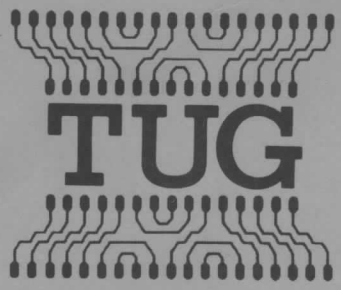


TANGERINE USERS GROUP

VIDEO MODULE

80/82+Vbug

ESTEN '82.

TABLE OF CONTENTS VIDEO 80/82

THE VBUG V1.1 OPERATING SYSTEM

The Video 80/82 VBUG Operating System is supplied in an Eprom of 4K capacity. It provides for an 'Intelligent' exchange of information and commands between itself and the host computer over a wide range of facilities for both Text and Graphic handling routines and is supported with its own standard 96 Ascii character set.

VBUG has been provided in Eprom format to enable the operator the choice of exchanging operating systems at will should dedicated monitors or routines wish to be used.

At the heart of the operating system is the Status/Command Register and a 256 character Silo (First In - First Out) Buffer. Together these provide for a rapid exchange of data or commands between the Video module and the host computer.

VBUG is capable of testing its hardware enviroment upon a Reset, and configue itself for either the 40 or 80 column mode of operation according to the amount of video ram employed.

VBUG uses a 2K working random access memory area for Zero page and Stack operations. This is provided seperately from the video ram, thereby allowing the Vbug operating system to remain totally - independent from the host computer system. Using these methods of operation, the host computer is able to send a series of commands and/or data to the Video module thereafter allowing the Video module to process those instructions whilst it carries on with other tasks.

This monitor was chosen for its general facilities. VBUG V1.1 provides a range of facilities which enable complex Graphic and Text displays to be built, limited only be the skill and imagination of the programmer.

Throughout this manual it will be assumed that a full compliment system is in operation i.e. 80 character 512 x 256 format. The examples given here are legal for both types of operation subject to parameter changes.

VBUG STATUS & COMMAND REGISTER

$BE00 - STATUS REGISTER - READ ONLY

$BE01 - COMMAND REGISTER - WRITE ONLY

The host computer is able to write commands or data to the I/O address $BE01 only after having ensured that the Video processor is free to accept that data. Operation is carried out by monitoring the Status Register until D7 is set. Thereafter the commands or data may be written to the Command Register, and there by way of the Silo, for processing. Note:- Commands or Data written to the C/Register before D7 is set will cause that information to be lost.

$BE01 STATUS REGISTER

READ ONLY

D7							D0
128	64	32	16	8	4	2	1
READY	ERROR	SILO EMPTY					
/ - - - - - - - ERROR CODES - - - - - - /							

ERROR CONDITION

If an Error condition occurs either from previous programming or a processor busy condition, D6 in the Status Register will be set at the same time as D7. If this occurs, there will be an error code in the Low Order bits of the Status Register. The 6502 'Bit' instruction provides a convenient way of testing for both the Ready and the Error flags in the Status Register.

Example:-

```
WAIT:   BIT   $BE00    ; Test Status
        BPL   WAIT     ; Loop if not Ready
        BVS   ERROR    ; Branch if Error
        STA   $BE01    ; Else write Data
```

COMMAND STRUCTURE

The Command Structure falls into three main groups, these are as follows:-

1. SINGLE BYTE COMMANDS

2. COMMANDS THAT REQUIRE PARAMETERS

3. ESCAPE SEQUENCES

TYPE 1. SINGLE BYTE COMMANDS

The bulk of these commands will come in the form of the Ascii character set within the Hex codes $20 - $7F. A command byte within this range will cause that Ascii character to be echoed on the display at the current text cursor position.

Example:-

```
START     JSR   POLLKB      ; POLKB for character
          LDA   ICHAR       ; Load Acc with Char
          STA   $BE01       ; Store char in Command Register
                            ;
          JMP   START       ; Do it again
```

With the above example it can be seen that the full Ascii character set is available, including those that fall into the CTRL commands group. - Refer to the tables in this manual.

Example:-

CTRL L - Clear Screen - Cursor Home

Other Single Byte Commands are:-

HEX	EFFECT
$0C	; Clear Screen - Cursor Home - Top Left
$01	; Cursor Home - Display Intact - Top Left
$1A	; Cursor UP
$0A	; Cursor DOWN
$08	; Cursor LEFT
$09	; Cursor RIGHT
$0D	; Carriage Return (CR)
$0E	; Reverse Video ON
$0F	; Reverse Video OFF
$7F	; DELETE

Any of the above commands may be entered directly from the keyboard using the above example program.

TYPE 2. COMMANDS THAT REQUIRE PARAMETERS

This category includes all the Graphics commands which work on either the 512 x 256 or 256 x 256 bit screen formats. VBUG will identify which format is in operation and select the appropriate action to be taken subject to error handling.

Graphic control is divided into Commands and Four parameters. These parameters must be written to the Command register immediately after the Command byte is given.

The Graphic Commands are:-

HEX	EFFECT
$1C	; SET point at coordinates X,Y
$1D	; CLEAR " " " " X,Y
$18	; TEST " " " " X,Y
$1E	; DRAW line to " " X,Y
$19	; UNDRAW " " " X,Y
$1F	; MOVE graphics PEN " X,Y
$15	; INVERT point at " X,Y
$17	; INVERT line to " X,Y

The four parameters must be given in the following order, which are Horizontal 'X' axis - Vertical 'Y' axis.

1. Low Byte X coordinate within the range (0 - FF)
2. HI Byte X coordinate within the range (0 or 1)
3. Low Byte Y coordinate within the range (0 - FF)
4. HI Byte Y coordinate within the range Always 0

If the 40 column mode 256 x 256 is being used then 2. will always be 0. Out of range parameters will be subject to error handling i.e. if X is greater than 511 or Y is greater than 255 then an 'Out of Range' error will be reported back:-

Error Code 2 = X Out of Range

Error Code 3 = Y Out of Range

When line drawing, an invisible graphics 'PEN' is used to position the coordinates, these coordinates are set at 0 X and 0 Y on a Reset or Power on and thereafter have the value of the most recent X & Y axis coordinates.

