

**MSX2 Video superimposition unit specification**

First edition 12th June, 1985  
Second edition 25th September 1985  
English Translation 5th January 1986

ASCII corporation  
Microsoft Far East HQ

## 1.0 HARDWARE

## 1.1 I/O Port F5H Bit 3

The Bit 3 of I/O port address 0F5H enables/disables the built-in video superimposer. When the bit is 1 (H level), you can read the data of address 0F7H of the I/O port.

This is to avoid conflict of the I/O data bus, it is not necessary if there is another method (for example : mechanical switch) to avoid this problem.

## 1.2 A/V (Audio Visual) Control Port

Address 0F7H of the I/O port controls A/V interface.

## 1.2.1 Bit Assignment Of 0F7H - -

Bit	I/O	Purpose
b7	O	(see 1.2.2 for detail)
b6	O	(see 1.2.2 for detail)
b5	O	Ym control
b4	O	A/V control
b3	I O	Detects Video input Synchronize mode control
b2	O	Video input select
b1	O	Audio mixing control (left)
b0	O	Audio mixing control (right)

## 1.2.2 Detail - -

The bit 7 and bit 6 of the I/O port 0F7H contains the complements of bit 4 and bit 5 of VDP Register 9. The values of the bit 7 and the bit 6 correspond to the following display modes.

b7	b6	Mode	Comment
0	0	Not used	
0	1	TV	Synchronize mode is NTSC Compatible. Ys is always active
1	0	Computer/Super-impose	Synchronize mode is NTSC compatible ***
1	1	Computer	Synchronize mode is 9918 compatible

NOTE \*\*\* selected by TP bit of the VDP register 8 bit 5.  
When TP bit is 1, the Ys signal becomes active over the transparent colour.

## Ym Control (bit 5) and AV control (bit 4)

This controls the output from the multi-connector.  
When 0, it outputs EIAJ TTC-003 standard Logic level 0 and when 1, logic level 1.

## External Video Detector (bit 3, input)

It detects the status of the external video input.  
When there is a video signal input from input pin selected by bit 2, it returns 1, if not then 0. It is not affected by the mode selected by bit 6 and 7.

## Synchronization select. (bit 3 output.)

0 = internal sync  
1 = external sync

## Video input select (bit 2)

Selects the input connector of audio and video.  
0 = RGB Multiconnector  
1 = RCA connector

## Audio Mixing control

(bit 1 = left channel, bit 2 = right channel)

0 = Mixes sound from computer to sound from outside source.  
1 = Mxing Off. Computer sound only.

## 1.2.3 Detection Of Existence Of I/O Port -

F7H port that is connected outside of the system (i.e. attached to the system through the cartridge slot) should return 0 into bit 7 when it is read. If there is no outside A/V controller connected, the bit 7 of F7H port is expected to be read as 1 by pulled up register.

When initializing, system read the F7H port. If the port does not return 0111x111, the system assume that there is no outside F7H port and proceed to set port A5H bit 3 to on to enable outside A/V controller.

b7b6b5b4b3b2b1b0  
F7: 0 1 1 1 x 1 1 1

## 1.2.4 Default Setting -

The MSX2 system software initializes the F7H so the initial value of the hardware is not defined.

## 2.0 SOFTWARE

## 2.1 Initial Setting Of I/O Port F7H By The MSx2 System Software

bit	value	Meaning
7	1	displays computer screen
6	1	9918 compatible
5	0	Displays full tone
4	1	Selects input from outside
3	0	internal Synchronization
2	0	RGB multiconnector
1	0	No sound mixing
0	0	No sound mixing

These bits can be controlled by SET VIDEO statement, supported by MSX BASIC 2.0 upwards.

## 2.2 Display Modes' Standard Values

Display mode	b7	b6	b5	b4	b3	b2	b1	b0
Computer	1	1	0	1	0	*A	1	
Video RGB Multi-	0	1	0	1	0	0	0	
Video RCA	0	1	0	1	0	1	0	
Super-RGB Multi-	1	0	*B	1	1	0	*B	
Super RCA	1	0	*B	1	1	1	*B	

\* A not specified

\* B 0 is standard. 1 when necessary.

In order to set/reset each bits independently, system work area, FAF7H should have the copy of value output to port F7H. Whenever the software changes any bits of I/O port, update the contents of FAF7H also to have the same value output to the port.

## 3.0 OTHER COMMENTS

Ys and Ym signal output of RGB multi connector should become logic level 0, as defined by EIAJ TTC-003 standard, when the power of MSX is switched off. Otherwise some A/V standard television will not display properly.

