Model 801C

OWNER'S MANUAL

CUSTOMER WARRANTY

Quantum Data products are warranted against defects in materials and workmanship. This warranty applies for ninety (90) days from the date of delivery. Quantum Data will, at its option, repair or replace equipment which proves to be defective during the warranty period. This warranty includes labor and parts. Equipment returned to Quantum Data for repair must be shipped freight prepaid. Repairs necessitated by misuse of the equipment or damage caused by CRT arcs are not covered by this warranty.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. QUANTUM. DATA SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES.

MODEL 801C-CB5

Color Character Generator

USER'S MANUAL

Quantum Data Inc.
2111 Big Timber Road
Elgin, Illinois 60123
U.S.A.

Telephone: 708 / 888-0450
Telex: 206725 QUANTUM CASM
Facsimile: 708 / 888-2802

rev 3/90

QUANTUM DATA®

CONTENTS

SECTION 2 SPECIFICATIONS

APPENDICES

ILLUSTRATIONS

TABLES

COLOR GENERATOR FIRMWARE REVISION 21.2

Firmware revision 21.2 is now being shipped in all 801C generators. This revision of firmware provides several new features that are not covered in this manual.

New Horizontal Frequency Limits

The most significant difference between revision 21.2 and any previous versions is that the upper Line Rate (or Horizontal Frequency) limit has been increased to 655.36 KHz. This once optional feature is now standard.

A firmware revision message is now displayed whenever power is applied to the generator. This message reads "**EP21.2**", indicating that the generator has been outfitted with revision level 2 of firmware version 21. After displaying the revision level, the generator now checks the integrity of the information stored in EPROM. If a defective EPROM is sensed, an error message is displayed consisting of the letters "bad" followed by the letter(s) associated with the EPROMS(s) that was (are) found to be defective (the Generator has five EPROMs labeled **A**,**b**,**C**,**d**, and **E**). A bad EPROM will not necessarily disable the generator, however, corrective action should be taken since some of the functions on the generator may not work correctly.

The message "**bad E**" may be ignored if the EPROM at location U1 has not been programmed with check-sum and parity bytes. A check-sum byte containing the Mod 256 sum of the first 4094 bytes of U1 should be placed at the next-to-last location in U1. A parity byte containing the exclusive-OR of the first 4094 bytes of U1 should be placed at the last location in U1.

Also, on power-up, the pattern level which was last selected (before power was removed) is automatically loaded.

Byte 21 of the format library EPROM format (see Appendix D) has been changed slightly. The change was made in order to allow pattern level to be selected. In previous firmware revisions, pattern level could not be selected.

Byte 21 of the format library is now defined as follows:

Bits	Purpose
6-7	Reference frequency 00- If these bits are both zero, then the byte will be interpreted as being in the old format (see page D-3 of Appendix D). 01- Vertical rate = reference frequency 10- Horizontal rate = reference frequency
4-5	Pattern number 00- Pattern 1 01- Pattern 2 10- Pattern 3 11- Pattern 4
0-3	Pattern level 001-111 Depending on the selected pattern.

Revision 20.0 (or later) firmware will correctly read any EPROMs that use this Format library EPROM data configuration.

User Created Patterns

Provisions have made for additional patterns. Up to 32 extra patterns can be added. Patterns are added by inserting additional Z80 object code in U1. This additional pattern generating code must be pointed to by a two-byte address (also stored in U1) at locations $OFFC_H$ and $OFFD_H$.

The first 32 bytes of the additional code (pointed to by locations $OFFC_H$ and $OFFD_H$) have special meaning.

Bytes 4-7 contain the pattern # and max level for OPtion 10.3.
Bytes 8-11 contain the pattern # and max level for OPtion 10.4.
Bytes 12-15 contain the pattern # and max level for OPtion 10.5.
Bytes 16-19 contain the pattern # and max level for OPtion 10.6.
Bytes 20-23 contain the pattern # and max level for OPtion 10.7.
Bytes 24-27 contain the pattern # and max level for OPtion 10.8.

In each byte:

Bits 0-3 indicate maximum level (0001-1111).

These extra patterns are enabled by putting OPtion 10 into modes 2, 3, 4, 5, 6, 7 or 8. OPtion 10.9 is reserved for pattern sequencing (see explanation below). If one of these options is selected and the bytes at address $OFFC-OFFD_H$ contain $FFFF_H$ (not programmed), Err61 will result.

All color generators are shipped with additional patterns on OPtion 10 mode 2.

Automatic Sequencing Mode

An Automatic Sequencing Mode (Color Only) is now available to attract attention to your product at shows. The new mode changes the pattern that is displayed at five second intervals. To enter this sequencing mode, set OPtion 10 to mode 9. If the 'STEP' key is held, the generator will stop on the pattern currently being displayed. Releasing the 'STEP' key allows the generator to continue sequencing patterns. If the 'OUT' key is pressed, the generator exits the automatic sequencing mode, and returns OPtion 10 to mode 1. At this point, the generator is again fully operational. You will note that while in the sequencing mode, the only keys that the generator will recognize are 'STEP' and 'OUT'.

Additional Pattern Levels

Pattern 1 now has a total of six levels. The new levels are numbered 4, 5, and 6. These new levels allow you to test your red, green, and blue guns separately. Level 4 of pattern P1 provides red characters on a black background. Level 5 of pattern P1 provides green characters on a black background. Level 6 of pattern P1 provides blue characters on a black background.

The generator now remains in the OPtion entry mode after an OPtion value has been modified. This was done to reduce the number of times the OP key has to be depressed when modifying several options, one after another.

SECTION 1

This section of the manual will provide you with an overview of the generator. It does this by taking you through the steps necessary to provide signals for a standard 15.720 KHz monitor. In this way, you will be systematically introduced to each of the major features of the generator.

If you still have any questions after reading this section, we suggest you refer to the table of contents. It should help you in locating more detailed descriptions of the generator.

1.1 GETTING STARTED

In order to begin, you will need a monitor capable of operating at a horizontal rate of approximately 15.720 KHz. In addition to this, you will need the cabling necessary to connect it to the generator.

We suggest you use a monitor with separate (TTL compatible) horizontal, vertical, step, and video inputs. This will allow you to exercise more of the capabilities of the generator.

1.2 MAKING THE NECESSARY CONNECTIONS

You will find a number of connectors on the back panel of the generator. Nine TTL compatible outputs are provided for use when driving monitors with separate (TTL compatible) sync and video inputs. Most monochrome monitors require three of the nine provided; namely, horizontal drive, vertical drive, and video. Most color monitors require five of the nine provided; namely, horizontal drive, vertical drive, red, green, and blue.

Some monitors require a composite synchronization signal. In this case, the composite sync output should be used in lieu of separate horizontal and vertical drive.

If the monitor you are using has vertical stepping capability, then you will want to make a connection to the vertical step output.

A tenth TTL compatible output (not normally connected to the monitor) provides a square-wave dot rate clock. It allows you to use the generator as a frequency synthesizer when testing video logic circuits.

An analog video output is provided for monochrome monitors that require a composite video signal. The peak-to-peak amplitude from this output can be adjusted with the level control located directly below the composite video BNC connector.

The color buffer shipped with the generator provides analog outputs for three color signals. Refer to appendix K for information on the buffer.

CAUTION! Always power down the display under test before connecting or disconnecting signals from the generator. This will prevent the outputs of the generator from being damaged in the event an edge connector is accidentally cocked, causing one or more signal conductors to contact a supply voltage

cocked, causing one or more signal conductors to contact a supply voltage rail.

Once you have everything connected, rock the power switch on the front of the generator into the ON position.

1.3 SETTING UP A FORMAT

You are now ready to begin programming the generator. This involves establishing values for each of the 34 parameters which comprise a signal format. These parameters are randomly accessible from the front panel keypad.

1.3.01 Making An Entry

There are four things you must do in order to make an entry:

First, you must tell the generator which parameter you wish to modify. The exact method you will use to do this will depend on the type of parameter that you are trying to enter. We will discuss how to address each type of parameter later. For now, let's assume that you have addressed the parameter you wish change.

Second, you must enter the value you want substituted for the current value of the parameter you have addressed. This value is entered using the decimal entry keys on the keypad in much the same way as you would the decimal entry keys on a pocket calculator.

Third, you must verify that the keystrokes you have made are correct. To do this, check the display. The number you wish to enter should be displayed there. If you have accidentally entered one or more digits incorrectly, depress the CE key and re-enter the number in its entirety. You are allowed to make as many corrections as are necessary before terminating your entry.

Finally, you must terminate your entry by depressing the ENT key. If your entry is accepted, the signal generating circuits of the generator will be reconfigured.

1.3.02 Error Messages

If the value you enter violates one or more of the format limitations as described in section 2.2 (while the LED located directly below the OUT key is illuminated), an error message is displayed and the outputs of the generator are disabled.

If you encounter an error message while entering an entirely new format, keep going. Error messages encountered at this stage of the programming process should be ignored since they simply indicate that a conflict exists between what is being entered, and those values of a previous format that have not as yet been changed.

If an error message is displayed after you have entered all of the values of a new format, refer to section 4 for information concerning the problem.

1.3.03 The Lockout Feature

The generator has been outfitted with a lockout function. It is activated with a switch on the rear panel of the generator.

When activated, the lockout function prevents unauthorized persons from modifying any of the parameters in the generator while you are away.

If one attempts to make an entry (other than a format recall or pattern selection) while the generator is locked out, the "SAFE " message is displayed and the entry is ignored.

1.3.04 Entering The Timing Parameters

A signal format consists of three types of parameters; they are, the timing parameters, the option parameters, and the display parameters. We will start programming the generator by first entering the timing parameters.

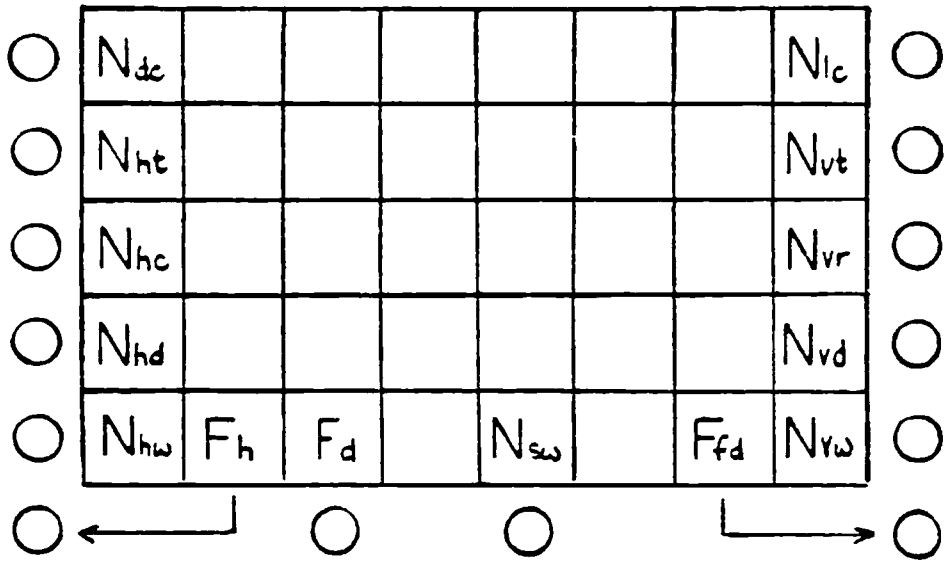
As was stated before, the first step when making an entry is to address the parameter that is to be changed.

The timing parameters are addressed using separate keys on the keypad. These keys are shown in Figure 1-1. You will notice that each key has a corresponding LED indicator. When a timing parameter key is depressed, the LED indicator associated with it is illuminated, while the value of that parameter is displayed on the 5 digit display. In this way, you may check the current value of each timing parameter.

Why don't you take a minute and try addressing a few of the timing parameters.

The timing parameter keys associated with horizontal timing are grouped on the left, while those associated with vertical timing are grouped on the right. Distributed along the bottom of the keypad are the real-time parameter keys. Also on the bottom row of the keypad is the vertical step width key.

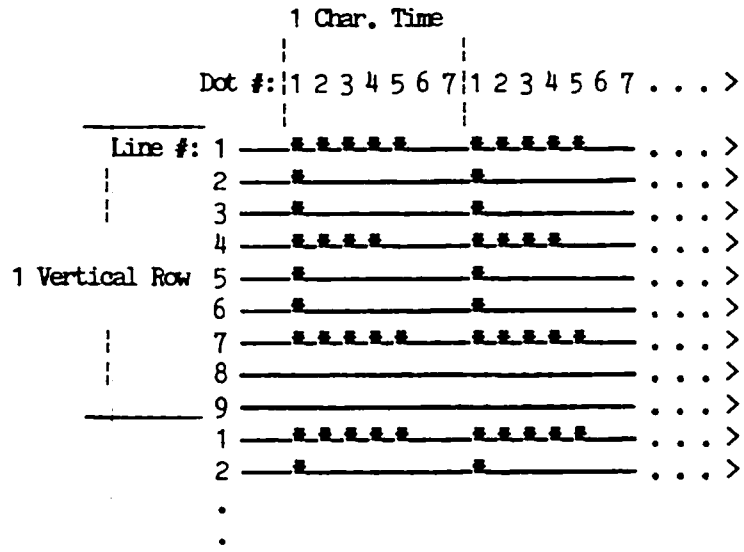
Figure 1-1 The Timing Keys



1.3.05 Defining A Character

Let's begin by establishing the size of a character block. To do this, we will have to enter two dimensions: the character block width and the character block height.

The width of a character block is measured in dots, and is entered using the (HORIZONTAL) DOTS/CHARACTER key. Since we will be displaying 5 X 7 characters, enter a character block width of 7. This will leave room for 2 dots of inter-character spacing.



