

**DATAMAX UV-1R
Zgrass GRAPHICS SYSTEM**

OPERATOR'S MANUAL

January 4, 1983

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References are made throughout this documentation to the equipment listed below. We hereby acknowledge use of these names and/or trademarks in this publication.

-ADM 5 Dumb Terminal Video Display Unit	Lear Siegler, Inc. Data Products Div. Anaheim, CA
-Televideo 910 Terminal	Televideo Systems, Inc. Sunnyvale, CA
-Micropolis Disk Drive	Micropolis Corporation Canoga Park, CA
-Bit Pad One Data Tablet/Digitizer	Summagraphics Corporation Fairfield, CT
-Datamax DFD-1 Dual Floppy Drive; WD-1 Winchester or WFD-1 Winchester/Floppy Disk Drive	Datamax, Inc. Elk Grove Village, IL
-Epson MX 80 Printer	Epson America, Inc. Torrance, CA
-CP/M (Control Program Monitor)	Digital Research Pacific Grove, CA

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OPERATOR'S MANUAL**

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DATAMAX UV-1R Zgrass GRAPHICS SYSTEM OPERATOR'S MANUAL

1. INTRODUCTION

1.1 The System

The Datamax UV-1R Zgrass Graphics System is a highly interactive, dedicated micro-computer color graphics system designed to easily produce visuals in motion. The UV-1R (University Version 1 Rack-mount) hardware is Z80 microprocessor-based. The Zgrass (Z80 GRAPHICS Symbiosis System) software is both a high-level computer graphics language and a sophisticated operating system. The EPROM (Eraseable Programmable Read Only Memory) firmware houses Zgrass and allows for easy software updates. The system's heritage derives from video arcade games, and the high-speed animation "tricks" so easily programmed on this computer are a result of the development of video game technology and custom video chips.

1.2 The Operator's Manual & Supporting Documentation

The Datamax UV-1R Zgrass Graphics System Operator's Manual has been designed to function not only as a guide for initial set up of the system, but also as a reference manual useful during routine operation of the system.

The TABLE OF CONTENTS doubles as a QUICK REFERENCE section, listing all section headings. Detailed instructions, descriptions, and appropriate illustrations are presented in the body of the manual to guide the user. The TROUBLESHOOTING section provides tips for solving problems. The INDEX OF SYSTEM TESTS locates all the testing programs (macros) contained within the body of the manual and explains how to use the UTILITY DISK to load and run these tests.

References are made throughout this manual to the following additional supporting documentation of the system:

The Datamax UV-1R Zgrass Lessons - The lessons were designed to aid the interested novice in learning how to control the system and create useful custom software.

The Datamax UV-1R Zgrass Glossary - The glossary defines and demonstrates commands and terms necessary for the use of the Zgrass language.

DATAMAX UV-1R Zgrass GRAPHICS SYSTEM

2. HARDWARE FEATURES

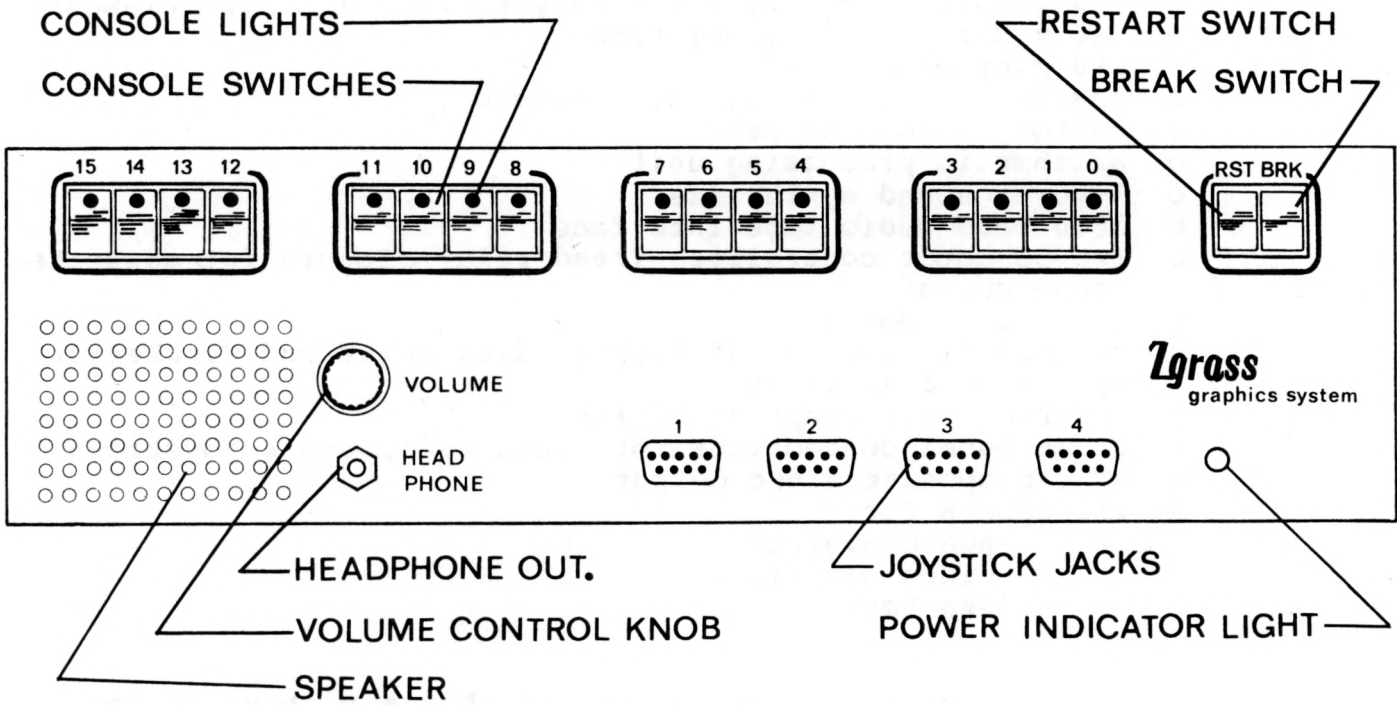
2.1 System Specifications

- o Zgrass firmware: 32K EPROM
- o 32K user RAM expandable to 64K for CP/M compatibility
- o 256K screen RAM: 16 screen pages of 16K bytes each, 12 of which may also be used for solid state disk cache
- o 256 possible colors, 4 colors per pixel (picture element)
- o 320 x 201 x 2 bit resolution
- o Z80 microprocessor
- o custom I/O (Input/Output) processor
- o custom video processor
- o arithmetic processing unit
- o 3-voice sound synthesizer
- o 1800 baud audio tape interface
- o two DC motor controllers (reed relay closure for cassette tape units)
- o two RS232C ports
- o capability for 5-1/4" floppy disk drive and Winchester-type hard disk drive
- o interface for graphics tablet
- o front panel connections for headphones, and 4 joysticks
- o NTSC composite video output
- o interfaces for:
 - RGB Converter
 - Video Digitizer
 - Gen Lock

NOTE: Specifications subject to change without notice.

2. HARDWARE FEATURES - Continued

FRONT PANEL ILLUSTRATION



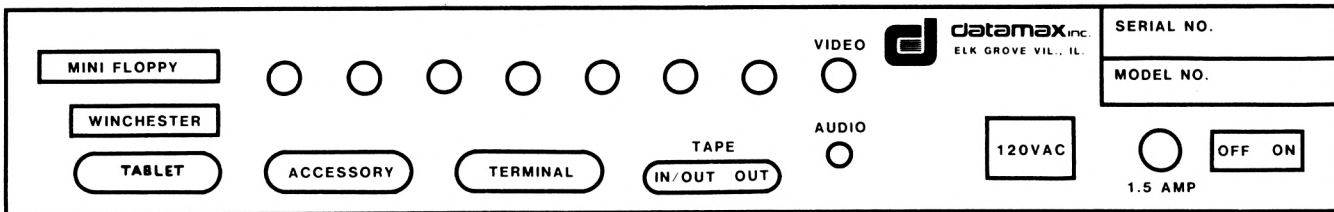
2. HARDWARE FEATURES - Continued

2.2 Front Panel Feature Detail

- 1) **CONSOLE LIGHTS** (16) - Assigned numbers 0-15, user-programmable on 2 different output ports (see **PORT** in **GLOSSARY**).
- 2) **CONSOLE SWITCHES** (16) - Assigned numbers 0-15, user-programmable on 2 different input ports (see **PORT** in **GLOSSARY**).
- 3) **RESTART SWITCH** (RST - leftmost of 2 red switches) - Same as **RESTART** command: clears user memory (RAM), and resets system to default colors if "Y" is typed in response to prompt on terminal. In the event of accidental restart, "N" response avoids the clearing of user memory.
- 4) **BREAK SWITCH** (BRK - rightmost of 2 red switches) - Same as **RESTART SWITCH** except that colors are not reset; same prompts and responses on terminal.
- 5) **HEADPHONE OUT** (1/4" phone jack) - Monaural, 8 ohms impedance, cuts out speaker, volume controlled by volume control dial; monitors audio output of three-voice synthesizer accessed via **PORT** command (see **GLOSSARY**).
- 6) **VOLUME CONTROL KNOB** - Controls audio output gain of headphone and speaker.
- 7) **SPEAKER** - Monitors audio output of three-voice synthesizer accessed via **PORT** command (see **GLOSSARY**). Speaker volume controlled by volume control dial; speaker disabled when headphone output is used.
- 8) **JOYSTICK JACKS** (four DB 9S joystick sockets) - Accessed as user-programmable device variables (see **JOYSTICK** and **DEVICE VARIABLES** in the **GLOSSARY**).
- 9) **POWER INDICATOR LIGHT** - Indicates status of power switch (located on rear panel).

2. HARDWARE FEATURES - Continued

REAR PANEL ILLUSTRATION



2.3 Rear Panel Feature Detail

- 1) **MINI FLOPPY** (34-pin connector) - Interface to connect 5-1/4" dual floppy drive.
- 2) **WINCHESTER** (26-pin connector) - Interface to connect 5-1/4" Winchester-type hard disk drive.
- 3) **TABLET** (DB 25S connector) - Parallel interface for graphics tablet currently compatible with Summagraphics Bit Pad One. Any other tablet uses accessory RS232C interface with user-developed software.
- 4) **ACCESSORY** (DB 25S connector) - RS232C serial interface to connect disk drive, printer, plotter, modem, additional computer, etc. See BAUD RATE SELECTION (Sec. 4.3.1) for instructions on setting baud rate; also see RS232 in GLOSSARY. *AND PORTS*
- 5) **TERMINAL** (DB 25S connector) - RS232C serial interface to connect terminals. To set baud rate, see BAUD RATE SELECTION (Sec. 4.3.1). See TERMINAL and RS232 in the GLOSSARY for instructions on setting editor control keys to your terminal and your taste. NOTE: The terminal used with the UV-1R must have both upper and lower case character capability.

2. HARDWARE FEATURES - Continued

2.2 Rear Panel Feature Detail - (Continued)

- 6) **TAPE** (two 1/8" mini phone jacks and two sub-mini phone jacks) - Mini jacks for audio data IN/OUT and OUT at 1800 baud rate and sub-mini jacks for remote motor trigger of DC signals. The motor controllers (reed relay closures rated at 1/2-amp, 100 volt DC, 500 ohms contact resistance) can be used to trigger other devices, such as film cameras, time lapse videotape recorders, etc. See PORT in GLOSSARY for direct program control of motor switch. See AUDIOTAPE STORAGE (Sec. 5.6 of this manual) for connections and procedures.
- 7) **VIDEO** (BNC connector) - NTSC composite out, RS 170; 1 volt P-P, 75 ohms impedance. Outputs composite, NTSC standard video to video monitor, videotape recorder, switcher, etc.
- 8) **AUDIO** (RCA phono connector) - Line audio out, approximately 1 volt P-P, 200 ohms impedance or higher. Output audio from three-voice synthesizer, accessed via PORT command (see GLOSSARY).
- 9) **120 VAC** (3-prong plug) - AC in, 110-125 V, 60 Hz.
- 10) **1.5 AMP** - Fuse; MDA-1.5 amp.
- 11) **OFF ON** - Power switch; On/Off status of the unit is indicated by the red power indicator light on the front panel.
- 12) **EXTRA HOLES** - The extra holes in the rear panel are for interfacing the RGB Converter, the Video Digitizer, and Gen Lock

3. INITIAL SET UP AND SYSTEM POWER-UP

Before configuring your UV-1R Zgrass Graphics System, consider your working environment. To avoid overheating the unit, set it up in a cool room. Always allow enough open space around the unit for adequate ventilation. Air is taken in from the left side of the unit, then forced out through the back panel by the fan. Be sure that there are no obstructions that might block the air flow and lead to overheating.

In order to reduce the possibility of static electricity interference, it is strongly recommended that you place an anti-static mat under your chair.

Note that the interface baud rates of your terminal and accessory are set to 19200 and 600, respectively, unless otherwise specified. If your peripherals require different settings, see BAUD RATE SELECTION (Sec. 4.3.1).

In general, all peripheral connections are made externally and there will be no need for you to access the internal components of the UV-1R. If it is absolutely necessary to access the internal components, **FIRST DISCONNECT ALL POWER CORDS**. Even if the UV-1R power switch is off, there is still live 120V inside the chassis when the power cord is attached.

3.1 Connection of Peripheral Devices

See PERIPHERAL DEVICE CONFIGURATION (Sec. 5) for instructions on making appropriate connections between the UV-1R, the terminal, video display device, etc., and then proceed with System Power-Up.