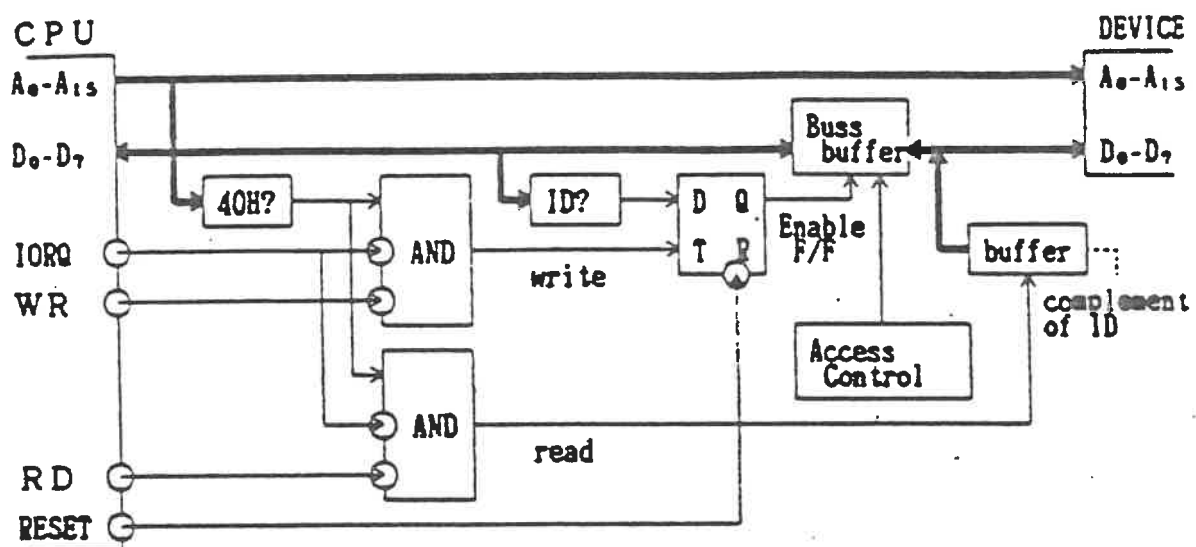
# **MSX EXPANSION I/O PORT MANUAL**

5th December 1985  
27th December 1985

(c) 1985 ASCII MS FE HQ

In the current MSX standard, the I/O port between 00H and 3FH are free for the end user to use while the I/O port address between 40H and FFH have been fixed for authorized peripheral devices. However due to the increase in the number of devices which requires allocation between 40H and FFH, it has become clear that not all peripherals can be catered for. Therefore I/O port address between 40H and 4FH is to be made usable by multiple devices. Devices are accessed only when it is selected. This expansion I/O port is used only when there is a special data written in address 40H to specify a device. When you write other data into address 40H the device will stop using the I/O port and shut the bus buffer from the CPU.

#### HARDWARE



When the device number in the I/O address 40H matches the device ID of the device, the hardware connects the peripheral to the CPU. If different, it will cut off. Default (when power on) is shut. If the CPU reads the address 40H while the device is connected, it returns the complement of the device ID number. This is necessary for interrupt driven program to know which device is connected.

## DEVICE ID

It is possible to give numbers between 0 and 255 as a device number. However when reading the device number, the complement is given so 0 and 255 is not used. ID numbers between 1 and 127 are manufacturers ID number as in expanded BIOS call. 128 to 254 are device numbers. As a basic rule, those device which are designed specifically for one machine should contain the manufacturers company ID while peripheral device which can be used for all MSX should have device ID number. Also, Z80 CPU has 16 bit address in I/O space so it is recommended to access in 16 bit by decoding the upper 8 bit for those ID which might be expanded in future. Especially for device which are connected with maker ID can expand the address space by 256 times so it is future proofed.

Maker ID	Maker name	Maker ID	Maker name
1	ASCII/Microsoft	17	SONY
2	Canon	18	Spectravideo
3	Casio	19	Toshiba
4	Fujitsu	20	Mitsumi
5	General	21	
6	Hitachi		
7	Kyocera		
8	Matsushita		
9	Mitsubishi		
10	NEC		
11	Nippon Gakki		
12	JVC		
13	Philips		
14	Pioneer		
15	Sanyo		
16	Sharp		

Device ID	Device
128	Image scanner (Matsushita)
129... ...253	
254	MPS2 (ASCII)