To select a character width of 7 dots, press:

(HORIZONTAL) DOTS/CHARACTER 7 ENT

The character block height is measured in lines. It is entered using the (VERTICAL) LINES/CHARACTER key. To accommodate the height of a 5 X 7 character and leave 2 lines for inter-character spacing, enter a character block height of 9 lines. You can do this by pressing:

(VERTICAL) LINES/CHARACTER 9 ENT

1.3.06 Defining A Line

Now that we have established the dimensions of the character block, let's put some characters together and form a horizontal line.

The length of a horizontal line is measured in characters and is entered using the (HORIZONTAL) TOTAL CHARACTERS key. The horizontal total consists of displayed as well as blanked characters.

A good estimate of the number of characters that should be included in the horizontal total can be obtained by multiplying the number of characters to be displayed by 1.25. This makes horizontal blanking equal to 20% of a horizontal line time.

In order to display 80 characters and leave 20 character times for horizontal blanking., we will need a horizontal total of (80 X 1.25 or) 100 characters, so press:

(HORIZONTAL) TOTAL CHARACTERS 1 0 0 ENT

1.3.07 Defining A Frame

Next, we will use the (VERTICAL) TOTAL LINES key to specify the number of lines in a frame. The number entered should include displayed as well as blanked lines.

Let's ask the generator for 262 lines. This will give us enough room for 24 rows of displayed characters and 46 lines of vertical blanking.

To enter a vertical total of 262 lines, press:

(VERTICAL) TOTAL LINES 2 6 2 ENT

1.3.08 Entering The Picture Dimensions

At this point, we have established the relationships between the five most basic units of non-real (or normalized) time; namely, the dot, character, line, row, and frame times. They provide the framework on which we will now "hang" a picture.

The (HORIZONTAL) DISPLAYED CHARACTERS and (VERTICAL) DISPLAYED ROWS keys control the size of the displayed picture.

We want a picture that is 80 characters wide by 24 rows tall, so press the following:

(HORIZONTAL) DISPLAYED CHARACTERS 8 0 ENT

(VERTICAL) DISPLAYED ROWS 2 4 ENT

1.3.09 Horizontal & Vertical Drive Pulse Positioning

Next, we will center this picture by correctly positioning the horizontal and vertical drive pulses.

A separate horizontal drive pulse is sent during each line in the frame. The leading edge of this pulse is positioned with respect to the leading edge of video using the (HORIZONTAL) DRIVE DELAY key.

The number entered represents the delay (in characters) from the leading edge of video (i.e. first character of each line) to the leading edge of horizontal drive.

To position the leading edge of the horizontal drive pulse so that it begins coincidentally with the leading edge of horizontal blanking, press the following:

(HORIZONTAL) DRIVE DELAY 8 0 ENT

A vertical drive pulse is sent during each frame (or field, when in either interlaced scanning mode). The leading edge of this pulse is positioned with respect to the leading edge of video using the (VERTICAL) DRIVE DELAY key.

The number entered represents the delay (in rows) from the leading edge of video (i.e. first character of first line) to the leading edge of vertical drive.

To position the leading edge of the vertical drive pulse so that it begins coincidentally with the leading edge of vertical blanking, press the following:

(VERTICAL) DRIVE DELAY 2 4 ENT

1.3.10 Defining The Pulse Widths

The generator allows you to control the width of the horizontal,vertical, and step pulses.

The width of the horizontal drive pulse is programmable in character increments from 1 to one less than the total number of characters on a horizontal line.

The width of the vertical drive pulse is programmable in lines from 1 to 16.

The numbers you enter for horizontal and vertical pulse width will not make much difference if the monitor you are using is edge triggered.

If you are driving a monitor that is edge triggered or requires composite video, press the following:

(HORIZONTAL) DRIVE WIDTH 8 ENT

(VERTICAL) DRIVE WIDTH 3 ENT

If the monitor requires a "direct" (horizontal) drive pulse, enter a drive width equal to 41% of the horizontal total (which assumes third harmonic tuning). With a horizontal total of 100 characters, this works out to 41 characters.

In case of direct drive, you should press the following:

(HORIZONTAL) DRIVE WIDTH 4 1 ENT

The generator allows you to adjust the width of the Vertical Step pulse.

The width of the step pulse is entered using the STEP key located on the bottom row of the keypad. It is programmable in character increments from 1 to 255. We'll enter a step width of 8, so press:

STEP 8 ENT

1.3.11 Entering a Real Time Reference

Next, we will direct our attention to the real time aspects of the video signal; that is to say, the rates at which dots, lines, and fields are produced.

The dot, line and field rates for the format we are entering are 11.004 MHz, 15.72 KHz, and 60.00 Hz respectively. All you will have to do is establish one of these three; the generator will calculate the rest based on non-real time relationships.

There are three real time keys located on the bottom row of the keypad; they are marked **MHZ**, **KHZ**, and **HZ**.

The **MHZ** key allows you to enter or display the dot rate in MHz.

The **KHZ** key allows you to enter or display the horizontal line rate in KHz.

The **HZ** key allows you to enter or display the field rate in Hz.

To enter a field rate of 60.00 Hz press:

HZ 6 0 ENT

Now that a reference frequency has been established, the remaining two real time parameters may be displayed by pressing the horizontal rate (KHz) and dot rate (MHz) keys.

1.3.12 Setting Up the Options

The option parameters are entered by using the OP key located in the upper right hand corner of the keypad. The key sequence that should be used is:

OP n . m ENT

where **n** is the address of the particular option you wish to access and **m** is the mode you want to put it in. The decimal point is used to separate the two numbers.

If you want to check to see what mode a particular option is in, then use they key sequence:

OP n ENT

The first four options (numbered 1-4) allow you to enable or disable the synchronization outputs independently. This is accomplished by putting each option in either mode 1 or mode 0 respectively.

When disabled, each output reverts to an inactive condition (e.g. inverted vertical sync reverts to a "1"; whereas, non-inverted vertical sync reverts to a "0").

Let's disable the step output, and enable the composite sync, horizontal drive, and vertical drive outputs. To do this, press the following:

OP 1 . 1 ENT (enables the composite sync output)
OP 2 . 0 ENT (disables the step output)
OP 3 . 1 ENT (enables the horizontal drive output)
OP 4 . 1 ENT (enables the vertical drive output)

The next four options (numbered 5-8) allow you to independently invert each of the synchronization outputs.

When an output is in mode 0 (i.e. the non-inverted mode), the active signal level is a "1". When in mode 1 (i.e. the inverted mode), "0" becomes the active signal level.

By typing the following, you will put all of synchronization outputs of the generator in the non-inverting mode:

OP 5 . 0 ENT (selects non-inverted comp sync)
OP 6 . 0 ENT (selects non-inverted step)
OP 7 . 0 ENT (selects non-inverted horizontal drive)
OP 8 . 0 ENT (selects non-inverted vertical drive)

The generator is capable of scanning a raster in any one of three different ways. The exact method used can be selected using option 9. The simplest form of scanning is obtained in the non-interlaced mode. In this mode, each line of the frame is refreshed at the field rate. To enter the non-interlace mode, press the following:

OP 9 . 0 ENT

One of two operating modes, monochrome (OP10.0) or color (OP10.1), can be selected using option 10. To enter the monochrome mode, press the following:

OP 10 . 0 ENT

Utilizing option 11, it is possible to vary the duty cycle of each pixel displayed via the TTL Video output. When in the single-phase character clocking mode (selected in the next step), you may choose between two different duty cycles: 50% and 100%. (The duty cycle of the color outputs is always 100% regardless of the setting of option 11.) To select the 50% duty cycle mode, press the following:

OP 1 1 . 0 ENT

The upper dot rate limit of the generator is (in most cases) limited by the speed at which characters can be reliably pulled out of pattern refresh memory. This limit is approximately equal to 3.7 million characters per second.

When in (what is referred to as) the single-phase character clocking mode, each character pulled out of the pattern refresh memory is displayed once, thereby limiting the maximum dot rate to a maximum of 3.7 MHz times the character block width. This limitation may present a problem, however, if you attempt to provide signals for a high-resolution display of the type commonly used in word processing applications.

When working with monitors of this kind, you will want to use (what is known as) the dual-phase character clocking mode. In this mode, each character pulled out of pattern refresh memory is displayed twice. This doubles the effective bandwidth of the pattern refresh memory and allows the generator to operate at dot rates up to 65.520 MHz (the upper limit of the frequency synthesizer).

When in the dual-phase character clocking mode, you will be limited to a character block width of 9 dots. In addition to this, some of timing parameters will become programmable in increments of even numbers only.

The color outputs are single-phase only. If used with the dual-phase character clocking mode, every other pixel will be missing.

The character clocking mode that is used is controlled with option 12. Since you will be operating the generator at lower dot rates to begin with, you will want to put the generator in the single-phase character clocking mode. To do this, press the following:

OP 1 2 . 0 ENT

With option 13, you can select the polarity of the picture as well as the logic levels used to represent beam on and beam off. To select the non-inverted/positive video mode, press:

OP 1 3 . 0 ENT

Option 14 allows you to skew the pixel information inside the character block to the right by as many as three dots.

To select no skew, press:

OP 1 4 . 0 ENT

Option 15 allows you to skew the pixel information inside the character block down by as many as nine lines.

To select no skew, press:

OP 1 5 . 0 ENT

Option 16 enables you to put a cursor in the upper/left hand corner of the picture.

We'll leave the cursor off for now, so press the following:

OP 1 6 . 0 ENT

1.4 FORMAT STORAGE

The generator has a total of 151 format registers. Each register holds one format.

There are two types of registers: "READ/WRITE" registers and "READ-ONLY" registers.

The READ/WRITE format registers reside in non-volatile CMOS RAM. There are five of them. Each of these registers may be either read from or written to. They are non-volatile; that is to say, when the power to the generator is removed, the information contained within them is retained.

One of the five READ/WRITE registers is used as a FORMAT BUFFER to hold the parameters that are actually used when setting up the signal generating circuits of the generator.

The parameters in the FORMAT BUFFER are the parameters that are interrogated as well as changed when using the parameter keys on the front panel keypad.

The STO key is used to transfer the format residing in the FORMAT BUFFER to any one of the other four READ/WRITE registers. In this way, the READ/WRITE registers can be used to store up to four hand-entered formats for future reference.

The STO-n-ENT key sequence (where n is a number from 1 to 4) causes the current contents of READ/WRITE register n to be overwritten with the contents of the FORMAT BUFFER.

The remaining 146 registers are "READ-ONLY" types. They reside in EPROM.

Five of the READ-ONLY registers reside in the top portion of the EPROM located at position Z22 inside the generator. The remaining 141 READ-ONLY registers completely fill another EPROM which is located at position U1.

The five formats in Z22 are test formats. They are intended to be used for checking the performance of the generator (refer to appendix I for more details).

All generators are shipped with an EPROM installed at location U1. This EPROM contains 9 standard signal formats. It is provided so that one may begin using the generator the moment it arrives. This EPROM may be subsequently reprogrammed (if necessary) by the customer (refer to appendixes D and J for more details).

The RCL key is used to recall formats. Formats from both READ/WRITE and READ-ONLY registers can be recalled. Recalling a format causes the current contents of the FORMAT BUFFER to be overwritten with the contents of the register being addressed.

When recalling a format from a READ/WRITE register, the RCL-n-ENT key sequence causes the current contents of the FORMAT BUFFER to be overwritten with contents of READ/WRITE register n.

When recalling formats from a READ-ONLY register, the RCL-n-ENT key sequence causes the current contents of the FORMAT BUFFER buffer to be overwritten with the contents of the register that contains serial number n.

NOTE: One of the features of the RCL function makes it impossible to confuse an exact copy of a READ-ONLY format (residing in the format buffer) with a one that has been modified.

Whenever a format is successfully recalled from memory, a "F" appears in the most siginificant digit of the display. As long as this "F" is displayed, you can rest assured that the format residing in the format buffer of the generator is, in fact, an exact copy of the format as recalled from memory.

1.5 ENABLING THE OUTPUTS

The outputs of the generator are enabled and disabled using the OUT key (located on the bottom row of the keypad).

If the outputs are disabled and you want them enabled; depress the OUT key. If the format buffer contains a valid format, the outputs will be enabled; otherwise, an error message will be displayed and the outputs will remain disabled.

If the outputs are enabled and you depress the OUT key, the outputs will be disabled.

The output LED (located directly below the OUT key) is used to indicate whether the outputs are enabled or disabled. When lit, the output LED indicates that the outputs are enabled.

We want the outputs enabled; if they are disabled, depress the OUT key.

1.6 TOUCHING UP THE DRIVE DELAYS

At this point, you may apply power to the monitor. After a brief warmup, you should have a picture. This picture may be off center. If it is, you should center it by touching up the horizontal and vertical drive delays.

By changing the value of the horizontal drive delay, you can move the picture left or right. Increasing the amount of horizontal delay moves the picture to the left. Decreasing the amount of delay moves the picture to the right.

Changing the value of the vertical drive delay moves the picture up and down. Increasing the amount of vertical delay moves the picture up, while decreasing the amount of delay moves the picture down.

Adjust the drive delays so that the picture is centered in the raster.

1.7 ENTERING THE DISPLAY PARAMETERS

There are a total of five display parameters. One of the five display parameters is used to select the pattern that is displayed. The remaining four display parameters select the characters that appear within the pattern that is selected.

1.7.01 The Character Select Keys

You tell the generator which characters you want to be displayed by entering character codes (from appendix B) using the character select keys marked C1, C2, C3, and C4.