3.2 Plug In Power Cord

With the power switch on the rear panel OFF, plug the power cord supplied with the unit into the AC IN jack on the rear panel. Plug the power cord into a 3-wire AC grounded outlet supplying 120V at 60 HZ with nominal 15 amp. This should be a dedicated circuit for the UV-1R system only.

3. INITIAL SET UP AND SYSTEM POWER-UP - Continued

3.3 Power-On Terminal and Display Device

Power-on your terminal and display device (video or RGB monitor). For specific instructions on how to turn your terminal on, see Sec. 5.2.

3.4 Power-On UV-1R

When the terminal and display devices are warmed up (about 5-10 seconds), power-on the UV-1R. At system start-up, always verify that the fan at the rear of the unit is blowing air out of the unit. If there is no air flow, turn the unit off and see TROUBLESHOOTING (Sec. 6) in this manual.

3.5 Verify System Power-Up

When the UV-1R is powered-up, the red power indicator will light up on the front panel. Press the RST (restart) switch on the front of the UV-1R. The display device will display a white screen and the terminal will flash this message:

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This is the official copyright notice of the Zgrass software residing in the EPROM firmware. The terminal will clear and then display:

```
Zgrass V*.*  
^C  
>
```

The "*.*" of "v*.*" will be replaced with the version number of your unit's Zgrass software. The next line indicates that a Control C has been generated and the last line displays the Zgrass > prompt. The prompt indicates that the system is ready for input.

Press the RST switch on the UV-1R front panel. The console lights will blink and the terminal will prompt you with:

ERASE ALL? (Y OR N)

respond by pressing the Y key. This erases or clears all of user memory.

3. INITIAL SET UP AND SYSTEM POWER-UP - Continued

3.6 Animation System Tests

SYSTEM TEST 1: GRAPHICS

To run a system test animation called NICE BOXES, type:

NB

Press the RETURN key. An animated display of colored boxes will appear on the display device; when the test has been completed, the Zgrass > prompt will appear on the terminal.

NOTE: Follow all typed commands on the terminal by pressing the RETURN key.

If you type:

NB

again, the boxes will erase themselves and clear the screen.

SYSTEM TEST 2: SCREENS

Now type:

NC

Press the RETURN key and a 16-screen animation of circles and squares will be drawn on the display device. When this test has cycled a few times, interrupt it by holding down the CONTROL key while pressing the C key. Throughout system documentation, this process of halting a program is referred to as CTRL+C or simply ^C.

^C

To complete this test, you must reset the screens and default colors by pressing CTRL+B:

^B

To clear the screen, type:

CLEAR

Then, press RETURN. If the system displays the tests as described above, the system has been successfully powered up.

3. INITIAL SET UP AND SYSTEM POWER-UP - Continued

3.7 What To Do If System Fails To Come Up

If any device fails to come up, see PERIPHERAL DEVICES (Sec. 5) and TROUBLESHOOTING (Sec. 6) in this manual before proceeding.

4. UV-1R Zgrass SYSTEM CONFIGURATION

This section provides an overview of the UV-1R, including the hardware, baud rate selection, and the use of the hardware ports.

4.1 Accessing Internal Components

Occasionally, it may be necessary for you to handle the main printed circuit (PC) boards contained in the card rack. For instance, to change baud rate settings of the RS232C ports, you must access the I/O Logic Board; to make a software update by changing the EPROMS, you must access Memory Board 2.

4.1.1 Opening the Cover on the UV-1R

WARNING!! Before you open the cover of the UV-1R, disconnect all power cords. When the power cord is attached, live 120V is still running in the chassis, even if the power switch is off.

To remove the cover, remove the ten screws on the top and the three on the rear above the row of connectors. Always replace the cover before re-connecting the power cord.

4.1.2 Handling Internal Components

WARNING! Extreme care must be exercised in handling internal system hardware components. PC boards can be damaged by improper handling, such as fingerprinting the gold plating on edge connectors, exposing the board to static electricity, or unduly flexing the board. Handling of internal hardware components is advised only when absolutely necessary.

4.2 Card Rack

This is the slotted mounting device designed to contain up to six PC boards. It is mounted on the front wall, with its opening facing the rear of the unit. Instructions for accessing and re-inserting PC boards follow. (Refer to board illustrations for highlighted information relating to each board.)

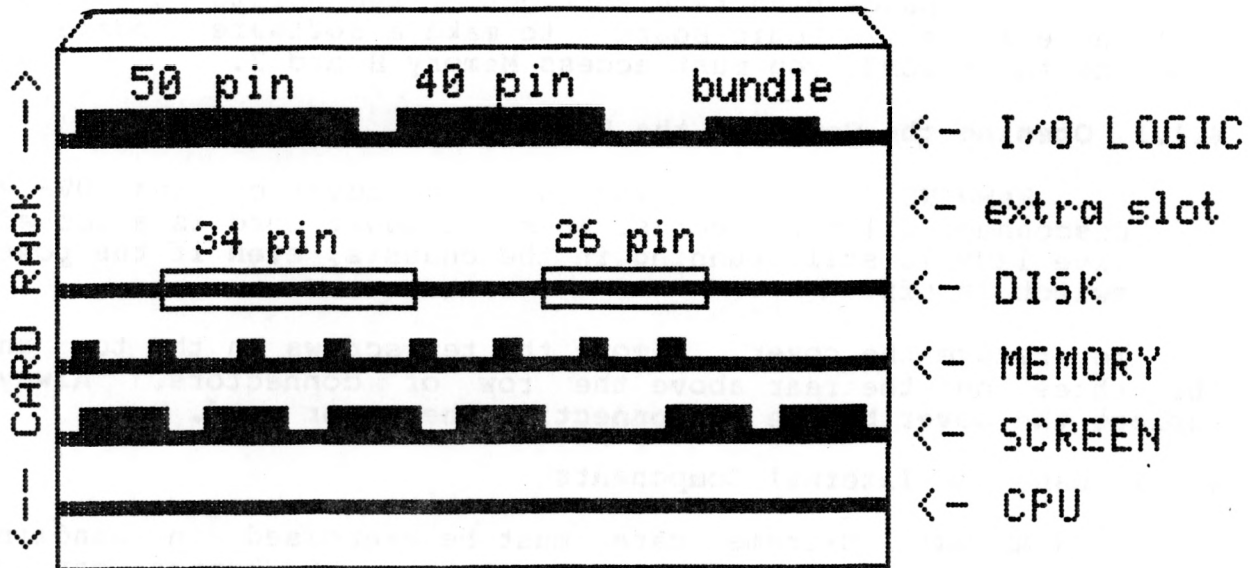
4.2.1 Accessing and Re-Inserting PC Boards in the Card Rack

TO ACCESS a board, pivot the card ejectors (white plastic tabs) located at the exposed corners of the board away from each other to eject the board from the card cage. Then, grasp the ejectors and pull the board straight back, away from the card cage, only as far as necessary to access a designated area of the board. DO NOT disconnect the cables attached to the board unless specifically instructed to do so by a board-handling procedure.

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.2.1 Accessing and Re-Inserting PC Boards - Continued

CARD RACK ILLUSTRATION



This image was generated using the PAINT program.

In the event you find it necessary to completely remove a board from the card cage, you must disconnect the 40-pin ribbon cable connecting the I/O Logic Board to the back panel board. Instructions for doing so are contained in MEMORY BOARD 2 (Sec. 4.5).

TO RE-INSERT a board, carefully orient and re-connect any cables disconnected to access the board. If it has been necessary to fully remove the board from the rack, align it in the proper slot of the rack, component side up, being sure to

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.2.1 Accessing and Re-Inserting PC Boards - Continued

insert the board into the metal tracks on either side of the card rack, and then re-connect any cables disconnected to access the board. Apply firm pressure to the card ejectors and push the board straight back into the card rack until all boards line up. You will notice a little resistance in seating the edge of the board in the socket at the far end of the card rack. Gently rocking the board by applying pressure first to one card ejector and then to the other will help properly seat the board.

Remember to reconnect the ribbon cable from the I/O Logic Board to the back panel board if you disconnected it. **Be sure to check this connection!** Both rows of pins must be connected and no pins should be exposed on either side of the connector.

If there is no response on the terminal after system power-up, turn off the unit, unplug the power cord, and check this connection.

NOTE: All boards are inserted component side up, with the 100-pin edge connector inserted into the card rack first.

4.3 I/O Logic Board (Baud Rate Switch)

This board is the interface between the microprocessor and the peripheral world. The DIP switch for setting baud rates of the two RS232C hardware ports is located on this board. This board is distinguished by the cables connected to the top of the board near the exposed edge. The leftmost connection is a 50-pin ribbon cable leading to the front panel. The middle connection is a 40-pin ribbon cable leading to the rear panel. The rightmost connection is a bundled cable harness leading to the Video Board located on the floor of the unit.

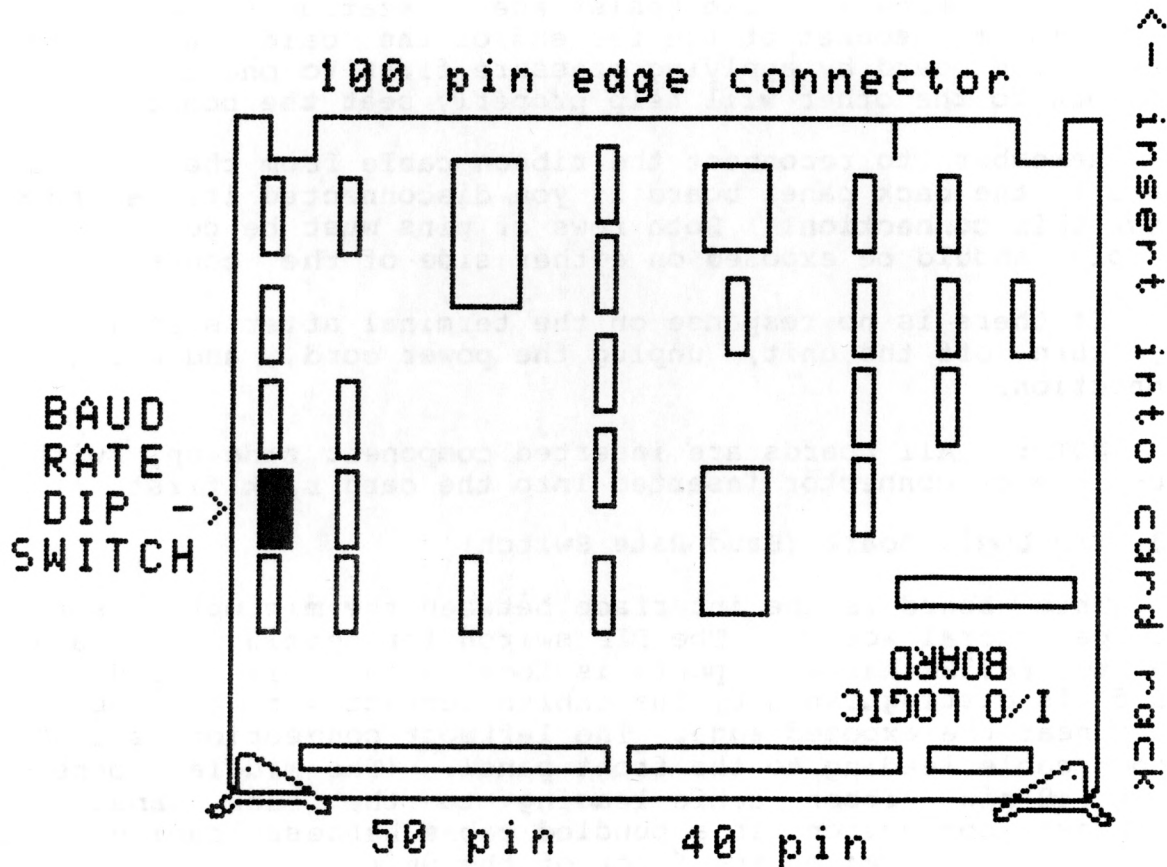
VERIFY THAT AC IN POWER IS UNPLUGGED BEFORE PROCEEDING!!

To access the DIP switch on the I/O Logic Board, carefully remove the 50-pin cable (the leftmost cable) by grasping the cable connector and gently pulling straight up. Gentle prying with a small screw driver will help lift the cable connector from its mating connector which is soldered to the board. **DO NOT** pull directly on the ribbon cable as this may separate it from its connector.

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.3 I/O Logic Board - Continued

I/O LOGIC BOARD ILLUSTRATION



4.3.1 Baud Rate Selection

To enable the UV-1R Zgrass Graphics System to communicate properly with such peripherals as a terminal, printer, plotter, modem, etc., you must set the eight baud rate selector switches located on the I/O Logic Board DIP switch as specified for each peripheral. The factory pre-sets the baud rate selector switches for the terminal to 19200 and the accessory port to 600. If these settings are appropriate for your devices, there is no need to re-set the baud rates or to remove this board.

VERIFY THAT AC IN POWER IS UNPLUGGED BEFORE PROCEEDING!!