Example:-

$1E,$80,$1,$80,$0 will cause a line to be drawn from the current 'PEN' position to location X = 384 /10 - Y = 128 /10 which will make this the new 'PEN' position.

TYPE 3. ESCAPE SEQUENCES

Escape sequences modify the characteristics of the VBUG monitor operations. They are always preceded by the Escape code $1B followed by the [code $5B. These may take one of the following definitions:-

A. ESC cd

B. ESC [PN cd

c. ESC [PN;PN cd

NOTE:- Where cd = Single lower case ascii digit to define the sequence type and PN = Ascii coded decimal number in the type range from 0 - 255. (Spaces between codes are not permitted). [= $5B Left Hand Square Bracket.

Example:-

If PN is 128 /10 the sequence of bytes:- $31 = (Ascii 1.) - $32 = (Ascii 2.) - $38 = (Ascii 8.).

VBUG V1.1 only supports forms B. & C.

The legal sequences are:-

```
ESC [ 0 b                ; Non-Blinking Cursor
ESC [ 1 b                ; Blinking Cursor
ESC [ Row;Column c       ; Move text cursor to Row;Column
                         ; Top Row  is 0 - Leftmost Column is 0
ESC [ 40 s               ; Set VBUG 40 Column Mode
ESC [ 80 s               ; Set VBUG 80 Column Mode
ESC [ Top;Bottom r       ; Set Scrolling Window
```

If an Error occurs during an Escape sequence, Error code 5 will be set in the Status register. This could mean either of the following:

1. An invalid cd

2. An invalid character - such as a Space code

3. PN out of range - greater than 255

4. Any other reason such as PN not valid for this sequence type:-

Example:-

ESC [81 s - is invalid as Set Column mode expects a parameter of 80 columns only.

THE SILO

VBUG uses a 256 character SILO or (First In - First Out) Buffer. This facility allows the host computer to very quickly send a sequence of commands or data directly to the Video module for processing, thereby allowing it to continue with other tasks whilst awaiting for the Video module to complete those instructions. The 'Ready Bit' in the Status Register is 'SET' almost immediately after the character has been received, if there is still room in the Silo

The rules governing the use of the Silo are that, when using the Graphic or ESC command modes, the sequence of commands plus parameters must remain unbroken and completed before the Silo returns to a 'Standby' condition. Aborting the transfer of data to the Video module after it has received the graphics command will result in VBUG V1.1 remaining in a 'WAIT' state for the rest of those graphics parameters to be passed over, which it expected in conjunction with the command instruction. It can be seen therefore that by aborting the program during this sequence of events, will leave the module waiting for data it will not likely receive. A typical example of this in operation would be under Basic language control where a 'Break' command is issued during graphic plotting etc. The Silo may be 'Cleared Down' to a 'Standby' condition by sending it a sequence of four single byte instructions such as 'Clear Screen'. This will replace the lost parameters caused by the 'Abort' command.

The Silo is automatically cleared on a Reset.

During Error handling when an 'Error' condition occurs, VBUG will automatically clear down the Silo as it is likely that commands and data synchronization will be lost at this point, thereby leaving an unknown sequence of commands and/or data which it is unable to differentiate between.

Likewise, if a 'Test Point' command is issued and the result is returned to the Status Register, the result could easily be overwritten if an illegal command followed the original command, thereby losing the 'Test Point' result. Due to this, a 'Silo Empty' Bit is provided in the Status Register. When a 'Test Point' command is issued it is recommended that no further commands be sent until the 'Silo Empty' bit is set and the result in D0 is valid.

It should be noted, that when using a Silo of this capacity, that VBUG operations will be continued until the Silo is empty even though the host computer has ceased operations.

THE SCROLLING WINDOW

VBUG V1.1 allows a section of the screen display to be set aside for a Scrolling Window. In perspective, the entire screen is in fact the true window at all times unless defined otherwise by this facility under the ESC command sequences.

For text purposes, the window will be set to the area from between row 'TOP' to row 'BOTTOM', thereafter, all commands such as Clear Screen, and Cursor movement will take place inside this window area only. Data which has been set up outside this will remain unaffected.

```
ESC [ 0;24 r            ; Set window to whole screen - 0,24

ESC [ 0;10 r            ; Set from line 0 to line 10

ESC [ 10;24 r           ; Set from line 10 to line 24
```

When a window has been defined, all text will scroll off the screen display at the pseudo top line. On a system reset or power on, the window will be returned or set to its normal size:-

```
i.e. ESC [ 0;24 r.      ; Set to normal screen size
```

If the window size is altered from these coordinates it will assume to remain in that condition unless otherwise defined. The operator must return the screen to its normal size after use either via a system reset or the ESC command sequence. Graphics remain unaffected and legal throughout the entire screen display area irrespective of the window set.

STATUS REGISTER SUMMARY

Address normally:- $BE00 - READ ONLY

BIT	TITLE	DESCRIPTION
D7	READY	Set when Video module is ready to accept a byte into the Command/Data register.
D6	ERROR	Set with Ready when error occurs - indicates there is a valid error code in D4- D0.
D5	SILO EMPTY	Set when Video module has completed all pending commands or when emptied as the result of an error.
D4-0	ERROR/RESULT	This is validonly when Ready is set. If Ready set and Error set, contains the error code. After a test point command, if ready set and silo empty set, contains result of test:- 0 - Point was not Set / 1 - Point was Set

Typical values for the Status Register are:-

$A0	Ready and Silo empty - Ready for commands.
$E1	Ready Set - Error Set - Silo Empty Set Error code = 1 An illegal command has been encountered.
$80	Ready Set - Video module can accept data into the Silo - but still executing a previous command.
$00 - $7F	Vbug is transferring a byte from C/Reg into the Silo - Do not write to C/Reg whilst this code is in the S/Reg.
$A1	After a Test Point command indicates that the selected point was Set.

