5120 Penn Ave S., Minneapolis, Mnm 55419	926-7471
Bill Zimmerman	380 E. Wheelock Parkway, St Paul, 55101	778-1575
Steve Sgeggeby	6950 Wayzata Blvd, Minneapolis, 55426	546-6611
Ken Borgendale	1603 41st St N.W Apt B-8 Rochester Mn	507-286-9058
Earl Keyser	22 Clover Lane Mason City Iowa	
T. C. Dantis	2684 Casio Pt Rd, Wayzata, Mnm 55391	871-6441
Keith Madonna	23885 Clover Lane, Excelsior, Minn	474-3876
Mike Flanery	3855 Blaisdale, Minneapolis, Mn, 55409	825-4166
Dick Lernas	806 Old Settlers Trail, Apt 3, Hopkins, 55343	933-2365

USER PROGRAMS DIRECTORY:

The following is a suggested format for the directory:

Name of Program

Minimum Memory

Language(I for Integer Basic

AT for Applesoft on Tape

AR for Applesoft on ROM

AD for Applesoft Disk -assumes use of disk I/O

M for Machine Language- i.e NO Basic

Special Hardware requirements such as Printer, more than 2 paddles, output lights, Heuristics Language hardware etc

Brief description of what the purpose of the software is

Author's name

Date

Type of Program

G for game

B for Business

I for Instructional (Computer aided instruction etc)

U for Utility eg. Create Shape

C for Compilers, Interpreters, Assemblers

S for System (Monitors, HIRES subs, etc)

M for Mathematical(Matrix inversion etc)

H for Home Economics(Checkbook etc)

P for Process Control

USER'S GROUP MEETING- August 9th 1978

Following matters were agreed to by the majority:

1. Meetings will be held at 7:30 pm on the 2nd Weds of each month
2. Place of meeting will be Computerland Store, Morgan Circle S, Bloomington. If the size of the group gets large, an alternate meeting place will have to be found.
3. Users' group will not have any elected officers. One person will act as chairman of each meeting. The chairman will be selected by the group. Dan Buchler has been asked to chair the first few meetings.
4. Users' meeting will be kept as short as possible so that users may have time following meeting to discourse with other users.
5. An Agenda will be prepared for each meeting.
6. A Newsletter will be published. Frequency of newsletter will depend on availability of contributions of news. Cost of printing newsletter will be born by Computerland Store in exchange for right to publish advertisements relating to Apple II or Apple II compatible products. Newsletter will not be mailed to users but will be available for pickup at user meetings. However some newsletter copies will be made available for distribution to other User groups in the USA. How such mailing costs will be financed has not been determined.

Newsletter will be handled by Dan Buchler. However helpers and contributors are solicited.

7. Computerland will maintain a directory of programs written by Users. This directory will probably be computerized on an Apple with Apple Disk.

MINI'APP'LES

August, 1978

MINI'APP'LES

Rostor of those attending Aug 9th kickoff.