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.3.1 Baud Rate Selection - Continued

See Section 4.1 for instructions on opening the cover of the UV-1R unit and the illustration in Section 4.3 (I/O Logic Board) for location of the DIP switch on the I/O Logic Board. Spread the card ejectors and gently pull the board out of the rack far enough to disconnect the leftmost ribbon cable connector (be careful not to bend any pins!). Pull the board out just far enough to access the baud rate selector switches on the DIP switch which look like this:



BAUD RATE SELECTOR SWITCHES
ON THE I/O LOGIC BOARD DIP
SWITCH

The bank of switches containing switches 1-4 controls the RS232C accessory interface; the bank containing switches 5-8 controls the terminal interface. The following table lists the switch settings for baud rates ranging from 50 to 19200. The setting for a specific baud rate is the same for either terminal or accessory, just set the proper bank of switches.

BAUD RATE	SWITCH SETTINGS			
	A	B	C	D
	1	2	3	4 (ACCESSORY)
	5	6	7	8 (TERMINAL)
50	ON	ON	ON	ON 0000
75	OFF	ON	ON	ON 1000
110	ON	OFF	ON	ON 0100
134.5	OFF	OFF	ON	ON
150	ON	ON	OFF	ON
300	OFF	ON	OFF	ON
600	ON	OFF	OFF	ON
1200	OFF	OFF	OFF	ON

ON = GROUNDED = 0
OFF = +5V = 1

---continued on next page---

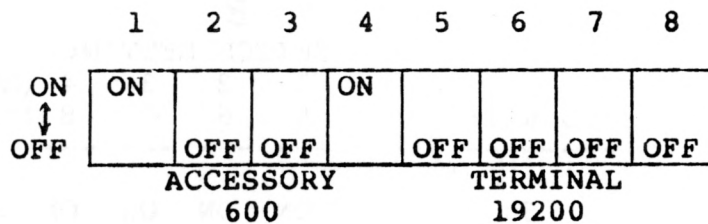
4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.3.1 Baud Rate Selection - Continued

BAUD RATE	SWITCH SETTINGS							
	1	2	3	4 (ACCESSORY)	5	6	7	8 (TERMINAL)
1800	ON	ON	ON	OFF				
2000	OFF	ON	ON	OFF				
2400	ON	OFF	ON	OFF				
3600	OFF	OFF	ON	OFF				
4800	ON	ON	OFF	OFF				
7200	OFF	ON	OFF	OFF				
9600	ON	OFF	OFF	OFF				
19200	OFF	OFF	OFF	OFF				

The recommended baud rate for the terminal is 19200, although 9600 is acceptable. The higher the baud rate, the faster data is transferred between the UV-1R and the terminal. Baud rates for accessories vary depending on device requirements. For example, the Epson printer with 2K buffer can receive data at several baud rates, including 600 or 1200 baud; a modem may transfer data at 300 baud. The factory setting for the DIP switch on the I/O Logic Board is illustrated below:

EXAMPLE BAUD RATE DIP SWITCH SETTINGS



When you have completed setting the baud rate switches to the baud rate specifications required by your equipment, reconnect the leftmost ribbon cable and carefully slide the I/O Logic Board into its slot in the card rack. If you meet resistance, gently rock the board from side to side until it slips in--DO NOT FORCE IT! Replace the cover on the UV-1R and secure it with the cover screws before you plug AC IN to a power source.

Before going further, verify that the baud rates on the terminal and accessory device are set as specified by their

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.3.1 Baud Rate Selection - Continued

documentation and that those rates agree with the rates that you have just set on the I/O Logic Board DIP switch.

If the baud rates are incorrectly set, the terminal/accessory device will display unintelligible character sequences.

4.4 Disk Interface Board (Disk Drive Cable Connection)

Refer to the Card Rack Illustration (Sec. 4.2.1) to see the location of the of the Disk Board edge connectors.

VERIFY THAT AC IN POWER IS UNPLUGGED BEFORE PROCEEDING!!

This board connects the 5-1/4" floppy and Winchester disk drives to the system. The cables connecting the external disk drive connectors on the rear panel of the UV-1R are connected to the exposed edge of this board, as follows:

Looking from the back of the unit, the leftmost and wider of the two edge connectors accommodates the 34-pin cable used to connect the 5-1/4" floppy disk drive. Pin 1 is located on the top right side of the connector, with Pin 33 on the top left. The rightmost and narrower connector accommodates the 26-pin cable used to connect a Winchester disk drive to the system. Pin 1 is on the top right side with Pin 25 on the top left. Refer to the Card Rack Illustration (Sec. 4.2.1) for the location of 34-pin and 26-pin edge connectors on the Disk Interface Board.

4.5 Memory Board 2 (EPROMs for Software Updates)

This board houses 32K (K=1024) bytes of EPROM (Eraseable Programmable Read Only Memory--system firmware) in which Zgrass (system software) resides and also holds 32K bytes of RAM (Random Access Memory), expandable to 64K bytes. The Memory Board 2 can be distinguished in the card rack from its visible edge. A bank of 8 chips are aligned edge-on, left of center. In the event of a Zgrass software update, the 8 EPROMs (the largest chips on the board) would need to be accessed, removed, and carefully replaced by new EPROMs containing the update. These chips should be replaced in the same order and orientation as marked on the board.

The EPROMs are numbered from 1 to 8 corresponding to the numbers printed on Memory Board 2 next to each socket. The EPROMs also have a notch on one end which must line up with the

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

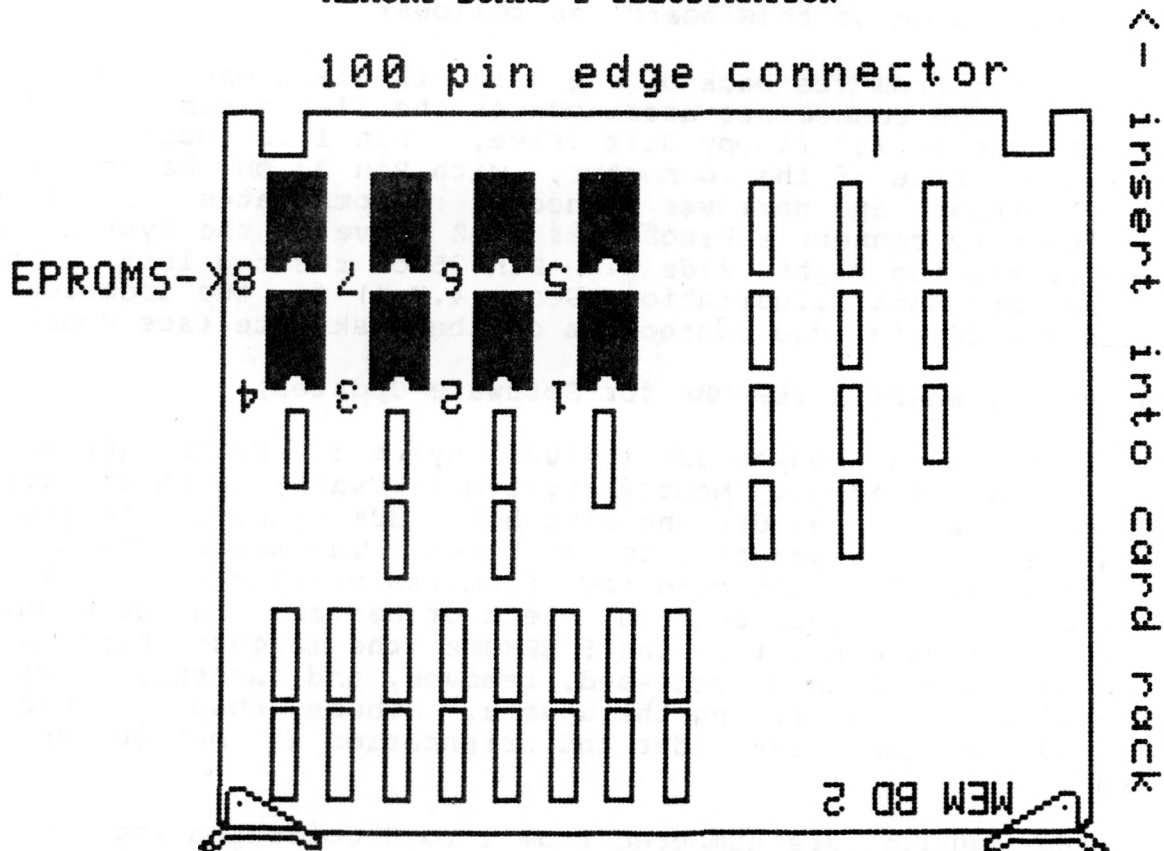
4.5 Memory Board 2 - Continued

notch printed on Memory Board 2. Inserting EPROMs incorrectly can damage them and cause a software failure necessitating EPROM replacement.

VERIFY THAT AC IN POWER IS UNPLUGGED BEFORE PROCEEDING!!

In order to extract Memory Board 2 for an EPROM update, first disconnect the 40-pin ribbon cable connecting the I/O Logic Board to the back panel board which blocks the removal of Memory Board 2. Grasp the cable connector where it connects the back panel board and gently pull straight up. DO NOT pull directly on the ribbon cable as this may separate it from its connector. If necessary, gently pry the connector with a small screw driver, being careful not to bend the pins.

MEMORY BOARD 2 ILLUSTRATION



This image was generated using the PAINT Program.

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.6 Additional Boards

Although additional boards are mounted in the card cage, there should not be any need to access these boards.

-Multi-Page RAM Board - This board contains 256K bytes of screen RAM (16 pages of screen memory, 16K bytes each). DO NOT alter the setting of the trim pot on this board.

-CPU Board - This board houses the Z80 CPU (microprocessor), system clocks, and custom address and data chips.

4.7 Console Lights

These are the 16 LED's (Light Emitting Diodes) numbered 0-15 on the front panel. Functionally, these lights are divided into two banks (0-7 and 8-15), each bank considered a "port" software-accessible by the PORT command. These programmable lights provide feedback about the status of system processes. For instance, after pressing the RST or BRK switch, the blinking of the lights indicates that the system is looping through a process requiring input to end the loop. These lights also provide feedback during some commands which take a long time to execute. By watching the sequential blinking of the lights during disk operations, you can determine which sector of the disk is currently being DINITIALIZED, DLOADED, OR DCOPY'd. See USING PORTS (Sec. 4.9) for details on evaluating and converting binary console light values to decimal values.

Console lights are set and cleared by the PORT command. Port 38 references lights 0-7 and Port 39 references lights 8-15. See PORT in the GLOSSARY.

SYSTEM TEST 3: LED'S/SWITCHES

Type in this test to lock console switches to LED's so that toggling a switch turns the light above it on/off:

```
TEST3= [.System Test 3; LED's/Switches
        PORT 38,PORT 20
        PORT 39,PORT 21
        SK -2]
TEST3
```

By locking the console switch ports to the console light ports, the output of the switch ports is the input of the light ports, turning them on and off.

To interrupt this test, press CTRL+C.

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.8 Console Switches

These are the 16 switches also numbered 0-15 on the front panel beneath the LED's. Like the console lights, these switches are functionally divided into two banks or ports (0-7 and 8-15) accessible via the PORT command. These switches may be programmed as input devices, program signals, user-programmable interrupts, signals to call utility programs, etc.

Console switches are set and cleared by pressing on the lower part of the switch. The status of a console switch can be determined by invoking the PORT command to read its status. Port 20 reads switches 0-7 and Port 21 reads switches 8-15. See PORT in the GLOSSARY. See USING PORTS (Sec. 4.9) for information on evaluating the binary value of a switch.

If you did not try SYSTEM TEST 3: LED'S/SWITCHES while in the CONSOLE LIGHTS (Sec. 4.7), do so now.

4.9 Using Ports

Ports are addresses for system input and output which give you direct access to internal and external devices. Ports for the 3-voice synthesizer and console lights are "writeable", which means you can alter the port values by using the PORT command. Other ports, such as those used for console switches or joysticks, are "readable", which means that when a switch is set, the value associated with that port is changed and can be read by using the PORT command. Another type of port, such as the RS232 port, is a "read/write" port. See PORTS in the GLOSSARY.

References to port numbers are in decimal notation (base 10), whereas the value of each port is stored internally in binary (base 2). Each port holds 1 byte of data composed of 8 bits. Each bit can have a value of either 0 or 1, referred to as cleared or set. Since each of the 8 bits have 2 possible states, 1 byte has a potential decimal value range from 0 (if all bits are cleared) to 255 (if all bits are set).

Certain devices require 2 ports. For instance, since there are 16 LED's (console lights), each of which can be set (lit) or cleared (unlit), 2 ports are needed to store the values. The same is true for the console switches. One port handles the low order byte (bits 0-7) and the other port handles the high order byte (bits 8-15).

4. INTERNAL SYSTEM CONFIGURATION - Continued

4.9 Using Ports - Continued

Each bit has a value relative to its position in the byte. A byte is evaluated by adding the values for each set bit. Cleared bits have a value of 0.

The following illustration gives the bit values for each position:

DECIMAL VALUE ->	128	64	32	16	8	4	2	1	
BIT OR BINARY VALUE ->	0 0 0 0 1 1 1 1								1=SET 0=CLEAR
LOW ORDER BYTE:	7	6	5	4	3	2	1	0	<-BIT #
HIGH ORDER BYTE:	15	14	13	12	11	10	9	8	<-BIT #

This byte has a binary value of 00001111 and a decimal value of $8+4+2+1$ or 15.

Re-type SYSTEM TEST 3: LED'S/SWITCHES provided in the Console Lights Section 5.7. Turn all LED's off by depressing the upper rockers of the console switches; then turn LED's 3, 2, 1, and 0 on by depressing the lower rockers of switches 3, 2, 1, and 0 in. By turning switches 0-3 on, you have loaded decimal values $8+4+2+1$ into Port 38. This port displays the binary value 00001111 for LED's 7-0.