SINGLE BYTE COMMAND SUMMARY

HEX	COMMAND	OPERATION
$0C	CTRL L	; Clear Screen - Cursor Home -
		; Inside Window
$01	CTRL A	; Cursor Home - Screen Secure
$1A	CTRL Z	; Cursor UP
$0A	CTRL J	; Cursor DOWN - Line Feed
$08	CTRL H	; Cursor LEFT - Back Space
$09	CTRL I	; Cursor RIGHT
$0D	CTRL M	; Carriage Return - $0D will
		; perform automatic line feed
$0E	CTRL N	; Reverse Video ON
$0F	CTRL O	; Reverse Video OFF
$7F		; DELETE - Deletes character to
		; left of cursor - moves current
		; line left one character
$20 - $7E		; Ascii character set - Print at
		; current cursor position and
		; move left current line

*1. Window assumed to be the whole screen unless defined.

N.B. $80 - $9F Future Expansion

N.B. $A2 - $FF Now flagged as Illegal Commands.

GRAPHIC COMMANDS

All commands must be followed by the four parameters X Lo Byte - X Hi Byte - Y Lo Byte - Y Hi Byte.

$1C	; SET point X,Y
$1D	; CLEAR point X,Y
$18	; TEST point X,Y
$15	; INVERT point X,Y
	And make X,Y current position
$1E	; DRAW Line from c/postn to X,Y
$19	; UNDRAW " " " " X,Y
$17	; INVERT " " " " X,Y
	And make X,Y current position
$1F	; MOVE graphics 'Pen' to X,Y

ESCAPE SEQUENCE SUMMARY

Started by Escape code $1B - followed by [code $5B - Spaces Illegal.

SEQUENCE	EFFECT
ESC [PN b	; PN = 0 - Non-Blinking Cursor
	; PN = 1 - Blinking Cursor
	; Any other value will cause error
ESC [PN s	; PN = 40 - Selects 40 column mode software
	; PN = 80 - Selects 80 column mode software
	; Any other value will cause error
	; ** Empties Silo - await Ready + Silo Empty Bits
	; before sending further commands - both set in
	; Status Register
ESC [PN1;PN2 c	; Move cursor to Row PN1 - column PN2.
	; Will not move cursor outside current window
	; PN1 = 0 - 24
	; PN2 = 0 - 79 when in 80 column mode
	; PN2 = 0 - 39 when in 40 column mode
ESC [PN1;PN2 r	; Set Scrolling Window from row PN1 to PN2 inc
	; PN1 = 0 - 24 - PN2 greater or equal to PN1
	; PN2 = 0 - 24 - PN1 less or equal to PN2

ON LINE

When power is applied to the host computer and/or a Reset issued to the system, the Video modules processor will be initialised along with the VBUG monitor. This action will be indicated by a flashing cursor in the bottom left hand corner of the screen. Also, the screen may be filled with random ultra high resolution graphic bit patterns which is the result of spurious data being present in the video display memory when power is applied to the system. This condition will confirm that the Video module has initialised its processor and operating system and is On-Line awaiting further instructions from the host computer.
The Video module is now subject to its Operating System rules which govern the communications link between itself and the host computer.

The communications link is via the two User selected I/O locations i.e. $BE00 - Status Register & $BE01 - Command Register.

An On-Line test may be provided by sending a single byte instruction to the Command Register. This may conveniently be the single byte instruction for a Clear Screen command $0C, i.e.

```
MBE01,0C, (CR)      ; Clear Screen instruction to Command Register.
```

Further testing may now be carried out with this simple keyboard interface program. It is advisable to clear the screen of the host computer with an additional routine before commencing to provide an uncluttered display.

```
START       SEI                 ; Set int. Disable Stat
START+1     LDA   $BFF3         ; Read keyboard
            BPL   START+1       ; Do it
            AND   #$7F          ; Mask top bits
            STA   $BFF0         ; Clear KB flag
            STA   $BE01         ; Vbug command register
            JMP   START+1       ; Do it again
```

All data now typed in from the keyboard will be directed to the Vbug Command Register for processing. CTRL commands may also be sent, likewise the Esc sequence commands. Remember, care should be taken as this routine does not read the VBUG Status Register.

- HAVE FUN -

I/O ADDRESS SELECTION

Four I/O selections of the host computer systems memory map are provided on the Video module. A summary of the address locations of the respective DIP switch pins and their preset conditions at the time of shipment are shown in Table 2.
Both the Status Register and the Command Register are selected together by the appropriate DIP switch.

Table 2.

I/O Address Selection - DIP Switch 'A'

SW pin No.	Function	ON	OFF
5	I/O Address $BE60 - $BE61		OFF
6	I/O Address $BE40 - $BE41		OFF
7	I/O Address $BE20 - $BE21		OFF
8	I/O Address $BE00 - $BE01	ON	

It is suggested that the module be selected for address $BE00 - $BE01 DIP switch No. 8 to maintain compatability with commercially available host computer software.

Interrupt Pin Mnemonics - DIP Switch 'A'

SW pin No.	Function	ON	OFF
1	VDU Interrupt Request	ON	
2	VDU Non Maskable Interrupt		OFF
3	Not used		OFF
4	Not used		OFF

For normal use it is recommended that the standard Video modules IRQ (Interrupt Request) line be used unless specialist applications require the Non-maskable interrupt facilities.

VIDEO 80/82 OPERATIONAL CONFIGURATIONS

The Video module permits the choice of two operating modes, a summary of which follows in Table 1.

40 Column Mode

40 characters per line by 25 text lines.
256 x 256 Bit mapped graphics display.

The minimum requirements for this mode of operation are as follows:-

8K of Video Ram plus 2K of Operating System Ram.

80 Column Mode

80 characters per line by 25 text lines.
512 x 256 Bit mapped graphics display.

The minimum requirements for this mode of operation are as follows:-

16K of Video Ram plus 2K of Operating System Ram.

Table 1.