Each key controls a specific area of the displayed pattern. For example, when using pattern 1 (illustrated in figure 1-2) the character keys work as follows:

The character that is used to make the columns in the pattern is selected using the C1 key.

The character that is used to make top and bottom rows is selected using the C2 key.

The character displayed inside the four quadrants is selected using the C3 key.

The character that is used to make the patch in the middle of each quadrant is selected using the C4 key.

To make an entry, you press one of the character select keys. The generator will respond by displaying the character code currently being used in that location. If you want some other character, simply enter a different code and press the ENT key.

In order to select pattern 1 (more will be said about pattern selection later) and make the columns in the picture out of "E"s, the top and bottom rows out of "H"s, the quadrants out of pixels, and the patches out of blanks, press:

P1

C1 5 ENT (selects a 5 X 7 "E")

C2 7 ENT (selects a 5 X 7 "H")

C3 3 3 ENT (selects a 5 X 7 pixel)

C4 4 ENT (selects a blank)

1.7.02 The Pattern Keys (Monochrome Mode - Option 10.0)

The pattern keys have two operating modes, monochrome and color, which are selected by option 10.

To select the monochrome mode, press:

OP 1 0 . 0 ENT

Figures 1-2 thru 1-5 illustrate the kind of patterns that can be generated by the generator when in the monochrome mode (OP10.0).

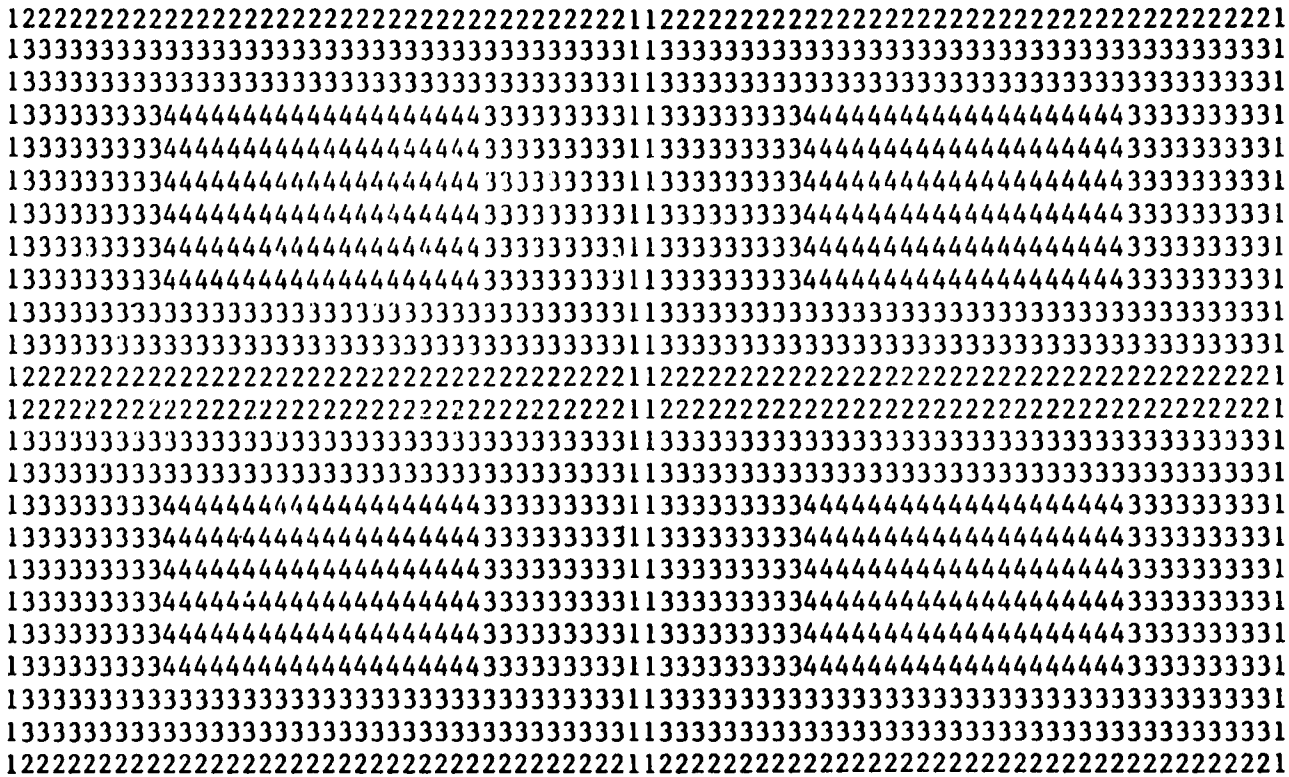

1222222222222222222222222222222222222211222222222222222222222222222222222221
1333333333333333333333333333333333333311333333333333333333333333333333333331
1333333333333333333333333333333333333311333333333333333333333333333333333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333333333333333333333333333333333311333333333333333333333333333333333331
1333333333333333333333333333333333333311333333333333333333333333333333333331
1222222222222222222222222222222222222211222222222222222222222222222222222221
1222222222222222222222222222222222222211222222222222222222222222222222222221
1333333333333333333333333333333333333311333333333333333333333333333333333331
1333333333333333333333333333333333333311333333333333333333333333333333333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333334444444444444444444433333333311333333334444444444444444444433333331
1333333333333333333333333333333333333311333333333333333333333333333333333331
1333333333333333333333333333333333333311333333333333333333333333333333333331
1222222222222222222222222222222222222211222222222222222222222222222222222221

Figure 1-2

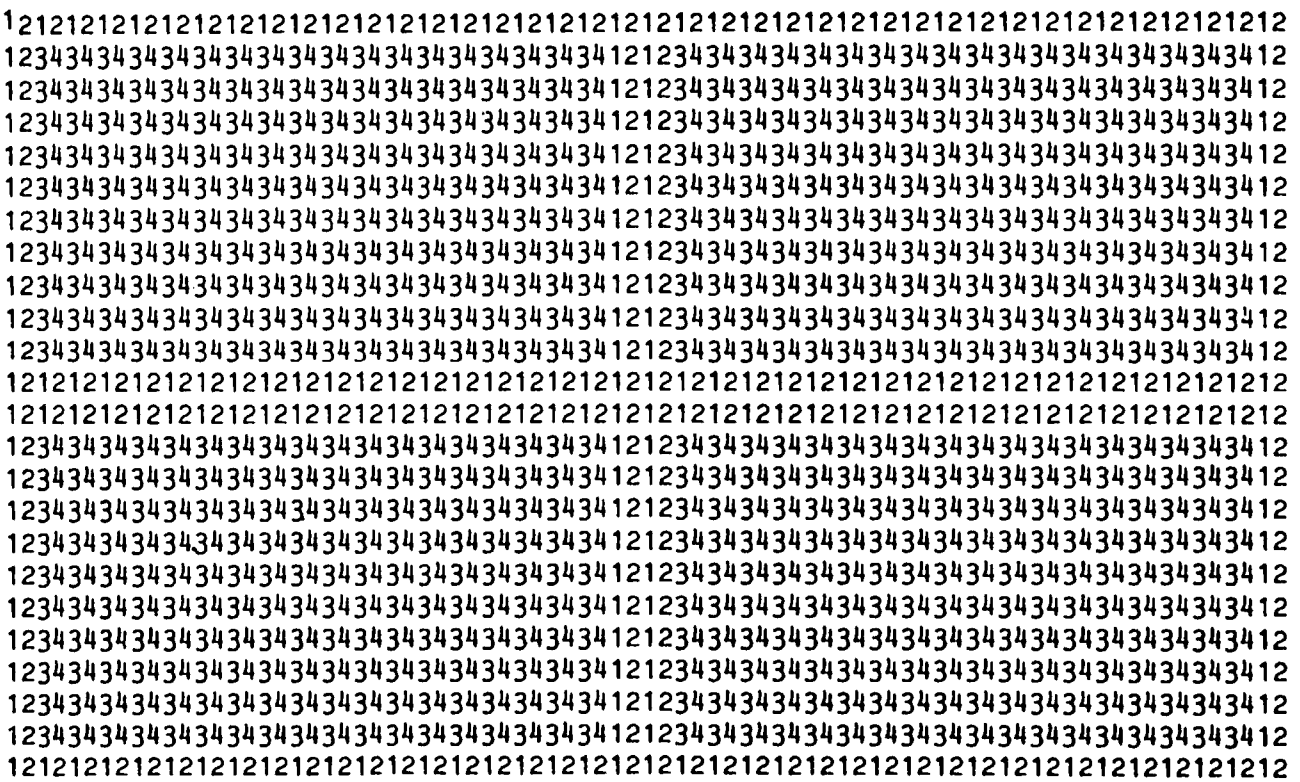


Figure 1-3

```
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
12121212121212121212121212121212121212121212121212121212121212121212121212121212
34343434343434343434343434343434343434341212343434343434343434343434343434343434
```

Figure 1-4

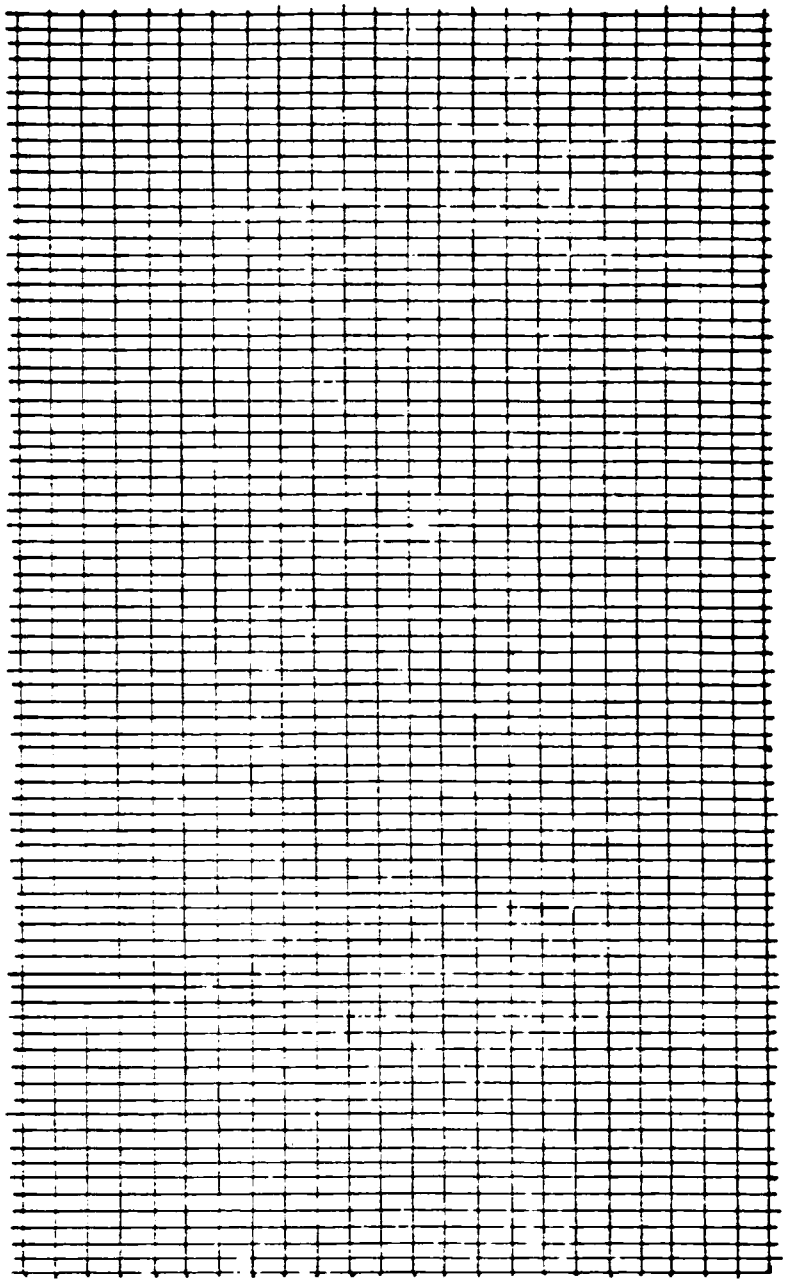


Figure 1-5

Patterns are selected using the keys marked P1, P2, P3, and P4.

To obtain the type of pattern shown in figure 1-2, press:

P1

Let's save a copy of this pattern for later, so press:

STO 1 ENT

To obtain the type of pattern illustrated in figure 1-3, press:

P2

Pattern P2 makes it possible to display characters having effective block widths of up to 16 dots/character. It does this by pairing characters horizontally.

To illustrate this, press the following:

(VERTICAL) DISPLAYED CHARACTERS 1 4 ENT

(VERTICAL) DRIVE DELAY 1 4 ENT

(VERTICAL) LINES/CHARACTER 1 6 ENT

C1 5 6 ENT

C2 5 7 ENT

C3 5 8 ENT

C4 5 9 ENT

The pattern that is being displayed is constructed using two different Japanese characters. Each character resides in a pseudo character block constructed using two 7 X 16 character blocks paired horizontally. The dimensions of the two pseudo character blocks are 14 X 16.

To obtain the pattern illustrated in figure 1-4, press:

P3

Pattern P3 not only pairs characters horizontally, but vertically as well. It makes it possible to display characters having block dimensions up to 16 X 32.

To illustrate this, press the following:

(HORIZONTAL) DOTS/CHARACTER 8 ENT

C1 6 2 ENT

C2 6 3 ENT

C3 6 4 ENT

C4 6 5 ENT

In this pattern, four 8 X 16 character blocks are used to make a single 16 X 32 pseudo block. The pseudo block is displayed in every location on the screen.