Some ports share bits in their byte with other ports. Ports 20, 21, 22, and 23 are examples of shared ports. (See 3-Voice Sound Synthesizer Section 5.10.) For instance, Port 22 controls two voices...the lower four bits for Voice A amplitude and the upper four bits for Voice B amplitude. By setting Port 22, Voice A can have a value ranging from 0 to 15 (0=low; 15=high). Voice B can also have a value from 0 to 15, but this value must be shifted to the upper bits by multiplying the value by 16. To load both values into Port 22, add (value of A) to ((value of B)*16):

$$\text{Port 22} = (\text{0 to 15}) * 16 + (\text{0 to 15})$$

Voice B Voice A

See PORT in the GLOSSARY.

4. UV-1R Zgrass SYSTEM CONFIGURATION - Continued

4.10 3-Voice Sound Synthesizer

Please refer to USING PORTS (Sec. 4.9) before proceeding with this section.

The sound synthesizer can produce three tones at one time, with vibrato, noise, and amplitude control. The output from the Master Oscillator (a programmable frequency divider) is input to the three tone oscillators: Voice A, Voice B, and Voice C. Thus, changes made to the Master Oscillator affect all three voices.

MASTER FREQUENCY FORMULA:

Master Oscillator frequency = $1789 \text{ Khz} / (\text{value of (PORT 16)} + 1)$

VOICE FREQUENCY FORMULA:

Voice frequency = $894 \text{ Khz} / ((\text{PORT 16}) + 1) * ((\text{voice PORT}) + 1)$
(refer to the following table for voice PORTs)

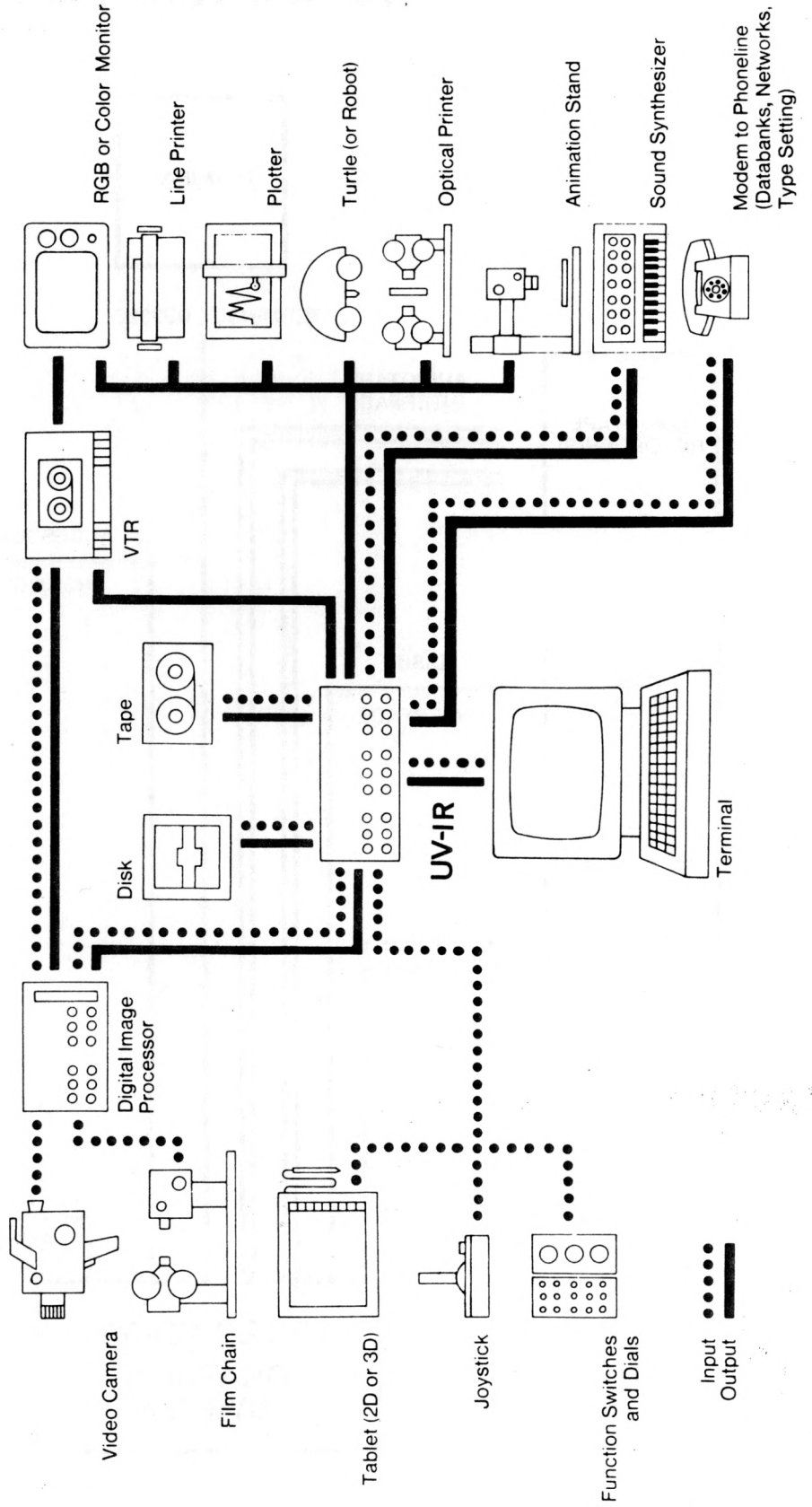
PORT	VALUE RANGE	ORDER:		DESCRIPTION
		LOW	HIGH	
16	0-255	255	0	Master Oscillator frequency
17	0-255	255	0	Voice A division ratio to compute tone
18	0-255	255	0	Voice B division ratio to compute tone
19	0-255	255	0	Voice C division ratio to compute tone
20	0-63	0	63	Amplitude of vibrato modulation of Master Oscillator
	+ [0, 64, 128, 192]	0	..192	Frequency of vibrato modulation of Master Oscillator
21	0-15	0	15	Voice C amplitude
	+ [0, 16]	0	..16	Switch: vibrato (0) or Noise (16) to modulate Master Oscillator
	+ [0, 32]	0	..32	Switch: noise added to final output; NO (0) or YES (32)
22	0-15	0	15	Voice A amplitude
	+ (0-15)*16	0	255	Voice B amplitude
23	0-15	0	15	Amplitude of noise to modulate Master Oscillator
	+ (0-15)*16	0	255	Amplitude of noise added to final output

NOTE: Ports 20 through 23 are shared ports, as indicated in USING PORTS (Sec. 4.9).

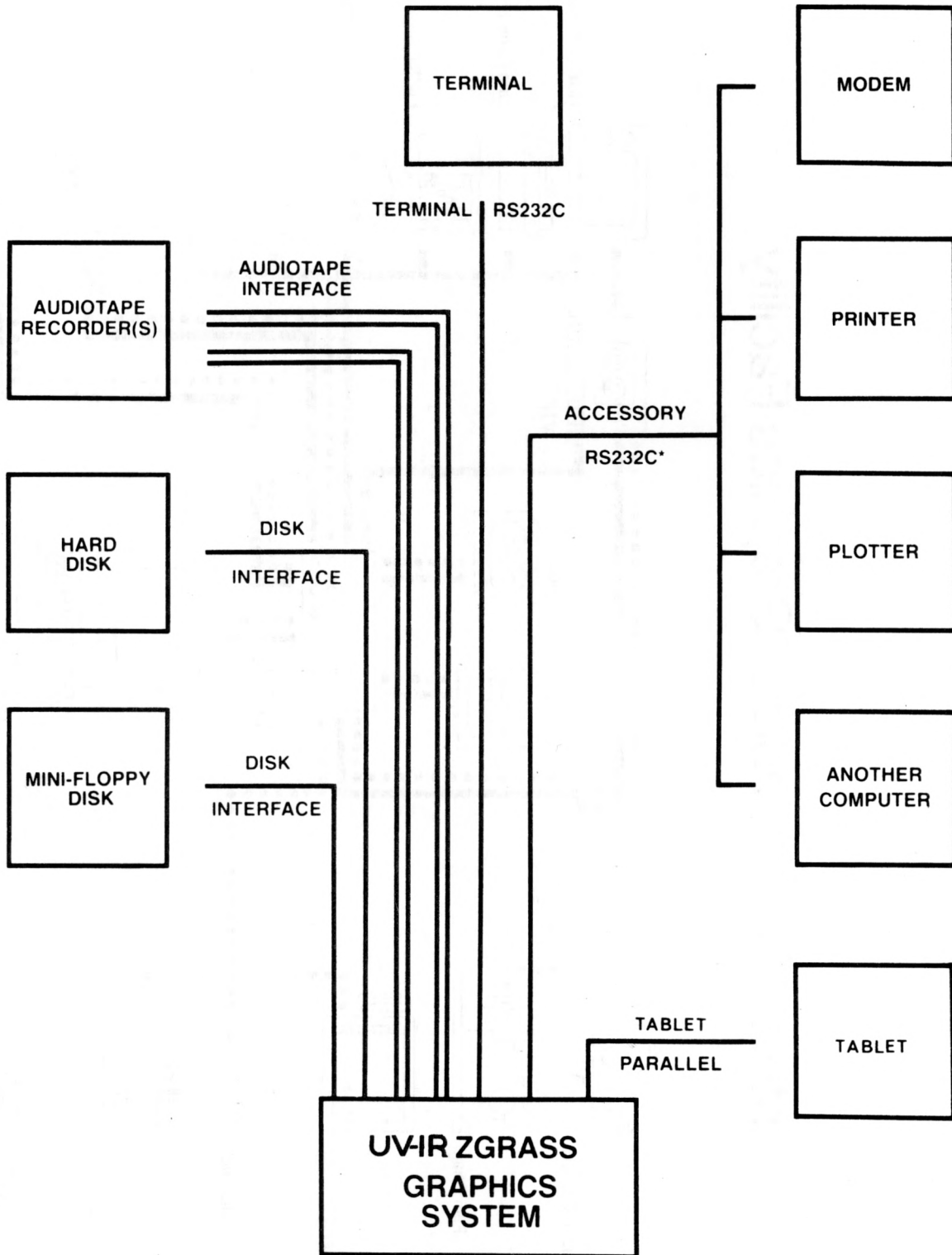
SYSTEM TEST 4: SOUND

Please refer to INDEX OF SYSTEM TESTS (Sec. 7) for System Test 4: Sound.

Interactive Computer Graphics Facility



DATA INTERFACES



*X-ON/X-OFF PROTOCOL

5. PERIPHERAL DEVICE CONFIGURATION

5.1 Data Interfaces and Peripheral Devices

Many of the features which make the UV-1R Zgrass GRAPHICS SYSTEM a powerful tool are those which support flexible interfacing with other data and video devices.

Some of these features are: programmability of DC signal controller and console switches, the 3-voice sound synthesizer, hardware interfaces for terminal, disk drives, printers, and plotters, and software for interactive controls such as handcontrols and a tablet. The diagram on the opposite page illustrates a fully equipped graphics station.

5.2 Terminal

The terminal used with the UV-1R must have both upper and lower case character capability. In Zgrass, general mode is upper case, with lower case being used only for local variables. This means that the Zgrass echo is the reverse of the upper/lower case functions of your terminal; i.e., when you type something in unshifted, lower case mode, the characters will be echoed on the terminal screen in upper case.

The editor control keys of Zgrass are compatible with the cursor control characters (directional arrows and HOME key) of your terminal. See TERMINAL in the GLOSSARY for instructions on reconfiguring the editor control keys. For specific instructions on how to prepare your terminal, see:

ADM 5 Sec. 5.2.1
Televideo 910 Sec. 5.2.2

Once you have completed the terminal preparation procedures for your terminal, conduct SYSTEM TEST 5: TERMINAL.

SYSTEM TEST 5: TERMINAL

H;H;H

This test speeds the display of the Zgrass HELP listing on the terminal. When the Zgrass > prompt returns, the screen should be readable. If the screen is unintelligible, see TROUBLESHOOTING (Sec. 6).

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.2.1 ADM5 Terminal Preparation

It is suggested that you disable keyboard locking by setting Switch 4 inside the ADM 5 to GT (disable keyboard locking) instead of LK (enable keyboard locking). Refer to the ADM 5 User's Reference Manual for instructions.

The baud rate switches on the terminal and on the MV-1R I/O Logic Board should both be set to 19200 (although 9600 is acceptable). See BAUD RATE SELECTION (Sec. 4.3.1) for instructions on setting UV-1R baud rate. The configuration switches on the rear of the ADM5 are pre-set at the factory according to the following diagram. Confirm that the switches on your terminal are in conformance.

LEFT BANK - DEFAULT TERMINAL SETTINGS

	1	2	3	4	5	6	7	8	9	10
OFF	OFF		OFF		OFF	OFF			OFF	
ON		ON		ON			ON	ON		ON

This enables auto new line, a scan rate of 60Hz, an I/O signal of RS232 at full duplex, one start bit, eight bits of data, one stop bit, no parity, etc.

RIGHT BANK - BAUD RATE SETTINGS

	1	2	3	4	5	6	7	8	9	10
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
ON										ON

This sets the terminal baud rate to 19200.

Connect either end of the shielded RS232 cable to the MODEM socket on the back of the terminal and the other end to the 25-pin TERMINAL socket on the back panel of the UV-1R.