Name	Address	tel	memory	p'pherals	interests	available
Dan Buchler	13516 Grand Burnsville, Mn 55337	890-5051	16K	Tape A'soft ROM	Hires- Graphics Education Games	Weekend Eves afte 6
Phil Shuler	325 E 43rd St., Mpls, Mn, 55409	825-6646	16K	Tape	Graphics Op-Svsts	After 6 Wk-ends
Gene Qualle	3607 Bryant So Mpls, Mn, 55409	827-6977	16K	Tape	Business Applictns	Normal Wk hrs
John Klindworth	5213 W 56th Mpls, Mn 55436	926-8476	4K	Tape	Business Games, Graphics	Normal Wk hrs
Mel Edman	5905 Maplewood Ln Minnetonka, Mn, 55343	935-6096 home 835-7922	32k wk	Tape, Aid#1 Disc A'soft ROM	Graphics Music, Genl Business	Wk Hrs NOT Th/fr
Dave Sand	229 Russell Ave S Mpls Mn 55405	374-4657			Games, Graph- ics. Languages	nights Eves wk-en
Rob Wentworth	4844 Clinton Ave S Mpls Mn, 55409	825-9086	24K	Tape	EVERYTHING Leave msgs	6-midngt Wk-ends 8am- 6p
Jim Jirousek	Res: 5555 Zealand New Hope, Mn 55428 Mail: 5728 Xerxes Ave Edina, Mn, 55410	537-6089	16K	Tape	Games Graphics Assbly- lang.	After 6 excpt wed/thur
David Bondurant	4508 W 90th St Bloomington, 55437	831-4105	16K	Tape, I/O Selectric	Games/Graphics Scientific	Eve Wk-ends
Jan Rotenberg	2256 W. Lake Isle Blvd Mpls Mn 55405	377-8265	16K	Disk? Tape	EVERYTHING	Night
Paul Sand	771 N.E. Harding St Automatic Hdw Co Mpls Mn 55413		16K to 32K	Disk? Tape AHC Distr. Proc Syst.	Software Devlp.	9-4 Mon- Fri
James A. Henke T.I.E.S.	6708 12th Ave S Richfield, Mn 55423	869-6371		T.I.E.S may purchase	Educ. Graphics	Nights
Roger Smedman	3835 Ballantrae Apt #2 Eagan, Mnm 55122	452-5131	16K		Everything Games Math	Nights
Butch Rhoades	12513 Mystic Lane Burnsville, Mn, 55337	890-9779	16K	A-Soft ROM?	Games Business	Nights

USERS GROUP MEETING (CONTINUED FROM PREVIOUS PAGE)

8. Because of the time required to reproduce large quantities of program tapes, Apple IIs in the Computerland store will not in general be available for copying of programs. It was suggested that, copying of programs be handled by the individuals who provide those programs. It was pointed out that, Apple provided programs are copyrighted and may not be reproduced at the store without payment of the program price.
9. Initially there will not be a USERS group membership fee. However it may be necessary to charge such fees at a later date to cover expenses for such things as meeting room, mailing, etc.
10. It was suggested that new additions to the USERS library be listed in the Newsletter
11. Computerland premises must be vacated by 10pm off the night of the User meetings.

HIGH RESOLUTION COLOR(continued, page 2)

conflict. THE LINE WILL BE GREEN . However in the above example, if

$$10 X = 12$$

and HCOLOR remains set to 1, the vertical line consists only of EVEN numbered X-coordinate dots, which are Violet. RESULT- NO VISIBLE LINE! In fact, for vertical lines, green lines can only be plotted for odd values of X. Or Green lines can be plotted even when HCOLOR = 3 (White).

When working directly with the HIRES subroutines, the color is the mask itself. To understand that point, read HIRES Display (below).

When using the HIRES subroutine SHAPE, the 'mask' will mask all even dots if set to \$55, and all odd dots if set to \$AA. For this reason it is difficult to construct a SHAPE in color. If one succeeds in constructing a SHAPE of one color (either all EVEN or all ODD dots), it must be displayed at an even address (X value) to retain the original color. In practice it is easier to confine shapes to all White (Mask of \$FF)

Applesoft II nominally offers a HIRES Color set of HCOLOR from 0 through 7. HCOLOR values of 5 and 6 are described as 'depending on TV'. In this writer's experience, all TVs will give same color for 2 and 5, and for 3 and 6. The effect of using an HCOLOR value of 5 or 6 is to cause the high order bit 7 of the Apple LL byte(s) in the display area which contain the dot(s) to be set on (Bit 7 equals 1). See below for more information on byte structures in display area.

HIRES DISPLAY

A certain fundamental understanding of the High Resolution (HIRES) Display capability is useful in programming graphics on the Apple II in Applesoft II or with the HIRES Subroutines.

2 HIRES modes of operation are available:-

HIRES GRAPHICS MODE MIXED HIRES GRAPHICS MODE

In the HIRES Graphics Mode, the screen is divided into 280 horizontal by 192 vertical dots. NO TEXT can be displayed except by use of characters generated in software and displayed as HIRES patterns or SHAPES.

In the MIXED HIRES GRAPHICS MODE, the upper portion of the screen is divided into 280 horizontal by 160 vertical dots. The lower portion of the screen is available for 4 lines of 40 characters of standard text (PRINT statements)

Low Resolution 16 color graphics may not be used in conjunction with either HIRES mode.