Pattern P4 provides a crosshatch pattern which may be used when making horizontal and vertical linearity measurements. This pattern is a little different from the other patterns in that it generates its own characters. When this pattern is being displayed, the character select codes are ignored.

To select pattern P4, press:

P4

Let's retrieve the pattern we had before, so press:

RCL 1 ENT

1.7.03 The Pattern Keys (Color Mode - Option 10.1)

To select the color mode press:

OP 1 0 . 1 ENT

Note: A color monitor, used with the color buffer, is required to view all the pattern information provided by the color outputs. The buffer is capable of providing two levels of video. The lesser of the two levels, referred to as gray, is selected when a "1" is present at the Gray output of the generator. For information on the buffer refer to appendix K.

The operation of the pattern keys in the color mode is similar to operation in the monochrome mode with the following exceptions:

Several "levels" of patterns can be selected by repeatedly pressing the same pattern select key.

The "level" of the pattern will be indicated by the right most digit of front panel display.

To demonstrate these differences, press:

P2

The display now shows "P2 1" (green raster) indicating P2 is in the first level. P2, in the color mode, displays solid color rasters and has 7 levels, one for each color. To select the next level, press:

P2

The display now shows "P2 2" (red raster). If you continue to press the P2 key, the generator will step through each level until it reaches the highest level, "P2 7". Pressing the P2 key again will return to the first level, "P2 1".

When powering up or when selecting a new pattern, the first level of the selected pattern will be displayed, with the exception of "P1 3".

The following is a description of the patterns the generator will make in the color mode.

Note: Eight bits of color video information are provided for each character; four bits of foreground information and four bits of background information. The color outputs, Red (bit 0), Green (bit 2), Blue (bit 2), and Gray (bit 3), provide this information. Foreground colors are selected when a "1" (beam on) condition is present at the TTL Video output and background colors are selected when a "0" (beam off) is present.

P1 1: The characters are loaded as shown by figure 1-2. Additional color information is added to this pattern as follows:

The color refresh RAM locations that correspond to the C3 characters and C1 characters that intersect C2 rows are loaded with white foreground and black background information.

The color refresh RAM locations that correspond to the upper left and lower right C4 character blocks are loaded with white foreground and white background information. The remaining two C4 blocks are loaded with gray foreground and gray background information.

C2 background color information is loaded from the outside character locations toward the center of the picture in the following order:

Red-Green-Blue-Red . . .> <. . . Red-Blue-Green-Red

The foreground color information for each C2 character location is always the complement of the background color. (Blue-Green on Red, Red-Blue on Green, Red-Green on Blue)

C1 locations, not intersected by C2 rows, are loaded in a similar manner to the C2 locations except they are loaded from top and bottom ends towards the center and the foreground and background colors are reversed.

P1 2: This pattern shows all possible combinations of foreground and background colors (256 possible). The number of characters of each combination is dependent on the total number of displayed characters.

P1 3: Same as "P1 2" but pattern is reloaded every five seconds from a different starting point. This pattern is useful in an application,

such as burnin, where leaving the same pattern displayed for long periods of time may damage the CRT's phosphorus.

P2 1: Green raster. P2 displays solid fields of color (7 possible). The foreground and background are loaded with the same color information so no character information is visible.

P2 2: Red raster.

P2 3: White raster.

P2 4: Blue raster.

P2 5: Yellow (Red-Green) raster.

P2 6: Cyan (Green-Blue) raster.

P2 7: Magenta (Red-Blue) raster.

P3 1: Color bars. This pattern makes eight vertical color bars (seven colors and black) in the following order:

White, Black, Yellow, Cyan, Green, Magenta, Red, Blue.

If the horizontal displayed characters is not evenly divisible by eight, the remainder is loaded in the white bar.

P3 2: Color bars. The bar information in this pattern is identical to "P3 1" except the bottom half of the pattern is grayed.

P3 3: Color bars. This makes sixteen vertical color bars. The color outputs count up, in binary form, from 00 hex to 0F hex across the top half of the pattern and count down from 0F hex to 00 hex across the bottom half of the pattern. If the number of horizontal displayed characters is not divisible by sixteen, the remainder is loaded in the first bar.

Red = bit 0, Green = bit 1, Blue = bit 2, Gray = bit 3

P4 1: White crosshatch. The color mode crosshatch pattern is a symmetrical pattern of vertical and horizontal lines with dots. The pattern is loaded from the edges toward the center so that any odd spacing is displayed in the center axes of the pattern.

Note: A minimum of seventeen horizontal displayed characters and seventeen displayed rows are required for dots to be displayed. Also, if there are more than 4096 total displayed characters, the pattern will be loaded as in the monochrome mode.

Four characters, generated by the generator, are used to make this pattern: a cross, a horizontal line, a vertical line, and a dot. Character spaces not containing crosses or lines are loaded with dots.

This pattern is intended for checking and adjusting the convergence of color displays.

P# 2: Magenta (Red-Blue) crosshatch. This pattern, and the following two crosshatch patterns, display combinations of two colors to make them more visible when converging the two related guns.

P# 3: Yellow (Red-Green) crosshatch.

P# 4: Cyan (Green-Blue) crosshatch.

Let's retrieve the pattern we had before, so press:

RCL 1 ENT

1.8 PATTERN SYMMETRY

Notice that the pattern being displayed is symmetric. There are 40 columns to the right of center and an equal number of columns on the left. In the vertical direction, we have 12 rows at the top and 12 rows on the bottom.

This symmetry is preserved no matter what the dimensions of the picture might be.

Press the following:

(HORIZONTAL) CHARACTERS 7 9 ENT

This changes the dimensions of the picture to 79 X 24. Notice that the pattern is still symmetric. There are now 39 columns on the left and 39 columns on the right (with one column in the middle).

Press the following:

(VERTICAL) ROWS 2 3 ENT

This changes the dimensions of the picture to 79 X 23. Again, the pattern is symmetric with 11 lines being displayed above and below the row in the center.

1.9 THE CURSOR

Option 16 can be used to put a cursor in the upper left hand corner of the picture. In this way, you will be able to verify that the yoke in the unit you are testing has been wired correctly.

The cursor is displayed as a reversed video character block when using the monochrome outputs (TTL Video or Comp. Video) or as a blank character block when using the color outputs.

There are four cursor modes; they are, on, blinking fast, blinking slow, and off.

To turn the cursor on, press:

OP 1 6 . 3 ENT

You can make it blink by pressing:

OP 1 6 . 1 ENT

You can cut the blink rate in half by pressing:

OP 1 6 . 2 ENT

Return the cursor option to the off mode by pressing:

OP 1 6 . 0 ENT

1.10 INVERTED (TTL) VIDEO

The (TTL) video output of the generator can be inverted so that a logic "0" represents beam on. To obtain inverted/positive video press:

OP 1 3 . 1 ENT

1.11 NEGATIVE VIDEO

In the negative video mode, black pixels appear on a white pedestal. To enter the non-inverted/negative video mode press:

OP 1 3 . 2 ENT

If you need inverted/negative (TTL) video press:

OP 1 3 . 3 ENT

Otherwise, stick with the non-inverted/negative video mode by pressing:

OP 1 3 . 2 ENT

Note: The color video signals cannot be inverted. (ie. The blanking pedestal is always at a black level.) Negative video, when referring to the color mode, is the reversal of foreground (character) and background color information. When using the color outputs options 13.1 and 13.3 will have the same affect as options 13.0 and 13.2 respectively.

1.12 SKEW

The generator allows you to skew the pixel matrix inside each character block. This feature is most often required when displaying color or negative video patterns. It allows you to even out the amount of pedestal on all sides of the picture.

1.12.01 Horizontal Skew

The amount of horizontal skew is controlled using option 14. The mode number that is assigned to option 14 is directly translated into horizontal skew. For example, pressing:

OP 1 4 . 1 ENT

causes the pixel matrix inside the character block to skew to the right one dot.

The amount of horizontal skew can be varied from zero (OP 14.0) to a maximum of 3 dots (OP 14.3).

1.12.02 Vertical Skew

The amount of vertical skew is controlled using option 15. Like option 14, the mode number assigned to option 15 is directly translated into vertical skew.

By pressing:

OP 1 5 . 1 ENT

the matrix inside the character block is skewed down 1 line.

The amount of vertical skew can be varied from zero (OP 15.0) to a maximum of 9 lines (OP 15.9).

Recall the format that resides in register 1 by pressing:

RCL 1 ENT

1.13 STEP CONTROL

If the unit you are using has stepping capability and has been properly connected to the step output of the generator, press the following:

OP 2 . 1 ENT

This key sequence enables the step output and should cause the vertical size of the picture to increase.

Disable the step output once again by recalling the format stored in format register 1. To do this press:

RCL 1 ENT

Before proceeding, disable the outputs of the generator by pressing:

OUT

1.14 THE INTERLACED SYNC ONLY MODE

By putting the generator in the interlaced sync only mode, you will cause each line in the picture to be displayed twice.

Before entering the interlaced mode of operation, we need to increase the number of lines in the picture. This will keep the horizontal rate near 15.720. Let's increase the number of lines in the picture to 525. To do this,

press the following:

(VERTICAL) TOTAL LINES 5 2 5 ENT

We will also need to double the character block height, so press:

(VERTICAL) LINES/CHARACTER 1 8 ENT

To put the generator into the interlaced sync only mode, press the following:

OP 9 . 1 ENT

Turn the outputs of the generator back on by pressing:

OUT

Before proceeding turn the outputs back off again by pressing:

OUT

1.15 THE INTERLACED SYNC & VIDEO MODE

Next, we will put the generator in the interlaced sync & video mode. This will allow us to double the number of rows displayed in the picture.

To put the generator into the interlaced sync & video mode, press the following:

OP 9 . 3 ENT

Return the character block height to 9 lines/character by pressing:

(VERTICAL) LINES/CHARACTER 9 ENT

You should also change the number of displayed rows as well as the vertical drive delay by pressing:

(VERTICAL) ROWS 5 0 ENT

(VERTICAL) DRIVE DELAY 5 0 ENT

Turn the outputs of the generator back on by pressing:

OUT

1.16 THE DUAL-PHASE MODE

Finally, we will increase the dot rate to a frequency of 36.208 MHz. To do this we will need to enter the dual-phase mode.

Let's start by recalling the non-interlace format stored in format register 1. Press the following:

RCL 1 ENT

Change the character block width to 9 dots/character by pressing:

(HORIZONTAL) DOTS/CHARACTER 9 ENT

Now enter the dual-phase character clocking mode by pressing:

OP 1 2 . 2 ENT

To increase the dot rate, simply increase the horizontal total. Press the following:

(HORIZONTAL) TOTAL 2 5 6 ENT

Press the MHZ key to verify that the dot rate is 36.208 MHz.

1.17 THE MATRIX KEY

The matrix key allows you to create up to four 8 X 16 characters from the front panel keypad. These characters are brought into the displayed picture using character codes 0, 1, 2, and 3.

The pixel information for each character is entered one line at a time. Each line is addressed using the key sequence:

M x . y ENT

This expression is interpreted by the generator as meaning "modify line x of the character y".

Once the line to be modified has been addressed, pixel information may be entered.

You select which pixels you want "on" (foreground color) and which ones you want "off" (background color) by entering a series of ones and zeros. (1=On, 0=Off)

The generator always points to the next pixel that will be affected; for example, if the five digit display displays the message "1.2 3", it is to indicate that the next pixel to be entered is dot 3 and that the line currently being modified is the 1st line of character 2.

If you make an error while entering the series of ones and zeros, you may back up as far as you would like by pressing the CE key.

A worksheet may be found in appendix H which will make the process of entering characters from the keypad much easier.

NOTE: To eliminate confusion. Zero both skew options while using the matrix key.

SECTION 2

2.1 GENERAL SPECIFICATIONS

2.1.01 Frequency Synthesizer

Reference: 1 MHZ Crystal

Range	Resolution
1.024 - 4.096 MHZ	1KHZ
4.096 - 8.192 MHZ	2KHZ
8.192 - 16.384 MHZ	4KHZ
16.384 - 32.768 MHZ	8KHZ
32.768 - 65.520 MHZ	16KHZ

Accuracy: 100 PPM

2.1.02 Video Output

Interface: Schottky TTL Line Driver

Duty Cycle: 50% and 100%

Video Polarity: Positive or Negative

Signal Polarity: Inverted or Non-inverted

Gating: Common Individual

2.1.03 Color Outputs

Red (bit 0)
Green (bit 1)
Blue (bit 2)
Gray (bit 3)

Interface: Schottky TTL Line Driver

Duty Cycle: 100%

Video Polarity: Foreground & Background Reversible

Signal Polarity: Non-inverted

Maximum Frequency: 32.760 MHZ

2.1.04 Horizontal Drive Output

Interface:	Schottky TTL Line Driver
Frequency Range:	8.00 to 655.36 KHz
Position:	May be programmed to begin coincident with the leading edge of any character time within the horizontal period.
Width:	Programable in character times from one to one less than the total number of character times in a horizontal period.
Signal Polarity:	Inverted or Non-inverted
Gating:	Common or Individual

2.1.05 Vertical Drive Output

Interface:	Schottky TTL Line Driver
Frequency Range:	0.195 - 655.35 HZ
Position:	May be programmed to begin coincident with the leading edge of any character row within the vertical frame.
Width:	Programmed in line time from one to sixteen.
Signal Polarity:	Inverted or Non-Inverted
Gating:	Common or Individual

2.1.06 Composite Sync Output

Interface:	Schottky TTL Line Driver
Signal Composition:	Horizontal Drive ORed with Vertical Drive.
Signal Polarity:	Inverted or Non-inverted
Gating:	Common or Individual

2.1.07 Vertical Step Output

Interface:	Schottky TTL Line Driver
Position:	Coincident with the leading edge of horizontal blanking before the last line in each displayed row (independent of the position of horizontal drive).
Width:	Programmable in character times from a minimum of 1 to 255 (not affected by either the width of the horizontal drive pulse nor the boundaries of the horizontal period).
Signal Polarity:	Inverted or Non-inverted
Gating:	Common or Individual

2.1.08 Dot Rate Output

Interface:	Schottky TTL Line Driver
Frequency Range:	Same as the synthesizer.