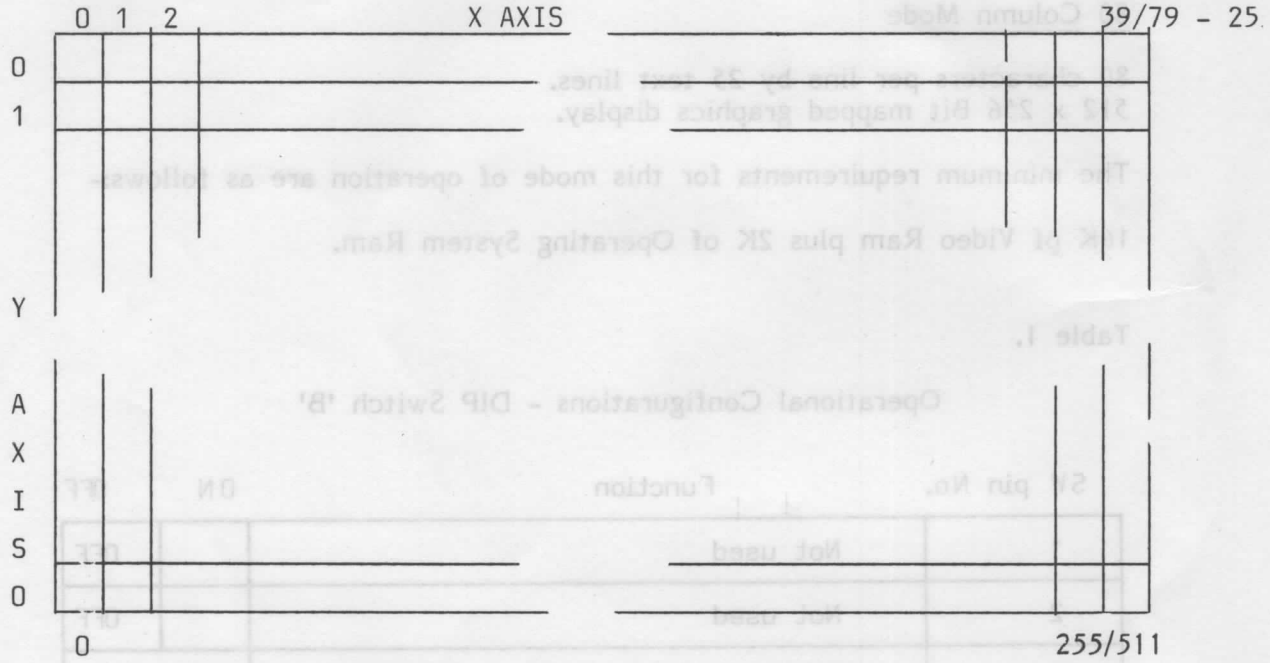
Operational Configurations - DIP Switch 'B'

SW pin No.	Function	ON	OFF
1	Not used		OFF
2	Not used		OFF
3	80 Column Mode 16K Ram	Optional	
4	Not used		OFF
5	Not used		OFF
6	Write Protect	ON	
7	40 Column Mode 8K Ram	Optional	
8	Video Select Disable	ON	

Included is the choice of Video 'ON/OFF' selection and a 'Write Protect' facility, both of which are assumed to be in the 'ON' position. CAUTION DIP Switch pin 3 and 7 must not be 'ON' together at the same time.

THE VIDEO DIPLAY

There are two displays to be considered with the Video module, one for Text displays and the other for Graphic displays. Taking the Text display first, it must be noted that the coordinates of the rows and columns that are refered to in this manual are in accordance with the accepted standard for text handling. Graphic display coordinates are slightly different being that the 0,0 X,Y coordinates commence from the bottom left hand corner of the screen. Any reprogramming by the operator should be guided by these standards to maintain compatability with commercial software/firmware packages.



VIDEO SCREEN DISPLAY FORMAT

TEXT MODE 40/80 Character Mode

The coordinates are given as Line PN by Column PN.
If Line PN=0 and Column PN=0 then those coordinates would place the text cursor on the top line in the leftmost column.
If PN=0 and Column PN=2, then the coordinates would place the text cursor on the top line in the third column.

