REVOLUTION 512 X 32

With REVOLUTION 512 X 8 Operation Mode

PRODUCT MANUAL

Version 2.00

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PREFACE

Welcome to the family of REVOLUTION graphics boards. You now own today's most advanced PC graphics controller board, the only graphics board which combines Number Nine's unique Multi-Ported RAM design with the NEC 7220 Graphics Display Controller and either 32 bits or eight bits of data per pixel.

The REVOLUTION 512 X 32 is part of Number Nine's high-performance family of graphic systems designed for the IBM® AT, XT, PC and compatible microcomputers. When coupled with the appropriate professional software, the REVOLUTION 512 X 32 hardware becomes a powerful tool for efficiently producing high-resolution video display images in "true" color.

This single, low-power expansion board provides a displayable resolution of 512 X 480 pixels and can display one-quarter million simultaneous colors selected from a palette of more than 16.7 million possiblities. This large capacity makes the REVOLUTION 512 X 32 ideally suited to use with rendering and animation software and makes anti-aliasing of the video image practical. These are capabilities previously unavailable on a microcomputer.

In addition, the REVOLUTION 512 X 32 offers complete REVOLUTION 512 X 8 pixel mode compatibility, giving you access to the largest library of eight bit-per-pixel software available on any graphics board. Most REVOLUTION 512 X 8 software will run flawlessly on the 512 X 32. And, while the original REVOLUTION 512 X 8 only accommodated Number Nine's Genlock module, the REVOLUTION 512 X 32's NTSC Encoder will now encode eight-bit images, as well as 32-bit images, with near-broadcast quality.

The REVOLUTION 512 X 32 is based upon and supports the NEC 7220 16-bit Graphic Display Controller (GDC), supplementing the GDC's capabilities with a multi-ported, one Megabyte Display Buffer which is directly accessible to both the GDC and the IBM host processor. The Buffer maps 32 bits of data per pixel directly to the IBM-PC address space, and Number Nine's efficient hardware design provides several distinct modes to access the pixel data.

The REVOLUTION 512 X 32 takes full advantage of the standard 7220 zoom, windowing, pan, and scroll operations. Because direct bus access to the Display Buffer allows fast software drawing, 7220 figure drawing operations are not supported.

Software support for the REVOLUTION 512 X 32 includes, at the tool-kit level, HALO, GSS-VDI, NAPLPS, AND NOVA-GKS. High-level applications include imaging, three-dimensional modelling, CAD, and design arts.

The REVOLUTION 512 X 32 offers two output stages which insure compatibility with the widest possible assortment of video equipment and monitors. Standard output is 15.75 KHz analog-RGB for monochrome or color analog-RGB monitors.

The optional output is NTSC for composite video color monitors, recorders, and related equipment. NTSC adds versatility to the REVOLUTION 512 X 32 by offering the advantage of RS-170A or CCIR-624 Gen-Lock circuitry. This enables the broadcasting and videotaping of any REVOLUTION graphic image by locking onto an external video or composite sync source.

The REVOLUTION 512 X 32 is one of a growing family of IBM-bus-compatible graphic controller boards from Number Nine, including:

REVOLUTION 512 X 8	512 X 512 addressable pixels. 512 X 480 displayable pixels. 256 simultaneous colors
REVOLUTION 1024 X 8	1024 X 1024 addressable pixels. 1024 X 768 displayable pixels, max. 256 simultaneous colors.
REVOLUTION 2048 X 4	2048 X 1024 addressable pixels. 1280 X 960 displayable pixels, max. 16 simultaneous colors.

Number Nine welcomes your inquiries and comments regarding our products. User feedback is Number Nine's best tool for refining the REVOLUTION family's complete graphic solutions to meet your needs.

REVOLUTION 512 X 32

With REVOLUTION 512 X 8 Operation Mode

(Version 2.00)

CONTENT

(Content continues on next page.)

APPENDICIES

SECTION 1

REVOLUTION 512 X 32
GETTING STARTED

GETTING STARTED

USING THIS PRODUCT MANUAL

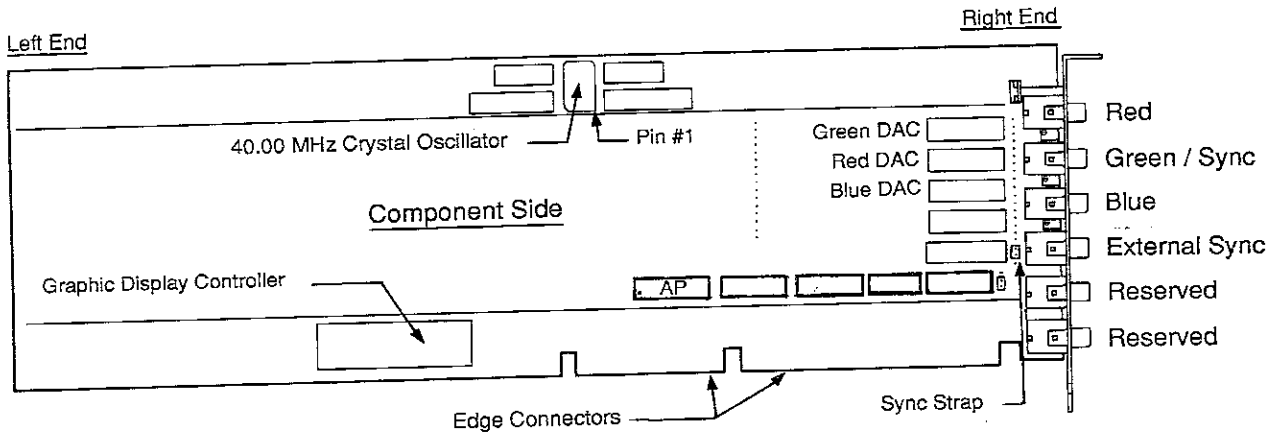
This manual is divided into two sections. The first, "Getting Started," discusses everything necessary to make the board run correctly in a system. It covers everything from unpacking the board to displaying a test pattern on the graphics monitor.

The second section, "Architecture of the REVOLUTION 512 X 32," focuses upon board operation and how various board components relate to one another. This discussion provides the foundation upon which programs using the board must be built.

In those sections of the text which are related to software, DOS is the presumed operating system. The software supplied with the board is written for a DOS environment and this text is written with the assumption that its readers are familiar with the basic use of DOS.

Text which references hexadecimal data values adds the suffix "H" to the values, as in F7H = decimal 247. Text which refers to memory addresses uses hexadecimal "segment:offset" notation. For example, address C0707H is shown as C000:0707.

For reference purposes, the primary components of the board are shown in the illustration below.



Primary Components of REVOLUTION 512 X 32

UNPACKING AND INSPECTION

The REVOLUTION 512 X 32 is shipped in a sturdy foam-lined cardboard box. The Board itself is slipped inside a plastic anti-static sleeve to protect static-sensitive components. Save the box, foam, and sleeve for future board transportation.

Verify that the correct board was shipped by comparing the board serial number with the packing slip. The serial number is found etched on the back side of the board and should agree with the invoice number found on the packing slip. The packing slip will then list the board type and correct product part number. If there is a discrepancy, please notify Number Nine's Customer Service Department.

Inspect the Board for visible damage. This is rare, but sometimes damage occurs during shipping. Occassionally, the mounting bracket on the right end of the board is bent in shipping. It may be staightened by gently hand-bending. If other damage is noted, please notify Number Nine's Customer Service Department promptly.

If cables were ordered with your board, they are coiled and placed on top of the board before closing the box. Verify that the number of cables agrees with the quantity on the packing slip. When packing the board for storage or transport, the coiled cables should be placed similarly. It is best to place the metal connectors on the cables so that they do not lie directly on top of the board.

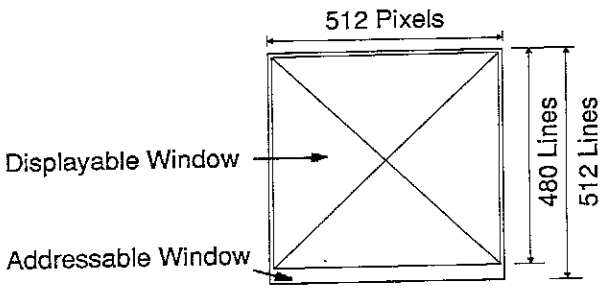
Beneath the bottom layer of foam are found this Product Manual, documentation for the Number Nine Graphics Interface Library (NNGIL), a 5-1/4" diskette, and a registration form. The files on the diskette are discussed in this manual and in the NNGIL document.

Please complete the registration form at your earliest convenience. It will help us to better serve you should you need assistance or in the unlikely event that the board requires repair.

BOARD CONFIGURATIONS

Your REVOLUTION 512 X 32 has an addressable resolution of 512 pixels horizontally by 512 lines vertically by 32 bits of data per pixel. Of the 32 bits, twenty-four are allocated to the three primary colors: eight bits to Red, eight to Green, and eight to Blue. The remaining eight bits are used for graphic overlay.

The 512 X 32 displays 480 lines with 512 pixels. The reduction in number of displayed lines to 480 (from the addresasble 512 lines) allows the board to output to an NTSC video environment when the Genlock and NTSC encoder option is installed. Complete configuration information is shown below.



REVOLUTION 512 X 32 Resolution

REVOLUTION 512 X 32 CONFIGURATIONS

MODEL NUMBER:	211032
ADDRESSABLE RESOLUTION:	512 X 512
DISPLAYABLE RESOLUTION:	512 X 480
PIXEL DEPTH:	32 Bits
VIDEO BANDWIDTH:	10 MHz
VERTICAL FRAME REFRESH RATE:	30 Hz interlaced
HORIZONTAL SCAN RATE:	15.75 KHz

Each model of the REVOLUTION 512 X 32 is shipped with:

Analog-RGB output, for color or monochrome monitors, with sync on green. The board may be changed to separate sync, as explained in the installation section.

Compact memory addressing using 64K at the IBM segment A000:.

Optional equipment includes:

RS-170A Genlock Module, Part Number 2080.
NTSC Encoder (includes RS-170A Genlock), Part Number 2070.

SYSTEM CONFIGURATION

Before installing your REVOLUTION board, verify that you have all the necessary components for a complete system. If you are using the REVOLUTION board with a commercially available software package, the documentation for that software should be very specific about the system configuration. If the software is not well documented, or if you are designing your own system, use the following paragraphs as guidelines.