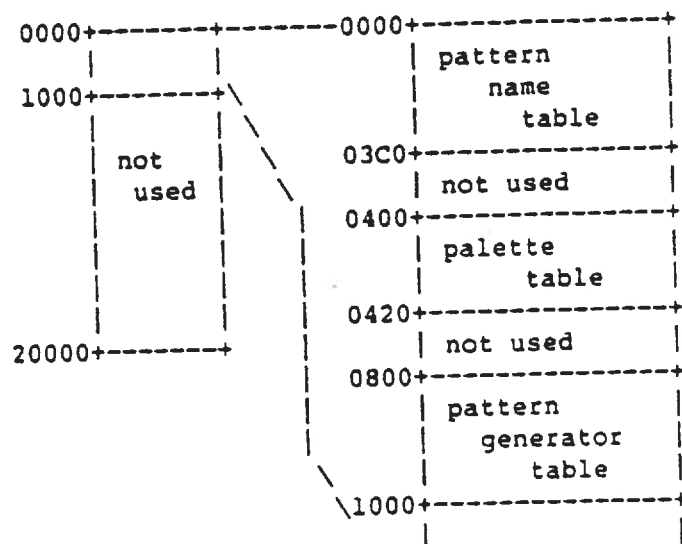
**MSX-2 VIDEO RAM MEMORY MAP**

6th, Jun. 1985 by ASCII Microsoft FEHQ

## 1. SCREEN 0 TEXT-1(40 characters) TEXT-2(80 characters)

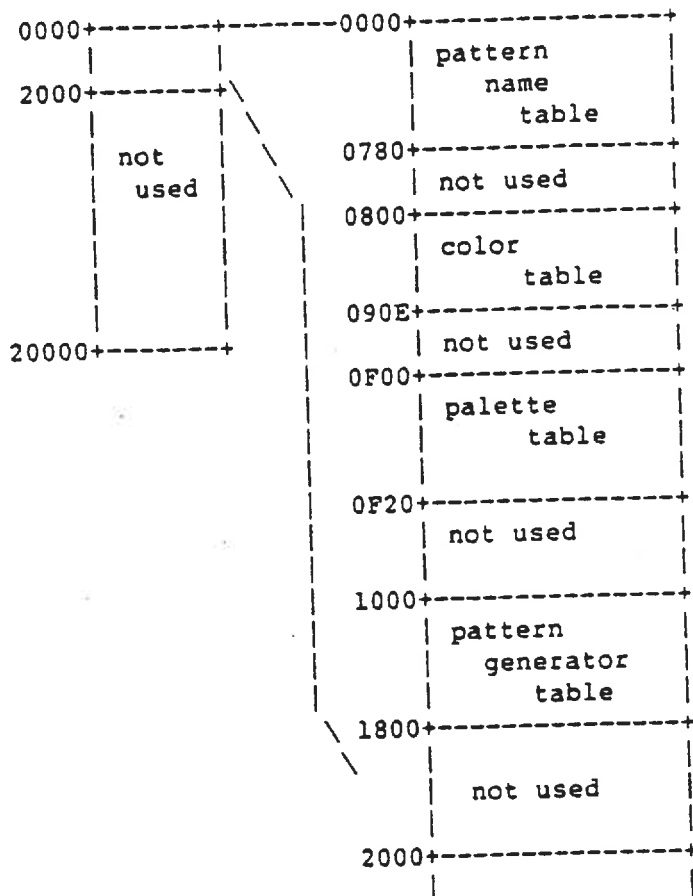
## 1. 1 TEXT-1 (40 characters)

PATTERN NAME TABLE	0000H - 03BFH	960 bytes
PATTERN GENERATOR TABLE	0800H - 0FFFH	2048 bytes
PALETTE TABLE	0400H - 041FH	32 bytes