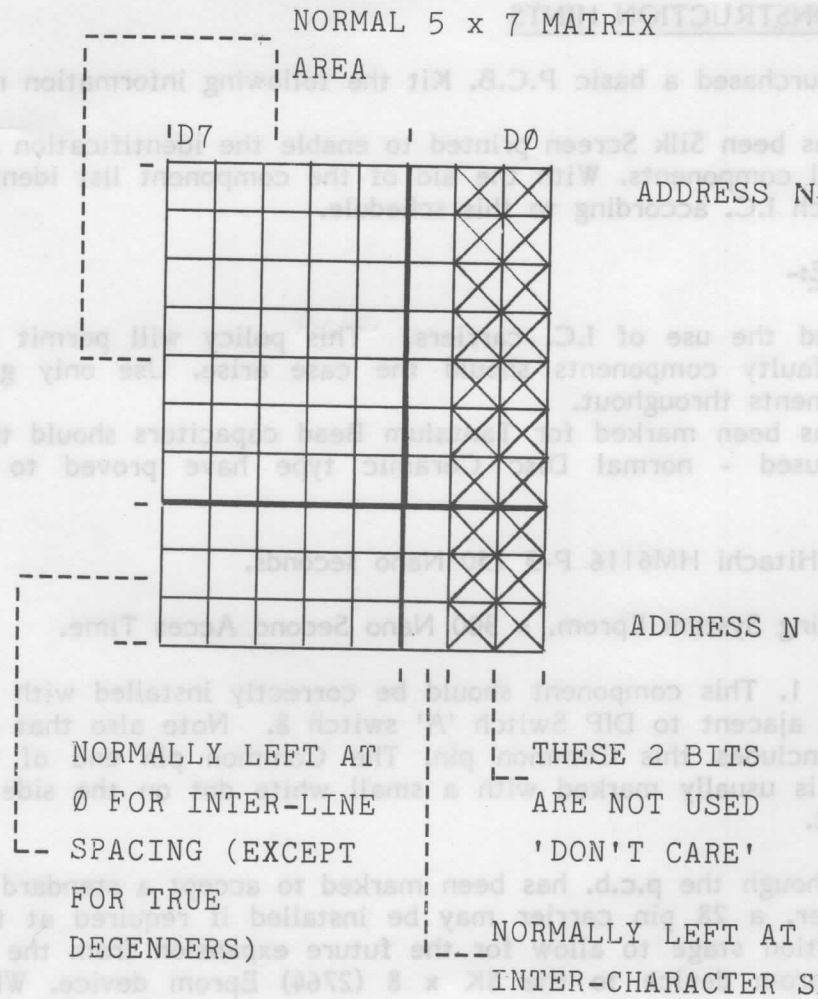
GRAPHICS MODE

In graphics mode the coordinates commence from the bottom left hand corner of the screen. The X & Y axis remain legal in both cases.
If X axis PN=0 and Y axis PN=0, the coordinates would place the graphics Pen in the bottom left hand corner of the screen.
If X axis PN=511 and Y axis PN=255, the coordinates would place the graphics Pen in the top right corner of the screen.
See example programs overleaf.

THE ASCII CHARACTER SET

The full standard 96 Ascii character set has been provided in firmware format within the VBUG V1.1 Operating System Monitor. These characters are software generated on the video display and may, if required, be reprogrammed and replaced by other specific characters or symbols. The Ascii characters supplied are formatted on a 5 x 7 matrix pixels and include the required Inter-Line and Inter-Character spacing. The character matrix is shown below.

The character set table is at Rom address $F000 - $FC2F and commences with the definition of the Ascii space code $20.



INSTALLATION & CONSTRUCTION

If you have purchased the Video module fully assembled it will have been preset to meet immediate service. All that is required by the user is the installation within the Microtan 65 system of the Video signal line. This signal line leaves the Video module by way of the 64 way Edge Connector Pin B20. From this point the signal line must be routed from Pin B20 on the 'Additional' slot of the Microtan 65 system mother board to Pin A20 of the Microtan 65 'CPU' SMB Socket.

Video Module:-
Video Signal Out - Pin B20.

System Mother Board:-
Link Pins B20 'Additional' socket to A20 'CPU' socket.

Microtan 65:-
Link Pin A20 of the 64 way Edge connector to the relevent location as shown overleaf.

GENERAL CONSTRUCTION HINTS

If you have purchased a basic P.C.B. Kit the following information may be helpful.
The P.C.B. has been Silk Screen printed to enable the identification and location of all components. With the aid of the component list identify and install each I.C. according to this schedule.

PLEASE NOTE:-

We recommend the use of I.C. carriers. This policy will permit the recovery of faulty components should the case arise. Use only good quality components throughout.
The P.C.B. has been marked for Tantalum Bead capacitors should they wish to be used - normal Disc Ceramic type have proved to be acceptable.

6116 Rams = Hitachi HM6116 P-3 150 Nano seconds.

I.C.28. Operating System Eprom. = 300 Nano Second Acces Time.

Resistor Pack 1. This component should be correctly installed with the 'Common' pin ajacent to DIP Switch 'A' switch 8. Note also that the 8 way also includes this Common pin. The Common pin end of the resistor pack is usually marked with a small white dot on the side of the component.

I.C.28. - Although the p.c.b. has been marked to accept a standard 24 pin I.C. carrier, a 28 pin carrier may be installed if required at this early construction stage to allow for the future expansion from the 4K x 8 (2732) Eprom device to the 8K x 8 (2764) Eprom device. When installing the optional 28 pin carrier, it can be seen on the p.c.b. that Pin 1. of the 24 pin carrier would represent Pin 3. of the 28 pin carrier. With a 28 pin carrier installed it is still possible to use a 2732 in this carrier by simply using Pin 3. of the 28 pin carrier as the Pin 1. marker position for the 2732 device. This arrangement would therefore leave pins 1,2,27,28 of the 28 pin carrier vacant.

VIDEO 80/82 BUS CONNECTIONS

HOST SYSTEM

	b		a	
HOST SYSTEM SUPPLY	+5v	1	+5v	HOST SYSTEM SUPPLY
6MHz CLOCK	CLK	2		
		3		
HOST SYSTEM RESET	$\overline{RST}$	4	$\overline{I/O}$	
ADDRESS BUS	A1	5	A0	ADDRESS BUS
" "	A3	6	A2	" "
" "	A5	7	A4	" "
" "	A7	8	A6	" "
" "	A9	9	A8	" "
		10		
		11		
		12		
		13	$\overline{IRQ}$	INTERRUPT REQUEST
		14	$\overline{NMI}$	NON-MASKABLE INTERRUPT
		15		
		16		
FIELD BLANKING	$\overline{FB}$	17	R/$\overline{W}$	READ NOT WRITE
		18	$\overline{HB}$	HORIZONTAL BLANKING
		19	DB0	BUFFERED DATA BUS
VIDEO OUT TO HOST	VIDEO	20	DB1	" " "
		21	DB2	" " "
		22	DB3	" " "
		23	DB4	" " "
		24	DB5	" " "
		25	DB6	" " "
		26	DB7	" " "
		27		
		28		
		29		
		30		
		31		
EARTH RETURN	0v	32	0v	EARTH RETURN