Your ADM5 is now ready to power up. The power switch is located on the back of the terminal.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

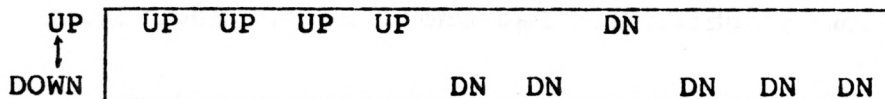
5.2.2 Televideo 910 Preparation

Unpack and inspect your Televideo 910 terminal according to the instructions in the Model 910 Operator's Manual. The Power Select Switch on the bottom of the terminal should be set to 115VAC. If you are located outside the United States and use 230VAC, see the Model 910 Operator's Manual for detailed instructions.

The baud rate switches on the terminal and on the UV-1R I/O Logic Board should both be set to 19200 (although 9600 is acceptable). See BAUD RATE SELECTION (Sec. 4.3.1) for instructions on setting UV-1R baud rate. The configuration switches S1 and S2 on the rear of the Televideo 910 are pre-set at the factory according to the following diagram. Confirm that the switches on your terminal are in conformance.

SWITCH S1

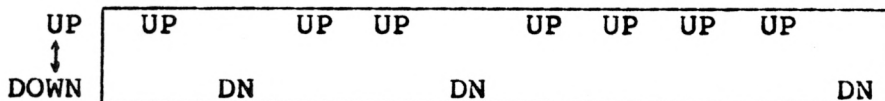
POSITION 1 2 3 4 5 6 7 8 9 10



Positions 1 through 4 define a baud rate of 19200. Positions 5 through 10 configure your terminal for eight bit word structure, no parity, even parity, one stop bit, no wraparound, and CR without LF.

SWITCH S2

POSITION 1 2 3 4 5 6 7 8 9 10



This configures the Televideo 910 for ADM5 emulation, 60Hz, steady block cursor, full duplex, white characters on a black screen, Data Set Ready disconnected, Data Carrier Detect disconnected, and Data Terminal Ready disconnected.

Connect either end of the shielded RS232 cable to the socket labeled P3 on the back of the terminal and the other end to the 25-pin TERMINAL socket on the back panel of the UV-1R.

Your Televideo 910 is now ready to power up. The power switch is located on the back of the terminal.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.3 Graphics Tablet

The UV-1R Zgrass GRAPHICS SYSTEM can utilize a graphics tablet as an input device to supplement keyboard commands and provide X and Y digitization of graphic input. The position of the cursor on the tablet can be used to generate graphics via use of the TABLET command, as in the Paint Program. See TABLET in the GLOSSARY.

The tablet operates on the magnetostrictive principle. On a substrate beneath the tablet surface is a mesh of wires. When a current causes a strain wave to move down all the wires in one direction, the receive coil in the stylus or cursor senses the passing of the strain wave. The time delay for the strain wave to reach the receive coil is registered in a binary counter and formatted by the microprocessor for output as X and Y coordinate data.

For specific instructions on the preparation procedures for your graphics tablet, see:

Summagraphics Bit Pad One Sec. 5.3.1

After you have completed the preparation procedures for your graphics tablet, conduct:

SYSTEM TEST 6: TABLET

Please refer to INDEX OF SYSTEM TESTS (Sec. 7) for details.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.3.1 Summagraphics Bit Pad One Preparation

ITEM ----	SPECIFICATION -----	PART NUMBER -----
Bit Pad One	parallel	01-0016-002
Power Supply	regulator, cable, & power connector	115V 01-0019-001
Four-Button Cursor		C01-0012-001
Data Interface Cable	parallel, 10-ft.	78-6002-001

After unpacking and before initial operation, it is necessary to bias the tablet. Follow the directions on the magnetic strip shipped with the tablet. After biasing the tablet, do not store the magnetic strip near magnetic media (tablet, disks, or tapes). Unless the tablet comes in contact with magnetic materials, it should not be necessary to repeat the biasing process. An indication that the tablet needs biasing exists if there appear to be "holes" or "dead spots" in an active display area.

Connect the Summagraphics Bit Pad One as follows:

- o connect the "mating" power plug to the 5-pin socket on the rear right of the Bit Pad; this mates the tablet's writing surface to its lower compartment; use the screws provided with the tablet to hold the plug in place.
- o connect the cursor plug to the 7-pin socket on the front right of the Bit Pad.
- o connect the power supply socket to the 6-pin connector on the rear of the Bit Pad. Use screws provided to secure the connection.
- o connect the tablet to the UV-1R with the ribbon cable that has 25-pin connectors at both ends; one end plugs into the 25-pin socket on the tablet and the other end plugs into the 25-pin TABLET socket on the rear panel of the UV-1.
- o connect the tablet power transformer to a 3-prong power source.

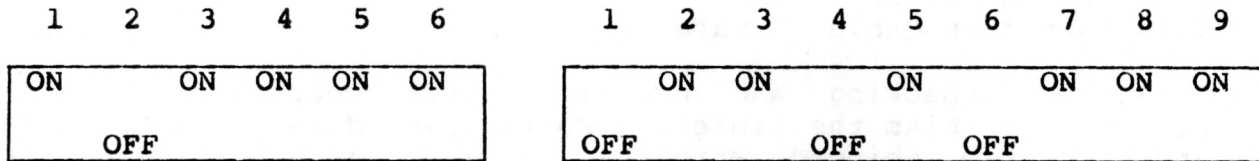
Note that the tablet is ON when the power supply is connected and OFF only when disconnected.

If the tablet does not work, press the black reset button on the right side of the tablet. If it still does not work, verify or re-set the internal tablet DIP switch settings by opening up the tablet casing, as follows: **First, disconnect all cables connected to the tablet.** Next, turn the tablet upside down and unscrew the four screws located on the mounting brackets on either side of the lower compartment to expose the PC board.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.3.1 Summagraphics Bit Pad One Preparation - Continued

Avoid inadvertent removal of the other four screws next to the four rubber feet, or you will unnecessarily unmount the PC board located inside the lower compartment. The two DIP switches mounted on the PC board should be set as diagrammed below:



To replace the lower compartment, orient the compartment to reconnect the mating power cord (the 5-pin cable "mating" the tablet surface to the lower compartment) and re-mount the four screws.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.4 Handcontrols (Joysticks)

One handcontrol (joystick) is supplied with the UV-1R system; others may be purchased as additional input devices for the UV-1R. Programming control is accessed according to the number of the handcontrol jack on the front panel of the UV-1R (1-4), not the number on the handcontrol knob. For instance, the Paint Program requires the handcontrol to be plugged into Jack 1 of the UV-1R. Either ignore the handcontrol knob numbers completely or plug each handcontrol into the corresponding jack.

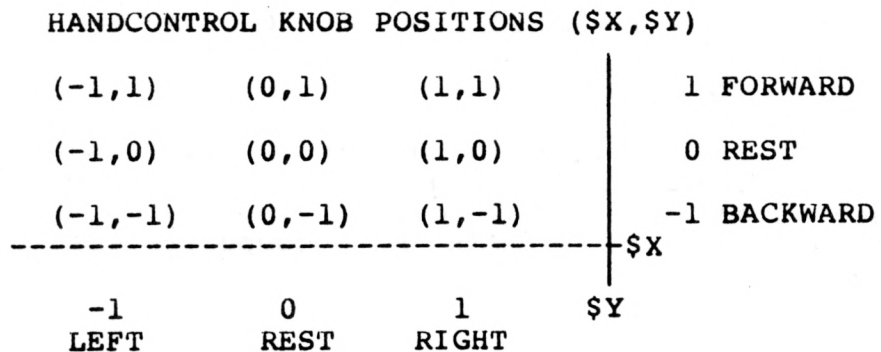
The proper orientation for the joystick handcontrol is with the knob up and the trigger pointed away from you. These devices correspond and control access to the DEVICE VARIABLES as indicated in the table below:

DEVICE VARIABLES CORRESPONDING TO JACK NUMBERS

jack #	X axis	Y axis	knob rotation	trigger position
-----	-----	-----	-----	-----
1	\$X1	\$Y1	\$K1	\$T1
2	\$X2	\$Y2	\$K2	\$T2
3	\$X3	\$Y3	\$K3	\$T3
4	\$X4	\$Y4	\$K4	\$T4

The knob range is from -128 (rotated all the way to the left) to +127 (rotated all the way to the right). The trigger range is 0 for rest position or 1 when the trigger is depressed. See DEVICE VARIABLES in the GLOSSARY for additional information on the range of possible values.

The knob on top of the handcontrol can also be pushed from its center position to the 8 other positions diagrammed below. When the knob is pushed to each position, the values for \$X and \$Y vary from -1 to 0 to 1, as shown below. To simplify the diagram, the number corresponding to the jack used is dropped from the \$X and \$Y variables and the \$X and \$Y variables are displayed in ordered-pair notation.



5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.4 Handcontrols (Joysticks) - Continued

SYSTEM TEST 7: HANDCONTROLS

Please refer to INDEX OF SYSTEM TESTS (Sec. 7) for SYSTEM TEST 8: HANDCONTROLS.

5.5 Disk Storage

The UV-1R Zgrass GRAPHICS SYSTEM interfaces to Datamax and Micropolis 5-1/4" floppy disk drives, the Datamax WD-1 Mini-Winchester 5-1/4" hard disk drive, and the Datamax WFD-1 Winchester/Floppy disk drive.

The double-sided dual floppy drives (Datamax DFD-1 and Micropolis models 1033-IV and 1035-IV) can store and retrieve 192K bytes of data on each side of each disk. With two disks inserted, total storage space available is 4 * 192K or 768K bytes.

A single-sided Winchester-type hard disk stores as much information as 28 one-sided floppy disks (about 5.5M bytes).

When using a dual floppy drive, one of the drives is referred to as Drive 0 and the other as Drive 1. When a disk is inserted into Drive 0, the lower side of the disk is referred to in the DSETUP command as Disk 0 and the upper side as Disk 4. For a disk inserted into Drive 1, its lower side is referred to as Disk 1 and its upper side as Disk 5. For further information on disk drive preparation, see:

Micropolis Floppy Drives	Sec. 5.5.3
Datamax Dual Floppy DFD-1	Sec. 5.5.4
Datamax WFD-1 and WD-1 Winchester Drives	Sec. 5.5.5

5.5.1 Floppy Disk Management

This section is designed to assist the UV-1R Zgrass GRAPHICS SYSTEM user in the management of disks. Information presented here supplements the LESSONS and the GLOSSARY.

--Disk Description

The disks used in the Micropolis Disk Drive are 5-1/4" double-sided, double-density, soft-sectored floppy disks. Each side will contain over 196,000 bytes of data, referred to as 192K bytes. NOTE: As a computer-related constant, K = 1024.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.5.1 Floppy Disk Management - Continued

--Write Protection

Write protection prevents the contents of a disk from being altered. A write-protected disk can only be read (or copied). Covering the small write-enable notch on the side of the disk with a small adhesive write-protection sticker write protects the disk. For example, in the process of making a back-up disk, if you accidentally DCOPY a blank disk onto the original as a result of transposing the arguments of the DCOPY command, the information on your original disk will be erased if it is not write-protected. The FILE PROTECT indicator next to the drive number on the front of the Micropolis drives lights up when write-protected disks are loaded.

--Care of Disks

- o Do not fold or bend.
- o Do not touch exposed areas of magnetic disk.
- o Keep away from: magnetic fields (i.e., do not put floppy disks on the graphics tablet); air-borne contaminants (i.e., smoke); static electricity.
- o Insert carefully and gently.
- o Write on the label ONLY with fiber-tip pens; NEVER use ballpoint pens.
- o Return to protective envelope after use.
- o Do not power on or off the disk drive with a disk inserted in the drive.

--Formatting

To prepare disks for use on the UV-1R Zgrass GRAPHICS SYSTEM, they must be formatted into 384 sectors (numbered 0 through 383), each containing 512 bytes. This process imposes an internal structure on the disk compatible with Zgrass. Formatting need be done only once.

The command to format disks, DFORMAT, is a swap command (not resident in the Zgrass EPROMs). Insert the PAINT/UTILITY DISK into Drive 0 and depress the disk drive lever. The following command sequence assumes that the UTILITY DISK program is on the upper side of the disk. It is a good idea to write-protect your Utility disk. Load the DFORMAT command into your system by typing:

```
DSETUP 4
DGET DFORMAT
```

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.5.1 Floppy Disk Management - Continued

These commands select Disk 4 and then loads the swap module DFORMAT into user RAM.

Now, to format a disk, insert a blank disk into Drive 1 and type:

```
DSETUP 1
DFORMAT 1
```

This selects Disk 1 and formats the disk in it. If the disk does not format (the system returns an Error 78, 79, or 80), first verify that the new disk is not write-protected. Then, try DFORMAT again. To verify that DFORMAT succeeded, type:

```
DFETCH
```

The console lights will count down as Zgrass verifies that each sector has actually been created.

To DFORMAT the other side of the disk, type:

```
DSETUP 5
DFORMAT 5
DFETCH
```

--Initialization

After a disk has been formatted, a section of space must be reserved, starting at sector 0 (the outermost sector on the disk) for the directory of the contents of the disk (also referred to as the byte map). The command to set up the directory space is DINIT.

DINIT initializes the disk, erasing all previous information on the disk currently selected, reserving space for the number of entries specified by its argument, MAXNAMECOUNT. Different types of entries are: MACROS, ARRAYS, SNAPS, SWAP MODULES, SCREEN DUMPS, and STRINGS, as defined in the GLOSSARY.

