

# Manual

Revision 7 June 2018

# Index

1 Introduction
1.1 – MSX Viewer History
2 MSX Viewer 54
2.1 – Introducing MSX Viewer 54
2.2 – What's new in version 5.15
3 Loading MSX Images6
3.1 – What is a MSX Image?6
3.2 – Loading MSX Images6
4 Converting PC Images to MSX
4.1 – Load PC Image8
4.2 – Select MSX Image Type9
4.3 – Resize Image9
4.4 – Color Reduction11
4.5 – Color Recognition
4.6 – Screen 2 / 3 Adjustment16
4.7 – Save Image17
5 Color Reduction Techniques
5.1 – Color Quantization
5.2 – Error Diffusion
5.3 – Euclidean Distance
5.4 – Fuzzy
5.5 – Ordered Dithering19
6 Palette21
6.1 – PC palette with MSX palette included22
6.2 – MSX Basic Codes For Loading Images With Palette23
6.3 – Testing V9990 images on openMSX25
7 Credits

# 1 Introduction

### 1.1 – MSX Viewer History

The MSX Viewer project was designed to provide a good and powerful tool to help MSX enthusiastics and software developers converting images from PC to MSX and also loading MSX images into PC. Once modern computers have more powerful image handling, this tool gives an opportunity to bring these modern approaches to this magnificent computer from the 80's.

It all started during my under-graduated project in Computer and System Engineering, while doing my researchs on how to send remote desktop screen-shots to another PC. At that moment, I had in touch at the first time with PC programming tools for image dealing. So, I noticed that 24-bit color system had a quite similarity to the MSX screen 8, regarding from their differences in color depth. That fact wakened up me some curiosity to see if I was abled to port an image from PC to MSX. Fortunetelly, it was pretty easy to do that, once it was a matter of doing a linear convertion to that MSX color system.

At that point, the first version of MSX Viewer project was just a matter of time. So, MSX Viewer 1 was released in 2003 and could only load and show some MSX screens. The 2<sup>nd</sup> version was the first one capable of converting PC screens to MSX format. The MSX Viewer 3 brought the fist preprocessing tools, which helped much on PC/MSX conversion taks. It also introduced the "error diffusion" technique for color quantization, making it possible to convert 24-bit images to MSX 16 color screens! The MSX Viewer 4 brought the MSX palette exhibition, some bugs fix and, finally, all MSX 2+ Screens dealing.

The MSX Viewer 5, re-built the whole project, also migrating the develop tool from Borland C+ + Builder 3 to Trolltech Qt3. A lot of new tools were added, like MSX palette handling, MSX 2+, V9990 and SymbOS screens, and some other techniques to achieve quality MSX screens colors.

Version	Features	Released on
1	- Windows only - Could only open some MSX screens	March, 27th 2003
2	<ul> <li>Load MSX screens 2, 5, 7, 8 and 12</li> <li>Convert to MSX screens 2, 5, 7, 8 and 12</li> <li>Subversions: 2.1, 2.2</li> </ul>	April, 30th 2003
3	- Graphic tools added - Subversions: 3.1, 3.2	May, 23rd 2003
4	- All MSX 2+ screens - MSX 2 Palette viewer	February, 26th 2004
5	<ul> <li>Windows and Linux</li> <li>Qt3 migration</li> <li>Added all MSX screens handling: MSX 2+, V9990 and SymbOS.</li> <li>Palette handling.</li> <li>Versions released to the public: betas 9 – 17 / releases 5.0 to 5.1.1.</li> </ul>	December, 3rd 2009

Table 1.1 – MSX Viewer Versions.

# 2 MSX Viewer 5

#### 2.1 – Introducing MSX Viewer 5

MSX Viewer 5 was designed to work as a wizard, in order to make easier and more intuitive the task of converting PC images to MSX. Now, MSX Viewer has a workflow, according to the task you want to do (see figure 2.1).



Figure 2.1. MSX Viewer 5 workflow.

MSX Viewer was compiled for Windows and Linux. There is no need to install the program. Just download and uncompress the file into a folder. Click on the executable file – msxvw for Linux and msxvw5.exe for Window – in order to run the program.

Obs: You may need some Qt3 libraries and MingW (Windows) to make it run.

The first thing you should do is select the language. This program is available in 3 different languages: English, Portuguese and Spanish. Then, you achieve the first decision: load an MSX image to PC or convert an image to MSX. See figures 2.2 and 2.3.

