HIGH RESOLUTION GRAPHICS CARD

PBK Rev 0.

CONTENTS

DESCRIPTION AND INSTALLATION

The Tangerine High Resolution Graphics card is designed to give a high quality graphics display of 256 x 256 pixels, giving a resolution of 65536 addressable points, on a domestic UHF television through an onboard high quality modulator or by direct video input into a video monitor. As the card is ready assembled all that is required for physical installation is to insert the card into one of the "Additional" slots on the system motherboard and to connect a TV aerial lead to the modulator, or video and sync connections to the appropriate take off points on the board. If more than one graphics card is used (e.g. for colour purposes) it is strongly recommended that they are not installed into adjacent slots on the motherboard but have at least one slot between them. This is to promote a continuous flow of air over the boards for cooling.

Tangerine suggest that if three boards are used for colour that they be installed with connections to an appropriate colour monitor/modulator in the order, going left to right, of Red board, Blue board, Green board. Furthermore it is recommended that the boards are used in block mode with each one configured to begin at location 8000H (see section on address switching). This will then allow for future standardisation of software and simplify access to each board by allowing each to be selected by writing to location FFFFH the appropriate status word.

The graphics card offers the facility of mixing the video signal from the Microtan card (text and chunky graphics) with that of the High Resolution graphics screen through the wideband modulator or video output to give a much clearer and higher contrast picture than can be obtained with the Microtan's modulator. This requires a slight modification to the Microtan board and the system motherboard.

a) On system motherboard: Connect a wire from pin B19 on slot Ø to pin A19 on the CPU slot.

b) On Microtan board: Connect a wire from pin A19 on the edge connector to pin 8 of IC C3 (owners of Issue 4

The video signal from the Microtan may now be switched in and out by using switch 4 on the graphics card.

Figure 1 shows the difference in resolution between a chunky graphics pixel and a block of high resolution graphics pixels, there being 16 high resolution pixels to one chunky graphics pixel. This is in fact the same resolution as the screen text characters themselves are displayed at. Each high resolution byte is displayed as a single row of 8 pixels with the MSB (Most Significant Bit) to the left (see figure 2). There are 32 bytes across the screen and 256 down.

Chunky Graphics

High Resolution Graphics Pixels

Figure 1: Comparison of Chunky Graphics Pixel to High Resolution Pixels.

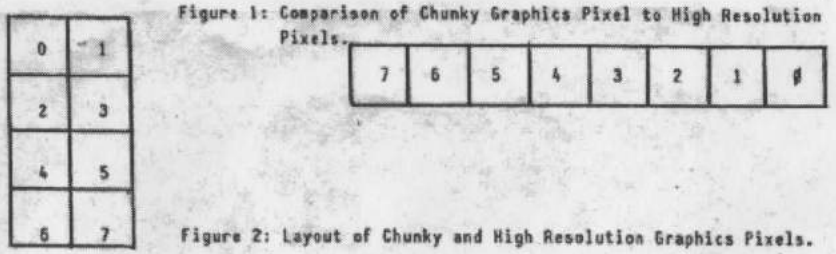

Figure 2: Layout of Chunky and High Resolution Graphics Pixels.

CONFIGURATION AND ADDRESS SWITCHING

A block of six switches on the High Resolution Graphics board enables the user to configure the board to his own specifications. Figure 3 shows the function of each of these switches.

Switches 1,2 and 3 control the top three address lines of the graphics card and enable it to be switched on 8K boundaries through out the system memory map. However problems will arise if it is attempted to switch the board into TANEX memory or into I/O space. Figure 4 shows all the combinations of address that

function if the previously described modification to the system motherboard and Microtan board has been performed. Switch 6, Block Enable, allows the user to decide whether the board recognises the block select signals on the system motherboard or not. This means that the board with either appear as a discrete memory block which is selected using the software in TANBUG V2.3 (or by writing to location FFFFH the slot you want to access) or in a "phantom" mode where the board appears in the same memory space no matter which page is selected. Switch 5, Inhibit RAM, is used to prevent bus contention if there is already memory residing at the locations that the board occupies. This prevents the system trying to read or write data to two sets of parallel memory locations. INHRAM works in favour of the graphics' boards' RAM. Normally switch 6 should be in the same position as switch 5, i.e. both on or both off.

Switch	Function
1	Most Significant Bit (MSB) of address
2	Second MSB of address
3	Third MSB of address
4	Video In/Out
5	Inhibit RAM (INHRAM)
6	Block Enable (BE)

Note: For address switches on = ∅ (binary), off = 1

Figure 3: Switch Functions Table

Address Space	Switch 1	Switch 2	Switch 3	Binary Code
∅∅∅∅ - 1FFF	ON	ON	ON	∅∅∅
2∅∅∅ - 3FFF	ON	ON	OFF	∅∅1
4∅∅∅ - 5FFF	ON	OFF	ON	∅1∅
6∅∅∅ - 7FFF	ON	OFF	OFF	∅11
8∅∅∅ - 9FFF	OFF	ON	ON	1∅∅
A∅∅∅ - BFFF	OFF	ON	OFF	1∅1
C∅∅∅ - DFFF	OFF	OFF	ON	11∅
E∅∅∅ - FFFF	OFF	OFF	OFF	111

Note that switching into I/O space or zero will cause system errors.