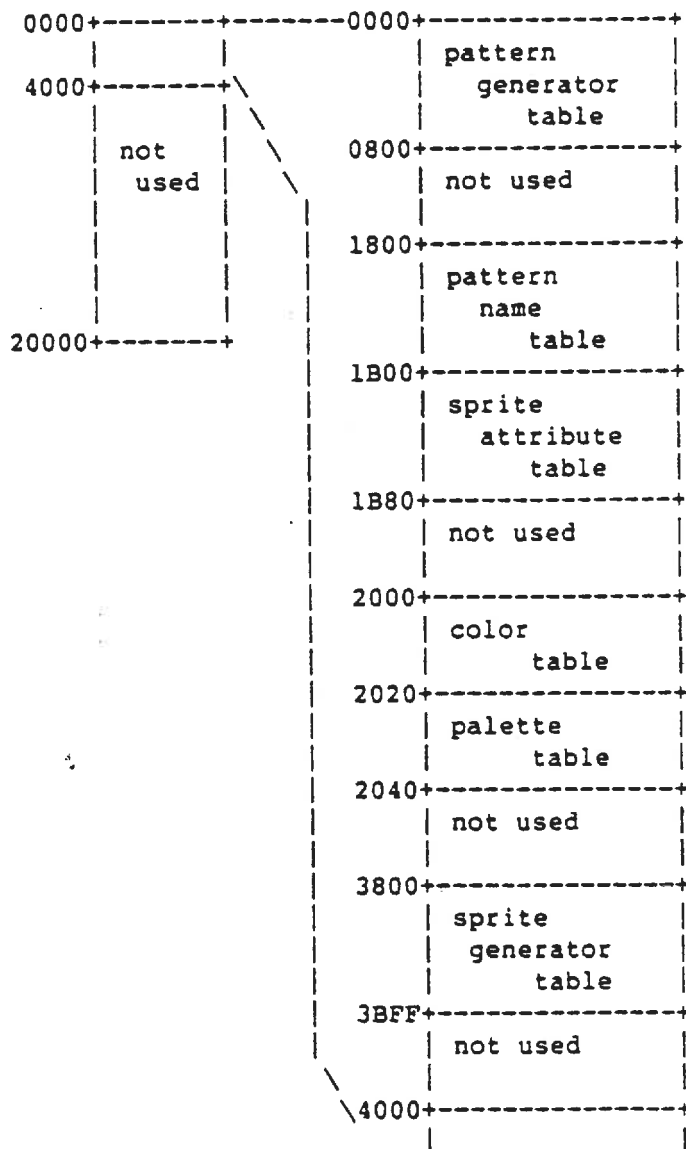
## 1. 2 TEXT-2 (80 characters)

PATTERN NAME TABLE	0000H - 077FH	1920 bytes
PATTERN GENERATOR TABLE	1000H - 17FFH	2048 bytes
COLOR TABLE	0800H - 090DH	270 bytes
PALETTE TABLE	0F00H - 0F1FH	32 bytes



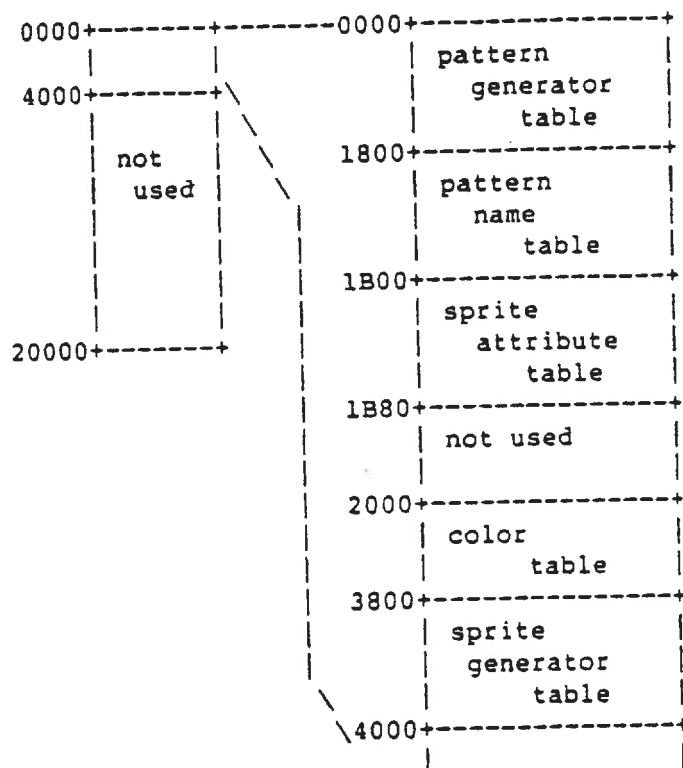
## 2. SCREEN 1 GRAPHIC-1 (32 characters)

PATTERN GENERATOR TABLE	0000H - 07FFH	2048 bytes
PATTERN NAME TABLE	1800H - 1AFFH	768 bytes
COLOR TABLE	2000H - 201FH	32 bytes
SPRITE ATTRIBUTE TABLE	1B00H - 1B7FH	128 bytes
SPRITE GENERATOR TABLE	3800H - 3FFFH	2048 bytes
PALETTE TABLE	2020H - 203FH	32 bytes