To navigate the wizard pages, click on the *Back / Next* buttons located at the bottom of the page.

Depending on your choice, different steps will take place. Chapter 3 describes the steps to load a MSX image and save it to PC. Chapter 4 explains how to convert a PC image to MSX.



# 2.2- What's new in version 5.1

MSX Viewer 5 interface was improved in order to display greater images and fonts. Thus, the color identification strategies were changed, which eliminates the color reduction step for any screen mode with color number different from 256.

Now the user is forced to choose a color quantization method for screen 8, while screens with less than 256 colors go directly to the recognition step.

# 3 Loading MSX Images

3.1 – What is a MSX Image?

MSX image is a dump image (raw data) extracted from the MSX VRAM, representing the screen data according to a given screen. This data refers only to the pixel information without taking in account the palette data, which is generally stored in a file apart.

Dump images are loaded using the Basic command:

BLOAD"image.ext",S.

There is another MSX image type where it is a binary self-extractor file. The extractor is an assembly program that is responsible for loading the image data into the VRAM. This image format is loaded using the following Basic command:

BLOAD"image.ext",R

MSX Viewer is not compatible for loading binary images. Nevertheless, it is easy to convert from binary images to dump images (supported by MSX Viewer 5). See how to do it:

```
10 SCREEN n
20 BLOAD"image.ext",R
30 BSAVE"image.ext",<start_vram_address>,<final_vram_address>,S
```

Each MSX screen has a start and final VRAM address. Check out the MSX Viewer Appendix.

### 3.2 – Loading MSX Images

After you choose "Open MSX Picture" option, you have to select the MSX screen type you want to open. The following options are available:

MSX	V9990/C	SymbOS	
Screen 2/4	Gscreen 5	Gscreen 19	4 colors
Screen 5	Gscreen 6	Gscreen 20	8 colors
Screen 6	Gscreen 7	Gscreen 21	
Screen 7	Gscreen 8	Gscreen 22	
Screen 8	Gscreen 10	Gscreen 23	
Screen 10/11	Gscreen 11	Gscreen 24	
Screen 12	Gscreen 12	Gscreen 25	
	Gscreen 13	Gscreen 26	
	Gscreen 14	Gscreen 27	
	Gscreen 15	Gscreen 28	
	Gscreen 16	Gscreen 29	
	Gscreen 17	Gscreen 30	
	Gscreen 18	Gscreen 31	



Figure 3.1. Select the MSX screen.

Table 3.1. MSX screens available.

There are some screens that allows interlacing, for instance, screens 5-12. The interlace is a MSX resource that superimposes two images giving an impression of doubling sizing the height.

For V9990 Imagespace and SymbOS image size, please see chapter 4.

After choosing the screen format, you have to choose the file name to open (figure 3.2). If you selected the interlaced option, you must also load the name of the second file.

You can also load the image palette if you have previously saved the MSX image together with its palette using MSX Viewer 5. It only supports binary palette for loading.

Click on the *Load* button to load everything at once, then click on the *Next* button.



Figure 3.2. Select MSX File to open.

Now you can save as PC image, choosing the following formats: BMP, GIF, JPG or PNG.



Figure 3.3. Save to PC format.

Obs:

1. If you want to edit MSX images on PC, choose BMP or PNG formats, once they save with no loss of information.

2. I recommend to use open-source softwares for editing MSX images like Kolourpaint and Gimp. If you are working with a 16-color image, remember to not create new colors or add smooth effects, which also create new colors.

3. You can edit on PC and convert back to MSX.

# $4 \, { m Converting \, PC \, Images \, to \, MSX}$

After you choose "Convert PC Picture to MSX", you are ready to start converting your favorites pictures to MSX!

As MSX has many screen types, there are also many different strategies for converting PC images to MSX. Table 4.1 shows the strategies to get the best results according to the number of MSX colors from a given 24-bit PC image.

MSX number of colors	Color Reduction Method	Color Recognition Method
32768 colors	Quantization (automatic)	-
19268 colors	Quantization (automatic)	-
12499 colors	Quantization (automatic)	-
256 colors	Error Diffusion / Ordered Dithering	-
64 of 32768 colors	-	Any + Palette optimization
16 of 32768 colors	-	Any + Palette optimization
4 of 32768 colors	-	Any + Palette optimization
16 of 512 colors	-	Any + Palette optimization
4 of 512 colors	-	Any + Palette optimization
16 native MSX colors	-	Euclidean / Fuzzy

Table 4.1. Strategies for best MSX color fitting.