COMPONENT LISTING

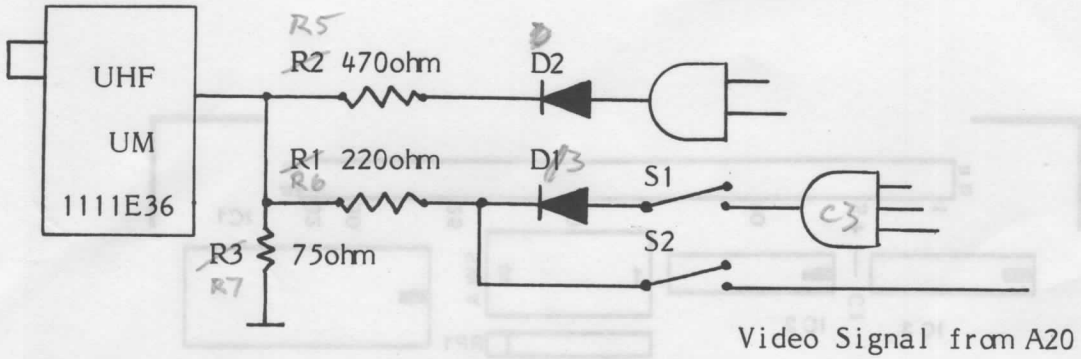
I.C. No:-	DEVICE	No.Pins	REMARKS
01	8212	24	Support Device
02	74LS 139	16	TTL
03	74LS 138	16	TTL
04	8212	24	Support Device
05	74LS 163	16	TTL
06	74LS 00	14	TTL
07	74LS 123	16	TTL
08	74LS 04	14	TTL
09	74LS 74	14	TTL
10	6502A	40	Central Processor 2MHz
11	74LS 02	14	TTL
12	74LS 00	14	TTL
13	74LS 157	16	TTL
14	74LS 157	16	TTL
15	74LS 139	16	TTL
16	74LS 10	14	TTL
17	74LS 393	14	TTL
18	74LS 393	14	TTL
19	74LS 32	14	TTL
20	74LS 157	16	TTL
21	74LS 157	16	TTL
22	74LS 138	16	TTL
23	74LS 165	16	TTL
24	6116	24	Video Ram (See Option 2.)
25	74LS 245	20	TTL
26	6116	24	Video Ram (See Option 2.)
27	6116	24	Video Ram (See Option 2.)
28	2732 MONITOR	24→28	Eprom 300 Nano Seconds
29	6116	24	Video Ram (See Option 2.)
30	6116	24	Video Ram (See Option 1.)
31	N/A	N/A	N/A
32	6116	24	Video Ram (See Option 1.)
33	6116	24	Video Ram (See Option 1.)
34	6116	24	2K Operating System Ram
35	6116	24	Video Ram (See Option 1.)

Additional

64 Way A + B Edge Connector
1K ohm ¼ watt 8 way Resistor Network (Including Common Pin)
Diode 1N4148 ; Optional (See Installation)
470 ohm ¼ watt Resistor ; Optional (See Installation)
Sockets as indicated
2 x DIP Switch 8 Way ; Optional Requirements
Capacitors - Disc Ceramic / Tantalum Bead (Optional)
C1 - C21 - 0.047uF 12 Volts ; 0.1 uF Optional

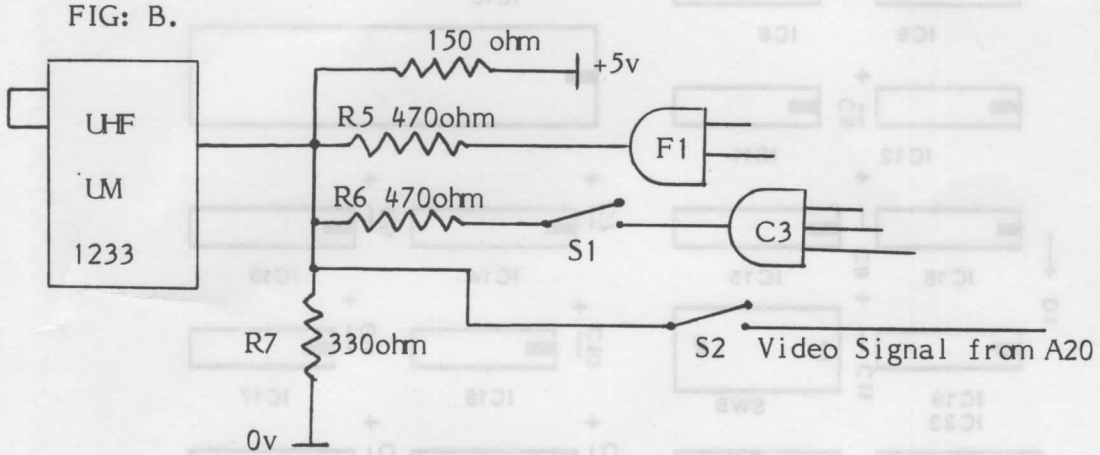
8K 40 Column mode 256 x 256 requires I.C.s 30, 32, 33, 35, installed.
16K 80 " " 512 x 256 " I.C.s 24, 26, 27, 29, installed additionally.

FIG: A.



ISSUE 1. Low Bandwidth Modulator - Video Signal taken from across 75 ohm resistor.
* If Monitor incorporates internal 75 ohm load - R3 should be removed.

FIG: B.