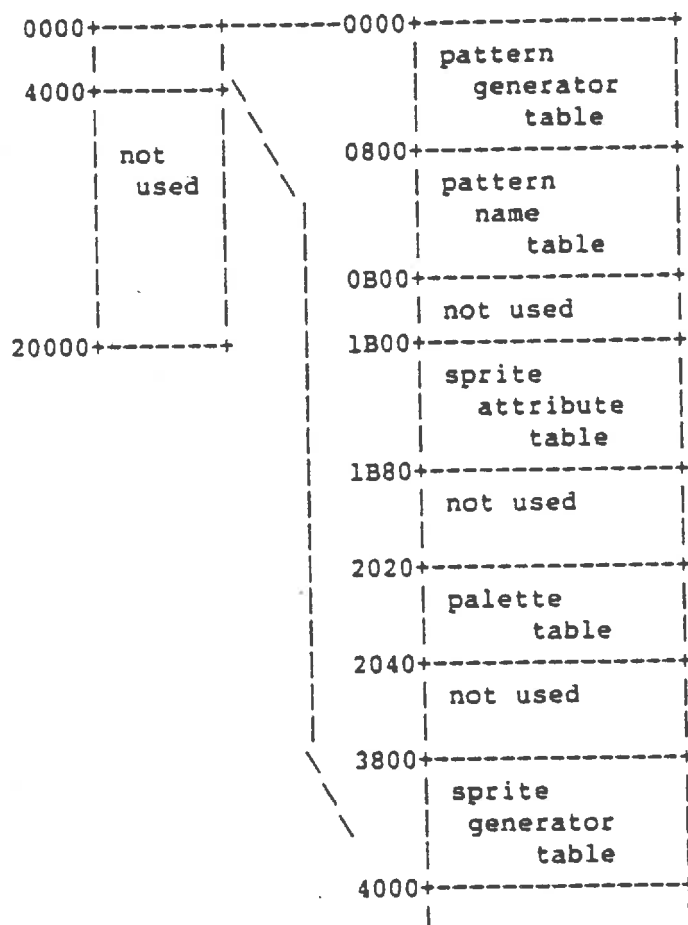
## 3. SCREEN 2 GRAPHIC-2 (256X192)

PATTERN GENERATOR TABLE	0000H - 17FFH	6144 bytes
PATTERN NAME TABLE	1800H - 1AFFH	768 bytes
COLOR TABLE	2000H - 37FFH	6144 bytes
SPRITE ATTRIBUTE TABLE	1B00H - 1B7FH	128 bytes
SPRITE GENERATOR TABLE	3800H - 3FFFH	2048 bytes
PALETTE TABLE	1B80H - 1B9FH	32 bytes



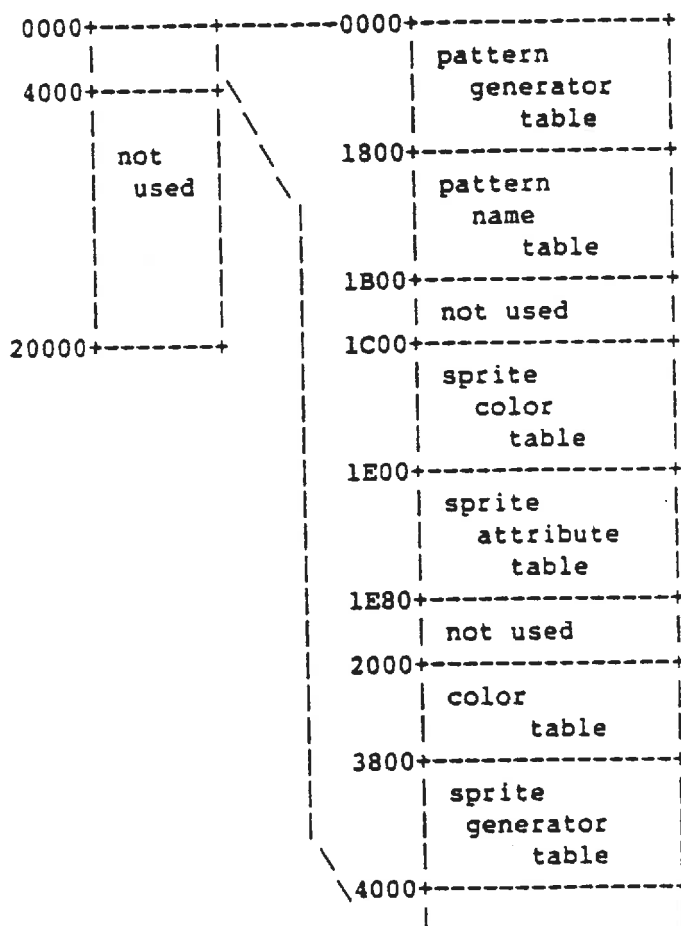
## 4. SCREEN 3 MULTI COLOR (64X48)