Low-level colors (from 64 to 4) depends on the type of image you are using. For flat color drawings, use Euclidean or Fuzzy method. For photographs, use Error Diffusion or Ordered Dither.

### 4.1 - Load PC Image

The first step is to load a PC image (figure 4.1). You may click on *Open* button, drop the file onto the image space or paste an image from clipboard.



Figure 4.1. Load an image to convert.

### 4.2 – Select MSX Image Type

Now, you must select the MSX image type to convert to (figure 4.2). See table 3.1 on chapter 3 for more details on MSX screens types supported. Screens 5-12 and all V9990 screens support interlace. For them, choose between normal or interlaced.

MSX Viewer S.1.1 - MarMSX 2018     Chose MSX screen type     MSX Screen 2/4 Normal      GScreen 5     Symbol GScreen 5	♥9990 Image Space V9990 V9990 Vetter Vette	GSET IMAGE = 512	V9990 / GFX9000 Image space changes the image resolution to work as a big screen. Change GSET
MSX Screen informations: Name: GSCREEN 5 Widht: 256 Height: 212 Simultaneous colors: 16 Total colors of the palette: 512 Color system type: RGB Number of page: 16 MSX Version: HSX 21 + v9990 Bits per pixet: 4 (single impace): 256 x 212	Use this option for SymbOS images.		IMAGE values to change the big screen resolution.
	<b>2 5</b>		If Image space were not opened, MSX Viewer 5 will assume that it is a single image !!
Help	< Back Next > Cancel	Selected Ok Discarted	



Figure 4.3. Image space.

V9990 screens have a built-in concept of image space, which puts together many screen pages as big one. But, one page can be shown at time. I works like giant map where you can scroll it.

For creating a image space, select any V9990 screen and click on *Image Space* button. The Image Space map then pops up (figure 4.3).

There are many layouts you may select for it at "GSET IMAGE =" option. You may also discard some pages by clicking at the last page you want to incorporate. In figure 4.3, the page 13 was clicked, discarding pages 14 and 15.

#### 4.3 – Resize Image

After choosing the MSX screen type, you must resize the original image to fit to the MSX size according to the screen mode you selected in the previous step (figure 4.4).

There are two options to resize:

- Fit to MSX Automatically fits to MSX.
- Manual Clip area Manually fits to MSX.

For automatic resize, MSX Viewer 5 has three options:

- Stretch: keeps no proportion of the original image (uncheck "keep aspect ratio").
- Keep aspect ratio, adding stripes.
- Keep aspect ratio, centering and cutting the exceeding edges.



Figure 4.4. Resize PC image to MSX.

If the PC image aspect ratio is different from MSX and you want to keep it, you may choose between add a stripe to fill the blank area or center the image and cut the edges that lies out of the image. For "add stripe" option, the program will open a color dialog asking you the color you want to fill the blank area.

Select the interpolation method to resize the image: nearest neighbor or smooth.

For manual resize, click on the *Editor* button and the Clip Area Editor will pop up (figure 4.5).



Figure 4.5. Clip Area Editor.

Choose the interpolation method before clipping.

There are three ways to create an area:

- Free: keeps no aspect ratio.
- Screen N: keeps MSX aspect ratio.
- TV: keeps 4:3 aspect ratio.

To create an area selection, click and drag the mouse over the image. From version 5.1, you may freely restart creating an area selection, just repeating this operation.

If you are satisfied with your selection, click on the *Ok* button. The *Cancel* button aborts the image selection (from version 5.1 on).

At last, we have the grayscale and transparency tools. The transparency works only with 32K colors (V9990). Click on the *Transparency* button in order to select the transparent color (figure 4.6) and the color tolerance.

In the example shown in figure 4.6, the tolerance was set to 10 and the color (176, 230, 255) was picked from image. So, the range of colors (166-186, 220-240, 245-255) will be set as transparent. Please, select the transparency effects BEFORE clipping the image.



Figure 4.6. Choose transparent color.

# 4.4 – Color Reduction

From version 5.1, this step is only addressed to screens with 256 colors like screen 8.



Figure 4.7. Color reduction.

Color reduction has the following options:

Method
Color Quantization
Error diffusion
Ordered Dithering

Filters			
	Floyd-Steinberg		
	Stucki		
	Burkes		
	Sierra		
	Jarvis		
	Steverson		

Table 4.2. Color reduction options.