2.1.09 Composite Video Output

Level:	Adjustable from 0 - 1.5 V_{p-p} (when terminated in 75 ohms).
Ratio:	2.5 parts video to 1 part sync (not affected by the level adjustment)

2.1.10 Character Block Dimensions

Horizontal:	Min 6 dots Max 12 dots (16 dots when using paired characters)
Vertical:	Min 1 line (2 lines in interlace) Max 16 lines (32 lines with interlaced sync-only mode or stacked characters)

2.1.11 Format Storage

READ/WRITE Formats:	4 formats stored in and recalled from CMOS RAM
READ-ONLY Test Formats:	5 formats for checking the performance of the generator

READ-ONLY
Customer Formats: 141 formats selectable from an EPROM programmed by the customer (Shipped with 9 sample formats which can be erased.)

2.1.12 Characters

READ/WRITE
Character Set: 4 characters selectable from CMOS RAM (programmed from the front panel keypad)

READ-ONLY
Character Set: 64 characters selectable from EPROM (May be changed by customer.)

2.1.13 Overall Dimensions

Width: 12.52 inches (318.0 mm)

Height: 5.01 inches (127.3 mm)

Depth: 11.64 inches (295.7 mm)

2.1.14 Weight

Shipping Weight: 20 lbs.

2.1.15 Power Requirements

Voltage Ranges: 4 (externally selectable)
100 Volt Range: 88-108 VAC 220 Volt Range: 193-238 VAC
120 Volt Range: 105-130 VAC 240 Volt Range: 210-260 VAC
Line Frequency: 50/60 HZ
Current: 0.5 Amp

2.1.16 Environment

Operating
Temperature: 40 degrees fahrenheit (5 degrees celsius) to 100 degrees fahrenheit (38 degrees celsius)

Humidity: 20 to 80 percent (noncondensing)

2.2 FORMAT LIMITATIONS

2.2.01 Character Block Width The number of 100% duty cycle pixels (or dots) to a character time.

a. The character block width must exceed 5 dots.

b. The character block width must be 9 dots while in the dual-phase character clocking mode (OP 12.2).

c. The character block width must not exceed 12 dots.

d. Also see 2.2.20b.

2.2.02 Character Block Height The number of lines in a row.

a. The character block height must exceed 0 lines.

b. The character block height must be even while in the interlaced sync only mode (OP 9.1).

NOTE: This limitation **does not** apply when in the interlaced sync and video mode (OP 9.3).

c. The character block height must not exceed 32 lines while in the interlaced sync only mode (op 9.1).

d. The character block height must exceed 2 lines if either interlace mode is selected (OP 9.1 or OP 9.3) or the vertical step output is used.

e. The character block height must not exceed 16 lines while in either the non-interlaced or interlaced sync & video modes (OP 9.0 or OP 9.3).

f. Also see 2.2.20b.

2.2.03 Horizontal Total The total number of character times in a horizontal period.

a. The horizontal total must be even while in the dual phase character clocking mode (OP 12.2).

b. The horizontal total must be even while in either interlace mode (OP 9.1 or OP 9.3).

c. The horizontal total must exceed 5 character times while in either interlace mode (OP 9.1 or OP 9.3).

d. The horizontal total must exceed 3 character times.

e. The horizontal total may not exceed 256 character times.

2.2.04 Horizontal Displayed The number of displayed columns in a frame.

a. The number of characters displayed horizontally must be even while in the dual-phase character clocking mode (OP 12.2).

b. The number of characters displayed horizontally must be less than the horizontal total.

c. The number of characters displayed horizontally must be even when using the "paired character" patterns (P2 and P3) in the monochrome mode (OP 10.0).

2.2.05 Horizontal Drive Delay The delay in character times from the trailing edge of the horizontal blanking interval (or the beginning of video) to the beginning of horizontal drive.

a. The horizontal delay before sync must be even when in the dual-phase character clocking mode (OP 12.2).

b. The horizontal delay before sync must be less than the horizontal total.

NOTE: A drive delay of 0 character times is equivalent to a drive delay equal to the horizontal total.

2.2.06 Horizontal Drive Width The width of the horizontal drive pulse in character times.

a. The horizontal drive pulse width must exceed 0 character times.

b. The horizontal drive pulse width must be even while in the dual-phase character clocking mode (OP 12.2).

c. The width of the horizontal drive pulse must be less than the horizontal total.

2.2.07 Vertical Total The total number of line times in a frame.

a. The vertical total must be odd while in either interlace mode (OP 9.1 or OP 9.3).

b. The vertical total may not exceed 128 times the character block height.

c. The vertical total must exceed the product of the vertical delay times the character block height by no less than a character block height.

2.2.08 Vertical Displayed The number of displayed rows in the frame.

a. The vertical displayed must be less than the vertical total divided by the character block height (excluding any remainder).

b. The number of displayed rows must be even when using a "stacked" character pattern (P3) in the monochrome mode.

2.2.09 Vertical Drive Delay The delay in row times from the trailing edge of vertical blanking (or the beginning of video) to the beginning of vertical drive.

The vertical delay must be less than the quotient of the vertical total divided by the character block height (excluding any remainder).

2.2.10 Vertical Drive Width The width of the vertical drive pulse in line times.

a. The width of the vertical drive pulse must exceed 0 line times.

b. The width of the vertical drive pulse must not exceed 16 line times.

2.2.11 Vertical Step Width The width of the vertical step pulse in character times.

a. The width of the vertical step pulse must exceed 0 character times.

b. The width of the vertical step pulse must be even while in the dual-phase character clocking mode (OP 12.2).

c. The width of the vertical step pulse must be less than 256 character times.

2.2.12 Dot Rate (MHZ) The rate at which 100% duty cycle pixels are produced.

a. The dot rate must exceed 1.023 MHZ while in the single- phase character clocking mode (OP 12.0).

b. The dot rate must exceed 2.047 MHZ while in the dual- phase character clocking mode (OP 12.2).

c. The dot rate may not exceed 32.760 MHZ while in the color mode (OP 10.1) or the single-phase character clocking mode (OP 12.0).

d. The dot rate may not exceed 65.520 MHZ while in the dual-phase character clocking mode (OP 12.2).

NOTE: The frequency limits given above represent the minimum and maximum rates available at the DOT RATE connector, should the generator be used as a frequency synthesizer.

Refer to Table 2-1 for additional restrictions that must be imposed when using other outputs of the generator.

TABLE 2-1 Additional Dot Rate Restrictions

Character Clocking Mode	Width (dots)	Recommended Dot Rate Limits (MHZ)
Single Phase (OP 12.0)	6	1.024-22.224
Single Phase (OP 12.0)	7	1.024-25.896
Single Phase (OP 12.0)	8	1.024-29.632
Single Phase (OP 12.0)	9	1.024-32.760
Dual Phase (OP 12.2)	9	2.048-65.520
Single Phase (OP 12.0)	10	1.024-32.760
Single Phase (OP 12.0)	11	1.024-32.760
Single Phase (OP 12.0)	12	1.024-32.760

2.2.13 Horizontal Frequency (KHZ) The rate at which horizontal lines are produced.

The horizontal frequency may not exceed 65.535 KHZ.

2.2.14 Vertical Frequency (HZ) The frame rate when in the non-interlaced mode (OP 9.0). The field rate when in either interlace mode (OP 9.1 or OP 9.3).

The vertical frequency may not exceed 655.35 KHZ.

2.2.15 Option Modes Special modes of operation entered using the OP key.

All options must be in valid modes of operation. (See Table 2-2 for a list of valid modes.)

TABLE 2-2 VALID OPTION MODES

Option Code	Mode Code	Description of Mode
OP 1	0	Composite sync output disable
OP 1	1	Composite sync output enable
OP 2	0	Vertical step output disable
OP 2	1	Vertical step output enable
OP 3	0	Horizontal drive disable
OP 3	1	Horizontal drive enable
OP 4	0	Vertical drive output disable
OP 4	1	Vertical drive output enable
OP 5	0	Non-inverted composite sync
OP 5	1	Inverted composite sync
OP 6	0	Non-inverted vertical step
OP 6	1	Inverted vertical step
OP 7	0	Non-inverted horizontal drive
OP 7	1	Inverted horizontal drive
OP 8	0	Non-inverted vertical drive
OP 8	1	Inverted vertical drive
OP 9	0	Non-interlace
OP 9	1	Interlaced sync only
OP 9	3	Interlaced sync & video
OP 10	0	Monochrome video mode
OP 10	1	Color video mode
OP 11	0	Duty cycle 50 (OP 12.0) or 100% (OP 10.1,12.2)
OP 11	1	100% Duty Cycle
OP 12	0	Single-phase character clocking
OP 12	2	Dual-phase character clocking
OP 13	0	Non-inverted positive video
OP 13	1	Inverted positive video
OP 13	2	Non-inverted negative video
OP 13	3	Inverted negative video
OP 14	0-3	Skew to right 0-3 dots
OP 15	0-9	Skew down 0-9 dots
OP 16	0	Cursor disable
OP 16	1	Cursor enable (blinking fast)
OP 16	2	Cursor enable (blinking slow)
OP 16	3	Cursor enable (no blink)

2.2.16 Character Library A memory from which character pixel matrices are recalled.

a. Character codes 0 thru 3 are reserved for the "soft" characters stored in CMOS RAM.

b. Character codes 4 thru 67 are reserved for the "firm" characters stored in EPROM.

2.2.17 Format Library A memory used to store up to 150 formats.

a. The READ/WRITE storage registers are numbered from 1 to 4.

b. Format numbers 5 thru 9 are reserved for the five test formats stored in EPROM at position Z22 inside the generator. (see Appendix C)

c. The customer's formats are recalled by serial number. Serial numbers 10 thru 9999 are used by the user when creating a custom library (see Appendix D). The customer's format library cannot contain more than 141 formats. (The generator is shipped with 9 sample formats, numbered 10 thru 18, which can be erased if desired.)

2.2.18 Patterns Software generated patterns.

Monochrome Mode (OP 10.0)

Patterns P2 and P3 cannot be entered while the generator is operating in the dual-phase character clocking mode (OP 12.2).

2.2.19 Pattern Refresh Memory A memory used to store character placement information.

a. The active video area will be loaded with character C3 if the total number of displayed characters (displayed columns X displayed rows) exceeds 4,096 while in the single-phase character clocking mode (OP 12.0).

b. The active video area will be loaded with character C3 if the total number of displayed characters (displayed columns X displayed rows) exceeds 8,192 while in the dual-phase character clocking mode (OP 12.2).

2.2.20 Color Refresh Memory A memory used to store color information.

a. The total number of displayed characters (displayed columns X displayed rows) cannot exceed 6,144 in the color mode (OP10.1).

2.2.21 Pixel Refresh Memory Four memories used to store pixel placement information.

a. The generator is capable of displaying up to four different 8 X 16 pixel matrices at one time (excluding inter-character spacing).

b. Larger matrices can be accommodated by using patterns P2 and P3. Pattern P2 pairs characters horizontally to provide two extended matrices of up to 16 X 16 pixels each (including inter-character spacing). Pattern P3 provides one extended matrix of up to 16 X 32 pixels.

SECTION 3

The generator has both digital and analog output capabilities. Both digital and analog output signals are available at the rear of the unit.

3.1 DIGITAL OUTPUTS

Nine digital outputs are provided so that the generator will interface with monitors ,monochrome or color, having separate sync and video inputs.

Most monochrome monitors simply require three of the nine signals provided; namely, horizontal drive, vertical drive, and video.

Most color monitors require five of the nine signals provided; namely, horizontal drive, vertical drive, red, green, and blue.

Note: The color outputs are normally used to drive the Color Buffer shipped with each generator. For information on interfacing and operation of the Buffer, see appendix K.

Some monitors require a composite synchronization signal. In this case, the composite syncronization signal output is used in lieu of separate horizontal and vertical drive.

The vertical step output is provided for use with monitors having vertical stepping circuitry.

A tenth digital output (not normally connected to the monitor under test) provides a square wave clock to allow the generator to be used as a frequency synthesizer when testing video logic circuits.

While in the single-phase character clocking mode (OP 12.0), the DOT RATE output provides a clock frequency exactly twice that displayed in the MHZ register. This allows one to easily implement precision 50% duty cycle chopping circuits.

When in the dual-phase character clocking mode (OP 12.2), the DOT RATE output provides a clock frequency equal to the value displayed in the MHZ register.

3.1.01 Digital Signal Transmission

Proper transmission techniques must be used when interfacing with the digital outputs of the generator. There are basically two reasons for this; first, the transition times for the outputs of the generator are very short (typically less than 5 nanoseconds); secondly, the distance between the generator and whatever it has to drive is likely to be more than a few inches.

In short, coaxial cable should be used when making signal connections and each cable should be terminated in its characteristic impedance.

NOTE: Video cables tend to behave as comb filters if not properly terminated [When the electrical length of an open-ended piece of coax approaches an even multiple of a quarter-wavelength, the signal source is effectively shorted and very little signal reaches the load]. It is for this reason that failing to properly terminate a video coax (in most cases) causes an inconsistency in the intensity of various pixels making up the displayed picture.