Host Computer

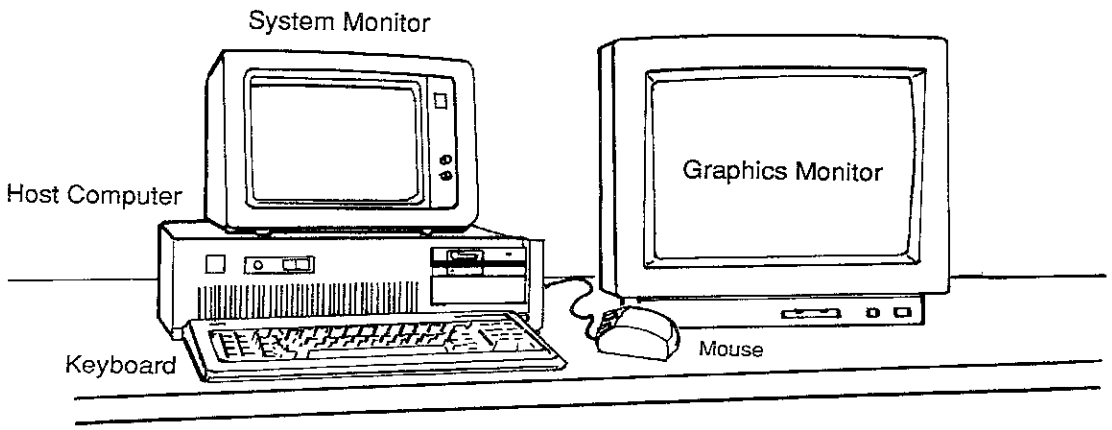
The REVOLUTION 512 X 32 is designed to work with the IBM family of personal computers, including the AT, XT, and PC. The board works with several of the "IBM-compatible" computers, but Number Nine only warrants compatibility with the IBM family.

Memory and disk storage requirements are dependent upon the application for which the boards are used. The REVOLUTION board carries the correct amount of memory to store image and color data, while the host computer must have sufficient memory for program data and other data.

Monitors

Two monitors are required for a graphics workstation using the REVOLUTION 512 X 32. The first is referred to as the "system" monitor. It is either the familiar IBM monochrome text monitor or the color graphics monitor. The system monitor is used for displaying operating system information and is connected to either the IBM monochrome display adapter card or to the color/graphics adapter card, respectively. System monitor graphic adapter cards other than these may conflict with REVOLUTION 512 X 32 memory mapping and might cause your system to function improperly.

The second monitor is the "graphics" monitor which is used to display the images created on the REVOLUTION 512 X 32. Select the graphics monitor to match the video specifications shown in Table 1 on the previous page. Number Nine stocks graphics monitors which work very well with the REVOLUTION 512 X 32.



Basic System Configuration

Cables

The REVOLUTION 512 X 32 connects to analog-RGB graphics monitors with either 3 or 4 coaxial cables. The fourth cable is used if the monitor requires separate sync. The cables have RCA male connectors on the board end (to minimize stress on the board), and typically have BNC connectors on the monitor end. Number Nine provides 6' RCA- to-BNC cables as an option.

Input Devices

The REVOLUTION 512 X 32 receives all input through the PC bus, which makes it compatible with most input devices. The requirements of the application software will determine which input device and corresponding controller card should be used in the system.

Input devices include:

- Digitizing tablets.
- Mice.
- The keyboard.

Output Devices

Output devices receive data from the REVOLUTION 512 X 32 either through the board's video output jacks or via the IBM bus through a controller card. Again, the application will determine the appropriate output device.

Output devices include:

- Analog monitors (15.75 KHz horizontal scan rate).
- Printers:
  - Dot matrix.
  - Ink jet.
  - Laser.
  - Thermal transfer.
- Plotters.
- Film recorders.

INSTALLATION

Three steps are necessary to install the REVOLUTION 512 X 32:

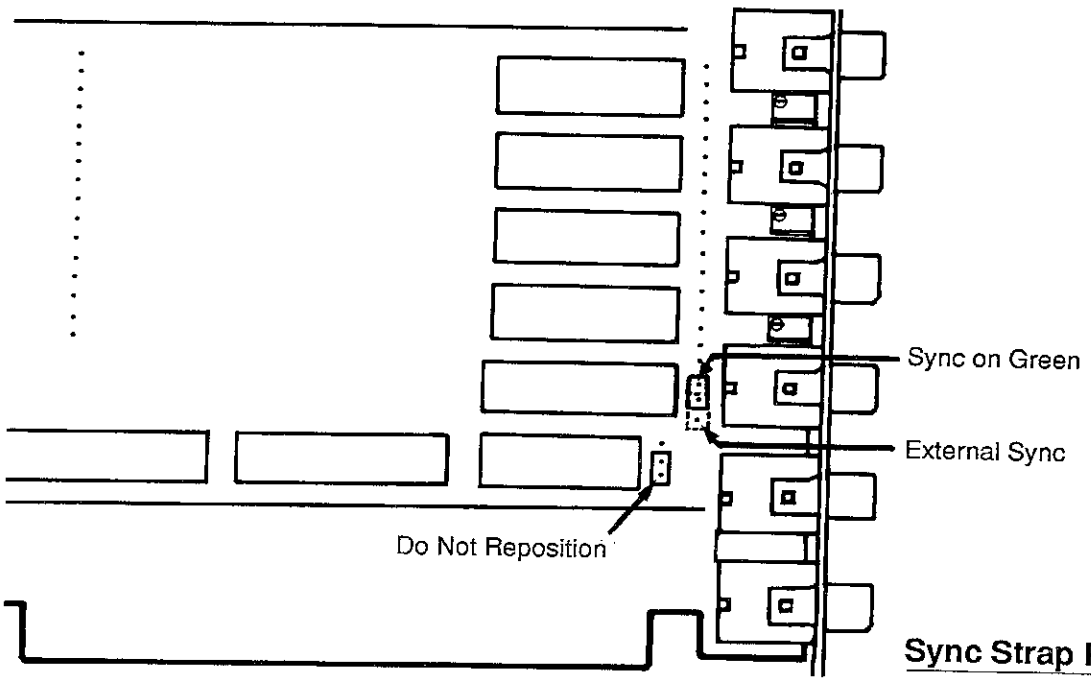
1. Verify or change the sync strap setting.
2. Install REVOLUTION board in computer's system unit.
3. Connect graphics monitor.

Setting the Sync Strap

Prior to installing the REVOLUTION 512 X 32 in the system unit, determine whether your monitor requires sync on green or external sync. Once determined, look at the right end of the component side of the board. Behind the RCA jacks is a vertical strip of pins. Pins #1, 2, and 3, numbered from the bottom, are used to direct the sync signal to one of two output jacks.

Number Nine ships the 512 X 32 strapped for sync on green. You can see this strap (a blue piece of plastic with a metal conductor inside) placed over pins #2 and #3. This configuration directs sync to the green output, the second RCA jack from the top.

If external sync is required, use a small pair of nose pliers to gently pull the strap from the pins and then reinstall the strap over pins #1 and #2. This configuration directs the sync signal to the fourth jack and removes the signal from the green jack.



Sync Strap Positions

These pin configurations will change if the Genlock or NTSC Encoder module is installed. In that case, you should review the documentation that comes with the installed module.

Board Installation

Other than the synchronization strap, there are no user-servicable parts or components on the REVOLUTION 512 X 32, nor is user adjustment required. Install the board by following the instructions in the "Guide to Operations" for your computer.

The board may occupy any of the slots in the system unit, although it is best not to place it adjacent to your hard disk or diskette controller. In the IBM AT use a slot with either a single or double edge connector. Also in the AT, the board will not seat properly in a few slots because of the height of the piggy-backed memory chips on the system board. You should avoid installing the 512 X 32 in one of these slots.

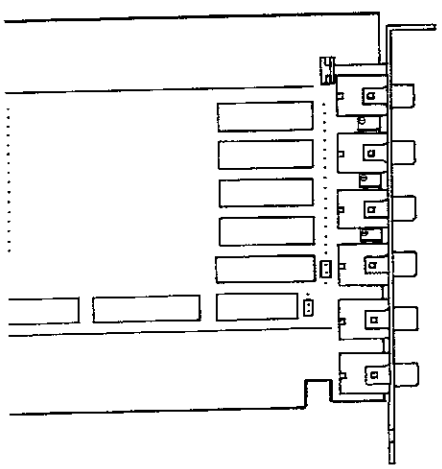
Number Nine includes a black plastic guide to secure the front end of the REVOLUTION board. Snap this into the system unit before installing the board. Then, slide the front end of the board into the guide as you gently press the board into the socket or sockets on the system board.

Install any other internal expansion cards necessary for the application, then complete reinstallation of the basic computer system components according to the system's "Guide to Operations".

Monitor Installation

As with all interconnected components in an electronic system, computers and monitors should use a common ground to minimize ground loops. This is accomplished by plugging both the PC and the graphics monitor to the same power source.

For analog-RGB monitors with BNC connectors, connect the monitor's BNC input jacks to the corresponding RCA jacks on the REVOLUTION board. Use either 3 or 4 coaxial cables, depending upon whether the monitor requires separate sync. The BNC connectors are usually labelled on the monitor. The REVOLUTION jacks are identified below, starting from the top of the board:



RCA Jack #1	RED
RCA Jack #2	GREEN / SYNC
RCA Jack #3	BLUE
RCA Jack #4	SEPARATE COMPOSITE SYNC
RCA Jack #5	Reserved for options.
RCA Jack #6	Reserved for options.

If the monitor has switches which select between "High" impedance or "75 ohm" impedance, position the switches to "75 ohm" (to "terminate" the monitor) unless you are connecting the monitor to a second monitor (looping through).

Monitors may be configured for "internal" sync (sync-on-green), for "external" sync (separate sync), or for both. In some monitors there is an internal switch to select internal or external; in others you must use the factory pre-set configuration. Verify that your monitor's sync configuration and your board sync configuration are the same.

Monitors may also be configured for either "composite" sync or for separate horizontal and vertical sync. To work with the REVOLUTION board it must be configured for "composite" sync.

Please reference your monitor's user manual for further configuration details.

BEFORE TURNING YOUR MONITOR ON, INITIALIZE YOUR REVOLUTION 512 X 32. This will prevent the monitor circuits from from possible damage resulting from stray sync signals.

INITIALIZING THE REVOLUTION 512 X 32

Once the board is installed and the system is completely assembled, boot the system with DOS. The appropriate version of DOS is dependent upon the application. To run the Number Nine demonstration and utility software described in this section, any version of DOS will work.

Once the computer is booted, view the directory of the Number Nine diskette (with DIR d:, where d: is the drive designation for the Number Nine diskette). The directory will show several files with .EXE or .COM extensions, including, among others:

PREP8.EXE	DEMO8.EXE	NGS.LIB	B_TYPE_C.H
PREP32.EXE	DEMO32.EXE	DEFAULT.DAT	TEST.C
INIT8.EXE	SETUP.EXE	FILE.DAT	LNK.BAT
INIT32.EXE			

If these files are not on your diskette, notify the Number Nine Customer Service Department.