It is important to plan the initialization of a disk. If you do not plan for enough entries, you may run out of space for names in the directory before you run out of actual space on the disk, in which case the DISK FULL error message will occur. Likewise, if you allocate too much space for names in the directory, you could be wasting valuable disk space.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.5.1 Floppy Disk Management - Continued

To calculate how much directory space should be reserved, use a ratio of 4 entries per sector of directory space. Each entry requires 128 bytes to store the entry name, type, size, comments, and pointer to the entry's actual location on the disk. In addition to the 4:1 ratio, allow several sectors for overhead.

For instance, using the DPUT.TV command to save a screen dump (saving on disk a full screen of information) uses 16K bytes (or 32 sectors) of a disk. Based on 32 sectors per dump, you can store up to 10 or 11 screen dumps on one side of a disk. To optimize usable space on a disk used for **storage of screen dumps only**, initialize the directory for roughly 20 entries, so that 8 sectors are used for the directory information and more than 370 sectors remain for storage of screen dumps. Type:

DINIT 20

If you wish to store many strings and macros, you would want to have a large directory of perhaps 300 entries, using almost 78 sectors for the directory and leaving over 300 sectors of free storage space on the disk. Type:

DINIT 300

If you are in doubt about the kind of entries you will be storing on a disk, a suggested value for MAXNAMECOUNT is 200, which should allow adequate directory and storage space for general purposes. Type:

DINIT 200

To see how many sectors are available, type:

DUSEMAP

NOTE: It is not necessary to initialize a disk (using DINIT) if you use DCOPY, since the directory information will be copied with the rest of the disk.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.5.2 Disk Cache

DLOAD takes the currently DSETUP'd disk and loads it into SCREEN MEMORY, screens 4-15, for quick access. Thereafter, all references to that disk will access MEMORY instead of the drive until the system is reset or until you DLOAD.CLEAR. DLOAD.CLEAR does not clear the information stored in the screens--it releases the reference to the screens so that you reference the disk drive instead of the screens. DLOAD.SET re-enables the screen cache, re-establishing the reference to screens 4-15 and allowing access to the information previously stored there. For example, if you are working with a DLOADED disk and have to restart the system, typing DLOAD.SET will easily re-establish your DLOAD. See DLOAD in the GLOSSARY.

5.5.3 Micropolis Floppy Drives - Preparation and Operation

With the UV-1R power cord unplugged and the disk drive off, connect the disk ribbon cable, which has a card-edge connector at one end and a keyed 34-pin connector at the other. Attach the card-edge connector to the card edge on the rear of the drive, orienting the connector so that slot 1 (marked on the face of the connector) is up. Attach the 34-pin connector to the keyed receptacle marked "MINI FLOPPY" on the rear panel of the UV-1R.

On the front of the disk drive are two horizontal slots into which disks are inserted. When the drive is turned on (the power switch is on the back above the power cord), these slots are marked 0 and 1 by the ADDRESS LIGHTS and identify Drive 0 and Drive 1, respectively. Located in the center of each slot is the drive load lever, a black, ribbed lever. When the drive is empty, the lever is aligned with the horizontal slot. If a disk has been properly loaded, the lever is depressed to the bottom of the vertical channel.

TO LOAD A DISK: The proper orientation for inserting a disk is with the manufacturer's label up and the oblong disk head slot edge entering the disk drive first. To insert a disk, **gently** push it into the slot until it clicks. It is then loaded by pressing the load lever down until it locks in place.

TO UNLOAD A DISK: Press the disk load lever down momentarily and the load lever will pop up. To eject the disk, "flick" the load lever up (the disk should emerge enough for easy retrieval).

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.5.4 DFD-1 Dual Floppy Drive - Preparation and Operation

With the UV-1R power cord unplugged and the disk drive off, connect the disk ribbon cable, which has keyed 34-pin connectors at both ends. Attach one end to the receptacle on the rear of the DFD-1 and the other end to the keyed receptacle marked "MINI FLOPPY" on the rear panel of the UV-1R.

On the front of the disk drive are two horizontal slots into which disks are inserted. The slot on the left is referred to as Drive 0 and the one on the right as Drive 1.

TO LOAD A DISK: The proper orientation for inserting a disk is with the manufacturer's label up and the oblong disk head slot edge entering the disk drive first. To insert a disk, first open the load lever by pushing in on the top of the lever. Insert the disk until you meet resistance and push the lever down until it clicks.

To remove the disk, push in on the top of the load lever to unlock it, reach in and remove the disk.

5.5.5 Winchester Hard Disk Preparation and Management

Winchesters are extremely sensitive components and it is inadvisable to move them once they are set up and operating. If it is necessary to move a Winchester drive, the power cord and cables should be removed. Then the drive head should be removed from the chassis and transported separately, taking great care not to jar it.

In shutting down your system, always turn the Winchester power off before you power-down the UV-1R. This will help eliminate "crashes" in which data is lost.

To connect your Winchester, first make sure that the power switch is off. Attach the 26-pin and 34-pin ribbon cables to the Winchester connectors, and attach them to the connectors labeled WINCHESTER and MINI FLOPPY, respectively, on the rear panel of the UV-1R. Then attach the power cord to the Winchester and to a grounded AC power source.

When you insert a floppy disk into the floppy drive on the WFD-1, orient the floppy so that the label-side of the disk is to the right.

The Datamax WD-1 and WFD-1 Mini-Winchester disk drives house a permanently mounted 5-1/4" hard disk internally organized to emulate 28 floppy disks. These disks are referenced by the DSETUP command as disks -1 through -28.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.6 Audiotape Storage

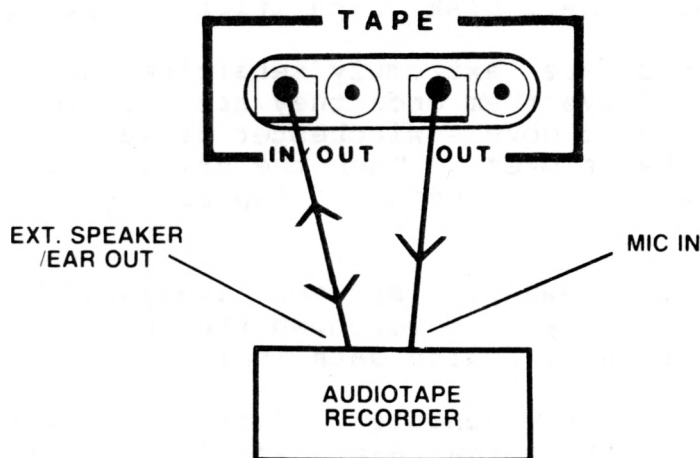
The audiotape interface allows you to store files (MACROS, STRINGS, ARRAYS, SNAPS, SWAP MODULES, SCREEN DUMPS) on audio tape and then read files back into memory (RAM). The audiotape interface transmits and receives computer data as audio signals at 1800 baud rate.

5.6.1 Tape Recorder Preparation

Different models of audio tape recorders have a variety of controls and connections, so experiment with interfacing your recorder/s and test the read/write operations with a simple program before attempting to store anything important.

--Recorder Configurations - Illustrations

To use one audio recorder for both play and record (read and write) functions, connect audio cables to the UV-1R as diagrammed below:

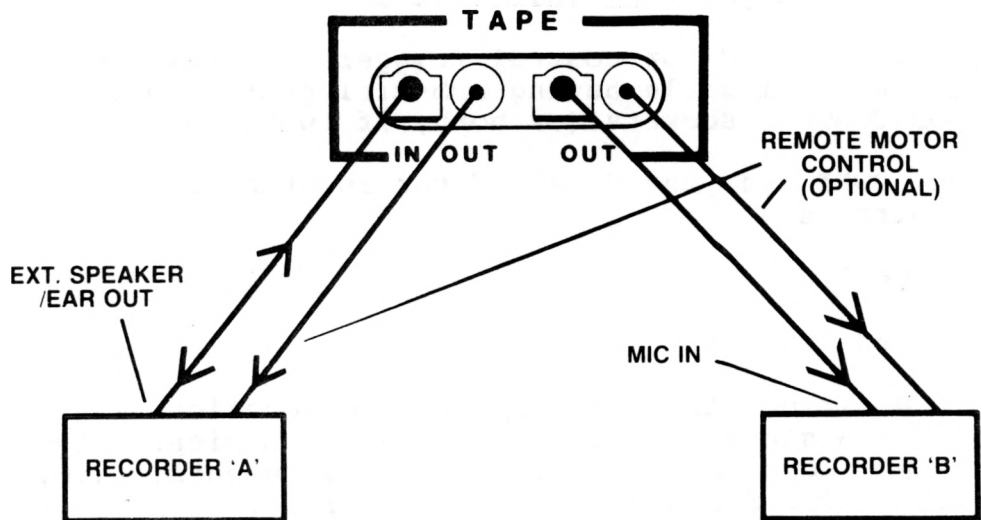


With this configuration, reading files into memory from the tape as the tape plays back and writing files onto tape from memory are separate tasks, usually punctuated by changing tapes or fast-forwarding past existing files.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.6.1 Tape Recorder Preparation - Continued

To use two audio recorders, one to play and one to record (primarily useful for editing/copying tapes), connect audio cables to the UV-1R as follows:



This configuration enables you to easily read files into memory from Recorder A (the "player"), edit them, and then write the new versions to another tape in Recorder B (the "recorder").

NOTE: AUDIO OUT marking on recorders varies; this may also be marked as EXTERNAL SPEAKER, EAR OUT, or MONITOR.

--Recorder Tuning

TO RECORD files on audio tape:

- if your recorder has a record-volume control dial, set it in the upper half of its range
- if your recorder has a VU meter, set record level at 0db

TO PLAY files into memory:

- set playback volume control in the upper half of its range
- set tone control (if present) to HIGH or treble bias

Before proceeding beyond this point, see GETTAPE, PUTTAPE, and PUTTAPE.TV in GLOSSARY and Lesson 5 in the LESSONS.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.6.2 Audiotape Cable Connections

Connect shielded coaxial cables having 1/8" mini phone plugs to TAPE IN/OUT and OUT on UV-1R rear panel. The other end can be connected to a tape recorder as illustrated in the Recorder Configurations segment of this section.

If DC remote motor control triggers are desired, connect a shielded coaxial cable having sub-mini phone plugs to either of the MOTOR CONTROL sockets (or both, if two signals are wanted).

See PORT in the GLOSSARY for information on programming motor controllers.

5.6.3 Tape I/O

--Record (Output)

Position the audiotape to the locations where you want to begin storage of the file and its copies. Type in the PUTTAPE command with appropriate arguments; i.e., PUTTAPE NUMBEROFCOPIES,FILENAME, COMMENTSTRING .

Start recording and then press the RETURN key on the terminal keyboard. The arguments passed with the PUTTAPE command are stored as a "header" on the tape preceding the file.

When the record operation is completed, the Zgrass > prompt will return to the terminal screen. Note that the console lights display the number of copies you specify. When you have finished PUTTAPing files, turn the recorder off. See CONSOLE LIGHTS (Sec. 4.7) and USING PORTS (Sec. 5.9).

PUTTAPE COMMAND SWITCHES: .TV FILENAME, COMMENTSTRING ;
a 16K dump of the display
screen will be output on tape
under the filename

NOTES:

-To take advantage of Zgrass' automatic file integrity checking feature, always PUTTAPE two or three copies of any file you store.

-Tape I/O is slow, sequential, and rather tedious; however, compared to disk I/O, it is very inexpensive. To use it successfully, you must be organized and deliberate. A good technique is to keep frequently used "tool" programs together

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.6.3 Tape I/O - Continued

on one tape (always adding new and improved versions to the end) and to accumulate other MACROS, SNAPS, ARRAYS, and SCREEN dumps in affinity groups on separate tapes. When the "tool" tape fills up with old versions, put the most up-to-date versions on a fresh tape and start again. It is probably a good idea to keep the old tape as a back-up. Keep an "image bank" tape for accumulating odd screen dumps. As you will soon learn, shorter tapes are more convenient to use and save much shuttle time.

--Play (Input)

Selection of a file to be read into memory may be accomplished by either setting the tape at the exact location where the file begins or by starting at the beginning of the tape and letting the computer search the tape for the file you want.

Type in the GETTAPE command with the appropriate file name. Start the recorder in PLAY mode and then press the RETURN key on your terminal keyboard. You will get a complete directory listing (header information) of the files on the tape as they are played back. NOTE: You can GETTAPE as many filenames in one operation as will fit on one line of the terminal screen.

Use BREAK or RESTART with an "N" response to stop the GETTAPE process prematurely. When you've finished GETTAPing files, turn the recorder off.

GETTAPE COMMAND SWITCHES:

.ERR	accept the file even if an error is read
.ANY	get the next file whatever its name is on the tape and read it in with the name specified
.OR	OR's the screen if doing a screen dump read
.XOR	XOR's the screen if doing a screen dump read

CAUTION: Pay attention when using the .ERR switch for GETTAPE. Sometimes, bad data can zap memory and result in an Error#23 or worse...so make sure you do not have anything irreplaceable in memory when you use it. CORE or USEMAP will indicate whether memory has been zapped.

5. PERIPHERAL DEVICE CONFIGURATION - Continted

5.6.3 Tape I/O - Continued

NOTES:

-As a file is read into memory, it is checked for errors. Should any occur, the next copy of the file specified will be read automatically. In order to take advantage of this feature, be sure to specify that several copies be recorded of each file you wish to store.

