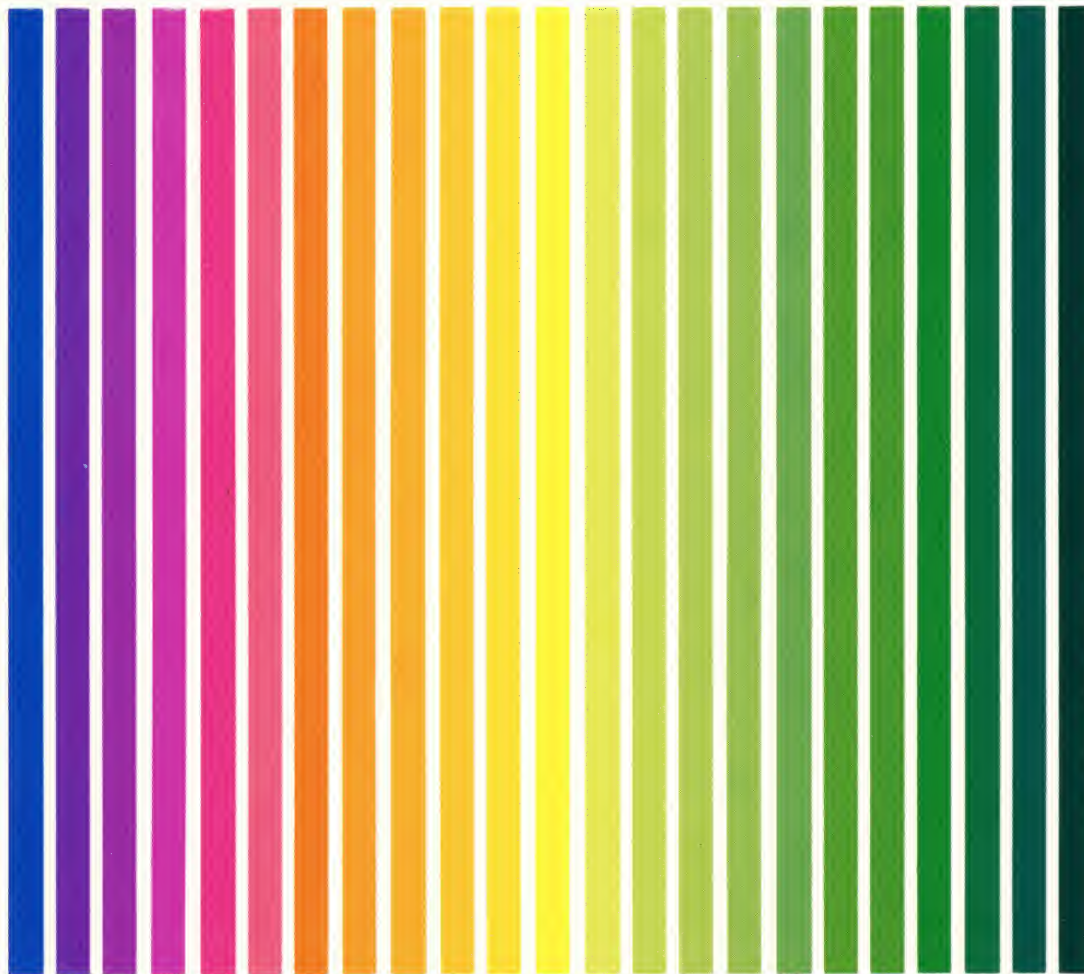


APX ATARI® PROGRAM EXCHANGE



William D. Volk

FORTH TURTLE GRAPHICS PLUS

Turtle graphics for use with EXTENDED fig-FORTH

Diskette: 24K (APX-20157)

User-Written Software for ATARI Home Computers

FORTH TURTLE GRAPHICS PLUS

by

William D. Volk.

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INTRODUCTION

OVERVIEW

FORTH TURTLE GRAPHICS PLUS is a package of FORTH "words" (functions) that adds the standard turtle graphics of languages like ATARI PILOT and LOGO to EXTENDED fig-FORTH, available through APX. Implemented in integer math, the package also supports a normalized coordinate system, the ability to create windows with clipped lines on any part of the screen display without having to modify a program, the twelve graphics modes available with the new GTIA chip, and the TRIG functions *SIN, *COS, and *TAN for use in FORTH programs. Also included is a graphics mode 8 screen dump utility for Epson printers with GRAFTRAX. Yet with all these features, FORTH TURTLE GRAPHICS PLUS compiles to only 2K of memory!