Determine whether you wish to run the board as a normal REVOLUTION 512 X 32 or as a REVOLUTION 512 X 8. Then, run either PREP32.EXE or PREP8.EXE to PREPare your board for either 32-bit or 8-bit operation, respectively. The board is now ready for you to initialize.

Run the INITialization program appropriate for your selected use, either INIT8.EXE for 512 X 8 operation or INIT32.EXE for 512 x 32 operation. After initialization, turn the graphics monitor on. It should show a random display which may be cleared by using the SETUP "Clear" command (see next section). The board is now ready for use.

The board may be initialized in other ways which will be explained in the next section. Also, commercially available applications software will either initialize the REVOLUTION board as part of its boot procedure or should give specific instructions for initialization. Before running commercial applications software, be sure to PREPare the board for either 512 X 8 or 512 X 32 operation, as explained above.

To insure that you run the proper PREParation file before your application, you may wish to write a short batch file to call both the PREParation file and the application program. For example, if you have an application called "32-bit Wonderpaint" which is stored in the file WPAINT32.EXE, create the batch file named WPAINT32.BAT to call PREP32.EXE then WPAINT32.EXE, as follows:

```
PREP32
WPAINT32
```

This short batch program will PREPare your REVOLUTION board for 512 X 32 operation and will call your application program, WPAINT32. Your DOS programming manual explains batch files in more detail.

EXERCISING THE REVOLUTION BOARD

Number Nine provides several files for using the REVOLUTION board and for verifying that it is working properly. These are the files listed in the previous section. Their use is explained below:

PREP8.EXE
PREP32.EXE

These two files PREPare your REVOLUTION board to work as either an 8-bit-per-pixel board or as a 32-bit-per- pixel board. They correctly set all softswitches and load the overlay look-up table to emulate either the REVOLUTION 512 X 32 or the REVOLUTION 512 X 8.

Either file may be called at any time to switch from one operation mode to another. For example, you may wish to work in 8-bit mode with a three-dimensional CAD sortware package to create a wire-frame model. Before running the CAD software, run PREP8.EXE. After you create the model, you may then wish to switch to a 32-bit rendering software package to render the model. Enter 32-bit mode by running PREP32.EXE before running your rendering software.

INIT8.EXE
INIT32.EXE

This program INITializes the REVOLUTION board. It sets the display raster parameters, clears display memory (sets all pixel values to 0), and sets the overlay and color look-up tables to the default values and palette used for the test patterns in the DEMO8.EXE or DEMO32.EXE programs. The graphics monitor has a blank (black) display after running INIT.

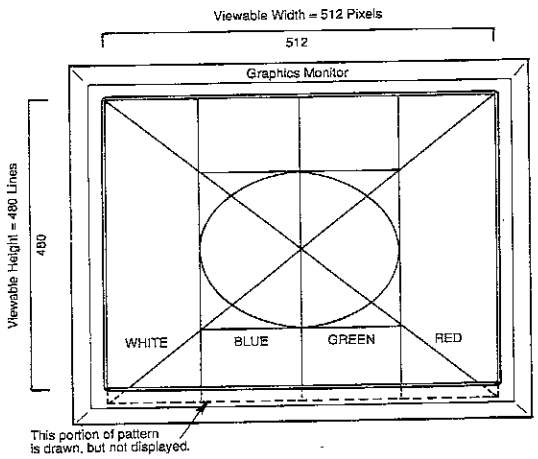
DEMO8.EXE
DEMO32.EXE

These programs display a test pattern which DEMOnstrates the color capabilities of the REVOLUTION board and which help to verify that the board is working properly. Before running one of these two DEMO programs, run the PREP program then the INIT program which corresponds to the DEMO that you wish to see.

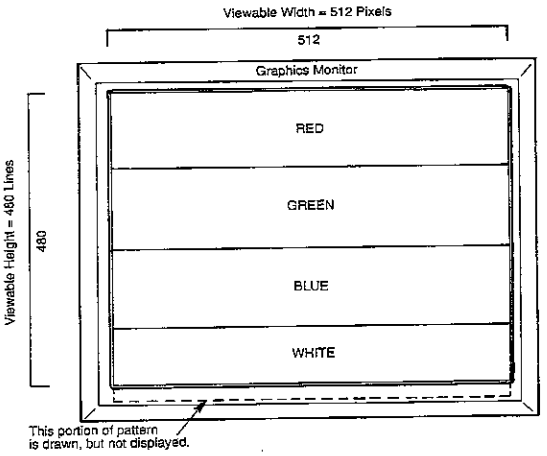
DEMO8 displays four vertical color bars: red (on the right), green, blue, and white (on the left). Each bar is shaded with 64 intensities of the same color, from 0-intensity on the right (black) to full-intensity on the left. Superimposed in white over the bars is a pattern with eight radial lines, a rectangle with an inscribed ellipse, and an enclosing border. The bottom 32 lines of the pattern do not show because the pattern is drawn to the board's full 512 lines.

DEMO32 displays four horizontal color bars: red (at the top), green, blue, and white (at the bottom). Each bar is shaded with 256 intensities of the

same color, from 0-intensity (black) on the left to full intensity in the middle and back to 0-intensity on the right.



DEMO8



DEMO32

SETUP.EXE

This is a menu-driven program which INITializes the REVOLUTION board, toggles between 8-bit and 32-bit operation modes, modifies board display parameters, and checks board memory. Menus appear on the system monitor and provide choices for clearing the graphic screen, displaying a test pattern, and other functions. The modifiable display parameters include raster parameters, zoom, and roam (pan and scroll). Modified parameters may be stored to diskette. Default parameters may always be recalled.

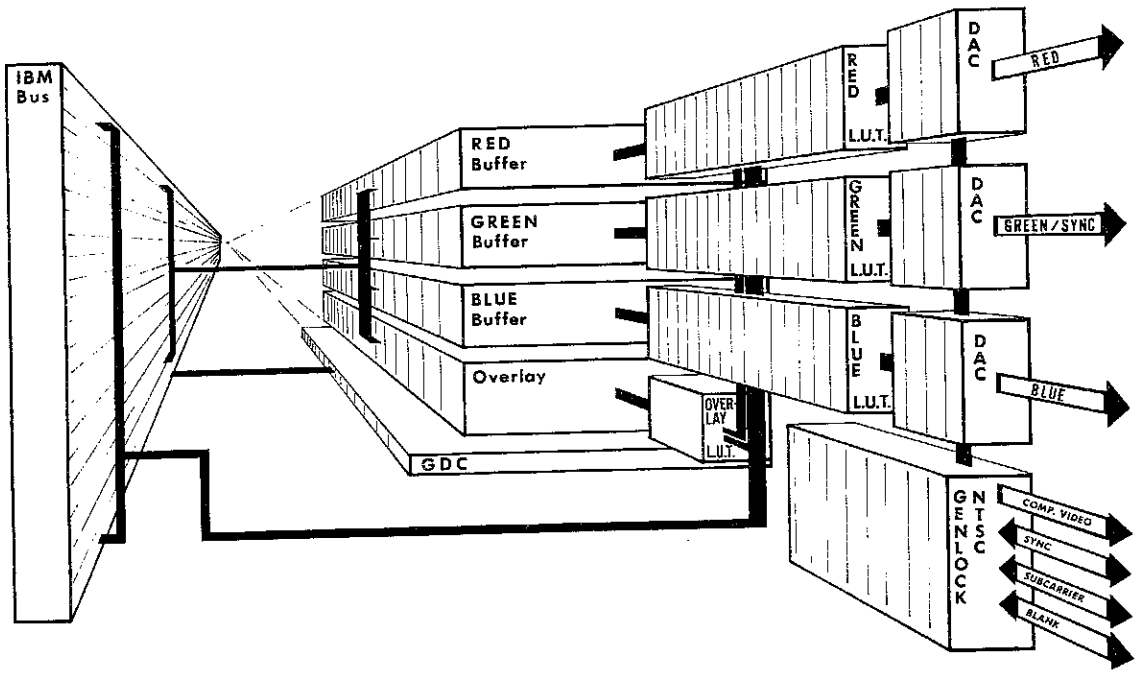
SETUP.EXE uses other files on the diskette, as follows:

DEFAULT.DAT	Stores default initialization parameters.
FILE.DAT	Stores user-modified initialization parameters.

The other files on the diskette are explained in the documentation for the Number Nine Graphics Interface Library, included with your REVOLUTION board.

SECTION 2

REVOLUTION 512 X 32
TECHNICAL OVERVIEW



TECHNICAL OVERVIEW

This section presents an overview of the REVOLUTION 512X32 architecture and memory map, then summarizes the operations of the major system components. These include the 7220 Graphics Display Controller (GDC), the Display Buffer (One Megabyte of RAM), the Color Look-Up Tables (three 4096 x 8 bit RAMs), the Overlay Look-up Tables, and the output modules. These components are fitted onto an integrated circuit card (approximately 13-1/2" x 4-1/4") which plugs into any one of the expansion slots in the AT, XT, or PC System Unit. The complete board, with analog RGB output, draws approximately 2.5 amps.

The diagram on this section's title page illustrates the principal REVOLUTION 512 X 32 architecture. The foremost relationship to note on the drawing is the multiported access to the Display Buffer. The first port provides direct access to the IBM 8088 or 80286 host processor. The second port is the set of data paths from the Display Buffer to the board outputs via the Overlay and Color Look-up Tables. A more detailed block diagram is presented as Appendix "A."

The REVOLUTION 512 X 32 standard output is analog-RGB, which is found on the top three RCA video jacks on the board mounting bracket. These three jacks are for Red, Green, and Blue signals, with synchronization overlaid on the Green signal. Except when other output options are selected, the fourth jack outputs a composite synchronization signal, the fifth outputs positive vertical sync, and the sixth outputs positive horizontal sync.

REVOLUTION boards with the Genlock or NTSC option will use the lower three RCA video jacks differently. They will provide composite sync in or out, sub-carrier in or out, and external blank in. External connection of boards equipped with Genlock is discussed in the manual for that option.

Operation Modes

The REVOLUTION 512 X 32 operates in two distinct modes:

REVOLUTION 512 X 32 Operation Mode.
REVOLUTION 512 X 8 Operation Mode.

The distinctions between the two operation modes are found in the way that the Display Buffer is accessed and in the way that the Softswitches are used. It is possible to switch between operation modes if an application so requires, but the change between modes requires complete understanding of how the Display Buffer and Softswitches are used.

Memory Map

Appendix "B," "REVOLUTION 512 X 32 Memory Map," illustrates the assignment of IBM addresses to the components of the REVOLUTION 512 X 32. Note that in addition to the Display Buffer, GDC, and Color and Overlay Look-Up Tables, the memory map shows a set of sixteen software controlled switches. These softswitches are vital to the

management of data transfer between the IBM host processor and the REVOLUTION 512 X 32.