# 4.5 - Color Recognition

If the screen you are working has less than 256 simultaneous colors, you must find MSX colors using more sophisticated tools. The objective here is to find the best way to match these colors.

There are two groups for color identification:

- MSX palette optimization: finds the best palette for the input image.
- Identify MSX colors: match the MSX colors according to the current palette.



Figure 4.8. Color recognition.

For changing the palette, you may edit it manually (figure 4.9) or try to find automatically the best palette for the current image using K-Means algorithm.



The options for K-Means are:

- Maximum number of iterations.
- Number of color to use: you may reserve some colors (e.g. transparency).
- Initial cluster: random or linear.
- Show or not the histogram after processing.

If you use palette optimization, you can reserve some colors for further applications like sprites etc. For that, use the following formula: *colors to use* = *total colors* – *reserved colors*. E.g.. from a set of 16 colors, if you want to reserve 2 colors, use 14 colors.

On palette editor, there are some pre-defined palettes such as MSX default, PC 16 colors, gray,

RGB (shades of red, green or blue) or Random. Thus, you can create your own palette by dragging and dropping the color index onto the desired color. It is possible to save and load your palettes.

After optimizing or editing the palette (both are optional), you have to identify the MSX colors. To achieve color identification, choose one of the following strategies:

- Euclidean
- Fuzzy (only for default 16 MSX colors)
- Error Diffusion
- Ordered Dithering

Always click on Recognize button to re-identify MSX colors after changing the palette. It is also possible to identify colors using customized palettes. For that, open palette editor, change the palette as you wish and then recognize the colors. See Figure 4.10.



Original (a)

Red palette (b)

Random palette (c)

Figure 4.10. Creating images with customized palettes.

Figure 4.11 shows an example of optimized palette, recognized by Euclidean Distance, Error Diffusion and Ordered Dithering.



Euclidean Distance (a) Error Diffusion (b) Ordered Dithering (c)

Figure 4.11. Creating images with optimized palettes.

Always remember: if you use a palette different from MSX 1 default, you must save both image and palette at the end. Otherwise, the palette will be lost !!

Why it is necessary to recognize the colors after palette changing? Because after editing the palette, the image colors will be updated according to the new palette.

Let's see the following example: imagine that we change the palette index 12 from green color to yellow on palette editor. After this change, all pixels having index 12 will be changed to yellow. See figure 4.12.



Original (a)

After change (b)



The recognize button will re-process the image color identification, choosing another green colors to represent those green areas on the picture.

At last, on palette editor, you may save the palette as MSXViewer palette (.pal), which can be loaded later, Gimp palette (.gpl) or save as image sample. This is useful to help on selecting msx colors on Gimp or other image editors. See figure 4.13.



Figure 4.13. Palette saved as image sample.

You may Analyze the resulting image or even change color properties on it, by clicking on Analysis button, as seen on figure 4.14.



Figure 4.14. Image analysis on Color Recognition.

The Result Analysis window is composed by:

- Image image to be analyzed or changed.
- Tools
  - Colors allows select two colors code on the palette.
  - Palette change change the two selected colors on the palette.
  - Image change change the two selected colors on the image (Color Magic tool).
  - $\circ~$  Join colors join the two selected colors in only one (on the second color).
- Selected Color Shows only the select color on image
  - $\circ\quad$  Color code color code to be shown.
  - Background color choose between black or white.
- Image histogram shows the color frequency on image for each palette entry.



Figure 4.15. Image Analysis tool.

### 4.6 – Screen 2 / 3 Adjustment

For screens 2 and 3 you must adjust the image to fit the pattern of these screens (figure 4.16).



Figure 4.16. Screen 2 and 3 adjustment.

Screen 2 has three available strategies for the adjustment:

- Local
- Neighborhood
- Gaussian

Local option only analyzes the pixels inside the current group. It selects the most 2 colors occurrences.

Neighborhood option analyzes the neighborhood in the following way: individual pixels or in group (for that, check the Group option). The group is the valid area for fitting. In screen 2, for example, is the 8x1 area.

Gaussian is the same as Neighborhood, but applies Gaussian weight.

Screen 3 has 8x4 blocks. In this case, we have the following options:

- Upper-left
- Rank
- Random

The Upper-left option selects the upper-left pixel of the block, while rank selects the most 4x4 block pixel occurrences and randomly selects the pixel color.