3.1.02 Digital Signal Levels

All digital outputs of the generator are driven by 74S140 Schottky TTL line drivers. This means that even when loaded with 50 ohms to ground, all outputs remain level compatible with standard transistor - transistor - logic (TTL) circuitry.

Each digital output has two stable states. They are designated as "0" and "1".

The "0" state is represented by a signal voltage of between 0 and 0.5 volts at sink currents up to 60 milliamperes.

The "1" state is represented by a signal voltage of between 2 and 5 volts at source currents up to 40 milliamperes.

There are a variety of ways in which the digital outputs of the generator may be terminated. A few of these are shown in figure 3-1. Also shown are typical waveforms.

3.1.03 Video Level Compensation

The video input circuits of most displays are not (in the strict sense) TTL compatible; as a result, signal level problems are very often encountered. Remember, the TTL video output of the generator has only two stable states: one representing "beam on" and the other "beam off" - grey scale information is not provided.

The Buffer shipped with each generator has adjustable output levels for the three color outputs to overcome this problem. See appendix K for more information on the Buffer.

If you do not wish to use the Buffer for this purpose, try using either (analog) composite video output (adjusting the level control to suit) or one of the precision pulse generators listed below (between the generator and the unit you are testing):

TEKTRONIX	HEWLETT/PACKARD	PHILIPS
PG501	8012B	PM5712
PG502	8013B	PM5715
PG508	8082A	PM5716
		PM5771

When using one of the generators listed above, use the TTL video output of the generator as a trigger signal.

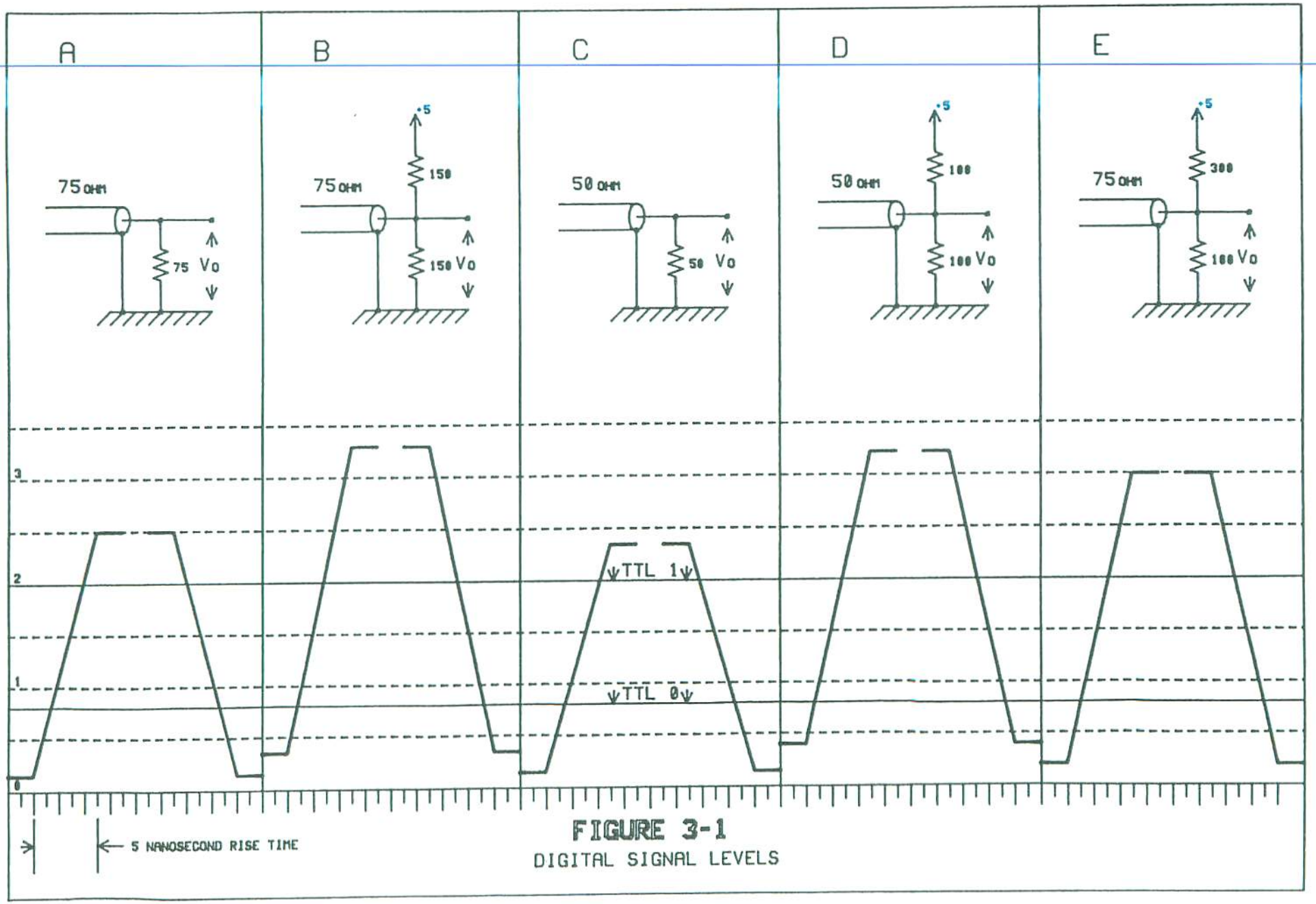


FIGURE 3-1
DIGITAL SIGNAL LEVELS

3.1.04 Digital Signal Polarity

The polarity of each digital output of the generator (excepting the DOT RATE output) can be controlled from the front panel keyboard.

The polarity of each digital output is selected using the appropriate option code sequence (see Table 3-1).

TABLE 3-1 Optional Polarity Modes

FOR:	PRESS:				
Non-inverted comp sync	OP	5	.	0	ENT
Inverted comp sync	OP	5	.	1	ENT
Non-inverted vertical step	OP	6	.	0	ENT
Inverted vertical step	OP	6	.	1	ENT
Non-inverted horizontal drive	OP	7	.	0	ENT
Inverted horizontal drive	OP	7	.	1	ENT
Non-inverted vertical drive	OP	8	.	0	ENT
Inverted vertical drive	OP	8	.	1	ENT
Non-inverted (positive) video *	OP	13	.	0	ENT
Inverted (positive) video *	OP	13	.	1	ENT
Non-inverted (negative) video *	OP	13	.	2	ENT
Inverted (negative) video *	OP	13	.	3	ENT

* Note: The color outputs cannot be inverted. Selecting option 13.1 or 13.3 will have the same affect as 13.0 or 13.2 respectively.

When referring to the color outputs, positive video is considered true foreground and background colors. Negative video is reversed foreground and background colors.

3.1.05 Digital Signal Gating

a. All of the digital outputs of the generator can be gated off using the OUT key located on the front panel keypad. Whenever the output LED (located directly below the OUT key) is extinguished, all digital outputs revert to their inactive state (e.g. inverted vertical sync reverts to a "1" whereas non-inverted vertical sync reverts to a "0").

b. All digital outputs of the generator (except the DOT RATE and VIDEO outputs) may be gated on and off independently by using the option (OP) key. See Table 3-2 for details.

TABLE 3-2 Independent Gating Modes

SIGNAL	MODE	PRESS				
Composite Sync	OFF	OP	1	.	0	ENT
Composite Sync	ON	OP	1	.	1	ENT
Vertical Step	OFF	OP	2	.	0	ENT
Vertical Step	ON	OP	2	.	1	ENT
Horizontal Drive	OFF	OP	3	.	0	ENT
Horizontal Drive	ON	OP	3	.	1	ENT
Vertical Drive	OFF	OP	4	.	0	ENT
Vertical Drive	ON	OP	4	.	1	ENT

NOTE: The OUT key (on the front panel of the generator) overrides the independent gating options.

c. The video and color signals from the generator can be gated off using the HORIZONTAL DISPLAYED CHARACTERS parameter as follows:

1. Press the (HORIZONTAL) DISPLAYED CHARACTERS key.
2. Enter a 0.
3. Press the ENT key.

3.2 ANALOG OUTPUT

The generator has one analog output. It is normally used when interfacing with monochrome monitors requiring a composite video signal.

The color buffer provides analog color signals, if required. (Refer to appendix K)

3.2.01 Analog Signal Transmission

A single 75 ohm coaxial cable should be used to connect the composite video output (of the generator) to the unit under test. This cable must be terminated in a 75 ohm resistive load in order to preserve the nominal video to sync ratio of 2.5 to 1.

3.2.02 Analog Signal Levels

The composite video output has three stable states. They are designated as "white", "black", and "sync".

The "white" level is normally represented by a signal voltage of approximately 1 volt; although, it can be set to any level between 0 and 1.5 volts by adjusting the level control directly below the composite video BNC connector.

When properly terminated in 75 ohms to ground, the "black" and "sync" levels are fixed in proportion to the "white" level as follows:

$$E_{(white)}-E_{(black)} = 100 \text{ IEEE units (or } 71.4\%)$$

$$E_{(black)}-E_{(sync)} = 40 \text{ IEEE units (or } 28.6\%)$$

where:

$$E_{(white)}-E_{(sync)} = 140 \text{ IEEE units (or } 100\%)$$

NOTE: Adjusting the level of the composite video output signal does not affect the sync-to-video ratio (which remains 2.5:1).

3.2.03 Analog Synchronization Signal

The synchronizing portion of the composite video signal is derived by ORing both horizontal and vertical drive pulses.

When using the composite video output of the generator, be sure that the horizontal and vertical drive pulses are contained within blanking. This is important since both video and synchronizing portions of the composite signal must share a single coax. In the event there is a conflict, the synchronizing portion of the composite signal will override the video portion.

SECTION 4

The generator has been programmed to detect and identify a variety of entry, format, and system errors. Whenever an error is detected, an error message (consisting of either a word or the letters "Err" followed by a decimal number) is displayed. This section explains the meaning of each error message.

4.1 INVALID FORMAT MESSAGES

The format residing in the format buffer of the generator is tested whenever the OUT key is depressed. If the output LED is lit, making a valid* entry, cycling the power, recalling a format, or selecting a pattern will also cause the format in the format buffer to be tested.

The test that is performed on the format buffer determines whether or not any of the format limitations (as outlined in section 2.2) have been violated. If an error is detected, the output signals of the generator are disabled and an error message is displayed.

If (while correcting an error) you should forget the number of the error you are trying to eliminate, simply depress the OUT key. If an error still exists, another error message will be displayed and the outputs of the generator will remain disabled.

It should be noted that there are several ways in which the format limitations of section 2.2 can be violated without encountering an error message.

The first of these is to enter (or have the generator calculate) a dot rate that exceeds the recommended limits as shown in Table 2-1.

Another way is to select a character code for either C1, C2, C3, or C4 that is not found in the character library.

By specifying a character block size that is too small to support either the size of the character selected or the amount of skew requested, it is possible to cause a character to be only partially displayed.

Storing an invalid format (using the STO key) will not result in an error message.

The generator ignores option 11 (which controls duty cycle) while operating in the dual-phase mode (OP 12.2) or the color mode (OP 10.1). If option 11 is put into mode 0 (50%) while the generator is operating in the dual-phase character clocking mode or color mode, the generator will continue to output 100% duty cycle pixels.

* See section 4.2 (invalid entry messages).

4.1.01 Option Mode Errors

Error messages 0-9 are displayed whenever invalid mode codes are entered; for example, if a mode code of 3 is entered for option 1, the "Err 0" message is displayed. This is because the only mode codes that option 1 can accommodate are 0 (for disable) and 1 (for enable). Mode 3 is not defined.

Error messages Err 0-Err 3 and Err 7 cover a pair of options each. These messages are displayed if either one (or both) of the options listed are in error.

Err 0 Option 1 must be either 1 (enable) or 0 (disable).
Option 2 must be either 1 (enable) or 0 (disable).

Err 1 Option 3 must be either 1 (enable) or 0 (disable).
Option 4 must be either 1 (enable) or 0 (disable).

Err 2 Option 5 must be either 1 (enable) or 0 (disable).
Option 6 must be either 1 (enable) or 0 (disable).

Err 3 Option 7 must be either 1 (enable) or 0 (disable).
Option 8 must be either 1 (enable) or 0 (disable).

Err 4 Option 9 must be either 0 (non-interlace), 1 (interlaced sync only), or 3 (interlaced sync & video).

Err 5 Option 11 must be either 0 (50% duty cycle) or 1 (100% duty cycle).

Err 6 Option 12 must be either 0 (single-phase character clocking mode) or 2 (dual-phase character clocking mode).

Err 7 Option 13 must be either 0 (non-inverted positive video), 1 (inverted positive video), 2 (non-inverted negative video), or 3 (inverted negative video).

Option 14 must be either 0 (no horizontal skew), 1 (skew right one dot), 2 (skew right two dots), 3 (skew right three dots).

Err 8 Option 16 must be either 0 (cursor disable), 1 (cursor enable blinking fast), 2 (cursor enable blinking slow), or 3 (cursor enable no blink).

4.1.02 Character Block Width Errors

Err20 The width of a character block must be 9 dots while in the dual-phase character clocking mode (OP 12.2).

Err21 The width of a character block must exceed 5 dots.

Err22 The width of a character block may not exceed 12 dots.

4.1.03 Horizontal Total Errors

Err23 The horizontal total must be even when in the dual-phase character clocking mode (OP 12.2).

Err24 The horizontal total must be even when in either interlace mode (OP 9.1 or OP 9.3).

Err25 The horizontal total must exceed 5 character times when in either interlace mode (OP 9.1 or OP 9.3).

Err26 The horizontal total must exceed 3 character times.