2 colors are available in HIRES Modes as described in the section on HIRES color. The setting and clearing of the above HIRES modes is described in the Applesoft II manuals and in the Apple II manual.

HIRES DISPLAY (Continued)

The Information displayed on the screen is derived from Apple II memory. This memory is called a 'page'. 2 different pages may be defined.

PAGE 1 uses 2nd 8k of memory \$2000 to \$3FFF
 PAGE 2 uses 3rd 8K of memory \$4000 to \$5FFF

Page 2 may be invoked with references to \$C054 and \$C055.
 See page 30 of Apple II Reference Manual.

Each dot on the screen is represented by one bit in the selected page of memory. If the bit is on, that is a one, the dot is on. See HIRES COLOR above for discussion on color of dot. In each byte in the selected page of memory, only the lower 7 bits are used to turn dots on and off. That is bits 0 through 6. Bit 7 is used to select the alternate HIRES Color (Applesoft II colors (HCOLOR) 4 through 7). Since there are 280 dots in a line, $280 \div 7$ which is 40 bytes are needed per line. These bytes are contiguous for any particular line. See figure below

Word 0	Word 1	word 2
6 5 4 3 2 1 0 X	13 12 11 10 9 8 7	20 19 18 17 16 15 14
• • • • • • •	• • • • • • •	• • • • • • •
7 6 5 4 3 2 1 0 Bit	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0

1st 3 bytes in a 40 byte set which displays one horizontal line in
 HIRES GRAPHICS

Note the Bit 7 is used for the alternate HCOLOR selection(See HIRES
 Color)

The 40 words(bytes) which display one horizontal line of the 160 or 192 available are not sequential in the memory page with respect to the Y coordinate value. Apple adopted a nifty addressing scheme which was easily implemented in the display hardware logic. This scheme works as follows:

Y, the Y coordinate lies between 0 and 159(or 191) and is represented pictorially as an 8 bit number-

H₇ H₆ M₅ M₄ M₃ L₂ L₁ L₀

L, M and H are bits with the L, M and H standing for Low order(3 bits). Medium order(3 bits) and High order (2 bits). Bit representation is standard 6502 nomenclature. In assembling the page address of the first word of the 40 that represent a horizontal line, the word(byte) with the X coordinates 0 through 6 in it, the resultant address looks like

this:- P₁ P₀ L₂ L₁ L₀ M₅ M₄ M₃ H₇ H₆ H₇ H₆ 0 0 0

P₁ P₀ is 0 1 for page 1,
 1 0 for page 2

Note that the 2 high order bits H₆ H₇ appear twice each. This is the nifty scheme which makes the address go up in jumps of 40. The actual addresses corresponding to different values of Y can be found in the table on the next page. 40 bytes X 192 lines results in 7680 bytes of the 8192 available in a page. Those 512 unused bytes(warning they are

HIRES DISPLAY (Continued)

set to zero by the HIRES clear routine) are spread through the page in 8 byte blocks, These are shown by dashes in table below.

TABLE SHOWING RELATIONSHIP OF PAGE 1 HIRES 40 BYTE DISPLAY LINE ADDRESS TO Y-COORDINATE VALUE

Hex addr	Y	Hex addr	Y	Hex addr	Y
2000	0	2400	1	2800	2
2028	64	2428	65	2828	66
2050	128	2450	129	2850	130
2078	-	2478	-	2878	-
2080	8	2480	9	2880	10
20A8	72	24A8	73	28A8	74
20C0	136	24C0	137	28C0	138
20F8	-	24F8	-	28F8	-
2100	16	2500	17	2900	18
2128	80	2528	81	2928	82
2150	144	2550	145	2950	146
2178	-	2578	-	2978	-
2180	24	2580	25	2980	26
21A8	88	25A8	89	29A8	90
21C0	152	25C0	153	29C0	154
21F8	-	25F8	-	29F8	-
2200	32	2600	33	2A00	34
2228	96	2628	97	2A28	98
2250	160	2650	161	2A50	162
2278	-	2678	-	2A78	-
2280	40	2680	41	2A80	42
22A8	104	26A8	105	2AA8	106
22C0	168	26C0	169	2AC0	170
22F8	-	26F8	-	2AF8	-
2300	48	2700	49	2B00	50
2328	112	2728	113	2B28	114
2350	176	2750	177	2B50	178
2378	-	2778	-	2B78	-
2380	56	2780	57	2B80	58
23A8	120	27A8	121	2BA8	122
23C0	184	27C0	185	2BC0	186
23F8	-	27F8	-	2BF8	-