# 4.7 – Save Image

The last step is to save the image (figure 4.17).



Figure 4.17. Save image.

#### Image Name

First, click on the Path browse ("...") button to select the directory to save.

Then, fill the name of the images. If interlaced was chosen, you must fill the name of image 2. The form will auto-correct the names to fulfill MSX file patterns.

#### Palette

You must also save the palette you created for the image. There are two type of files:

- Binary: self executable program to load the palette. Run in MSX with BLOAD"file", R.
- Basic: creates a MSX Basic program that sets the palette colors and loads the image(s).

#### Self-extract Binary Image with Display

You may also save image as a self-extract binary image. Thus, this option is only available for MSX screen 2. This is an implementation of MSX Viewer 4 "Screen 2 Show" project.

There are five different ways to show image on screen (displays): direct, from up to down, from left to right, snail in and frame in.



#### Export to PC

There is also an option to export the results to PC. Choose the following formats: BMP, GIF, JPG or PNG.

# 5 Color Reduction Techniques

This chapter presents some color reduction techniques and how to take advantage of them. MSX Viewer 5 divides the task of best finding MSX colors in 2 steps: color reduction and color recognition. The first is used for 256 colors or more and the last is used with images with palette.

MSX Viewer 5 kept the color reduction working together with color recognition as experimental support this last step, although the color reduction step is always unnecessary for color recognition.

### 5.1 – Color Quantization

This techinque divides the color space into equal areas. The task here is to find which area best represents a given color. This is the simpler and most intuitive color reduction technique. Nevertheless, this is not compatible with images with palette.

The quantization method is used anyway for images with more than 256 colors, as screen 12.

#### 5.2 – Error Diffusion

Error diffusion applies noise on image to reduce the color shading problems, when the color space is reduced (Mach bands).

Error diffusion uses quantization to find the current pixel color at color reduction step, while error diffusion uses Euclidean Distance to find the current pixel color at color recognition step.

The Error Diffusion technique is strongly recommended for photos. If applied on picture drawings, some artifacts may appear and give bad results. So, for drawings use the methods Nearest Neighbor, Euclidean or Fuzzy.



Original Image





Euclidean Distance – 16 colors Error Diffusion – 16 colors Figure 5.1. Error Diffusion applied on a photo.

#### 5.3 – Euclidean Distance

This technique is applied on images with palette. The task here is to compare a given RGB color to each palette entry and return the most alike color. The Euclidean Distance for each palette entry is calculated as follows:

$$d = \sqrt{(R - R[i])^2 + (G - G[i])^2 + (B - B[i])^2}$$

Where: R, G, B are the RGB values of the current pixel and R[i], G[i], B[i] are the palette RGB values at the i<sup>th</sup> position.

The palette index which returns the shortest Euclidean Distance value is assigned to that pixel.

It is strongly recommended for drawings, but not for photos.

#### 5.4 - Fuzzy

Fuzzy is a sophisticated image interpretation tool which uses *a priori* knowledge. It simulates the human ability of interpreting things.

It only was designed to support MSX 1 default colors, once it is necessary to create fuzzy rules for each different palette.

Figure 5.2 compares the results between Fuzzy and Error Diffusion applied on a drawing. Observe the artifacts (grain) caused by the Error Diffusion applied on drawing.



Original Image Fuzzy – 16 colors Error Diffusion – 16 colors Figure 5.2. Fuzzy and Error Diffusion applied on a drawing.

#### 5.5 – Ordered Dithering

Ordered Dithering uses Bayes filter to apply noise on the given image to reduce the number of colors. This method presented better results for images used in SymbOS than the Error Diffusion. Figure 5.3 shows a comparison between Error Diffusion and Ordered Dither.





Error Diffusion Ordered Dithering Figure 5.3. Error Diffusion and Ordered Dithering.

# 6 Palette

In MSX Viewer 5, the palette tool was turned into a powerful one. Now, you can edit the colors, save and load the palette. Moreover, you can combine the color identification techniques presented in the chapter 5 with you own palette!

There are two different editors: 16 out of 512 colors palette or 64 out of 32K colors palette.



Figure 6.1. MSX palette editor for 16 colors.

For 64 colors palette, another palette editor was created. This is quite similar to Windows and Linux color dialogs.



Figure 6.2. Palette Editor for 64 colors (V9990 / GFX9000).