4.1.04 Horizontal Displayed Errors

Err27 The number of horizontally displayed characters must be even when in the dual-phase character clocking mode (OP 12.2).

Err28 The number of horizontally displayed characters must be less than the horizontal total.

Err29 The number of horizontally displayed characters must be even when using patterns P2 or P3.

4.1.05 Horizontal Delay Errors

Err30 The horizontal delay before drive must be even when in the dual-phase character clocking mode (OP 12.2).

Err31 The horizontal delay before drive must be less than the horizontal total.

4.1.06 Horizontal Drive Width Errors

Err32 The width of the horizontal drive pulse must be greater than 0 character times.

Err33 The width of the horizontal drive pulse must be even while in the dual-phase character clocking mode (OP 12.2).

Err34 The width of the horizontal drive pulse must be less than the horizontal total.

4.1.07 Character Block Height Errors

Err40 The character block height must exceed 0 lines.

Err41 Because each line of a character is displayed twice (once in each field) when in the interlaced sync only mode (OP 9.1), the character block height must be even.

Err42 The character block height must not exceed 32 lines when in the interlaced sync only mode (OP 9.1).

Err43 The character block height must exceed 2 lines while in either interlace mode (OP 9.1 or OP 9.3).

Err44 The character block height must not exceed 16 lines when in either the non-interlaced or interlaced sync & video modes (OP 9.0 or OP 9.3).

4.1.08 Assorted Vertical Parameter Errors

Err50 The vertical total must be odd while in either interlace mode (OP 9.1 or OP 9.3).

Err51 The vertical drive width must exceed 0 lines.

Err52 The vertical drive width must not exceed 16 lines.

Err53 The width of the vertical step pulse must be even while in the dual-phase character clocking mode (OP 12.2). (Enter a width of 2 when not used.)

Err54 The vertical step width must exceed 0 character times. (Enter a width of 2 when not used.)

Err55 The quotient of the vertical total divided by the character block height must not exceed 128 (excluding any remainder).

Err56 The number of vertically displayed rows must be less than the quotient of vertical total divided by the character block height (excluding any remainder).

Err57 The delay before vertical drive must be less than the quotient of the vertical total divided by the character block height (excluding any remainder).

Err58 The number of displayed rows must be even when using pattern 3 (P3).

4.1.09 Pattern Errors

Err60 Patterns P2 and P3 cannot be entered while in the dual-phase character clocking mode (OP 12.2).

4.1.10 Real Time Errors

Err70 The product of the vertical total times the vertical frequency results in a horizontal rate that exceeds 655.36 KHz.

Err71 The product of the character block width times the horizontal frequency results in a dot rate that exceeds 65.535 Mhz

Err72 The quotient of the dot rate divided by the product of the character block width times the horizontal total exceeds 655.36 KHz.

Err73 The quotient of the horizontal frequency divided by the vertical total exceeds 655.35 Hz.

Err74 The dot rate must not exceed 32.760 MHz while in the single-phase character clocking mode (OP 12.0).

4.2 Invalid Entry Messages

The first thing the generator will do after the ENT key is depressed is decide whether or not the number you entered is "in the ball

park". If it isn't, the entry is discarded and one of the following error messages is displayed.

When making an invalid entry, you will notice that the outputs of the generator remain enabled. This is because the format buffer remains unchanged.

4.2.01 Format Storage Errors

Err80 Recall register does not exist.

Err81 Storage register does not exist.

4.2.02 Option Code Errors

Err82 No such thing as option 0.

Err83 No option codes above 16.

Err84 Option syntax error.

4.2.03 Limit Errors

Err85 The number just entered was either too large or too small.

NOTE: The real time parameters are entered using floating point notation. You may need to use the decimal point key; for example, entering 1 5 7 2 KHz instead of 1 5 . 7 2 KHz will cause the Err85 message to be displayed.

4.2.04 Matrix Entry Errors

Err86 Invalid line.character specification.

4.2.05 Color Mode Errors

Err90 Color mode (OP10.1) cannot be entered while in the dual-phase character clocking mode (OP12.2).

Err91 The total number of displayed characters cannot exceed 6144 while in the color mode (OP10.1).

Err92 Option 10 must be either 10.0 (normal video mode) or 10.1 (color mode)

4.3 SELF-DIAGNOSTIC ERROR MESSAGES

The generator has been outfitted with five self-diagnostic error messages to help you in the event a problem should develop with the hardware inside the generator. The exact meaning of each self-diagnostic error message is discussed in this section.

4.3.01 The "Cold " Message

Whenever power is applied to the generator, a test is run to determine whether or not any information remains in non-volatile memory from the last time the generator was on. If nothing is found, the generator proceeds with a "cold" bootstrap routine, which clears each location in memory and causes the "Cold " message to be displayed.

When the generator is turned on for the first time at the factory, the "Cold " message is displayed since the generator has not yet had a chance to store anything into memory. A return of the "Cold " message at any time thereafter means that the battery that supplies bias to non-volatile memory (while the generator is shut off) has expired and needs to be replaced.

4.3.02 The "CrASH" Message

A microprocessor is used to interface you with the signal generating electronics of the generator. If (e.g. as the result of a CRT arc or static discharge) this microprocessor gets out of control and begins reading or writing into areas of memory that it is not supposed to, all format related information is discarded and a "CrASH" message is displayed. Should this happen, you will have to reenter **all** of the format parameters.

4.3.03 The "LAPSE" Message

Cycling the power, or depressing any key on the keypad causes the generator to verify the integrity of the format storage area in non-volatile memory. If a change in the data stored there has occurred (e.g. as the result of a CRT arc or static discharge), it will be detected, and all format related information will be discarded. In addition, the keypad will be disabled and a "LAPSE" message displayed. When this happens, you will have to cycle the power and reenter **all** of the format parameters.

4.3.04 The "H " Message

The generator goes into a halt state whenever a low line, power failure, or static discharge is sensed. When this happens, the generator displays the "H " message (as long as there is enough power to do so), the keypad ceases to function, and the contents of non-volatile memory are saved.

To recover from this type of failure, you must cycle the power. If the line voltage is acceptable, the generator will exit the halt state and resume operation.

4.3.05 The "SAFE " Message

The "SAFE " message is displayed if one attempts to modify the format information in the generator while the lockout switch (located on the rear panel of the generator) is activated.

4.4 DEFECTIVE PRODUCT RETURN INFORMATION

In the event that you require service from Quantum Data, you will need to know the following:

Equipment being returned to Quantum Data must include a Return Materials Authorization Number (RMA #). This authorization can be obtained by contacting our Customer Service Department.

Equipment returned for repair must be shipped freight prepaid, preferably using the original packing materials.

Record this information for your convenience

Date you received unit: _____
Warranty period: _____
Serial Number/s: _____

APPENDIX A

Timing Diagrams

TIMING DEFINITIONS

Ndc =	character block width	dots
Nht =	horizontal total	characters
Nhc =	displayed columns	characters
Nhd =	horizontal drive delay	characters
Nhw =	horizontal drive width	characters
Nlc =	character block height	lines
Nvt =	vertical total	lines
Nvr =	displayed rows	rows
Nvd =	vertical drive delay	rows
Nvw =	vertical drive width	lines
Nsw =	step pulse width	characters
Td =	dot time	seconds
Tc =	character time	seconds
Th =	line time	seconds
Tfd =	field time	seconds
Tfm =	frame time	seconds
Fp =	pixel rate	Hz
Fd =	dot rate	Hz
Fh =	line rate	Hz
Ffd =	field rate	Hz
Ffm =	frame rate	Hz

$$Fd = \frac{1}{Td}$$

$$Fp = \frac{1}{Td} \quad \text{[100\% duty cycle]}$$

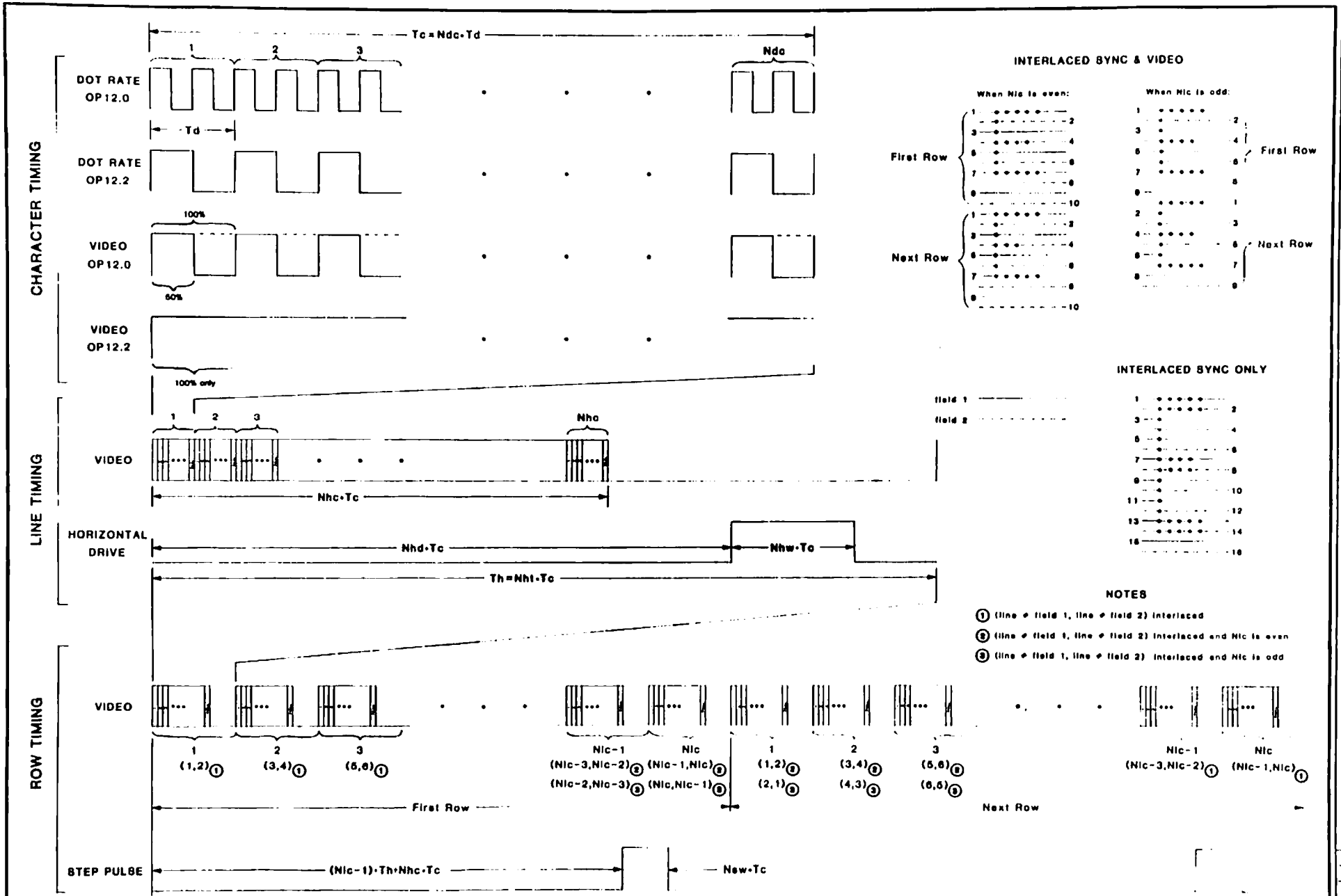
$$Fp = \frac{2}{Td} \quad \text{[50\% duty cycle]}$$

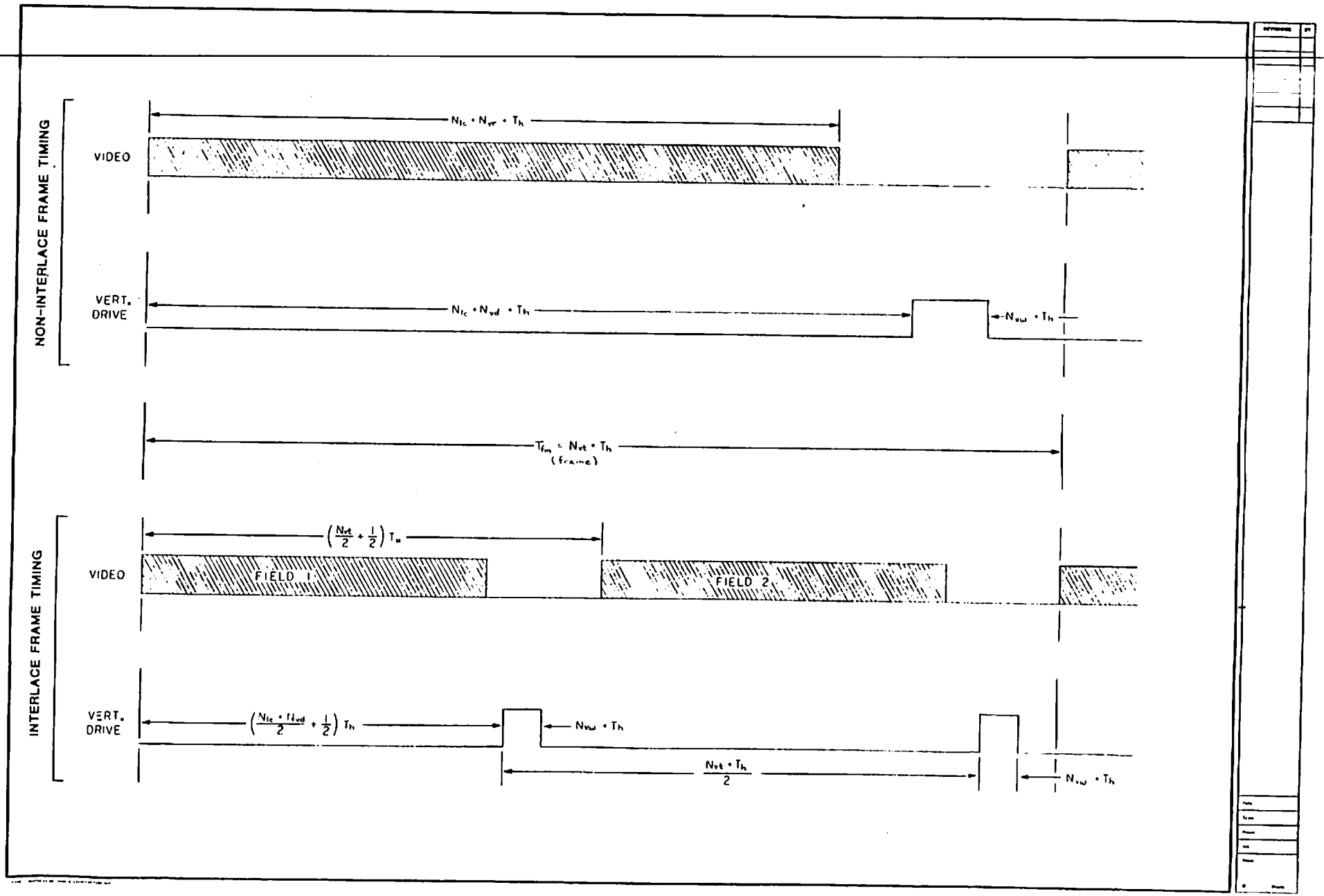
$$Fh = \frac{1}{Th}$$

$$Ffm = \frac{1}{Tfm}$$

$Ffd = Ffm$ [non-interlace] $\qquad Tfd = Tfm$ [non-interlace]