Each of the mapped address areas is discussed in the following sections.

Display Buffer

The Display Buffer, also known as the Bit-Map, is a one megabyte block of REVOLUTION board memory used to store image data as it is being displayed on the graphics monitor. As shown in the Memory Maps, one 64K segment of IBM address space is assigned to the Display Buffer. This is the segment beginning at A000:0000 (using standard Intel segment:offset address notation). This does not reduce the amount of "user" memory available for other applications.

From the perspective of the IBM PC's memory map, the Display Buffer is accessed in either four or sixteen pages (or segments) through this window. Proper softswitching and the use of a Bank Select Register (or Bank Select softswitches in 8-bit operation mode) then give direct access to the Display Buffer address and data busses (an ability referred to as "Bus Access" in this document).

In 32-bit operation mode, the 64K IBM segment is paged across the REVOLUTION 512 X 32's one megabyte Display Buffer by setting the least significant nibble of the Bank Select Register at address C000:0400. This nibble represents the highest-order address bits of the Display Buffer. (The sixteen possible register values select which of sixteen 64K Display Buffer segments the host processor will access).

In 8-bit operation mode, the 64K IBM segment is paged across the REVOLUTION boards 256K of addressable Display Buffer memory by setting the softswitches at C000:0705 and :0706. These two softswitches select which of four possible 64K Display Buffer segments the host processor will access.

When reading or writing a pixel in the Display Buffer to or from the IBM, software must logically align the correct Bank of the Display Buffer with the window of IBM address space. Do this by correctly setting the Bank Select Register or Softswitches to indicate the required Bank.

Using the IBM host processor, the Display Buffer may be read from and written to in five distinct bus access modes:

32-bit PIXEL	Figure "C-1"
32-bit PIXEL with Overlay Write-Protect	Figure "C-1"
32-bit RGBO	Figure "C-2"
32-bit CONCURRENT	Figure "C-3"
8-bit CONCURRENT (= 8-bit PIXEL)	Figure "C-4"

These figures, found in Appendix "C," show the relationship of address 00000H ("H" indicates "hexadecimal") and a few other representative

addresses on the REVOLUTION board to the thirty-two bit-planes that define each pixel. For each pixel, the binary data in each of the first three groups of eight bit-planes give addresses that point to entries in each of the three Color Look-up Arrays. The remaining eight bits of data are an address that points to entries in the Overlay Look-up Table, whose use will be described later.

In 32-bit operation mode, the active bus access mode is selected by softswitches xC0704 and xC0705.

In 32-bit PIXEL mode the host processor accesses the Display Buffer in a pixel-by-pixel sequence. Four consecutive data bytes represent the Red, Green, Blue, and Overlay values of a single pixel. In this manner, the focus of buffer read/write operations is upon pixel reading and writing. 32-bit pixel mode is selected by the program PREP32.EXE.

32-bit PIXEL mode with overlay write-protect is an alternative form of 32-bit pixel mode which prevents software from inadvertantly updating the overlays, the fourth byte of each pixel value.

In 32-bit RGBO mode the host processor accesses the Display Buffer sequentially within one of the four Display Buffer areas. Consecutive data bytes update consecutive pixels sequentially in a single primary color or overlay buffer area.

In 32-bit CONCURRENT mode the host processor treats the 24-bit image area of the Display Buffer as an 8-bit per pixel image area. The host processor writes identical data to all three color areas for a given pixel. The board will display 256 colors to provide a pseudo-color display with full-pallete editing capability. Or, by using the 8-bit overlay, the user may expand the number of displayable colors to 64K.

In 8-bit CONCURRENT mode, the REVOLUTION board provides complete REVOLUTION 512 X 8 PIXEL mode emulation. This is the mode which is selected by the program PREP8.EXE. Similar to the 32-bit PIXEL mode, 8-bit PIXEL mode assigns consecutive data bytes to adjacent pixels in the memory map, up to the limit of 256K pixels. See figure 'F.'

GDC (Graphics Display Controller)

Addresses C000:0000 and C000:0001 are used to send commands and parameters to the GDC and to read data and the status register in the GDC. For a detailed discussion of the GDC, reference the NEC PD7220/GDC systems description (published by NEC Electronics U.S.A. Inc., Microcomputer Division).

Color Look-up Tables

The REVOLUTION 512 X 32 has two sets of Color Look-up Tables, one for 32-bit operation mode, and one for 8-bit operation mode.

In 32-bit operation mode, a 36-bit Color Look-up Table is organized as three 4096 (12-bit) X 8-bit arrays, creating a palette of nearly 16.8 million colors. The Look-up Tables begin at address C000:1000 and are divided into 16 pages of 256 entries per color gun. The active pages (one per gun) are selected by 4 bits of Overlay data through the Overlay Look-up Table (see the discussion for the Overlay Look-up Table, below). One of the 256 entries for the active page of each color array is selected by the 8 bits of Display Buffer data associated with that color array.

In 8-bit operation mode, a 24-bit Color Look-up Table is organized as three 256 X 8 arrays, again with a palette of nearly 16.8 million colors. These begin at address C000:0100.

Each byte of either Color Look-up Table may be set, under software control, to any of its 256 possible binary values. These will govern the intensity of the associated color gun from full off (byte value 0) to full on (byte value 255). The 256 intensities for each of the three guns combine to make a possible 16.8 million colors (256 x 256 x 256). In 32-bit operation mode, any number of these colors may be simultaneously displayed up to the maximum of 245,760 colors on a 512 X 480 pixel screen. (There are 245,760 pixels on a 512 X 480 display).

In 8-bit operation mode, the maximum display is 256 simultaneous colors.

Overlay Look-up Table

The Overlay Look-up Table is provided to add flexibility to the REVOLUTION 512 X 32 in its 32-bit operation mode. It is arranged as two 256 X 12 arrays. Each array is a complete page of overlay look-up. The active page is selected by softswitch C000:0706; only one page can be active at a given time.

For each pixel, the eight-bits of data in the Overlay Buffer point to a three-nibble (12-bit) entry in the active page of the Overlay Look-up Table. Each nibble is associated with one of the three color arrays and sets the high-order four bits of the twelve-bit address to that array. (The low-order eight bits come from the Display Buffer). These are the four bits which select one of sixteen pages of color look-up.

PREP32.EXE prepares the Overlay Look-up Table so that the Buffer behaves exactly as it did on the original version of the REVOLUTION 512 X 32. That is, as two pages of 4-bit overlay from which the active page is selected by softswitch C000:0706.

More detail about the Overlay Look-up Table is presented in Appendix "D."

Pixel Display

Pixel display from the REVOLUTION 512 X 32 is independent of the current Operation and Bus Access Modes. These modes control only the means of inputting data to the board. Once stored on the board, the data in the Red, Green, Blue, and Overlay Buffers is translated by the Overlay Look-up Table and Color Look-up Table to yield the correct color outputs from the board.

When displaying a pixel, the REVOLUTION 512 X 32 reads the Display Buffer at the four addresses for that pixel, one address each for the Red, Green, Blue, and Overlay Buffer areas. The data in the Overlay is output to the Overlay Look-up Table which selects one of sixteen pages in each color array of the Color Look-up Table. The data in the first three bytes of the pixel then point to addresses in the selected pages of the color arrays, one address per color array. The digital intensity values stored at those addresses are converted to analog signals which are then output from the board to the monitor color guns. In the monitor the Red, Green, and Blue signals are combined to produce the selected color for each pixel.

Softswitches

Software switches (softswitches) occupy the sixteen addresses from C000:0700 to :0707 and are set by passing a one-byte value to the required address. The most significant bit (MSB) of that byte enables the softswitch if "1" is passed, or disables the switch if "0" is passed. Generally, FFH may be passed for "enable" and 00H for "disable".

Switches :0700 through :0703 are used for setting ZOOM FACTOR in both 8- and 32-bit operation modes. In order to zoom, one must send an appropriate value to these switches and must also send a zoom command and zoom factor to the GDC. The appropriate command and zoom factor must be passed to the GDC (reference the GDC's manual) and the corresponding ZOOM FACTOR must be set in the four softswitches as tabulated below. The four MSB's of these switches combine to binarily represent a Zoom Factor from 1 to 16, which is equal to 1 + the complement of the binary value of the four bits.

ZOOM TABLE

	Magnification						
	1	**2**	**3**	**8**	**9**	**10**	**16**
Address							
C000:0700	FF	00	FF	00	FF	00	00
C000:0701	FF	FF	00	00	FF	FF	00
C000:0702	FF	FF	FF	00	FF	FF	00
C000:0703	FF	FF	FF	FF	00	00	00

In 32-bit operation mode, the remaining Softswitches are as follows:

Address	Function	Values		
		704	**705**	**Mode**
C000:0704	Selects IBM Bus	00	00	RGBO
C000:0705	Access Mode	FF	00	CONCURRENT
		00	FF	PIXEL
		FF	FF	PIXEL w/ write-protect
C000:0706	Overlay Page Select	00		Selects Page 0
		FF		Selects Page 1
C000:0707	Board Enable	00		Disables Board
		FF		Enables Board
C000:0708	Reserved.			
C000:0709	Reserved.			
C000:070A	Reserved.			
C000:070B	Reserved.			
C000:070C	Reserved.			
C000:070D	Reserved.			
C000:070E	Reserved.			
C000:070F	Selects Board Operation Mode	00		32-bit operation mode (default)
		FF		8-bit Operation Mode

In 8-bit Operation Mode, the softswitches are assigned the same functions as in 32-bit Operation Mode, with the following exceptions:

C000:0704	Must be:	FF		
C000:0705	Segment Select	**705**	**706**	**Segment**
C000:0706		00	00	0
		FF	00	1
		00	FF	2
		FF	FF	3
C000:070C	Must be:	FF		
C000:070D	Must be:	00		

In 32-bit operation mode, when the REVOLUTION 512 X 32 is enabled by softswitch C000:0707, the IBM processor is allowed direct access to the Display Buffer in whichever bus access mode is selected by softswitches C000:0704 and :0705. When the board is disabled, the IBM cannot access the Display Buffer.