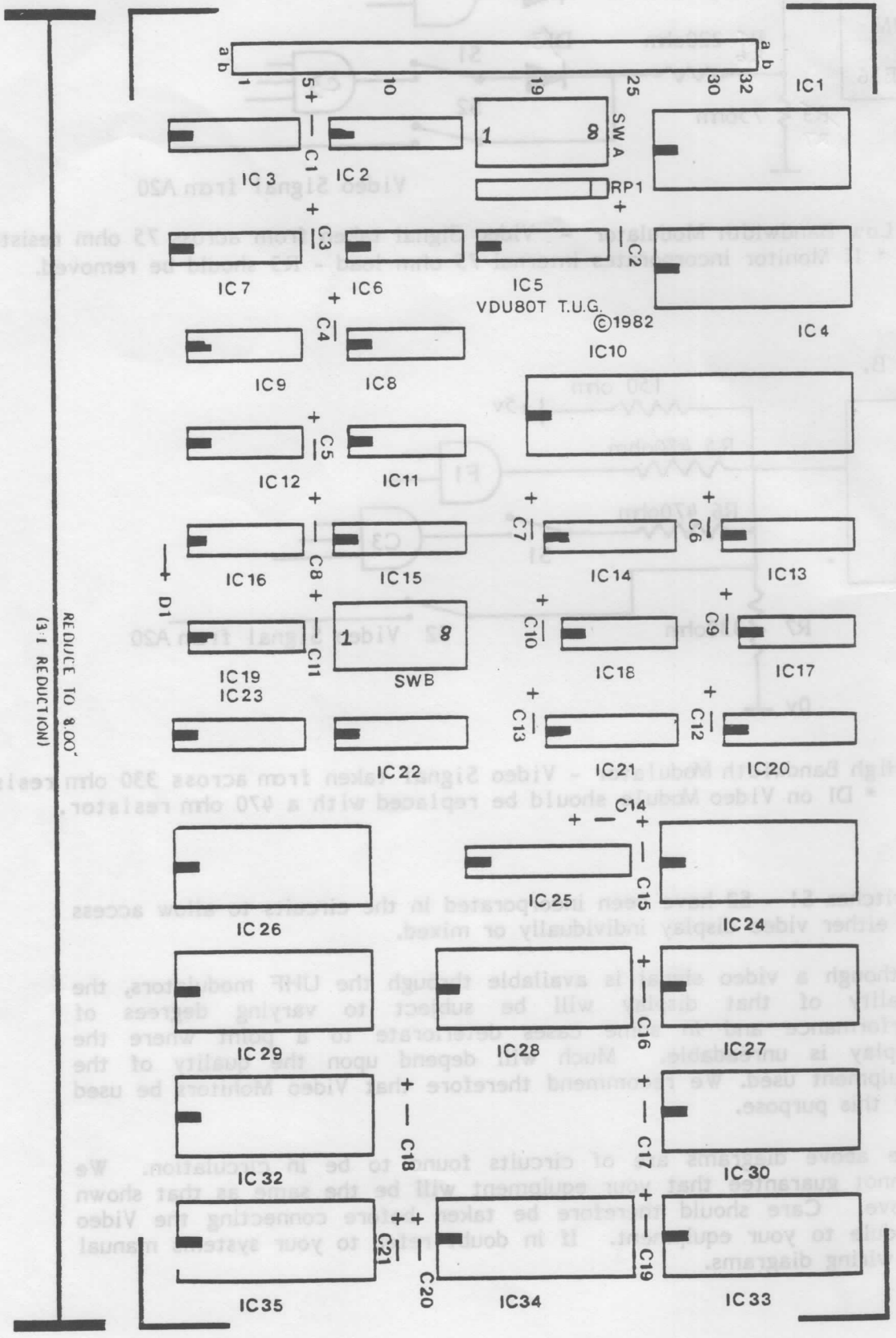


ISSUE 2. High Bandwidth Modulator - Video Signal taken from across 330 ohm resistor.
* D1 on Video Module should be replaced with a 470 ohm resistor.

Switches S1 - S2 have been incorporated in the circuits to allow access to either video display individually or mixed.

Although a video signal is available through the UHF modulators, the quality of that display will be subject to varying degrees of performance and in some cases deteriorate to a point where the display is unreadable. Much will depend upon the quality of the equipment used. We recommend therefore that Video Monitors be used for this purpose.

The above diagrams are of circuits found to be in circulation. We cannot guarantee that your equipment will be the same as that shown above. Care should therefore be taken before connecting the Video Module to your equipment. If in doubt refer to your systems manual or wiring diagrams.


a b
1
5
10
19
25
30
32
a b
IC1
SW A
1
8
RP1
IC3
IC2
C1
IC7
C3
IC6
C2
IC5
VDU80T T.U.G.
©1982
IC4
C4
IC10
IC9
IC8
C5
IC12
IC11
C7
C6
IC16
C8
IC15
IC14
IC13
D1
C10
C9
IC19
IC23
C11
SWB
IC18
IC17
C13
C12
IC22
IC21
IC20
C14
IC25
C15
IC26
IC24
IC29
IC28
C16
IC27
C18
C17
IC32
IC30
C21
C20
C19
IC35
IC34
IC33
REDUCE TO 8.00"
(3:1 REDUCTION)

VIDEO DISPLAY RAM CONFIGURATIONS

The Video 80/82 module allows for the hardware selection, at the time of assembly, of either the 40 Column Text mode - Graphics 256 x 256 or the 80 Column Text mode - Graphics 512 x 256.

For 40 Column Text and Graphics mode the minimum amount of 8K of ram must be installed into I.C. sockets 30 - 32 - 33 - 35. With the appropriate DIP switch as shown in Table 1. in the 'ON' position all Text and Graphics handled by the on board operating system VBUG V1.1 will be configured to suit the display accordingly.

To increase the display configuration to the 80 Column Text and Graphis mode, simply install a further 8K of memory into I.C. sockets 24 26 -27 - 29 and select the appropriate DIP switch as shown in Table 1.

Once configured for the 80 Column display, the operator is able to revert to the 40 Column Text mode under control of VBUG V1.1

VIDEO MEMORY MAP

I.C. No.	Address Range - 6116 Memory Device	
30	$4000 - $47FF	
32	$4800 - $4FFF	
33	$5000 - $57FF	
35	$5800 - $5FFF	8K Min Config
24	$6000 - $67FF	
26	$6800 - $6FFF	
27	$7000 - $77FF	
29	$7800 - $7FFF	16K Max Config

ADDENDUM

Further to those facilities mentioned in this manual so far, three other firmware routines have been added to the VBUG V1.1 Operating System firmware package. These include the facilities:-

Auto Underlining all Text

Super Script facility

Sub Script facility

Enlarged Character facility

The summary of those commands are:-

SINGLE BYTE COMMANDS

$A0	Shift UP	:	Causes the next Text Character
		:	be shifted UP ½ a line - effective
		:	for only one character at a time.
$A1	Shift DOWN	:	Causes the next Text Character
		:	be shifted DOWN ½ a line - effective
		:	for only one character at a time,
		:	no effect if on bottom line.