REQUIRED ACCESSORIES

24K RAM (more for some graphics modes)
Extended fig-Forth (APX-20029)
ATARI 810 Disk Drive

OPTIONAL ACCESSORIES

EPSON MX-80 or 100 Printer with GRAFTRAX

CONTACTING THE AUTHOR

This package is an evolving entity. If you have suggestions or improvements, please write to the author at:

Box 2053 Babcock House
Durham, NH 03824

THE COORDINATE SYSTEM

While you're using FORTH TURTLE GRAPHICS PLUS, the coordinate system is fixed and independent of the ATARI Computer's graphic coordinates. It is centered on 0,0 and extends to +/-1000 along both the X and Y axes. Figure 1 depicts the range along both axes.

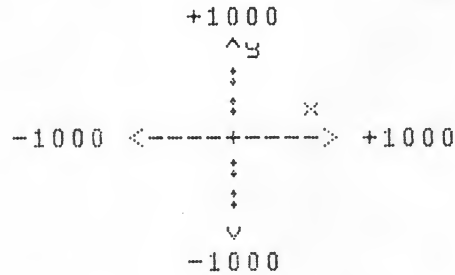


Figure 1 Range along X and Y axes

The two screen modes best used with FORTH TURTLE GRAPHICS PLUS are BASIC modes 7 and 8. These modes are accessed by the functions GR8 and GR7, which set the window to the entire graphic display. The GTIA modes are on screen 8, which includes the functions GR9 and GR11. To use other modes, use the GR. function (mode ---), as described in the EXTENDED fig-Forth documentation, and set an appropriate window.

TURTLE FUNCTIONS

MOVE (x ---)

Move in the current direction x units.

TURN (x ---)

Turn x degrees to the right.

TURNTO (x ---)

Turn to a direction of x degrees.

PEN (x ---)

Select pen color x and place the pen down. The color corresponds to the COLOR command in ATARI BASIC.

PENUP (---)

Lift the pen up.

PENDN (---)

Place the pen down.

GOXY (x y ---)

Go to the coordinate x, y with the pen up.

DRAWTO (x y ---)

Go to the coordinate x, y with the pen down.

CLEAR (n ---)

Fill the window with color n.

FRAMEIT (n ---)

Draw a box around the window in color n.

CENTER (---)

The same as a 0 0 GOXY command.

BOX (n ---)

Draw a box of dimension n.

SCREEN DESCRIPTIONS

Screen 1

Contains the code to create the trig table used by *SIN, *COS, and *TAN. This table is located by the variable TRIGTAB.

Screen 2

The recursion function RECURSE is defined on line 0. This allows a FORTH word to call itself. Recursion is used by the function ANGSET, which converts any angle to an angle within 0-359 degrees. The trig functions are defined on this screen. The trig functions *SIN, *COS, and *TAN are implemented by doing a look-up on TRIGTAB.

Screen 3

The variables used by FORTH TURTLE GRAPHICS PLUS are defined here. Some functions are also defined. The coordinate size, +/- 1000, is set on line 15.

Screen 4

Some of the clipping functions, the variables used by the clipping function, and the transformation to the window are defined here.

Screen 5

This screen contains the bulk of the clipping function, which clips lines to the +/- 1000 window. It is based on the FORTRAN clipping program in A Practical Introduction to Computer Graphics. This results in a larger FORTH function than is normally desirable.

Screen 6

The remaining turtle functions are defined here. Some examples of turtle functions (BOX, CUBE, and CIRCLE) are also defined.

Screen 7

The CLEAR and CENTER functions are defined here.

Screen 8

The GTIA extensions are defined, along with the demonstrations GSQUIRAL, BOXES, SPIRAL, DEMO1, and DEMO2. All demonstrations except DEMO2 have a stack diagram (n ---), specifying the number of iterations. (DEMO2 does not affect the stack.)

Screen 9

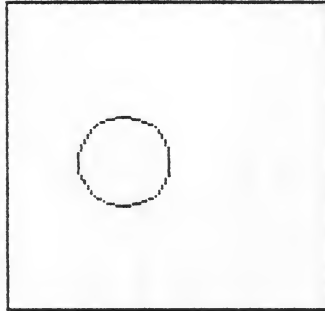
This screen defines GRDUMP (---), which sends a graphics mode 8 screen dump to an Epson printer with GRAFTRAX. You must execute a FON command before dumping. The data is echoed on the bottom of the screen; the data may include the bell character.