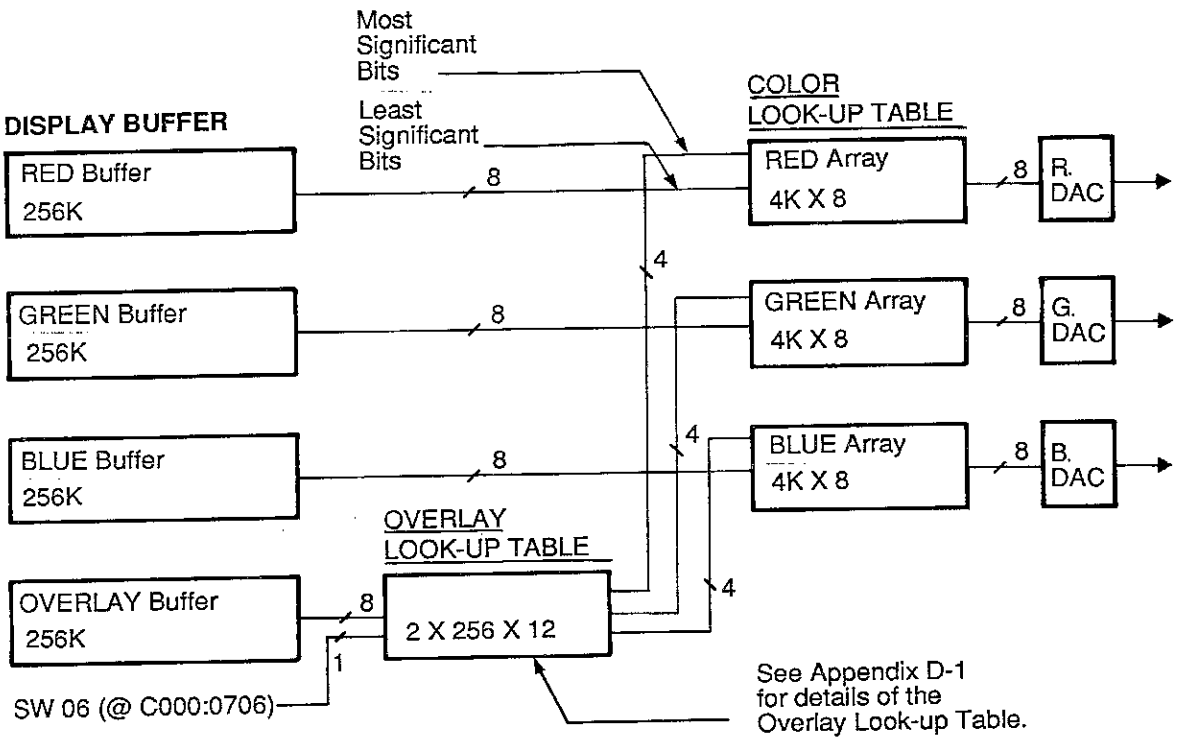
In 8-bit operation mode, the board is also enabled or disabled by softswitch C000:0707, but in 8-bit Pixel Mode, only.

Softswitch C000:070F selects either 32-bit or 8-bit operation mode. **On power-up, the REVOLUTION 512 X 32 defaults to 32-bit operation mode until PREP8.EXE is run.**

APPENDICIES

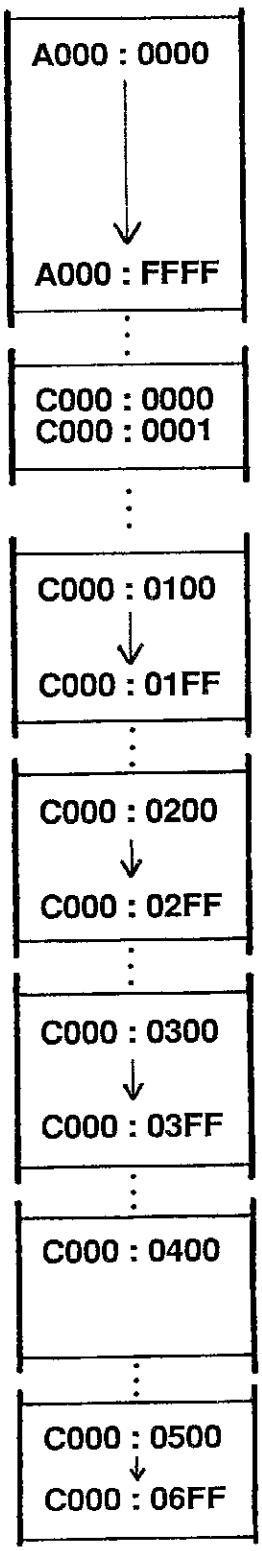
REVOLUTION 512 X 32

APPENDIX A
REVOLUTION 512 X 32 BLOCK DIAGRAM



REVOLUTION 512 X 32 BLOCK DIAGRAM

APPENDIX B
REVOLUTION 512 X 32 MEMORY MAP



DISPLAY BUFFER
64K of PC memory is mapped to 16 banks of REVOLUTION 512 X 32 memory. Each bank is 64K of RAM, for a total of 1 Megabyte. The active bank is selected by the Bank Select Register in 32-bit operation mode, or by softswitches C000:0705 and :0706 in 8-bit operation mode.

GRAPHICS DISPLAY CONTROLLER

COLOR LOOK-UP TABLE - 8-BIT OPERATION MODE

RED Array

GREEN Array

BLUE Array

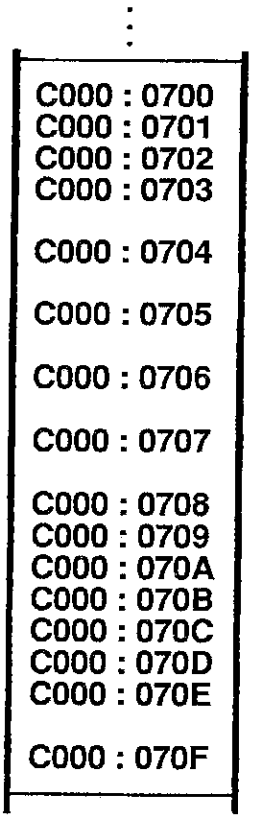
BANK SELECT REGISTER
Least significant nibble selects which of 16 Display Buffer banks is mapped to the PC bus when using 32-bit operation mode.

OVERLAY LOOK-UP TABLE

(Continues on next page)

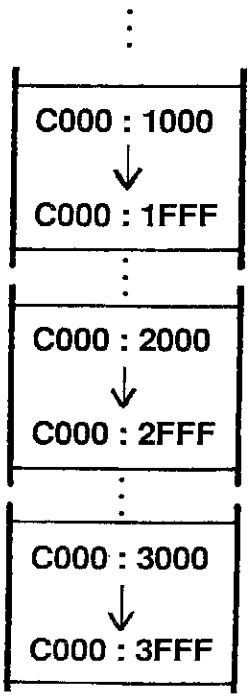
MEMORY MAP (Continued)

SOFTSWITCHES



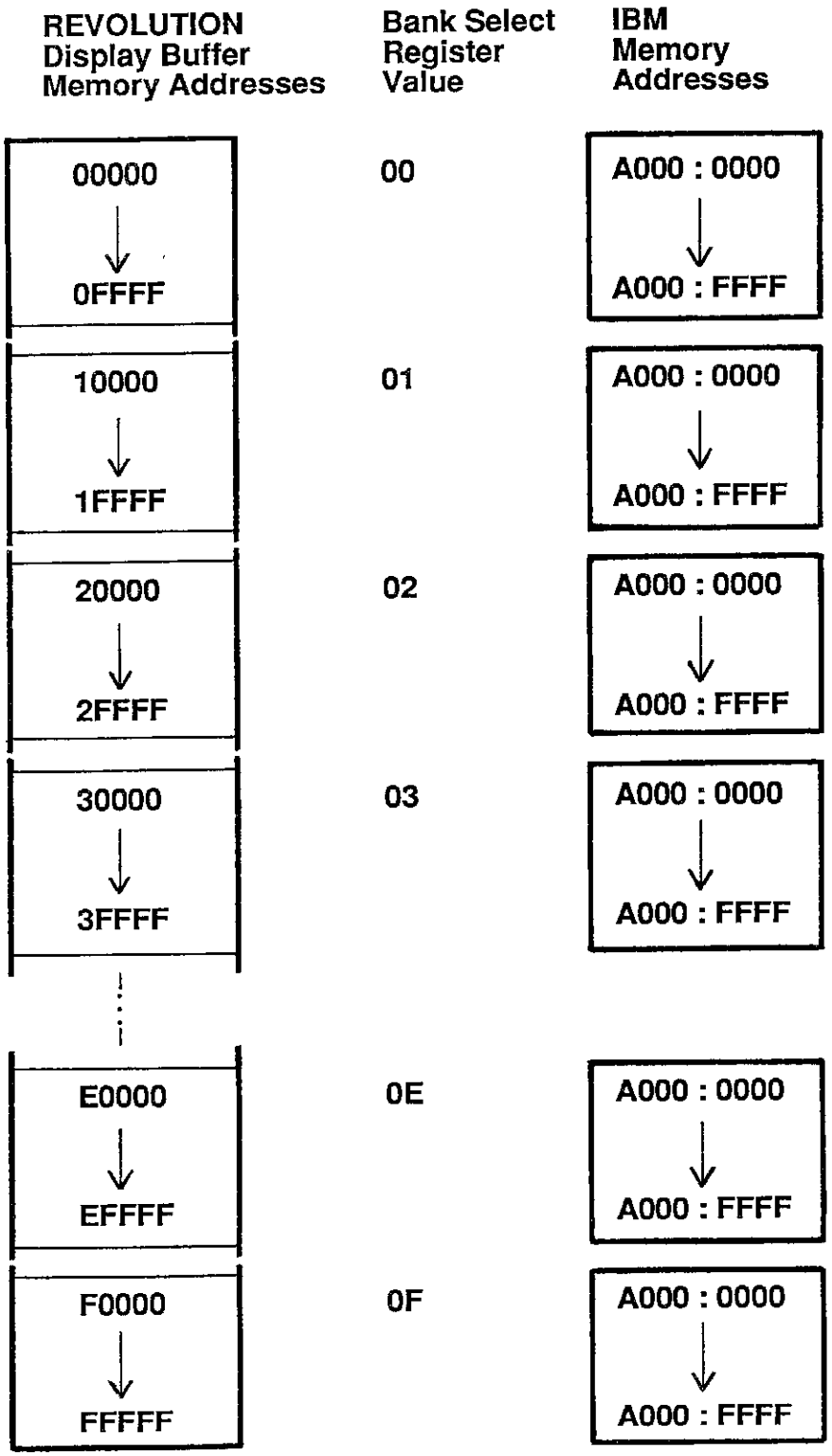
	32-Bit Operation Mode	8-Bit Operation Mode
C000 : 0700	Zoom	Zoom
C000 : 0701	Zoom	Zoom
C000 : 0702	Zoom	Zoom
C000 : 0703	Zoom	Zoom
C000 : 0704	Bus Access Mode Select (low bit)	Must be FFH
C000 : 0705	Bus Access Mode Select (high bit)	Segment Select (low bit)
C000 : 0706	Overlay LUT Page Select	Segment Select (high bit)
C000 : 0707	Board Enable	Board Enable
C000 : 0708	Reserved	Reserved
C000 : 0709	Reserved	Reserved
C000 : 070A	Reserved	Reserved
C000 : 070B	Reserved	Reserved
C000 : 070C	Reserved	Must be FFH
C000 : 070D	Reserved	Must be 00H
C000 : 070E	Reserved	Reserved
C000 : 070F	Mode Select (00H = 32-bit mode)	Mode Select (FFH = 8-bit mode)