PATTERN GENERATOR TABLE	0000H - 07FFH	2048 bytes
PATTERN NAME TABLE	0800H - 0AFFH	768 bytes
SPRITE ATTRIBUTE TABLE	1B00H - 1B7FH	128 bytes
SPRITE GENERATOR TABLE	3800H - 3FFFH	2048 bytes
PALETTE TABLE	2020H - 203FH	32 bytes



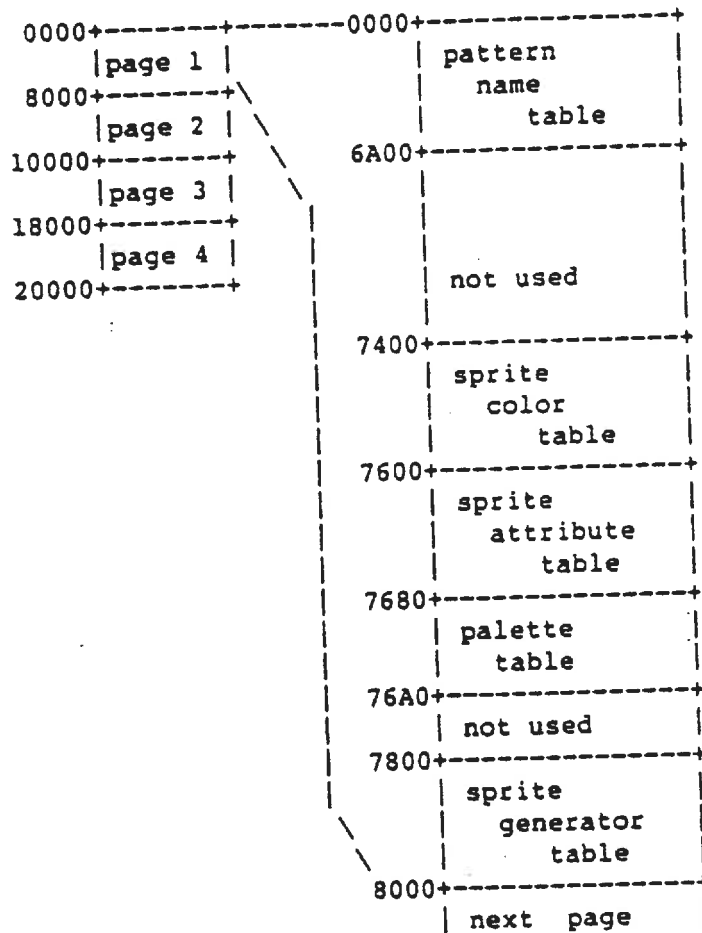
## 5. SCREEN 4 GRAPHIC-3 (256X192)

PATTERN GENERATOR TABLE	0000H - 17FFH	6144 bytes
PATTERN NAME TABLE	1800H - 1AFFH	768 bytes
COLOR TABLE	2000H - 37FFH	6144 bytes
SPRITE COLOR TABLE	1C00H - 1DFFH	512 bytes
SPRITE ATTRIBUTE TABLE	1E00H - 1E7FH	128 bytes
SPRITE GENERATOR TABLE	3800H - 3FFFH	2048 bytes
PALETTE TABLE	1E80H - 1E9FH	32 bytes



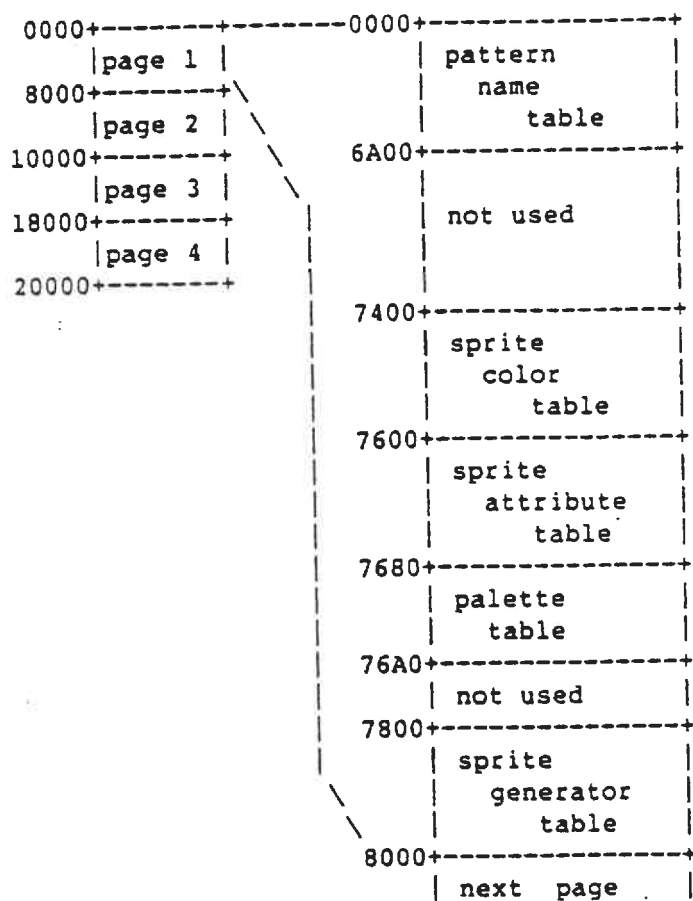
## 6. SCREEN 5 GRAPHIC-4 (256X212 bit map)