Only 1st 72 values of Y are detailed. The small table below details Y from 3 to 8. A study of these two tables will reveal how easy it is to extrapolate the values of Y not shown simply by incrementing by \$800 for each increment in Y.

2C00	3	3800	6
3000	4	3C00	7
3400	5		

High Resolution Operating Subroutines:
 (This page replaces page 47 in Apple II Ref Manual)

Those routines which require the passing of parameters have two entry points. With one, parameters are passed via specified memory locations. We will call this type 'm' (for memory). This entry point is always used from BASIC and may be optionally used from machine language programs. It causes the X register to be saved and then loads the A,X & Y registers from the appropriate memory locations. On exit the X register is restored.

The other entry point provides for the parameters to be passed via the 6502 registers without storing that information in the specified memory locations. This entry point may optionally be used from machine language programs. It may not be used for calls from BASIC. We will call this entry point type 'r' for register.

INIT Initializes High-Resolution Graphics mode.

From BASIC: CALL 3072 (or CALL -12288)

From machine language: JSR \$C00 (or JSR \$D000)

This subroutine sets High-Resolution Graphics mode with a 280 x 160 matrix of dots in the top portion of the screen and four lines of text in the bottom portion of the screen. INIT also clears the screen.

CLEAR Clears the screen.

From BASIC: CALL 3086 (or CALL -12274)

From machine language: JSR \$C0E (or JSR \$D00E)

This subroutine clears the High-Resolution screen without resetting the High-Resolution Graphics mode.

PLOT Plots a point on the screen.

From BASIC: CALL 3780 (or CALL -11580)

From machine language (type r): JSR \$c7C (or JSR \$D07C)
 (type m): JSR \$EC4 (or JSR \$D27C)

This subroutine plots a single point on the screen. The x & Y co-ordinates of the point are passed in location 800, 801 and 802 from BASIC (\$320, \$321 & \$322 from type m), or in the A,X and Y registers for type r machine language calls. The Y (vertical) coordinate can be from 0

HIGH RESOLUTION GRAPHICS SUBROUTINES (Cont)
 (This page replaces page 48 in Apple II ref manual)

PLOT (Continued)

top of screen to 159 (bottom of screen) and is passed in location 802 (\$322) or the Y register; but the X (horizontal) coordinate can range from 0 (left side of screen) to 279 (right side of screen) and must be split between locations 800 (\$320), X MOD 256 in BASIC or the A-register in r type calls and location 801 (\$321), X/256 or X > 256 in BASIC, or the X register for r type calls. Note the low order byte is in the first of the location pair following standard 6502 practice.

The color of the point to be plotted must be set in location 812 (\$32C)
 See discussion on HIRES colors.

POSN Positions a point on the screen.

From BASIC: CALL 3761 (or CALL - 11599)

From machine language (type r): JSR \$C26 (or JSR \$D026)
 (type m): JSR \$EB1 (or JSR \$D2B1)

This subroutine does all the calculations for a plot, but does not plot a point (it leaves the screen unchanged). This is useful when used in conjunction with LINE or SHAPE (described later). To use the subroutine, set up the X and Y coordinates just the same as for PLOT. The color in location 812 (\$32C) is ignored

LINE Draw a line on the screen.