### 6.1 – PC palette with MSX palette included

In order to preserve the MSX original palette, the PC 8-bit images store both PC and MSX palette. Once 8-bit images have a palette array with 256 size and MSX palette maximum value is 64 colors, this trick is possible.

This palette is saved as PNG and GIF formats. For saving this palette use the "Export Results to PC" – section 4.6 – and select the supported formats.

The first set of colors refers to the PC palette. The next set of colors refers to the MSX palette. The rest is filled with 0's (see figure 6.1).

For 16 colors, the first set is from 0-15 and the second from 16-31. For 64 colors, the first set is from 0-63 and the second from 64-127.

	0	0	0	0	64	0	0	0	128	0	0	0	192	0	0	0
	1	0	0	0	65	0	0	0	129	0	0	0	193	0	0	0
	2	36	218	36	66	0	0	0	130	0	0	0	194	0	0	0
	3	109	255	109	67	0	0	0	131	0	0	0	195	0	0	0
	4	36	36	255	68	0	0	0	132	0	0	0	196	0	0	0
	5	72	109	255	69	0	0	0	133	0	0	0	197	0	0	0
	6	182	36	36	70	0	0	0	134	0	0	0	198	0	0	0
	7	72	218	255	71	0	0	0	135	0	0	0	199	0	0	0
	8	255	36	36	72	0	0	0	136	0	0	0	200	0	0	0
	9	255	109	109	73	0	0	0	137	0	0	0	201	0	0	0
	10	218	218	36	74	0	0	0	138	0	0	0	202	0	0	0
	11	/218	218	145	75	0	0	0	139	0	0	0	203	0	0	0
PC palette	12⁄	36	145	36	76	0	0	0	140	0	0	0	204	0	0	0
1	13	218	72	182	77	0	0	0	141	0	0	0	205	0	0	0
	14	182	182	182	78	0	0	0	142	0	0	0	206	0	0	0
	15	255	255	255	79	0	0	0	143	0	0	0	207	0	0	0
	16	0	0	0	80	0	0	0	144	0	0	0	208	0	0	0
	10	1	0	0	81	0	0	0	145	0	0	0	209	0	0	0
	10	- 1	7	- 1	02	0	0	0	140	0	0		210	0	0	
	20	1	1	3	03	0	0	0	147	0	0		212	0	0	
	20	2	3	7	85	0	0	0	140	0	0	0	213	0	0	
	22	5	1	1	86	0	0	0	150	0	0	0	214	0	0	-
	23	2	6	7	87	0	0	0	151	0	0	0	215	0	0	0
	24	77	1	1	88	0	0	0	152	0	0	0	216	0	0	0
MSX nalette	-25	7	3	3	89	0	0	0	153	0	0	0	217	0	0	0
morr pulette	26	6	6	1	90	0	0	0	154	0	0	0	218	Ō	0	0
	27	6	6	4	91	0	0	0	155	0	0	0	219	0	0	0
	28	1	4	1	92	0	0	0	156	0	0	0	220	0	0	0
	29	6	2	5	93	0	0	0	157	0	0	0	221	0	0	0
	30	5	5	5	94	0	0	0	158	0	0	0	222	0	0	0
	31	7	7	7	95	0	0	0	159	0	0	0	223	0	0	0
	32	0	0	0	96	0	0	0	160	0	о	0	224	ο	0	0
	33	0	0	0	97	0	0	0	161	0	0	0	225	0	0	0
	34	0	0	0	98	0	0	0	162	0	0	0	226	0	0	0
	35	0	0	0	99	0	0	0	163	0	0	0	227	0	0	0
	36	0	0	0	100	0	0	0	164	0	0	0	228	0	0	0
	37	0	0	0	101	0	0	0	165	0	0	0	229	0	0	0
	38	0	0	0	102	0	0	0	166	0	0	0	230	0	0	0
	39	0	0	0	103	0	0	0	167	0	0	0	231	0	0	0
	40	0	0	0	104	0	0	0	168	0	0	0	232	0	0	0
	40	0	0	0	105	0	0	0	169	0	0	0	233	0	0	0
	42	0	0	0	106	0	0	0	170	0	0	0	234	0	0	0
	43	0	0	0	107	0	0	0	171	0	0	0	235	0	0	0
	44	0	0	0	108	0	0	0	172	0	0	0	236	õ	0	$\overline{}$
	45	0	0	0	109	0	0	0	173	0	0	0	237	0	0	
	46	0		0	110	0	0		174	0	0		238	0	0	Ť
	47	0	0	0	111	0	0	0	175	0	0		239	0	0	$\overline{}$
	48	0	0	0	112	0	0	0	176	0	0	0	240	0	0	
	40	0		0	112	0	0		177	0	0		241	0	0	$\overline{}$
	50	0	0	0	114	0	0	0	178	0	0		241	0	0	
	51	0	0	0	115	0	0		170	0	0		242	0	0	$\exists$
	52	0		0	116				180	0	6		243	0	-	$\overline{}$
	52	0		0	117	0	0		101	0	0		244	0	0	$\rightarrow$
	53	0		0	110	0		0	102	0	0		245	0	0	
	54	0		0	110	0	0		182	0	0		246	0	0	
	55	0		0	120	0	0		183	0	0		247	0	0	
	56	0	0	0	120	0	0	0	184	0	0	0	248	0	0	0
	57	0	0	0	121	0	0	0	185	0	0	0	249	0	0	0
	58	0		0	122	0	0	0	186	0	0	0	250	0	0	0
	59	0	0	U	123	0	0	0	187	υ	0	0	251	0	υ	0
	60	0	0	0	124	0	0	0	188	0	0	0	252	0	0	0
	61	0	0	0	125	0	0	0	189	0	0	0	253	0	0	0
	62	0	0	0	126	0	0	0	190	0	0	0	254	0	0	0
	63	0		0	127				101		0		255		0	