COLOR LOOK-UP TABLE - 32-BIT OPERATION MODE

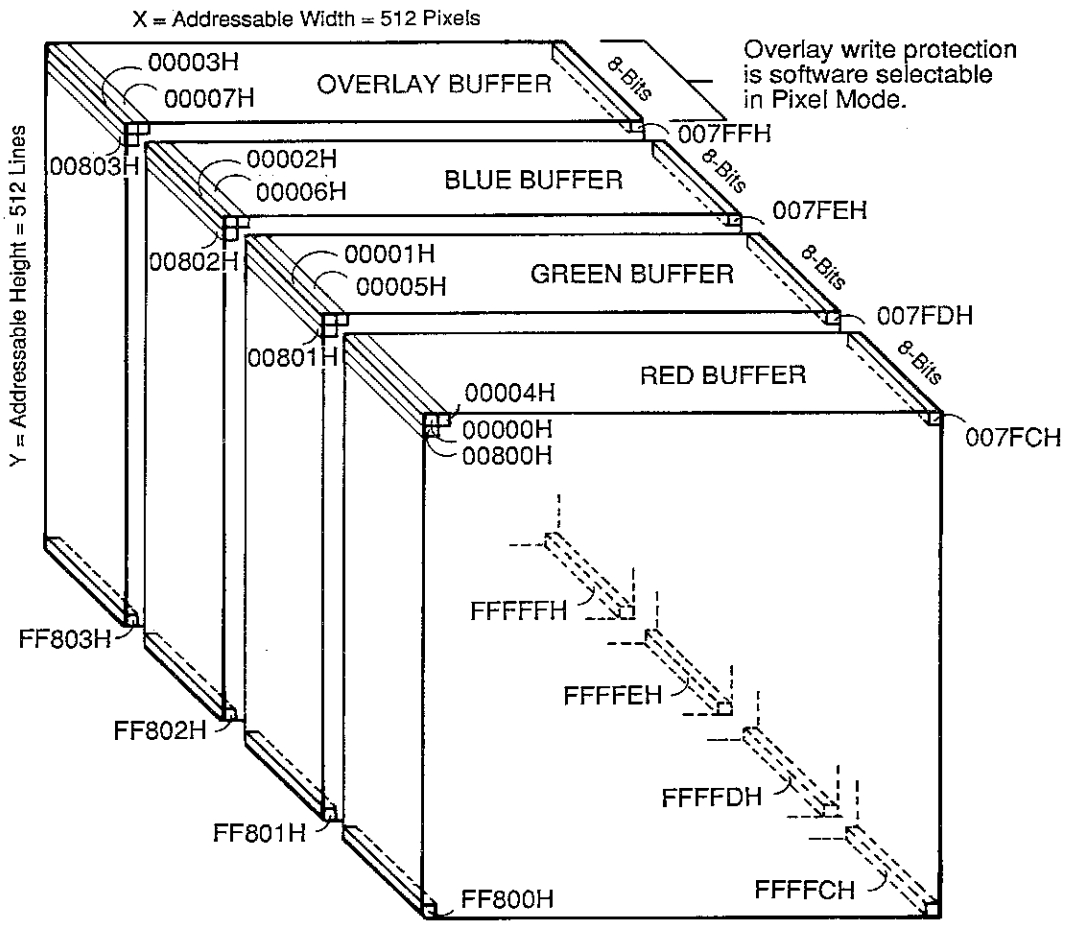


C000 : 1000 ↓ C000 : 1FFF	RED Array
C000 : 2000 ↓ C000 : 2FFF	GREEN Array
C000 : 3000 ↓ C000 : 3FFF	BLUE Array

DISPLAY BUFFER ADDRESSING



APPENDIX C
32-BIT PIXEL MODE



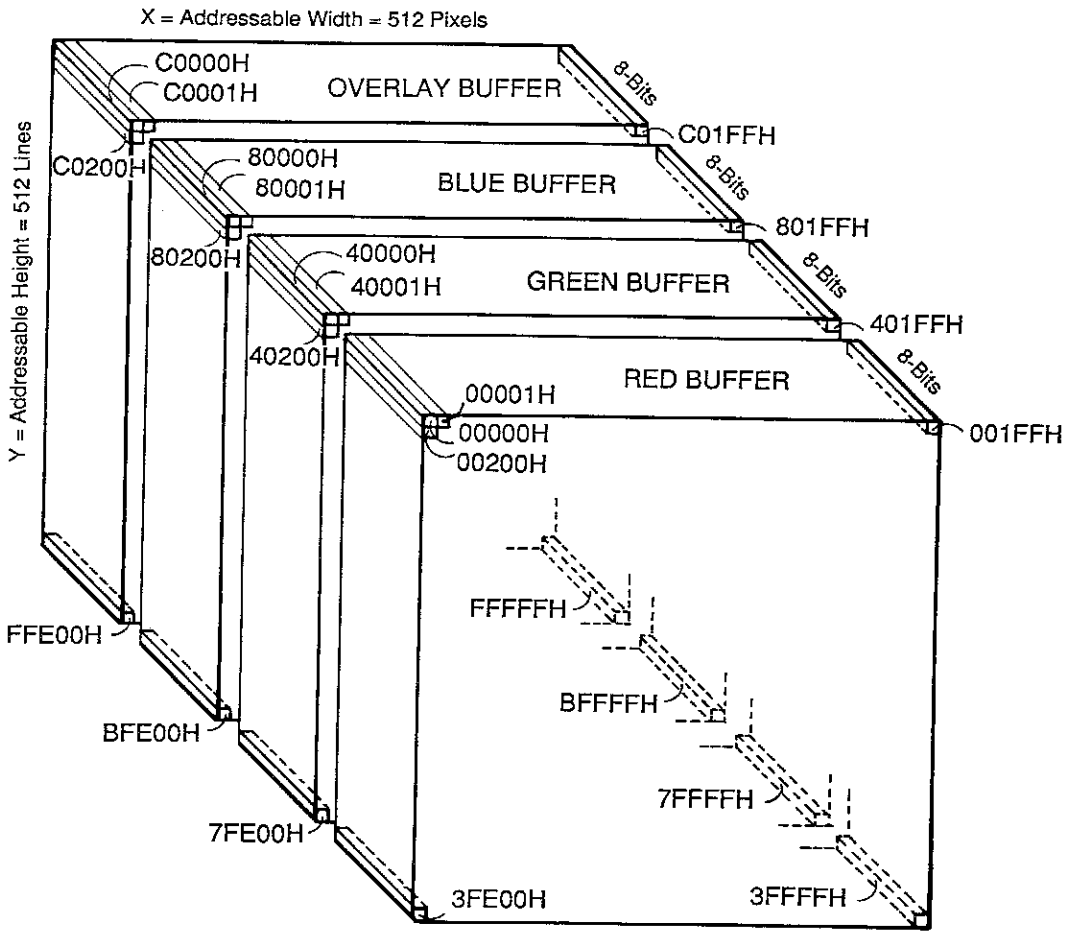
Softswitch Settings

C000 : 0704 = 00 (or FF for overlay write protection)
C000 : 0705 = FF
C000 : 070F = 00

Address for Red pixel data = 4 X [((Y-1) X 200H) + X - 1]
Address for Green pixel data = 4 X [((Y-1) X 200H) + X - 1] + 1
Address for Blue pixel data = 4 X [((Y-1) X 200H) + X - 1] + 2
Address for Overlay pixel data = 4 X [((Y-1) X 200H) + X - 1] + 3

32-BIT PIXEL MODE

32-BIT *RGBO* MODE



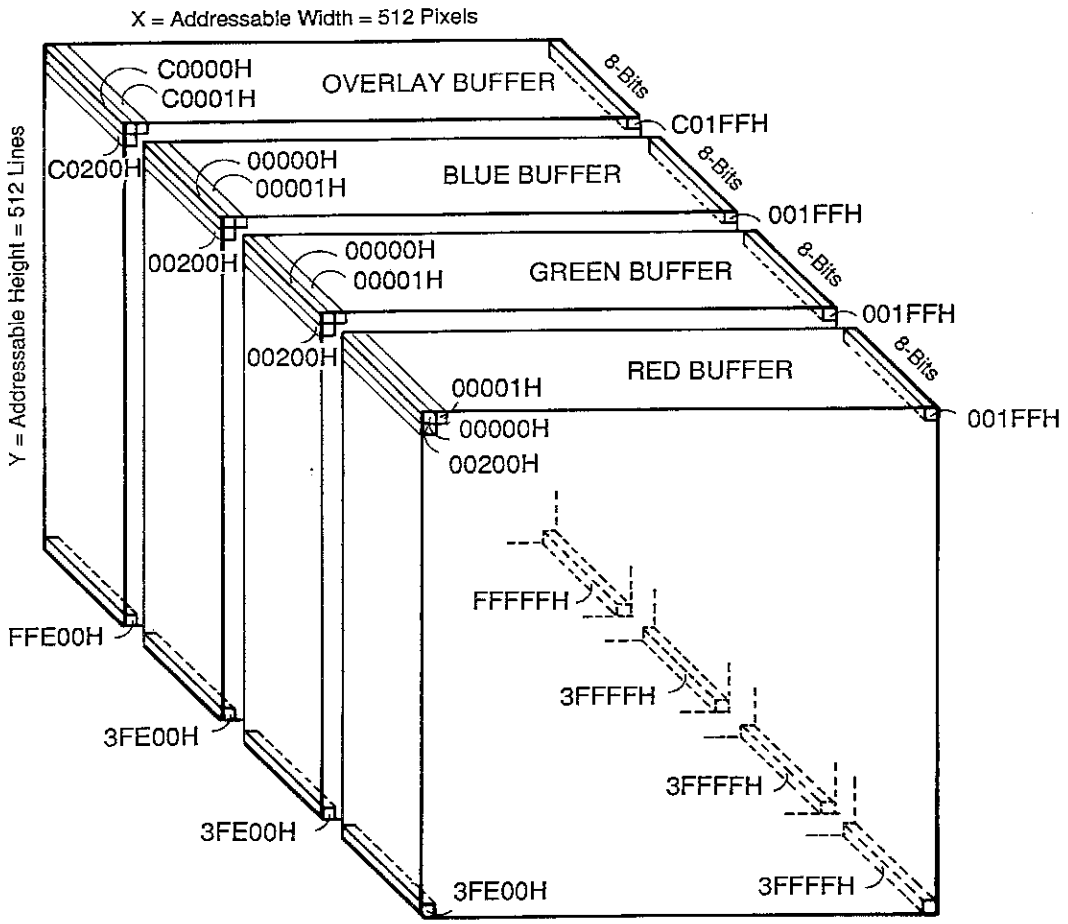
Softswitch Settings

C000 : 0704 = 00
C000 : 0705 = 00
C000 : 070F = 00

Address for Red pixel data = ((Y-1) X 200H) + X - 1
Address for Green pixel data = [Y-1) X 200H) + X - 1] + 3FFFFH
Address for Blue pixel data = [Y-1) X 200H) + X - 1] + 7FFFFH
Address for Overlay pixel data = [Y-1) X 200H) + X - 1] + BFFFFH