9 LOAD

to load in the screen containing the graphics mode 8 screen dump function. Then to dump the circle command, type

```
GR8 INIT 100 CIRCLE FON GRDUMP POFF
```

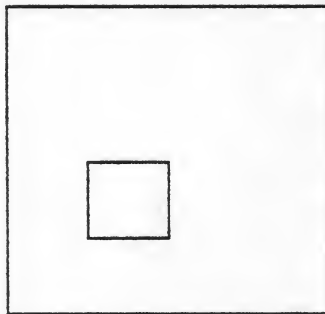
The figure looks like this:



To dump the BOX command, type

```
GR8 INIT 500 BOX FON GRDUMP POFF
```

The figure looks like this:



To dump the CUBE command, type

```
GR8 INIT 400 CUBE FON GRDUMP POFF
```


SUGGESTED REFERENCES

1. MIND-STORMS: Children, Computers, and Powerful Ideas, Seymour Papert.

A good introduction to turtle graphics and procedural programming.

2. Starting FORTH, Leo Brodie, Prentice-Hall, 1981.

The best introduction to FORTH programming.

3. A Practical Introduction to Computer Graphics, Ian O. Angell.

Good discussion of clipping functions. Contains FORTRAN listings of programs.

4. Fundamentals of Interactive Computer Graphics, J.D. Foley & A. Van Dam.

Excellent graphics text. Good explanation of windowing and its uses.

Additional documentation on fig-FORTH is available from the FORTH Interest Group, P.O. Box 1105, San Carlos, CA 94070.

SCR # 1

```
0 0 VARIABLE TRIGTAB 571 , 1143 , 1714 , 2285 , 2855 ,
1 3425 , 3993 , 4560 , 5125 , 5689 , 6252 , 6812 ,
2 7370 , 7927 , 8480 , 9031 , 9580 , 10125 , 10667 ,
3 11206 , 11742 , 12274 , 12803 , 13327 , 13847 ,
4 14364 , 14875 , 15383 , 15885 , 16383 , 16876 ,
5 17363 , 17846 , 18323 , 18794 , 19259 , 19719 ,
6 20173 , 20620 , 21062 , 21497 , 21925 , 22347 ,
7 22761 , 23169 , 23570 , 23964 , 24350 , 24729 ,
8 25100 , 25464 , 25820 , 26168 , 26509 , 26841 ,
9 27165 , 27480 , 27787 , 28086 , 28377 , 28658 ,
10 28931 , 29195 , 29450 , 29696 , 29934 , 30162 ,
11 30381 , 30590 , 30790 , 30981 , 31163 , 31335 ,
12 31497 , 31650 , 31793 , 31927 , 32050 , 32164 ,
13 32269 , 32363 , 32448 , 32522 , 32587 , 32642 ,
14 32687 , 32722 , 32747 , 32762 , 32767 ,
15 -->
```

SCR # 2

```
0 : RECURSE LATEST PFA CFA , ; IMMEDIATE ( RECURSION )
1 32767 CONSTANT MAXINT ( LARGEST INTERGER )
2 : GETRIG 2 * TRIGTAB + @ ; ( RETURNS TABLE ELEMENT N )
3 : ANGSET DUP 359 > IF 360 - RECURSE ELSE DUP
4 0 < IF 360 + RECURSE ENDIF ENDIF ; ( GET ANGLE 0-359 )
5 : SGNSIN ANGSET 180 > IF MINUS ENDIF ; ( GIVE SIGN TO VALUE )
6 : SGNCOS 90 + SGNSIN ;
7 : INDEXSIN DUP 180 > IF 180 - ENDIF DUP 90 > IF 180 SWAP -
8 ENDIF ; ( GET THE INDEX OF THE SIN FUNCTION )
9 : INDEXCOS INDEXSIN 90 SWAP - ; ( GET COS OFFSET )
10 : GETSIN ANGSET DUP INDEXSIN GETRIG SWAP SGNSIN ;
11 : GETCOS ANGSET DUP INDEXCOS GETRIG SWAP SGNCOS ; ( VALUES )
12 : *SIN GETSIN MAXINT */ ; ( N ANG --- N*SIN )
13 : *COS GETCOS MAXINT */ ; ( N ANG --- N*COS )
14 : *TAN DUP GETSIN SWAP GETCOS */ ; ( N ANG --- N*TAN )
15 -->
```