Figure 6.1. PC palette for MSX 16 colors palette.

# 6.2 – MSX Basic Codes For Loading Images With Palette

MSX 2 - Non Interlaced Images					
Binary Palette	Basic Palette				
<pre>10 SCREEN n 20 BLOAD"file.pal",R 30 BLOAD"file.s??",S 40 GOTO 40</pre>	<pre>10 SCREEN n 20 COLOR = (0,?,?,?) 30 COLOR = (1,?,?,?) 40 COLOR = (2,?,?,?) 50 COLOR = (3,?,?,?) 50 COLOR = (3,?,?,?) 60 COLOR = (4,?,?,?) 70 COLOR = (5,?,?,?) 80 COLOR = (6,?,?,?) 90 COLOR = (7,?,?,?) 100 COLOR = (7,?,?,?) 110 COLOR = (9,?,?,?) 120 COLOR = (10,?,?,?) 130 COLOR = (11,?,?,?) 130 COLOR = (12,?,?,?) 140 COLOR = (12,?,?,?) 150 COLOR = (13,?,?,?) 160 COLOR = (14,?,?,?) 170 COLOR = (15,?,?,?) 180 BLOAD"file.s??",S 190 GOTO 190</pre>				

MSX 2 - Interlaced Images					
Binary Palette	Basic Palette				
10 SCREEN n,,,,,3 20 BLOAD"file.pal",R 30 SET PAGE 1,0 40 BLOAD"file0.s??",S 50 SET PAGE 1,1 60 BLOAD"file1.s??",S 70 GOTO 70	10 SCREEN n,,,,,3 20 COLOR = (0,?,?,?) 30 COLOR = (1,?,?,?) 40 COLOR = (2,?,?,?) 50 COLOR = (3,?,?,?) 60 COLOR = (4,?,?,?) 70 COLOR = (5,?,?,?) 80 COLOR = (6,?,?,?) 90 COLOR = (6,?,?,?) 100 COLOR = (7,?,?,?) 100 COLOR = (10,?,?,?) 110 COLOR = (11,?,?,?) 120 COLOR = (11,?,?,?) 130 COLOR = (12,?,?,?) 140 COLOR = (12,?,?,?) 150 COLOR = (13,?,?,?) 160 COLOR = (14,?,?,?) 160 COLOR = (15,?,?,?) 180 SET PAGE 1,0 190 BLOAD"file0.s??",S 200 SET PAGE 1,1 210 BLOAD"file1.s??",S				
	<pre>100 COLOR = (8,?,?,?) 110 COLOR = (9,?,?,?) 120 COLOR = (10,?,?,?) 130 COLOR = (11,?,?,?) 140 COLOR = (12,?,?,?) 150 COLOR = (13,?,?,?) 160 COLOR = (14,?,?,?) 160 COLOR = (15,?,?,?) 170 COLOR = (15,?,?,?) 180 SET PAGE 1,0 190 BLOAD"file0.s??",S 200 SET PAGE 1,1 210 BLOAD"file1.s??",S 220 GOTO 220</pre>				

Obs:

- Change the screen number, filenames and color palette to the proper values.
- Binary palette has a built-in assembly code for loading palette on VRAM.