PATTERN NAME TABLE	0000H - 69FFH	27136 bytes
SPRITE COLOR TABLE	7400H - 75FFH	512 bytes
SPRITE ATTRIBUTE TABLE	7600H - 767FH	128 bytes
PALETTE TABLE	7680H - 769FH	32 bytes
SPRITE GENERATOR TABLE	7800H - 7FFFH	2048 bytes



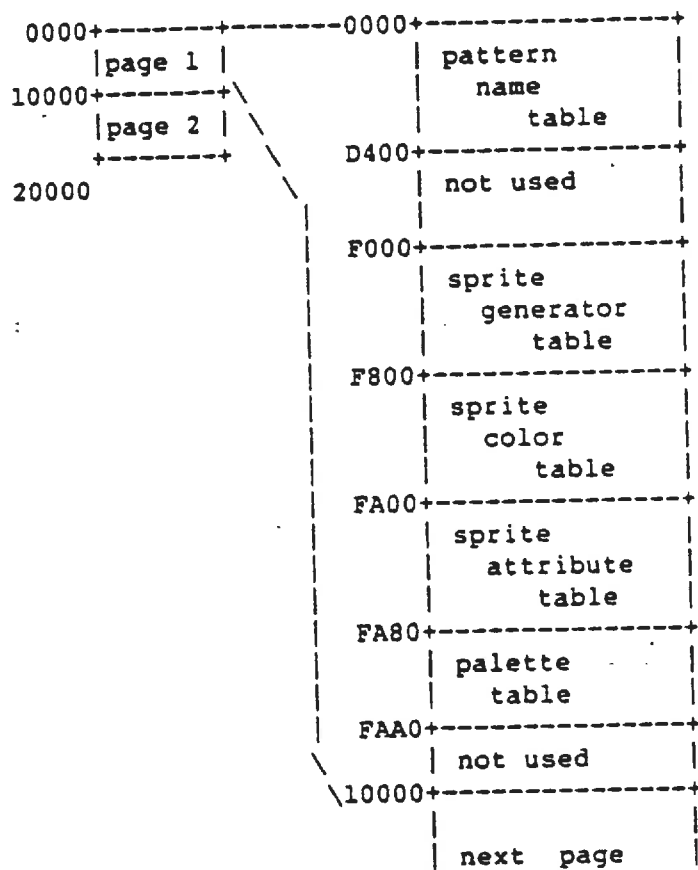
## 7. SCREEN 6 GRAPHIC-5 (512X212 bit map)

PATTERN NAME TABLE	0000H - 69FFH	27136 bytes
SPRITE COLOR TABLE	7400H - 74FFH	512 bytes
SPRITE ATTRIBUTE TABLE	7600H - 767FH	128 bytes
PALETTE TABLE	7680H - 769FH	32 bytes
SPRITE GENERATOR TABLE	7800H - 7FFFH	2048 bytes