From BASIC: CALL 3786 (or CALL -11574)

From machine language: (type r): JSR \$C95 (or JSR \$D095)
 (type m): JSR \$ECA

This subroutine draws a line from the last point PLOTTed or POSN'ed to the point specified. One endpoint is the last point PLOTTed or POSN'ed; the other endpoint is passed in the same manner as for a PLOT or POSN. The color of the line is set in location 812 (\$32C). Note, as described in section on HIRES COLOR, only points corresponding to the selected color will be plotted. Therefore, unless white '\$255' is used parts or even all of the line may be missing. After the line is drawn, the new endpoint becomes the base endpoint for the next line drawn

SHAPE Draws a predefined 'shape' on the screen

From BASIC: CALL 3805 (or CALL -11555)

From machine language (type r): JSR \$DBC (or JSR \$D1BC)
 (type m): JSR \$EDD

This subroutine draws a predefined shape on the screen at the point previously PLOTTed or POSN'ed. It also will start a SHAPE at the endpoint of the last SHAPE drawn. The SHAPE is defined by a table of vectors in memory. How to create this table of vectors is described later or the UTILITY program CREATE SHAPE, taken from the JULY/AUG edition of CREATIVE COMPUTING magazine maybe used to create and save shapes (Available in the MINI'APP'LES USERS GROUP LIBRARY)

The starting address of the table of vectors is passed in locations

HIGH RESOLUTION GRAPHIC SUBROUTINES (Cont)

(This page replaces page 49 of the Apple II reference manual)

SHAPE (Cont)

804 (\$324) and 805 (\$325) from BASIC or type m machine language, or i n the Y and X registers for type r machine language. The color of the shape should be passed in location 28 (\$1C) (The following has not been absolutely verified, but this writer beleives that since 28 is part of register #14 in the SWEET 16 16bit interpreter, which is itself part of the APPLE II monitor, location 28 gets clobbered by subsequent calls to POSN etc. It therefore must be restored prior to each call to SHAPE) Please also read the discussion on COLOR in HIRES COLOR. Use of colors other than white will almost certainly delete pieces of the shape.

There are two special variables that are used only with the SHAPE routine: the scaling factor and the rotation factor. When the scaling factor is used additional dots are generated under conditions but the routine will not create a solid line or block just because there was a solid block before. The ability to rotate the image depends on the scaling factor because the roation is calculated in a vector form similar to the way in which the vector table was created in the first place.

The rotation resolution is limited according to the following table

<u>Scale Factor</u>	<u>Available rotations</u>
1	0,16(90 degrees), 32, 48
2	0, 8(45 degrees),16,24,32,40,48 and 56
4	0,4,8,12, 16 etc
8	0,2,4,6,8,10,12,14,16,18 etc
16	All 64

The scaling factor determins the relative size multiplication of the shape. Foe example a scale factor of 2 will plot a shape 20 points long if the vector table defines it as 10 points long. When rotation is employed there will be some distortion of the image due to the non linearity of the vertical point spacing relative to the horizontal and because of the vector technique used to create rotations, A scaling factor of

High Resolution Graphic Subroutines

Additional information:

The last sector of the subroutine F00 to FFF contains a table of 8 bit SINE values called the SINTBL.

If THETA is the angle in degrees for which the SINE is to be found: then the SINE will be found at

$$\text{\$F00} + 256 * \text{THETA} / 360$$

$$\text{or } \text{\$F00} + 32 * \text{THETA} / 45$$

The resulting SINE value is excess 128 ; that is it has $\text{\$80}$ added to it . It is also multiplied by 128; or, thinking of it in another way, the decimal point precedes the 1st hexadecimal number.

Example in BASIC. Let us say we want to solve the problem:

$$A = B * \text{SIN}(\text{THETA})$$

This is performed as follows:

```
100  SINTBL = 3840
200  A = (PEEK (SINTBL+THETA*32/45) -128 ) * B / 128
```

In this particular example if B is less than 128, some precision is lost and the expression should be scaled accordingly. Note also that the SINTBL covers 4 quadrants (0 to 360 degrees). If THETA could be greater than 360, it must be modulus 360
i.e. THETA MOD 360

Since SINE is negative in the 3rd and 4th quadrant, the values of SINTBL lie between 0 and $\text{\$80}$. In the first and 2nd quadrant they lie between $\text{\$80}$ and $\text{\$FF}$.

Another routine FIND is also provided in HIRES at 3667. I have'nt figured that one out yet.