V9990 - Non Interlaced Images					
Binary Palette	Basic Palette				
<pre>10 GSCREEN n 20 BLOAD"file.pal",R 30 GSET IMAGE = value 40 GBLOAD"file.g??",S 50 GOTO 40</pre>	<pre>10 GSCREEN n 20 GSET PALETTE = vp,ap 30 GCOLOR = (0,?,?,?) 40 GCOLOR = (1,?,?,?) 50 GCOLOR = (2,?,?,?) 180 GCOLOR = (15,?,?,?):' If mode 0 340 GCOLOR = (31,?,?,?):' If mode 1 500 GSET IMAGE = value 510 GBLOAD"file.g??",S 520 GOTO 500</pre>				

V9990 - Interlaced Images						
Binary Palette	Basic Palette					
10 GSCREEN n,,,,3	10 GSCREEN n,,,,3					
20 BLOAD"file.pal",R	20 GSET PALETTE = $vp, ap$					
30  GSET IMAGE = Value	20  GCOLOR = (0, ?, ?, ?) $30  GCOLOR = (1, 2, 2, 2)$					
50 GOTO 40	$\begin{array}{l} 40 \ \text{GCOLOR} = (2, ?, ?, ?) \\ 40 \ \text{GCOLOR} = (2, ?, ?, ?) \end{array}$					
	50  GCOLOR = (3, ?, ?, ?)					
	900 GCOLOR = $(n,?,?,?)$					
	1000 GSET IMAGE = value					
	1010 GBLOAD"file.g??",S					
	1020 GOTO 1020					

Obs:

- You must have "gbasic.bin" driver to load V9990 images.
  - It can be found at: <u>http://www.msx.ch/sunformsx</u>
- The binary palette is loaded using "BLOAD" instruction, followed by ",R".
- There are 2 types of palette in V9990: 16 or 64 colors.
  - GSET PALETTE chooses between mode 0 and 1.
    - The "vp" is the visual palette (visible).
    - The "ap" is the active palette (modify).
  - Mode 0 is 16 out of 512 colors.
  - Mode 1 is 64 out of 32768 colors.
- If image space is never opened on MSX Viewer 5, it will assume that it is a single image.
- Adjust the image space using GSET IMAGE = value.
  - If single image, GSET IMAGE is not necessary.
  - If image space button used, set "value" to the GSET image you selected.
- Different from MSX 2, V9990 interlaced image is within a single file.

# 6.3 - Testing V9990 images on openMSX

Load openMSX Catapult, then select the MSX Machine and gfx9000 as extension.

Session	Misc Controls	Video Cont	rols	Audio Cont	rols	Input Text	Status Info		
MSX type	2:			Disk Drives					
Panasonic FS-A1GT 🔹		v	Disk A	/msx/disk			~		
Extensions: ESE SCC				Disk B	k B				
ESE WAY	/E-SCSI			Cartridge Sl	ots				
fmpac			Cart A						
gfx9000				COICA					
ide			Cart B						
Konami EC-702 Konami SD-Snatcher Sound Cartridge				Cassette Player					
Konami Snatcher Sound Cartridge mbstereo Mega Flash ROM SCC megaram Microsol CDX-2				Cassette				~	
			Record Play Rewind						

Be sure to place "gbasic.bin" on image directory or disk image before start the emulator. After starting the emulator, load "gbasic.bin":

#### BLOAD"GBASIC.BIN",R

Then, load or write the Basic program to load the image.



What happened? The image is not there !

Yes, because V9990 card outputs to another monitor. So, change the monitor by pressing F10 key and typing: "set videosource gfx9000" + enter + F10 (to exit command).



Press F10 key again and type "set videosource msx" to come back to MSX monitor.

# $7 \, \mathrm{Credits}$

This manual was written by Marcelo Teixeira Silveira, Rio de Janeiro, Brazil. Current version: 5.1.1 – June 2018. Contact e-mail: flamar98@hotmail.com Current homepage: http://marmsx.msxall.com.

MSX Viewer 5 has been developed by Marcelo Teixeira Silveira since 2008, and it is distributed under GNU General Public License (GPL) version 3.0: <u>http://www.gnu.org/licenses/gpl-3.0.txt</u>.