-If you want to GETTAPE two files that are widely separated on the tape and do not want to wait for the intervening tape to crawl past, GETTAPE the files in two separate operations. If you try to fast-forward the tape in between while still in GETTAPE mode, you may confuse your computer and are very likely to end up with a mess in memory. USEMAP will display ZAPPED next to destroyed files.

-BAD DATA: If you get this message while attempting to GETTAPE a file, go back and try to GETTAPE it again. Unless the tape itself is damaged, this will usually succeed the second time. If you are GETTAPing a series of files and you get BAD DATA, GETTAPing individually a second time is usually successful.

--Tape I/O Tips

- o I/O is a sequential process! Zgrass can only GETTAPE the filenames you request in the order they are listed in the GETTAPE statement. If this order does not conform to the order in which the files are actually recorded on the tape, you will send Zgrass on a futile search throughout the rest of the tape, looking for the first filename that is out of order.
- o An efficient way to PUTTAPE and GETTAPE a number of filenames is to write macros which do it for you. Such storage and retrieval macros can be stored right along with the group of related files. This way, each time you change or generate new files, you can easily store and retrieve the entire updated batch without having to type out the comments each time. Remember to update your storage/retrieval macros!
- o Make sure that the order of filenames is the same in your retrieval macro as it is in your storage macro or you will have the problems described above.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.6.3 Tape I/O - Continued

SYSTEM TEST 9: AUDIO TAPE

Please refer to INDEX OF SYSTEM TESTS (Sec. 7) for SYSTEM TEST 9: AUDIO TAPE.

5.7 Video Interfaces and Display Devices

One of the most useful features of the UV-1R Zgrass GRAPHICS SYSTEM is its ability to output real-time computer graphics as an NTSC standard video signal and to interface with video equipment ranging from videocassette recorders to educational video environments and commercial production switchers.

The UV-1R Zgrass GRAPHICS SYSTEM hardware and software have been optimized for accessible, interactive control structures and offer a rich, rapid feedback environment. The terminal gives you feedback about your program and the status of variables. For graphic feedback, you may choose an RGB monitor or composite video monitor. The form of visual feedback you choose depends to a high degree on what form of presentation/distribution you will be using. The diagram on the next page illustrates possible video device connections to the UV-1R.

5.7.1 NTSC Composite Video and Audio Out

A composite video monitor provides feedback that is representative of how your graphics will look to the world of NTSC video.

-Device Preparation

Select appropriate signal-in options on your display device. If your monitor has a LINE-VTR switch, set it to LINE. If your monitor has an RGB-VIDEO switch, its setting will depend on whether you are using an RGB converter or not.

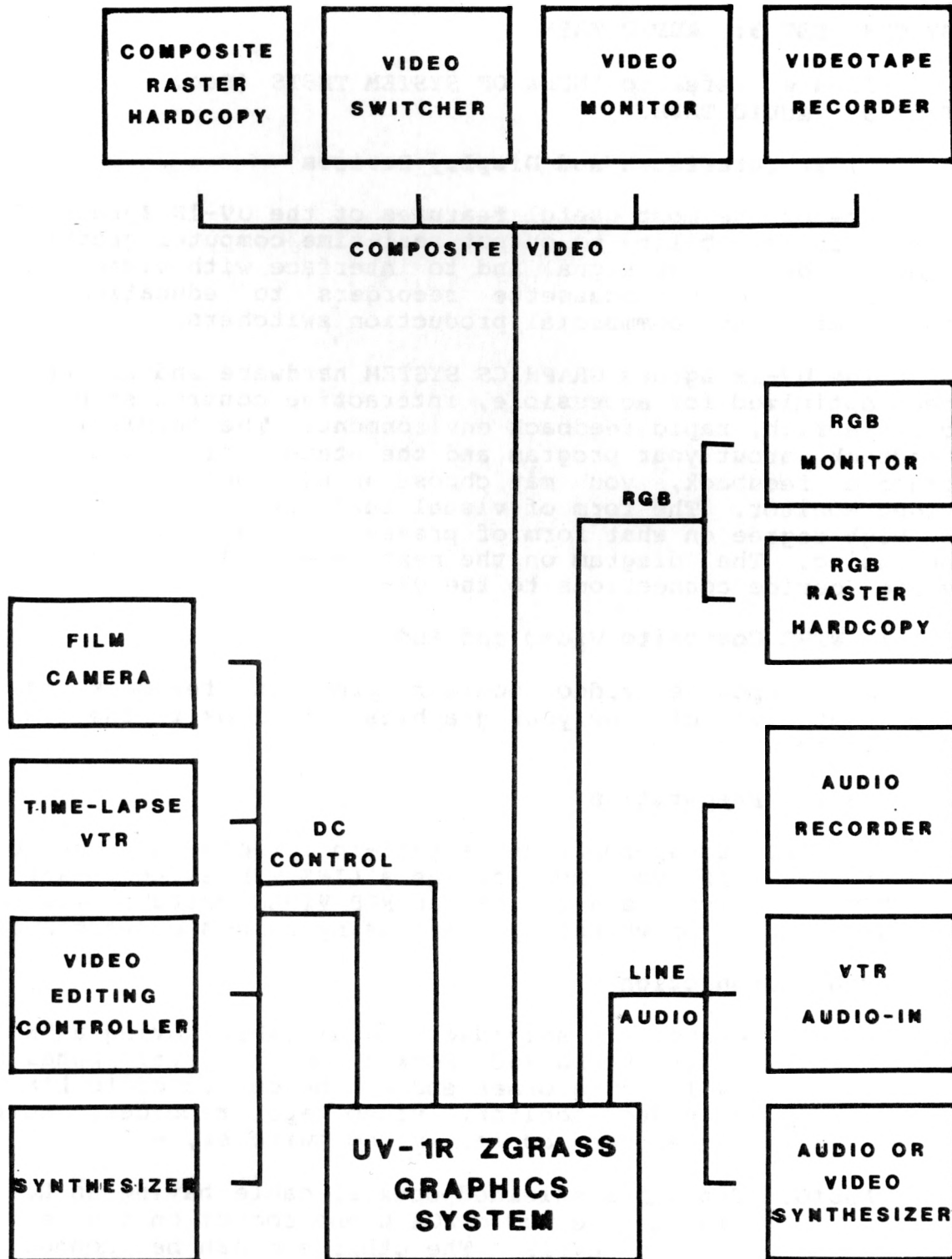
-Cable Connection

VIDEO: Connect a shielded coaxial cable having a BNC plug to the VIDEO BNC socket on the rear panel of the UV-1R. The other end can be connected to LINE IN on a video monitor, video tape recorder, composite raster hard copier, video switcher, etc.

AUDIO: Connect a shielded coaxial cable having an RCA phono plug to the audio RCA phono socket on the rear panel of the UV-1R. The other end can be connected to AUDIO IN on your device.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

VIDEO INTERFACES



5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.7.2 (Video) Display Considerations

--Center of the Screen

Draw a box on the display screen by typing:

```
BOX 0,0,320,201,1
```

The area of this box represents the Zgrass addressable area; i.e., that portion of the video raster where you can use Zgrass commands to draw and manipulate graphics. The color of the margins outside the addressable area can be assigned via the \$BC DEVICE VARIABLE. The area of this box also represents the default WINDOW. See DEVICE VARIABLES and WINDOW in GLOSSARY.

Now, draw this box by typing:

```
BOX,0,90,50,50,3
```

You can see that any portion of a graphic element located outside this addressable area will be clipped.

The large box also demonstrates how the alignment (the centering of the video raster on the CRT) of your particular monitor is biased. The alignment of monitors is rarely perfect, with a range of variations in direction and extent.

You now have the choice of allowing for your device's bias when programming your graphics, having your receiver or monitor aligned, or using a monitor with underscan capability so you can see the entire video raster. Whichever you choose, you should still allow for the diversity of alignment biases. Alignment adjustment is a standard service any TV repairperson can provide; some monitors provide user-accessible controls.

-Aspect Ratio

Aspect ratio is the proportion of frame width to frame height.

TV has a ratio of 4:3. Instead of being square (ratio 1:1), the display is a rectangle $33\frac{1}{3}\%$ wider (in the X direction) than it is high (in the Y direction).

Zgrass displays 320 pixels (picture elements) in the X direction and 201 in the Y direction. Its aspect ratio is 320:201, which reduces to approximately 8:5.

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.7.2 Video Display Considerations - Continued

When TV ratio and Zgrass ratio are combined and multiplied out as follows, the combined aspect ratio is 6:5, resulting in a vertical exaggeration of 20% for each pixel.

$$\begin{aligned} \text{COMBINED ASPECT RATIO} &= (\text{ZX}/\text{ZY}) * (\text{TVY}/\text{TVX}) \\ \text{" " " } &= (8/5) * (3/4) \\ \text{" " " } &= (8*3) / (5*4) \\ \text{" " " } &= (24) / (20) \end{aligned}$$

What this all means is that pixels are rectangular, not square, so that when you draw a box on the screen by typing:

```
CL
BOX 0,0,100,100,2
```

even though XSIZE = YSIZE, the resulting box will appear to be rectangular, not square.

To draw a box that looks square or an ellipse that looks like a circle, use this formula:

$$\text{XSIZE} = \text{YSIZE} * 1.2$$

and type in the following Zgrass command sequence to see for yourself:

```
CL
BOX 0,0,120,100,1
```

-Color Map

The actual "color" you see on a video screen at any given point is determined by a number of components. The range of visually distinguishable UV-IR color values is 0-255, organized as 32 hues, each having 8 grey values. Each color value can be analyzed according to this formula:

$$\text{COLORVALUE} = (\text{H} * 8) + \text{G}$$

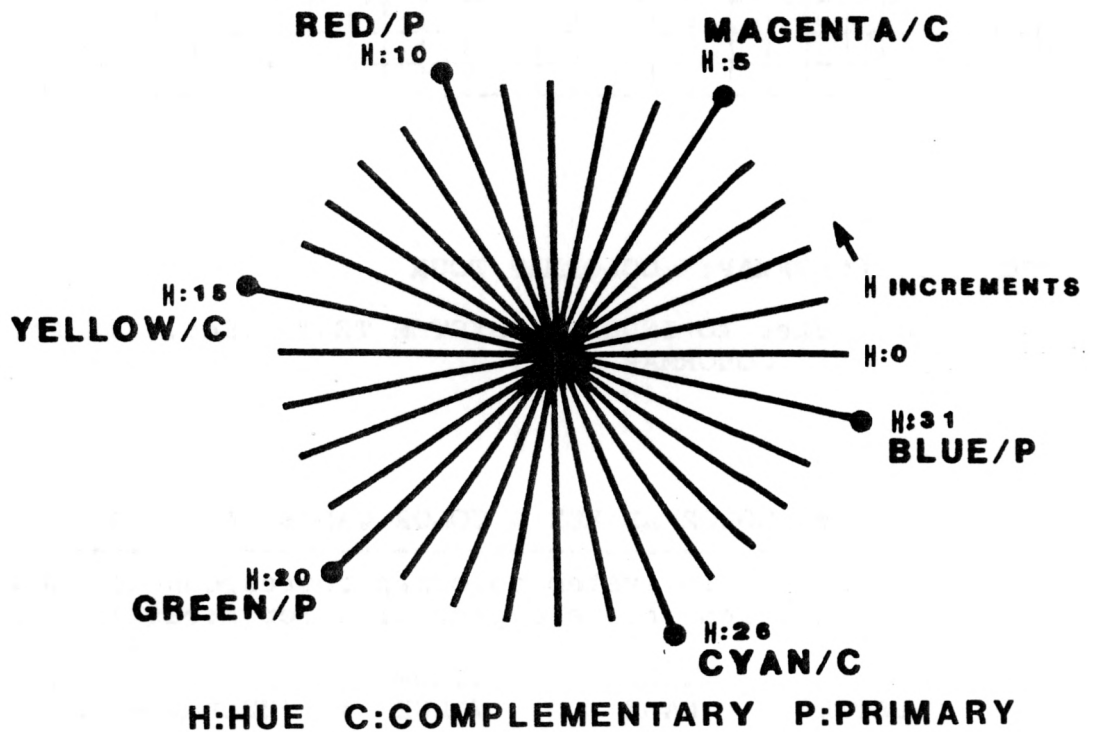
H -> HUE value component (range 0-31)

G -> GREY value component (range 0-7)

5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.7.2 Video Display Considerations - Continued

The following diagrams illustrate the progression of hue component values and identify the video primaries and complements to +/- one value accuracy. The locations of these values closely approximate a vector scope display of video colorbars.



5. PERIPHERAL DEVICE CONFIGURATION - Continued

5.7.2 Video Display Considerations - Continued

SYSTEM TEST CBARS: COLOR BARS

This test displays color bars on your monitor for purposes of color tuning. Type:

```
CBARS= [.System Test CBARS: COLOR BARS
        CL;A=-149;C=0;$HB=21
        $R0=0;$R1=82;$R2=43;$R3=249
        $L0=7;$L1=213;$L2=126;$L3=164
        IF A<115,BOX A=A+45,0,46,202,C=(C+1)\3+1;SK 0]
CBARS
```

The UV-1R sets its default colors as calculated in the following table:

COLOR #	DEFAULT COLOR- MAP VALUE	=	(HUE*8)	+	GREYLEVEL
-----	-----		-----		-----
0 (\$L0)	7	=	(0*8)	+	7
1 (\$L1)	91	=	(11*8)	+	3
2 (\$L2)	165	=	(20*8)	+	5
3 (\$L3)	8	=	(1*8)	+	0

6. TROUBLESHOOTING

TROUBLESHOOTING CHART

When in doubt, read the instructions!
It works better if it's plugged in.