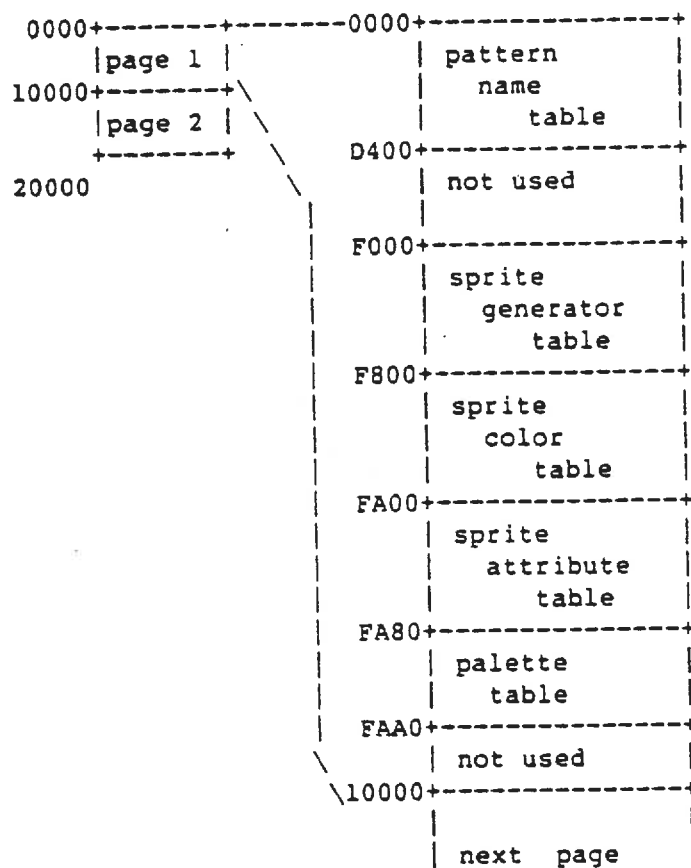
## 8. SCREEN 7 GRAPHIC-6 (512X212 bit map)

PATTERN NAME TABLE	0000H - D3FFH	54272 bytes
SPRITE GENERATOR TABLE	F000H - F7FFH	2048 bytes
SPRITE COLOR TABLE	F800H - F9FFH	512 bytes
SPRITE ATTRIBUTE TABLE	FA00H - FA7FH	128 bytes
PALETTE TABLE	FA80H - FA9FH	32 bytes



9. SCREEN 8 GRAPHIC-7 (256X212 bit map)

PATTERN NAME TABLE	0000H - D3FFH	54272 bytes
SPRITE GENERATOR TABLE	F000H - F7FFH	2048 bytes
SPRITE COLOR TABLE	F800H - F9FFH	512 bytes
SPRITE ATTRIBUTE TABLE	FA00H - FA80H	128 bytes
PALETTE TABLE	FA80H - FA9FH	32 bytes



## 10. Table addresses

SCREEN	pattern name	pattern gen.	color table	sprite gen.	sprite color	sprite attr.	palette	bytes/ page	number of page
0 (40)	0000	0800	-	-	-	-	0400	1000	32
0 (80)	0000	1000	0800	-	-	-	0F00	2000	16
1	1800	0000	2000	3800	-	1B00	2020	4000	8
2	1800	0000	2000	3800	-	1B00	2020	4000	8
3	0800	0000	-	3800	-	1B00	2020	4000	8
4	1800	0000	2000	3800	1C00	1E00	2020	4000	8
5	0000	-	-	7800	7400	7600	7680	8000	4
6	0000	-	-	7800	7400	7600	7680	8000	4
7	0000	-	-	F000	F800	FA00	FA80	10000	2
8	0000	-	-	F000	F800	FA00	FA80	10000	2

SCREEN	pattern name register #2	color table register #3,10	pattern gen. register #4	sprite attr. register #5,11	sprite pattern register #6
0 (40)	0GFEDCBA	-	00GFEDCB	-	-
0 (80)	0GFEDC11	#3 DCBA9111 #10 00000GFE	00GFEDCB	-	-
1	0GFEDCBA	#3 DCBA9876 #10 00000GFE	00GFEDCB	#5 EDCBA987 #11 000000GF	00GFEDCB
2	0GFEDCBA	#3 D1111111 #10 00000GFE	00GFED11	#5 EDCBA987 #11 000000GF	00GFEDCB
3	0GFEDCBA	-	00GFEDCB	#5 EDCBA987 #11 000000GF	00GFEDCB
4	0GFEDCBA	#3 D1111111 #10 00000GFE	00GFED11	#5 EDCBA987 #11 000000GF	00GFEDCB
5	0GF11111	-	-	#5 EDCBA111 #11 000000GF	00GFEDCB
6	0GF11111	-	-	#5 EDCBA111 #11 000000GF	00GFEDCB
7	00G11111	-	-	#5 EDCBA111 #11 000000GF	00GFEDCB
8	00G1111	-	-	#5 EDCBA111 #11 000000GF	00GFEDCB

\*6 = A6, 7 = A7, ... , A = A10, B = A11, ... , F = A15, G = A16

\*0 = constant 0

\*1 = constant 1

## 11. Address calculation algorithm

SCREEN | calculate algorithm

5		PAGE# X 8000H + (base address)
6		PAGE# X 8000H + (base address)
7		PAGE# X10000H + (base address)
8		PAGE# X10000H + (base address)