ESCAPE SEQUENCES

ESC [PN *w*	:	Set character Width
	:	Where PN = 1 - 5 in Ascii coded
	:	Decimal - Selects char multiplication
	:	factor to PN - Set to 1 on power
	:	on or Reset.
ESC [PN u	:	PN = 0 - Underlining OFF
	:	PN = 1 - Underlining ON
	:	Operational until switched off

SAMPLE GRAPHIC ROUTINES

This routine draws a line from the bottom left hand corner of the screen to the center.
Line 10 clears the host computers screen. Line 20 defines the variable X with the Command Register address $BE01. Line 30 sends a clear Video screen instruction to the Command Register. Thereafter, lines 31,32 & 33 position the graphics 'Pen' to X axis = 0,0 and Y axis = 0,0 (Bottom Left Hand Corner).
Line 40 sets the Draw instruction with the coordinates then following in lines 50 & 60.

```
10 PRINT CHR$(12)          ; Clear Screen - Host Computer
20 X=48641                 ; Command Register address $BE01
30 POKEX,12                ; Send Clear Screen command to C/R
31 POKEX,31                ; Send MOVE command
32 POKEX,0:POKEX,0         ; Send X coordinates 0,0
33 POKEX,0:POKEX,0         ; Send Y coordinates 0,0
40 POKEX,30                ; Send DRAW command
50 POKEX,255:POKEX,0       ; Send X coordinates
60 POKEX,127:POKEX,0       ; Send Y coordinates

RUN
```

With the line now drawn to the center of the screen, and the coordinates of both the X & Y axis being their last values, we can extend the routine to draw a further line.

```
70 POKEX,31                ; MOVE
80 POKEX,0:POKEX,0         ; X coord 0,0
90 POKEX,255:POKEX,0       ; Y coord 255,0
91 POKEX,30                ;  DRAW command
95 POKEX,255:POKEX,1       ; X coord 255,1
96 POKEX,100:POKEX,0       ; Y coord 100,0
```

By introducing a random factor to the coordinates line drawing can take on a new meaning, likewise a SET command in line 70 may prove interesting.

```
 5 PRINT CHR$(12)          ; Clear Screen - Host Computer
10 CR=48641                ; Command Register
20 POKECR,12               ; Clear Screen
30 XL=INT(RND(1)*255)      ; XL=low byte coordinate - random
40 XH=INT(RND(1)+.5)       ; XH=Hi byte coordinate - random
50 YL=INT(RND(1)*255)      ; YL=low byte coordinate - random
60 YH=0                    ; Y Hi always 0
70 POKECR,30               ; Send DRAW command   ( 28=SET )
80 POKECR,XL:POKECR,XH     ; Send coordinates X
90 POKECR,YL:POKECR,YH     ; Send coordinates Y
95 GOTO 30                 ; Do it all again
```

DEMONSTATION SOFTWARE ROUTINE

THE VIDEO FAN

```
LIST

 0 REM VIDEO 80/82 DEMO ROUTINE
 10 GOTO1000:REM SKIP OVER SUBROUTINES
 20 QQ=PEEK(ST):IFQQ<C2ORQQ=C1THEN20:REM WAIT FOR D7 IN STATUS REG
 30 POKECT,DT:RETURN:REM WRITE DT TO CONTROL REG
 40 DT=DR:GOSUB20:REM SET UP DRAW COMMAND
 45 X1=INT(X/C1):X2=X-C1*X1:REM SPLIT X INTO LO,HI BYTES
 50 Y1=INT(Y/C1):Y2=Y-C1*Y1:REM SPLIT Y
 60 DT=X2:GOSUB20:DT=X1:GOSUB20:REM SEND X LO, X HI
 70 DT=Y2:GOSUB20:DT=Y1:GOSUB20:REM AND Y LO, Y HI
 80 RETURN
 100 DT=MV:GOSUB20:REM SET UP FOR MOVE COMMAND
 105 REM MOVES 'PEN' TO XM,YM
 110 X1=INT(XM/C1):X2=XM-C1*X1
 120 Y1=INT(YM/C1):Y2=YM-C1*Y1
 130 DT=X2:GOSUB20:DT=X1:GOSUB20
 140 DT=Y2:GOSUB20:DT=Y1:GOSUB20
 150 RETURN
 190 REM S/R 200 PRINTS X$ ON THE VDU
 200 FORI=1TOLEN(X$):REM DO ONE CHAR AT A TIME
 210 DT=ASC(MID$(X$,I,1)):GOSUB20:REM SEND ASCII OF CHAR.
 220 NEXT:RETURN
 1000 ST=48640:CT=ST+1:REM SET UP STATUS=BE00,COMMAND=BE01
 1005 PRINTCHR$(12):POKE512,32:REM CLEAR MICROTAN SCREEN
 1010 C1=256:C2=128:X=0:Y=0
 1020 MV=31:DR=30:UD=25:REM SET UP VARIOUS COMMAND CODES
 1040 DT=12:GOSUB20:REM CLEAR VDU SCREEN
 1060 X=511:Y=255:XM=0:YM=0:GOSUB100:REM MOVE TO 0,0
 1070 FORX=0TO511STEP4:REM DRAW A LOAD OF LINES
 1090 GOSUB40:REM DRAW THE LINE
 1100 GOSUB100:REM AND MOVE BACK TO 0,0
 1110 NEXT
 1120 XM=511:YM=0:REM DO IT AGAIN FROM THE BOTTOM RIGHT CORNER
 1130 GOSUB100
 1140 FORX=0TO511STEP4
 1150 GOSUB40:GOSUB100:NEXT
 1160 MV$=CHR$(27)+"[21;30c":REM ESCAPE SEQ. TO MOVE TEXT CURSOR
 1170 TL$="LIKE THE GRAPHICS?"
 1180 X$=MV$:GOSUB200:REM MOVE TEXT CURSOR
 1190 X$=TL$:GOSUB200:REM PRINT TITLE
 1200 FORI=1TO1000:NEXT
 1205 REM REST JUST DRAWS/UNDRAWS RANDOM LINES
 1210 X=INT(512*RND(1)):Y=INT(256*RND(1))
 1220 DT=UD:IFRND(1)>.5THENDT=DR
 1230 GOSUB20:GOSUB45:GOTO1210
OK
```