Figure4: Table of Address Switching

NOTES ON USE

To set up the board to the Tangerine recommended standard the switches should be set to the following positions: Switch 1 off, switchs 2-6 on. This will cause the board to occupy memory locations 8ØØØ-9FFFH within a separate block of memory space, i.e. it will not overlay a TANRAM occupying the same address space. Assuming that the board is plugged into slot 1 of the system motherboard it would be possible to clear the screen after power-up by executing the following TANBUG commands:

MFFFF,XX,11	Select slot 1 for read/write.
M8ØØØ,XX,ØØ	Set first location to ØØ.
C8ØØØ,9FFF,8ØØ1	Copy first location to rest of board.

If other boards were being used for colour then this procedure would be changed by writing 33 and 55 to FFFF, assuming that the boards were plugged into the appropriate slots.

This process would be simplified if the boards are configured as blocks of consecutive memory with block enable and inhibit RAM switched off, e.g. Red board 4ØØØ-5FFF, Blue board 6ØØØ-7FFF, Green board 8ØØØ-9FFF. C4ØØØ,9FFF,4ØØ1 would then clear all boards. The danger is if you have a TANRAM and enter BASIC, then all the graphics boards would immediately fill with hex AA. Therefore BASIC's memory size would have to be set.

It is important to note that when the graphics card is used in block mode that all handling programs must reside in TANEX or below, otherwise as soon as the board was selected the block of memory containing the program would be deselected thus causing a system error. Power consumption of this board is 300mA.

MACHINE CODE SAMPLE PROGRAM

This machine code routine will plot a pixel at an x,y co-ordinate specified at locations $44 and $45 in zero page. Entry is at 1EØØ and may be via the BASIC USR command or from a machine code routine. At location 1E5Ø is a clear graphics screen routine. If used from BASIC these routines should be protected by stating a memory size of 4Ø96.

```
1E00 A980    LDA #$0080
1E02 8541    STA $0041
1E04 A900    LDA #$0000
1E06 8540    STA $0040
1E08 AA      TAX
1E09 A8      TAY
1E0A A9FF    LDA #$00FF
1E0C 38      SEC
1E0D E545    SBC $0045
1E0F 8545    STA $0045
1E11 A8      TAY
1E12 A920    LDA #$0020
1E14 18      CLC
1E15 6540    ADC $0040
1E17 8540    STA $0040
1E19 9002    BCC $1E1D
1E1B E641    INC $0041
1E1D 88      DEY
1E1E D0F2    BNE $1E12
1E20 A544    LDA $0044
1E22 4A      LSR A
1E23 4A      LSR A
1E24 4A      LSR A
1E25 18      CLC
1E26 6540    ADC $0040
1E28 8540    STA $0040
1E2A 9002    BCC $1E2E
1E2C E641    INC $0041
1E2E A544    LDA $0044
1E30 2907    AND #$0007
1E32 A8      TAY
1E33 B9411E  LDA $1E41,Y
1E36 A000    LDY #$0000
1E38 1140    ORA ($0040),Y
1E3A 9140    STA ($0040),Y
1E3C EA      NOP
1E3D EA      NOP
1E3E EA      NOP
1E3F EA      NOP
1E40 60      RTS
1E41 80      ?
1E42 40      RTI
1E43 201008  JSR $0810
1E46 04      ?
1E47 02      ?
1E48 01EA    ORA ($00EA,X)
1E4A EA      NOP

1E50 A980    LDA #$0080
1E52 8541    STA $0041
1E54 A900    LDA #$0000
1E56 8540    STA $0040
1E58 A8      TAY
1E59 A900    LDA #$0000
1E5B A2A0    LDX #$00A0
1E5D 9140    STA ($0040),Y
1E5F E640    INC $0040
1E61 D0FA    BNE $1E5D
1E63 E641    INC $0041
1E65 E441    CPX $0041
1E67 D0F4    BNE $1E5D
1E69 60      RTS
1E6A EA      NOP
```

MICROSOFT BASIC SAMPLE PROGRAM

This BASIC program illustrates how simple plots can be produced in the high resolution graphics card, albeit at a slower rate than machine code. The program assumes that the graphics card resides at 8ØØØH on phantom mode.

```
1 DIM LK(8):FORI=ØTO7:READLK(I):NEXT
2 DATA128,64,32,16,8,4,2,1
5 DEFFNA(Z)=90*EXP(-Z*Z/100)
10 GOSUB1500
20 Z=1
100 X=Ø
110 FORQ=-30TO30STEP.4
120 L=Ø
130 Y1=5*INT(SQR(1000-Q*Q)/5)
140 FORR=Y1TO-Y1STEP-2
150 S=INT(25+FNA(SQR(Q*Q+R*R))-.7*R)
160 IFS(=LTHEN190
170 L=S
180 Y=S:GOSUB1900
190 NEXTR
200 X=X+1
210 NEXTQ
380 GOTO380
1500 FORI=32768TO40960:POKEI,Ø:NEXT:REM CLEAR DOWN
1600 RETURN
1900 IFX)255ORX(ØTHENRETURN
2000 IFY)255ORY(ØTHENRETURN
2100 Y1=(255-(Y+100))*32
2400 X2=INT(X/8)
2500 X1=INT((X/8-INT(X/8))*8)
2600 POKE32768+Y1+X2+64,PEEK(32768+Y1+64)ORLK(X1)
3900 RETURN
```