32-BIT RGB0 MODE

32-BIT CONCURRENT MODE



Softswitch Settings

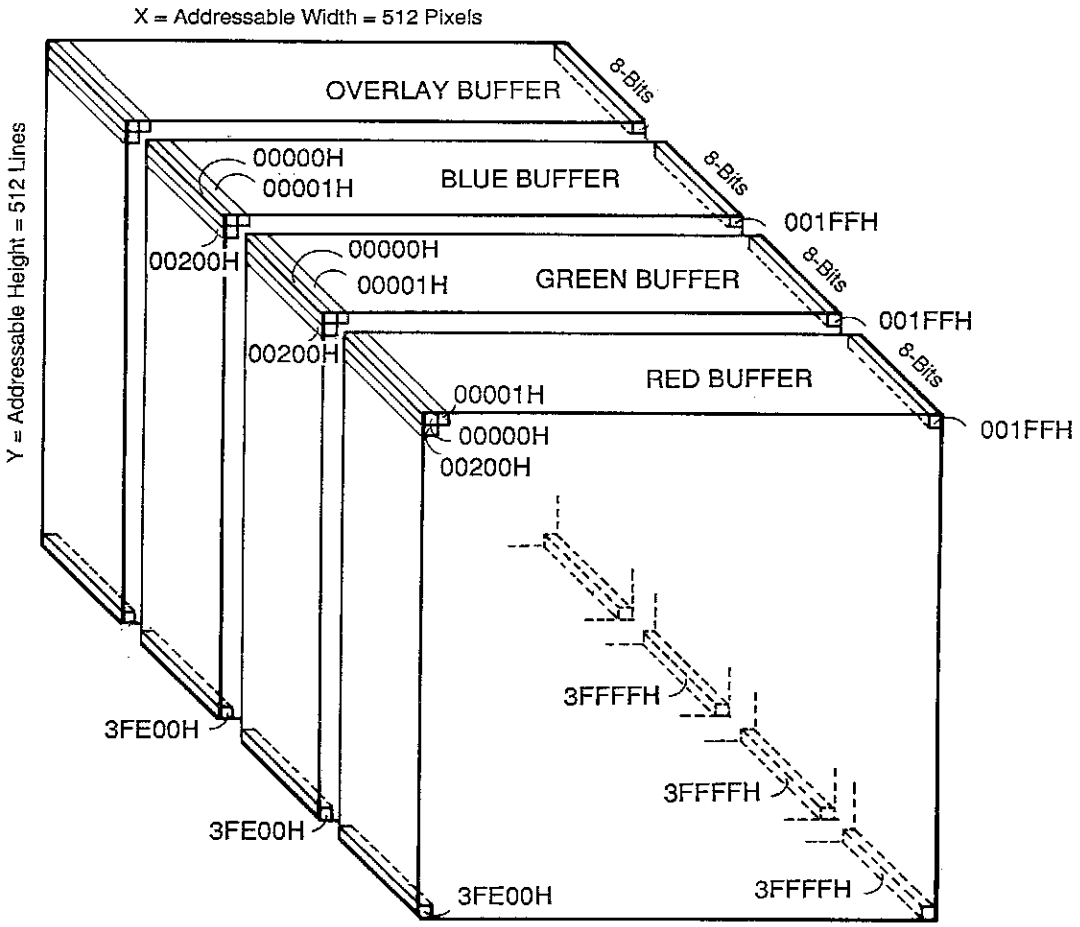
C000 : 0704 = FF
C000 : 0705 = 00
C000 : 070F = 00

Address for Red pixel data = ((Y-1) X 200H) + X - 1
Address for Green pixel data = ((Y-1) X 200H) + X - 1
Address for Blue pixel data = ((Y-1) X 200H) + X - 1
Address for Overlay pixel data = [Y-1) X 200H) + X - 1] + BFFFFH

Data written to addresses 40000H through BFFFFH will be written as if in RGBO Mode, but will be duplicated in all three color buffers at the same pixel location.

Data read from any address will be read as if the board were in RGBO Mode.

8-BIT CONCURRENT MODE (= 8-BIT PIXEL MODE)



Softswitch Settings

C000 : 0704 = FF
C000 : 0705 = 00
C000 : 070F = FF

Address for Red pixel data = ((Y-1) X 200H) + X - 1
Address for Green pixel data = ((Y-1) X 200H) + X - 1
Address for Blue pixel data = ((Y-1) X 200H) + X - 1

Addresses above 3FFFFH cannot be read or written, however the content of the Overlay Buffer will affect the display. You may modify the Overlay Buffer by changing to one of the 32-Bit Operation Modes, if required.

8-BIT CONCURRENT MODE (= 8-BIT OPERATION MODE)

APPENDIX D
OVERLAY LOOK-UP TABLE

MEMORY STRUCTURE

Address[1]	Word #[2]	Overlay Look-up Table[3]			
		Page 0		Page 1	
		ODD BYTE	EVEN BYTE	ODD BYTE	EVEN BYTE
		Unused | Blue	Green | Red	Unused | Blue	Green | Red
C000 : 0500	00	501	500	501	500
: 0502	01	503	502	503	502
: 0504	02	505	504	505	504
: 0506	03	507	506	507	506
: 0508	04	509	508	509	508
:	:	:	:	:	:
: 05FC	7E	5FD	5FC	5FD	5FC
: 05FE	7F	5FF	5FE	5FF	5FE
: 0600	80	601	600	601	600
: 0602	81	603	602	603	602
: 0604	82	605	604	605	604
:	:	:	:	:	:
: 06F6	FB	6F7	6F6	6F7	6F6
: 06F8	FC	6F9	6F8	6F9	6F8
: 06FA	FD	6FB	6FA	6FB	6FA
: 06FC	FE	6FD	6FC	6FD	6FC
: 06FE	FF	6FF	6FE	6FF	6FE

[1] "Addresses" are shown as hexadecimal values in IBM 'Segment:Offset' notation.

[2] "Word #" is a hexadecimal value which corresponds to one of the 256 Overlay Look-up Table entries.

[3] The table shows where data is read or written, depending upon which Overlay Look-up Table page is active (softswitch C000:0706) and whether the data address is odd or even. For example, with Overlay Look-up Table page 1 active, the data addressed by C000:0602 is the red and green data of Overlay Look-up Table entry 81. Red is in the least significant nibble, green in the most significant nibble. The least significant nibble of the data stored at C000:0603 is the blue data for the same entry, 81. The most significant nibble of C000:0603 is unused and is ignored.

OVERLAY LOOK-UP TABLE

MEMORY CONTENT WHEN EMULATING OLDER REVOLUTION 512 X 32's

To emulate earlier revisions of the REVOLUTION 512 X 32, load the Overlay Look-up Table with the following data and set softswitches according to the text presented earlier. The program PREP32.EXE does this for you automatically.

Address[1]	Word #[2]	Overlay Look-up Table[3]							
		Page 0				Page 1			
		ODD BYTE		EVEN BYTE		ODD BYTE		EVEN BYTE	
		Unused	Blue	Green	Red	Unused	Blue	Green	Red
C000 : 0500	00	X	0	0	0	X	0	0	0
: 0502	01	X	1	1	1	X	0	0	0
: 0504	02	X	2	2	2	X	0	0	0
: 0506	03	X	3	3	3	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 051E	0F	X	F	F	F	X	0	0	0
: 0520	10	X	0	0	0	X	1	1	1
: 0522	11	X	1	1	1	X	1	1	1
: 0524	12	X	2	2	2	X	1	1	1
:	:	:	:	:	:	:	:	:	:
: 053C	1E	X	E	E	E	X	1	1	1
: 053E	1F	X	F	F	F	X	1	1	1
: 0540	20	X	0	0	0	X	2	2	2
:	:	:	:	:	:	:	:	:	:
: 055E	2F	X	F	F	F	X	2	2	2
: 0560	30	X	0	0	0	X	3	3	3
:	:	:	:	:	:	:	:	:	:
: 06DE	EF	X	F	F	F	X	E	E	E
: 06E0	F0	X	0	0	0	X	F	F	F
: 06E2	F1	X	1	1	1	X	F	F	F
: 06E4	F2	X	2	2	2	X	F	F	F
:	:	:	:	:	:	:	:	:	:
: 06F8	FC	X	C	C	C	X	F	F	F
: 06FA	FD	X	D	D	D	X	F	F	F
: 06FC	FE	X	E	E	E	X	F	F	F
: 06FE	FF	X	F	F	F	X	F	F	F

[1] Addresses are shown as hexadecimal values in IBM 'Segment:Offset' notation.

[2] "Word #" is a hexadecimal value which corresponds to one of the 256 Overlay Look-up Table entries.

[3] Data entries required to emulate earlier revisions of the REVOLUTION 512 X 32 are shown in hexadecimal for each of the four nibbles of typical entries in the Overlay Look-up Table. "X" indicates that the data in the most significant nibble of the odd bytes is ignored.

OVERLAY LOOK-UP TABLE

MEMORY CONTENT WHEN EMULATING THE REVOLUTION 512 X 8

To emulate the REVOLUTION 512 X 8, load the Overlay Look-up Table with the following data and set softswitches according to the text presented earlier. The program PREP8.EXE does this for you automatically.

Address[1]	Word #[2]	Overlay Look-up Table[3]							
		Page 0				Page 1			
		ODD BYTE		EVEN BYTE		ODD BYTE		EVEN BYTE	
		Unused	Blue	Green	Red	Unused	Blue	Green	Red
C000 : 0500	00	X	3	2	1	X	3	2	1
: 0502	01	X	3	2	1	X	3	2	1
: 0504	02	X	3	2	1	X	3	2	1
: 0506	03	X	3	2	1	X	3	2	1
:	:	:	:	:	:	:	:	:	:
: 051E	0F	X	3	2	1	X	3	2	1
: 0520	10	X	3	2	1	X	3	2	1
: 0522	11	X	3	2	1	X	3	2	1
: 0524	12	X	3	2	1	X	3	2	1
:	:	:	:	:	:	:	:	:	:
: 053C	1E	X	3	2	1	X	3	2	1
: 053E	1F	X	3	2	1	X	3	2	1
: 0540	20	X	3	2	1	X	3	2	1
:	:	:	:	:	:	:	:	:	:
: 055E	2F	X	3	2	1	X	3	2	1
: 0560	30	X	3	2	1	X	3	2	1
:	:	:	:	:	:	:	:	:	:
: 06DE	EF	X	3	2	1	X	3	2	1
: 06E0	F0	X	3	2	1	X	3	2	1
: 06E2	F1	X	3	2	1	X	3	2	1
: 06E4	F2	X	3	2	1	X	3	2	1
:	:	:	:	:	:	:	:	:	:
: 06F8	FC	X	3	2	1	X	3	2	1
: 06FA	FD	X	3	2	1	X	3	2	1
: 06FC	FE	X	3	2	1	X	3	2	1
: 06FE	FF	X	3	2	1	X	3	2	1

[1] Addresses are shown as hexadecimal values in IBM 'Segment:Offset' notation.