<u>PROBLEM</u>	<u>CAUSE</u>	<u>SOLUTION</u>
UV-1R	AS LISTED BELOW	DETAILED INFORMATION IN SECTIONS 3,4,& 5
UV-1R does not power up (indicator light is off)	UV-1R not plugged in	Plug power cord into AC in; plug other end into power source
	UV-1R not turned on	Press power switch on UV-1R back panel to ON position
	Fuse blown	Replace fuse on back panel with MDA 1.5 amp fuse
No airflow from back of UV-1R	Fuse blown	Replace fuse on back panel with MDA 1.5 amp fuse
	Blocked airflow	Remove any obstruc- tion blocking air intake
UV-1R does not power up or no response at terminal after hand- ling of printed cir- cuit (PC) boards	Improper re- connections	Turn UV-1R off; unplug power cord; open cover; then: -verify that boards are properly inserted into card rack and that all edges are flush -align boards in metal tracks on either side of card rack

6. TROUBLESHOOTING - Continued

PROBLEM

CAUSE

SOLUTION

(continued from previous page)

UV-1R does not power up or no response at terminal after handling of PC boards

Improper re-connections

-insert boards component side up

-connect 50-pin ribbon to I/O Logic board

-connect 40-pin ribbon to Back Panel board

-verify that all pins are plugged into ribbon cables:

--both rows of pins are connected

--there are no pins left out on either side

-refer to Sec. 4.1, ACCESSING INTERNAL COMPONENTS and Sec. 4.2, CARD RACK

UV-1R does not power up after changing the EPROMs

EPROMs improperly inserted

Refer to Section 4.5 MEMORY BOARD 2

Board does not re-insert

Board not aligned in tracks

Align board in metal tracks on either side of card rack, component side up

Zgrass prints Error 27 "Not enough memory"

Not a large enough block of memory available

Save all files on disk or tape; then delete any unnecessary files; then restart UV-1R and set \$BF=1

System restarts by itself

Static interference

Place an anti-static mat under your chair and consider humidifying system's room

6. TROUBLESHOOTING - Continued

<u>PROBLEM</u>	<u>CAUSE</u>	<u>SOLUTION</u>
3-VOICE SYNTHESIZER	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 4.10
No sound from synthesizer	Volume control knob turned down	Turn volume control knob up
TERMINAL	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 5.1.1
No response on terminal	Terminal: -not plugged in -not turned on -confused -contrast turned down -incorrect DIP switch settings on back of terminal -incorrect baud rate setting on terminal -RS232 cable malfunctioning	Plug power cord into power source Press power switch to ON position Power terminal down and then power it up Turn contrast up Refer to Section 5.1.1 TERMINAL Refer to Section 4.3 I/O LOGIC BOARD Try another cable
Terminal displays unintelligible character sequences	Terminal confused Incorrect baud rate setting on terminal	Power terminal down and then power it up Refer to Section 4.3 and 5.2
Terminal locks up, not accepting input	Terminal confused Internal Switch 4 of ADM 5 is in LK mode	Power terminal down and then power it up Power down terminal and change internal switch to GT, per instructions in ADM 5 User's Reference Manual

6. TROUBLESHOOTING - Continued

<u>PROBLEM</u>	<u>CAUSE</u>	<u>SOLUTION</u>
TABLET		
	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 5.3
No response from tablet	Improper connection	See Section 5.3
	Internal tablet switches improperly set	See Section 5.3 and appropriate Tablet Preparation section
Dead spots on tablet-- some areas are not read and do not display	Tablet needs biasing	See Section 5.3 and appropriate Tablet Preparation section
HANDCONTROLS		
	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 5.4
Handcontrols do not function	Plugged into another port not referenced by device variable	Use device variables corresponding to jack handcontrol is plugged into, not the number printed on top of knob
DISK		
	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 5.5
Cannot write on disk	No disk inserted in drive or disk is in the other drive	Insert disk and DSETUP the loaded drive
	Disk is write-protected	Remove write protection sticker from notch on edge of disk
	Disk not properly inserted	See Section 5.5, DISK STORAGE
	Disk is not formatted	See Section 5.5, DISK STORAGE
	Ribbon cable not properly connected	See Section 5.5, DISK STORAGE
Unable to insert disk into disk drive	Disk not clearing write-protect sensor	There may be write-protect sensor resistance on the left side; gently repeat insertion

6. TROUBLESHOOTING - Continued

<u>PROBLEM</u>	<u>CAUSE</u>	<u>SOLUTION</u>
AUDIO TAPE	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 5.6
Files not properly recording on tape	Cables improperly connected	Properly connect cables, per Sec. 5.6, AUDIOTAPE STORAGE
	Recording level too low	Turn level up
	Crosstalk between play and record circuits	Disconnect cable into EXT.SPEAKER/EAR jack during recording
	Recording over other computer programs	Erase tape before recording
	Faulty cables or adapters	Change cables
	Tape heads mag- netized	De-magnetize record heads on recorder
Files not properly read into memory	Recorder playback volume or tone control too low or high	Change levels
MONITOR	AS LISTED BELOW	DETAILED INFORMATION IN SECTION 5.7
No display on monitor	Monitor not plugged in	Plug power cord into power source
	Monitor not turned on	Press power switch to ON position
	Cables improperly connected	Verify that all pins are plugged into ribbon cables: --both rows of pins are connected --there are no pins left out on either side
	Monitor fuse blown	Replace monitor fuse

6. TROUBLESHOOTING - Continued

PROBLEM

CAUSE

SOLUTION

(continued from previous page)

No display on monitor

Bundled cable harness from I/O Logic Board disconnected from Video Board while accessing boards in card rack

Turn UV-1R off; unplug power cord; open back door; check bundled cable harness connections from I/O Logic Board to Video Board

7. INDEX OF SYSTEM TESTS

The purpose of this section is to provide you with an index summarizing all of the macros (programs) used to test the UV-1R system. These tests verify and demonstrate that internal and external I/O devices are operating.

The internal devices tested are: graphics, screens, LED's/switches, sound, handcontrols, colormap, and color bars.

The external devices tested are: terminal, tablet, disk drives, and audiotape.

This index is organized to provide you with the following information:

- the name of the test as referenced in the manual
- section of this manual which references the test
- a description of what the test does
- the actual test macro (program)
- the sequence needed to terminate the test

These test macros may be typed in as listed below OR you may load the test macros into the UV-1R system from the UTILITY DISK provided with the system. All system tests are stored in a submap on the UTILITY DISK identified as SUBTEST. To run the tests, load the UTILITY DISK into drive 0 and type:

```
DS 4,SUBTEST
DG SYSTEST
SYSTEST
```

A menu will provide all information needed subsequent to loading the UTILITY DISK as instructed above.

7. INDEX OF SYSTEM TESTS - Continued

SYSTEM TEST 1: GRAPHICS

SECTION 3.6

-an animated display of colored boxes.

```
TEST1=[.System Test 1: GRAPHICS
      NB;NB]
TEST1
```

TERMINATION SEQUENCE: screen will clear on completion of test.

SYSTEM TEST 2: SCREENS

SECTION 3.6

-a 16-screen animation of circles and boxes.

```
TEST2=[.System Test 2: SCREENS
      NC]
TEST2
```

TERMINATION SEQUENCE: after several cycles, press CTRL+C; then press CTRL+B; then type: CLEAR

SYSTEM TEST 3:, LED'S/SWITCHES

SECTION 4.7

-locks console switches to LED's so that toggling a switch turns the light above it on/off.

```
TEST3=[.System Test 3: LED'S/SWITCHES
      PR "Press the console SWITCHES to blink the LIGHTS"
      PORT 38,PORT 20
      PORT 39,PORT 21
      SK -2]
TEST3
```

TERMINATION SEQUENCE: after testing lights and switches, press CTRL+C

7. INDEX OF SYSTEM TESTS - Continued

SYSTEM TEST 4: SOUND

SECTION 4.10

-produces an audio tone as it exercises each of the three voices.

```
TEST4=[.System Test 4: SOUND
.VOICE A + B amplitude
PORT 22,15+15*16
.VOICE C amplitude
PORT 21,15
PR "VOICE A"
a=0
PORT 17,a
IF (a=a+1)<255,SK -1
PORT 17,0
PR "VOICE B"
b=255
PORT 18,b
IF (b=b-1)>0,SK -1
PORT 18,0
PR "VOICE C"
c=0
PORT 19,c
IF (c=c+1)<255,SK -1
.NOISE
PORT 16,31
PORT 21,15+16+32
PORT 23,255
.QUIET
CONTROL 3,1
PR "DONE"]
COMPILE TEST4,CTEST4
CTEST4
```

TERMINATION SEQUENCE: ports are cleared on completion of test.

SYSTEM TEST 5: TERMINAL

SECTION 5.2

-speeds the display of the Zgrass HELP listing on the terminal screen.

```
TEST5=[.System Test 5: TERMINAL
H;H;H]
TEST5
```

TERMINATION SEQUENCE: the screen should be readable when the Zgrass > prompt returns.

7. INDEX OF SYSTEM TESTS - Continued

SYSTEM TEST 6: TABLET

SECTION 5.3

-draws boxes on the monitor as the cursor moves on the tablet.

```
TEST6=[.System Test 6: TABLET
PR "Move the CURSOR around on the TABLET, pressing
the buttons to change the size of the BOXES"
CLEAR
PR p=TAB(x,y),x,y
BOX x/7,y/11,p*2+10,p*2+10,20
SK -2]
COMPILE TEST6,CTEST6
CTEST6
```

TERMINATION SEQUENCE: after you've tested the tablet, press CTRL+C.

SYSTEM TEST 7: HANDCONTROLS

SECTION 5.4

-prints knob and trigger values of handcontrols on terminal

```
TEST7=[.System Test 7: HANDCONTROLS
PR "Plug HANDCONTROLS into jacks and test positions"
PRO " [# 1]",$X1,$Y1,$K1,$T1," [# 2]",$X2,$Y2,$K2,$T2
PRO " [# 3]",$X3,$Y3,$K3,$T3," [# 4]",$X4,$Y4,$K4,$T4
SK -2]
COMP TEST7,CTEST7
CTEST7
```

TERMINATION SEQUENCE: after you've tested the handcontrols, press CTRL+C.

8. INDEX OF SYSTEM TESTS - Continued

SYSTEM TEST 8: DISK DRIVES

SECTION 5.5

-tests both sides of both disk drives with PAINT/UTILITY disk.

```
TEST8=[.System Test 8: DISK DRIVES
PR "Put the PAINT/UTILITY disk in DRIVE 0"
DS 0
DFETCH;DUSEMAP
DS 4
DFETCH;DUSEMAP
DS 4,SUBTEST
DG SCREENTEST;$L0=0
PR "Put the PAINT/UTILITY disk in DRIVE 1"
DS 1
DFETCH;DUSEMAP
DS 5
DFETCH;DUSEMAP
PR "Disk Drive test successfully completed"]
TEST8
```

TERMINATION SEQUENCE: message appears on terminal when test ends.

SYSTEM TEST 9: AUDIO TAPE

SECTION 5.6

-tests recording and play-back of audio tape.

```
TEST9=[.System Test 9: AUDIO TAPE
PR "Put a TAPE in your RECORDER";WAIT 3
PR "Initialize your RECORDER'S counter";PR;WAIT 2
KANGA=NB
PR "Start RECORDing now";PR;WAIT 3
PUTTAPE 3,KANGA, copy of NICE BOXES
PR "Stop your RECORDER now";PR;WAIT 3
DEL KANGA
PR "Rewind your RECORDER now";WAIT 5
PR "Start PLAYing back";WAIT 2
GETTAPE KANGA
KANGA
PR "NICE BOXES SHOULD NOW BE DRAWN ON THE MONITOR"]
TEST 9
```

TERMINATION SEQUENCE: NB appears on monitor when test ends

7. INDEX OF SYSTEMS TESTS - Continued

SYSTEM TEST COLORMAP: COLORMAP TOUR

SECTION 5.7.1

-a tour of the UV-1R Zgrass colormap.

```
COLORMAP=[.System Test COLORMAP: COLORMAP TOUR
. A tour of the colormap using the joystick#1 knob;
. Y controls hue and X controls grey level
CL;STRIPE.OFF;$HB=37
BOX -160,0,80,201,0;BOX -60,0,80,201,1
BOX 20,0,80,201,2;BOX 98,0,76,201,3
hue=0;A=0
line=-11;inc=0
STRIPE inc,line=line+12.25,hue,hue+1,hue+2,hue+3
IF (inc=inc+1)<16,hue=hue+8;SK -1
A=A-$X1+8*$Y1;hue=A;SK -3]
COMPILE COLORMAP,CCOLORMAP
CCOLORMAP
```

TERMINATION SEQUENCE: When you've completed the tour, press
CTRL+C; type: CLEAR;STRIPE.OFF

SYSTEM TEST CBARS: COLOR BARS

SECTION 5.7.2

-displays color bars on your monitor to allow color tuning

```
CBARS=[.System Test CBARS: COLOR BARS
CL;A=-149;C=0;$HB=21
$R0=0;$R1=82;$R2=43;$R3=249
$L0=7;$L1=213;$L2=126;$L3=164
IF A<115,BOX A=A+45,0,46,202,C=(C+1)\3+1;SK 0]
CBARS
```

TERMINATION SEQUENCE: after you've tuned your monitor,
type: CLEAR