SCR # 3

```
0 ( TURTLE GRAPHICS WILLIAM VOLK 3/29/82 )
1 0 VARIABLE TURTANG ( ANGLE OF MOTION )
2 : TURN TURTANG @ SWAP - ANGSET TURTANG ! ; ( TURN TURTLE )
3 : TURNT0 ANGSET TURTANG ! ;
4 0 VARIABLE TURTCOL ( COLOR OF PEN )
5 0 VARIABLE LCORX 0 VARIABLE LCORY 0 VARIABLE RCORX
6 0 VARIABLE RCORY 0 VARIABLE X1 0 VARIABLE Y1 0 VARIABLE X2
7 0 VARIABLE Y2 0 VARIABLE PENDOWN ( 0 PEN IS UP, 1 DOWN )
8 : PEN TURTCOL ! 1 PENDOWN ! ; ( SET COLOR PEN IS DOWN )
9 : PENDOWN? PENDOWN @ ; ( LOGICAL TEST OF PEN )
10 : PENUP 0 PENDOWN ! ; ( LIFT THE PEN UP )
11 : WINDOW RCORY ! RCORX ! LCORY ! LCORX ! ; ( SET SCREEN )
12 : GR7 XGR 7 GR. 0 0 159 79 WINDOW ;
13 : GR8 XGR 8 GR. 0 0 319 159 WINDOW ;
14 : PENDN 1 PENDOWN ! ; ( PLACE THE PEN DOWN )
15 1000 CONSTANT PICSIZE -->
```

```

SCR # 7
0 ( TURTLE GRAPHIC FUNCTIONS )
1 ; CLEAR RCORY @ 1 + LCORY @ DO ( CLEAR WINDOW )
2 DUP LCORX @ I PLOT DUP RCORX @ I DRAW
3 LOOP DROP ;
4 ; CENTER 0 0 GOXY ;
5
6
7
8
9
10
11
12
13
14
15

```

```

SCR # 8
0 ( GITA DEMOS )
1 ; GR9 XGR 9 GR. 0 0 79 191 WINDOW CENTER ;
2 ; GR11 XGR 11 GR. 0 0 79 191 WINDOW CENTER ;
3 ; GSQUIRAL 1 DO I PEN I 10 * MOVE 123 TURN LOOP ;
4 ; BOXES 1 DO I PEN I 10 * BOX LOOP ;
5 ; SPIRAL 1 DO I PEN I MOVE 30 TURN LOOP ;
6 ; DEMO1 1 DO I PEN I 10 * BOX 10 TURN LOOP ;
7 ; DEMO2 12 1 DO I 1 - CLEAR I PEN 700 CUBE LOOP ;
8
9
10
11
12
13
14
15

```

```

SCR # 9
0 ( PRINT DUMP GR8 )
1 ; ROWDUMP -1 160 DO DUP 88 @ + I 40 * + @ EMIT -1 +LOOP DROP ;
2 ; SETDUMP ." " 27 EMIT 75 EMIT 160 EMIT ;
3 ; GRDUMP 27 EMIT 65 EMIT 8 EMIT CR 40 0 DO SETDUMP I ROWDUMP
4 CR LOOP ;
5 ; DEMO CENTER 1 DO I 20 * BOX 10 TURN LOOP ; ( GRAPHICS )
6
7
8
9
10
11
12
13
14
15

```

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We, Atari, Inc., guarantee to you, the original retail purchaser, that the medium on which the APX program is recorded and any hardware accessories sold by APX are free from defects for thirty days from the date of purchase. Any applicable implied warranties, including warranties of merchantability and fitness for a particular purpose, are also limited to thirty days from the date of purchase. Some states don't allow limitations on a warranty's period, so this limitation might not apply to you. If you discover such a defect within the thirty-day period, call APX for a Return Authorization Number, and then return the product along with proof of purchase date to APX. We will repair or replace the product at our option.

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ATARI PROGRAM EXCHANGE

REVIEW FORM

We're interested in your experiences with APX programs and documentation, both favorable and unfavorable. Many software authors are willing and eager to improve their programs if they know what users want. And, of course, we want to know about any bugs that slipped by us, so that the software author can fix them. We also want to know whether our documentation is meeting your needs. You are our best source for suggesting improvements! Please help us by taking a moment to fill in this review sheet. Fold the sheet in thirds and seal it so that the address on the bottom of the back becomes the envelope front. Thank you for helping us!

1. Name and APX number of program _____

2. If you have problems using the program, please describe them here.

3. What do you especially like about this program?

4. What do you think the program's weaknesses are?

5. How can the catalog description be more accurate and/or comprehensive?

6. On a scale of 1 to 10, 1 being "poor" and 10 being "excellent", please rate the following aspects of this program?

- _____ Easy to use
- _____ User-oriented (e.g., menus, prompts, clear language)
- _____ Enjoyable
- _____ Self-instructive
- _____ Useful (non-game software)
- _____ Imaginative graphics and sound

7. Describe any technical errors you found in the user instructions (please give page numbers).