[2] "Word #" is a binary value which corresponds to one of the 256 Overlay Look-up Table entries.

[3] Data entries required to emulate the REVOLUTION 512 X 8 are shown in hexadecimal for each of the four nibbles of typical entries in the Overlay Look-up Table. "X" indicates that the data in the most significant nibble of the odd bytes is ignored. In 512 X 8 Operation Mode, page 1 of the Red Color Array, page 2 of Green, and page 3 of Blue are used as the three color arrays which are addressed at locations C000:0100, :0200, :0300, respectively. See the Memory Map.

OVERLAY LOOK-UP TABLE

MEMORY CONTENT WHEN USING THE OVERLAY BUFFER AS A PSEUDO-COLOR DRAWING BUFFER.

This page shows how to load the Overlay Look-up Table to select between pseudo-color and true-color display. Select page 0 (zero) to display true-color and pseudo-color images simultaneously. Select page 1 to display only true-color images. With page 0 selected, true color is displayed when the Overlay byte for a pixel is set to 00H. Otherwise, pseudo-color is displayed according to the overlay data. This makes possible a true-color image with a pseudo-color window.

Address[1]	Word #[2]	Overlay Look-up Table							
		Page 0[3]				Page 1			
		ODD BYTE		EVEN BYTE		ODD BYTE		EVEN BYTE	
		Unused	Blue	Green	Red	Unused	Blue	Green	Red
C000 : 0500	0000 0000	X	0000	0000	0000	X	0	0	0
: 0502	0000 0001	X	1100	1000	1001	X	0	0	0
: 0504	0000 0010	X	1100	1000	1010	X	0	0	0
: 0506	0000 0011	X	1100	1000	1011	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 051E	0000 1111	X	1100	1001	1111	X	0	0	0
: 0520	0001 0000	X	1100	1010	1000	X	0	0	0
: 0522	0001 0001	X	1100	1010	1001	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 053C	0001 1110	X	1100	1011	1110	X	0	0	0
: 053E	0001 1111	X	1100	1011	1111	X	0	0	0
: 0540	0010 0000	X	1100	1100	1000	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 06DE	1110 1111	X	1111	1101	1111	X	0	0	0
: 06E0	1111 0000	X	1111	1110	1000	X	0	0	0
: 06E2	1111 0001	X	1111	1110	1001	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 06F8	1111 1100	X	1111	1111	1100	X	0	0	0
: 06FA	1111 1101	X	1111	1111	1101	X	0	0	0
: 06FC	1111 1110	X	1111	1111	1110	X	0	0	0
: 06FE	1111 1111	X	1111	1111	1111	X	0	0	0

[1] Addresses shown as hexadecimal values in IBM 'Segment:Offset' notation.

[2] "Word #" is a binary value which corresponds to one of the 256 Overlay Look-up Table entries.

[3] The "Page 0" data entries are shown as binary values. The bold digits correspond to the eight bits of the "Word Number". For convenience, the light-face digits are fixed. This arrangement allows the Overlay Buffer to select true-color for a given pixel by pointing to Overlay Look-up Table Word #0000 0000 (00H) or to select one of 255 pseudo-colors by pointing to Words # 0000 0001 (01H) through 1111 1111 (FFH). The Color Look-up Table Arrays pointed to by the Overlay Look-up Table are used as follows: Page 0 (zero) of each of the Color Arrays is loaded with a true-color palette. Pages 12 through 15 of the Blue Array are each loaded with 256 identical intensities, at the programmer's discretion. For example: all 256 entries of page 12 may be loaded with 00H, all 256 entries of page 13 with 55H, all 256 entries of page 14 with AAH, and all 256 entries of page 15 with FFH. The Red and Green Color Arrays, pages 8 through 15 may be loaded similarly. In this manner, the Overlay Buffer will control color at a given pixel location independent of the Red, Green, and Blue pixel values.

OVERLAY LOOK-UP TABLE

MEMORY CONTENT WHEN USING THE OVERLAY BUFFER FOR EIGHT ONE-BIT GRAPHIC OVERLAYS

This page shows how to load the Overlay Look-up Table to provide eight one-bit graphic overlays. Generally, the table is configured so that only one overlay bit per pixel will be set at a given time. A few exceptions to this rule are shown to illustrate conditions of two and three Overlay bits set for one pixel. Overlay Look-up Table entries of 0 (zero) imply that graphic overlay is not defined for the corresponding combination of Overlay bits, in which case the REVOLUTION board will display normal image data. This example uses only page 0 of the Overlay Look-up Table.

Address[1]	Word #[2]	Overlay Look-up Table							
		Page 0[3]				Page 1			
		ODD BYTE		EVEN BYTE		ODD BYTE		EVEN BYTE	
		Unused	Blue	Green	Red	Unused	Blue	Green	Red
C000 : 0500	0000 0000	X	0	0	0	X	0	0	0
: 0502	0000 0001	X	1	1	1	X	0	0	0
: 0504	0000 0010	X	2	2	2	X	0	0	0
: 0506	0000 0011	X	F	F	F	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 0508	0000 0100	X	3	3	3	X	0	0	0
: 050A	0000 0101	X	0	0	0	X	0	0	0
: 050C	0000 0110	X	0	0	0	X	0	0	0
: 050E	0000 0111	X	E	E	E	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 0510	0000 1000	X	4	4	4	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 0520	0001 0000	X	5	5	5	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 0540	0010 0000	X	6	6	6	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 0580	0100 0000	X	7	7	7	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 0600	1000 0000	X	8	8	8	X	0	0	0
:	:	:	:	:	:	:	:	:	:
: 06FA	1111 1101	X	1	2	3	X	0	0	0
: 06FC	1111 1110	X	0	0	0	X	0	0	0
: 06FE	1111 1111	X	0	0	0	X	0	0	0

[1]Addresses shown as hexadecimal values in IBM 'Segment:Offset' notation.

[2]"Word #" is a binary value which corresponds to one of the 256 Overlay Look-up Table entries.

[3]The "Page 0" data entries are shown as hexadecimal values and the Color Look-up Table Arrays pointed to by the Overlay Look-up Table are used as follows: Page 0 (zero) of each of the Color Arrays is loaded with a true-color palette. Pages 1 through 8 are loaded so that all 256 entries of each Color Array have the same value. For example, if the leftmost Overlay bit, only, is set to 1 and we wish that bit to specify a purple pixel, then all 256 entries in page 8 of the Red Color Array should be set to 7FH, all 256 entries in page 8 of the Green Array should be set to 00H, and all 256 entries in page 8 of the Blue Array should be set to 7FH. Colors may be assigned to the other combinations of Overlay bits accordingly. The combinations which point to pages E and F (entries 0000 0011 and 0000 0111) are examples of how multiple Overlay bit combinations might be interpreted. Another example is shown by entry 1111 1101 which shows different pages being used from each of the three Color Look-up Table Arrays.

Number Nine
Computer Corporation

REVOLUTION
VIDEO SPECIFICATIONS
AND
SYNC PARAMETERS

July, 1986

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REVOLUTION SYNC PARAMETERS

This table shows the sync (or initialization) parameters that the REVOLUTION SETUP program uses to initialize the fourteen standard REVOLUTION board configurations. These are the parameters used to generate the video frequencies in the "Video Specifications" table, preceding. Be careful to match both model number and displayable resolution when using the two tables together.

Addressable and displayable sizes are given in pixels, horizontal sync parameters are given in pixels, vertical sync parameters are given in lines, and softswitch settings are given in hexadecimal. "Board Type" is an index used internally by the SETUP program (versions 7.00 and later).

Model #:	111008	111008	211032	211032	211032	211032
Interlaced?	y	y	y	y	y	y
Addressable Width:	512	384	512	512	384	384
Displayable Width:	512	384	512	512	384	384
Displayable Height[1]:	484	572	484	484	572	572
Horizontal Front Porch:	24	32	24	24	32	32
Horizontal Sync:	40	32	40	40	32	32
Horizontal Back Porch:	48	32	48	48	32	32
Vertical Front Porch:	2	2	2	2	2	2
Vertical Sync:	3	3	3	3	3	3
Vertical Back Porch:	15	21	15	15	21	21
BOARD TYPE:	1	2	3	4	5	6
BITS/PIXEL:	8	8	8	32	8	32
Softswitch 4:			FF	00	FF	00
Softswitch 5:			00	FF	00	FF
Softswitch 6:			00	00	00	00
Softswitch C:			FF	[2]xx	FF	xx
Softswitch D:			00	xx	00	xx
Softswitch F:			FF	00	FF	00

Model #:	234008	232808	232008	231408	231508	231208
Interlaced?	y	n	y	y	y	y
Addressable Width:	1024	1024	1024	1024	1024	1024
Displayable Width:	1024	640	1024	768	768	640
Displayable Height:	768	480	484	572	484	484
Horizontal Front Porch:	48	48	48	24	24	24
Horizontal Sync:	80	80	80	72	56	40
Horizontal Back Porch:	80	80	96	80	56	48
Vertical Front Porch:	3	3	2	2	2	2
Vertical Sync:	3	3	3	3	3	3
Vertical Back Porch:	16	16	15	21	15	15
BOARD TYPE:	7	8	9	10	11	12
BITS/PIXEL:	8	8	8	8	8	8

Model #:	230908	231008
Interlaced?	y	y
Addressable Width:	1024	1024
Displayable Width:	512	512
Displayable Height:	572	484
Horizontal Front Porch:	24	24
Horizontal Sync:	40	40
Horizontal Back Porch:	56	48
Vertical Front Porch:	2	2
Vertical Sync:	3	3
Vertical Back Porch:	21	15
BOARD TYPE	13	14
BITS/PIXEL	8	8

[1]"Displayable Height" in this table differs from the height under "Displayable Resolution" in the preceding table because of programming peculiarities of the NEC 7220 Graphics Display Controller.
[2]"xx" = data not required and not used.