$Ffd = 2 \times Ffm$ [interlace] $\qquad Tfd = \frac{Tfm}{2}$ [interlace]

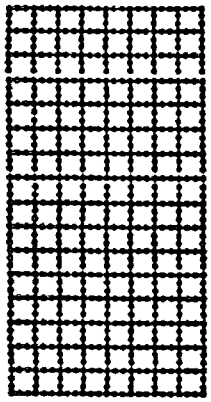

CHARACTER TIMING
LINE TIMING
ROW TIMING
Tc=Ndc·Td
Ndc
Td
DOT RATE OP12.0
DOT RATE OP12.2
VIDEO OP12.0
VIDEO OP12.2
100%
50%
100% only
VIDEO
Nhc
Nhc·Tc
HORIZONTAL DRIVE
Nhd·Tc
Nhw·Tc
Th=Nht·Tc
VIDEO
STEP PULSE
(Nlc-1)·Th+Nhc·Tc
New·Tc
First Row
Next Row
INTERLACED SYNC & VIDEO
When Nlc is even:
When Nlc is odd:
First Row
Next Row
INTERLACED SYNC ONLY
field 1
field 2
NOTES
① (line # field 1, line # field 2) interlaced
② (line # field 1, line # field 2) interlaced and Nlc is even
③ (line # field 1, line # field 2) interlaced and Nlc is odd


NON-INTERLACE FRAME TIMING
VIDEO
VERT. DRIVE
$N_{tc} \cdot N_{vv} \cdot T_h$
$N_{tc} \cdot N_{vd} \cdot T_h$
$N_{vw} \cdot T_h$
$T_{fm} = N_{vt} \cdot T_h$
(frame)
INTERLACE FRAME TIMING
VIDEO
VERT. DRIVE
$\left(\frac{N_{vt}}{2} + \frac{1}{2}\right) T_H$
FIELD 1
FIELD 2
$\left(\frac{N_{tc} \cdot N_{vd}}{2} + \frac{1}{2}\right) T_h$
$N_{vw} \cdot T_h$
$\frac{N_{vt} \cdot T_h}{2}$
$N_{vw} \cdot T_h$

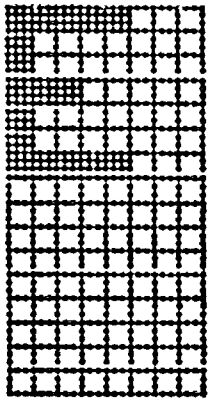
APPENDIX B

Character Codes

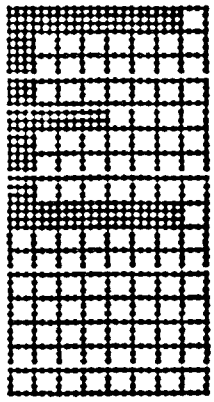
4



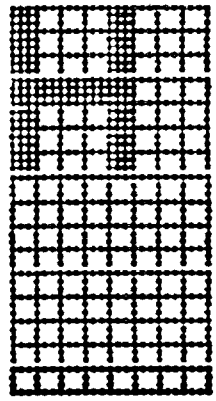
5



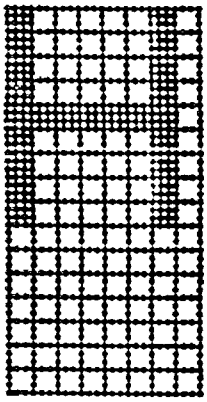
6



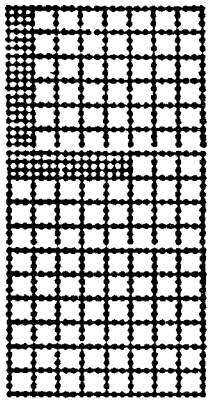
7



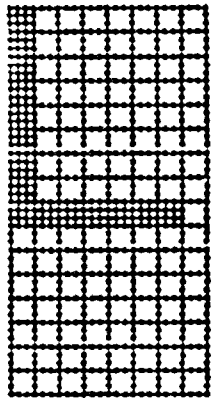
8



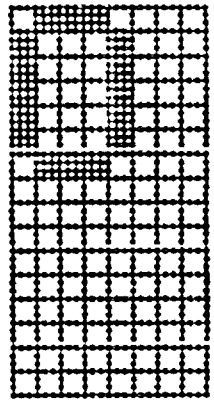
9



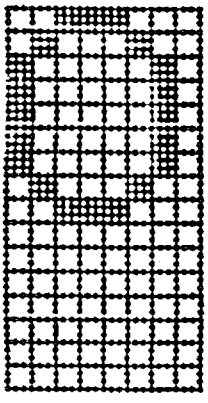
10



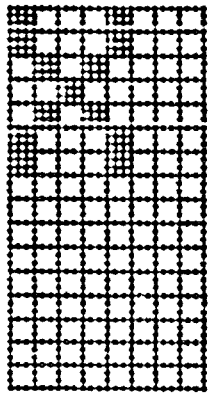
11



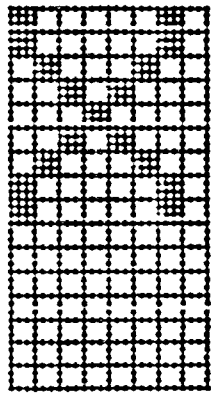
12



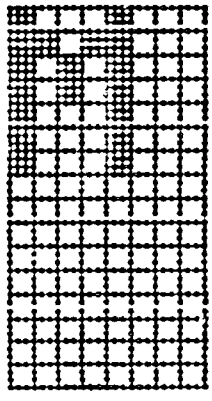
13



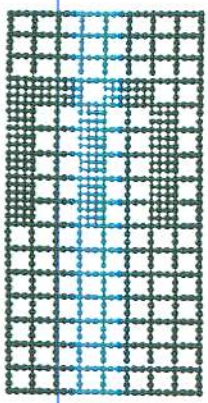
14



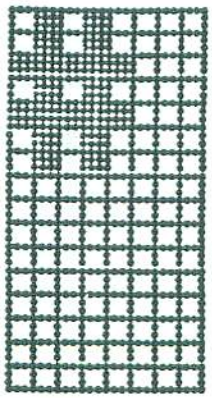
15



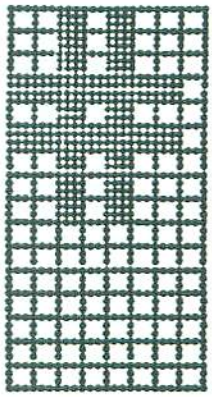
16



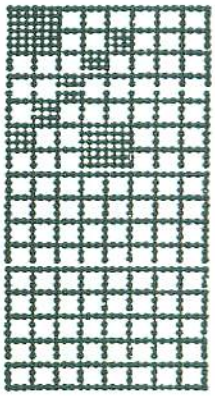
17



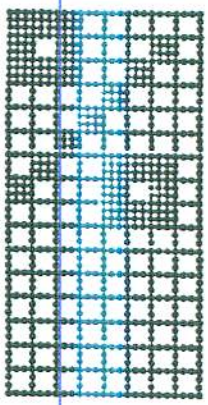
18



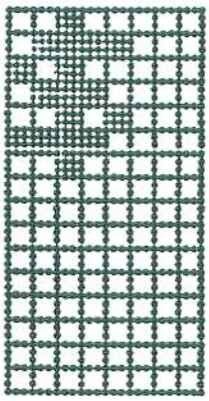
19



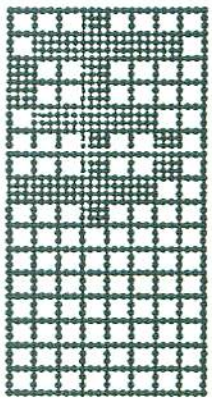
20



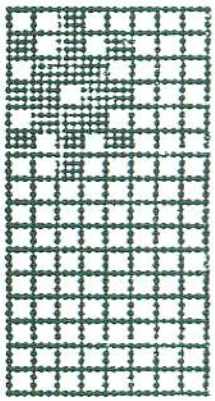
21



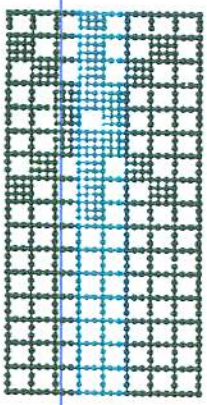
22



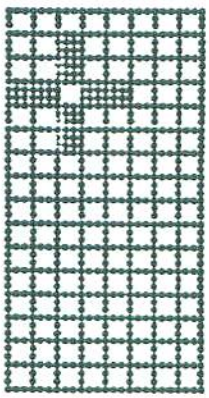
23



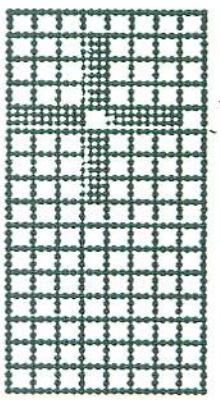
24



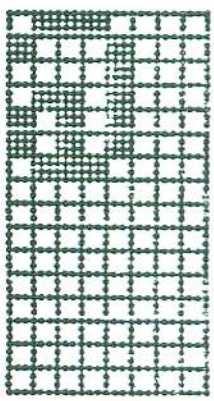
25



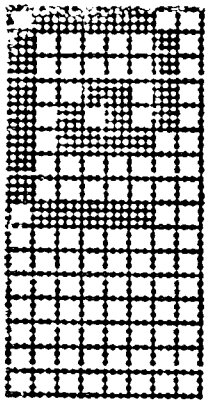
26



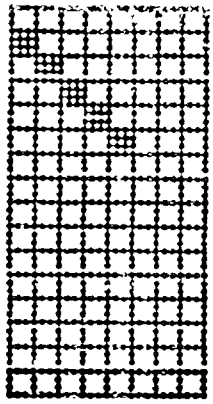
27



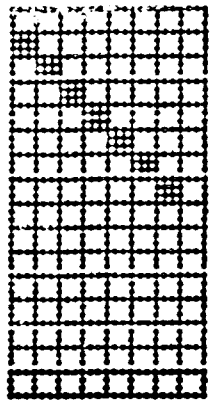
28



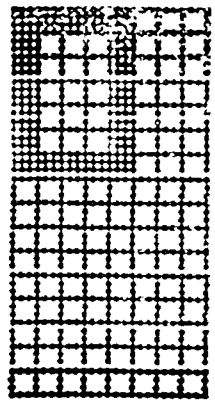
29



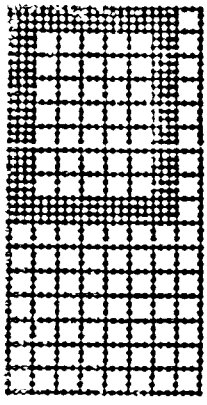
30



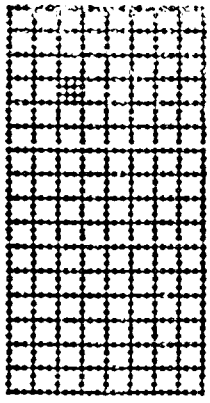
31



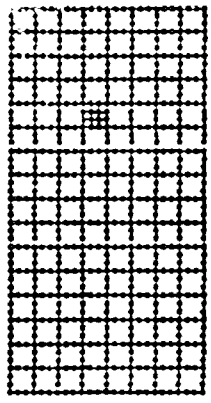
32



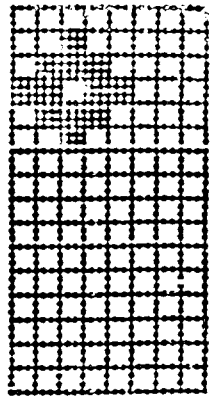
33



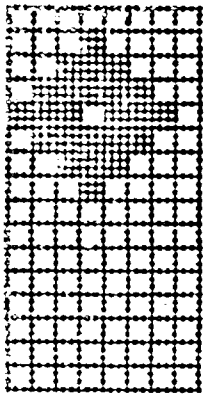
34



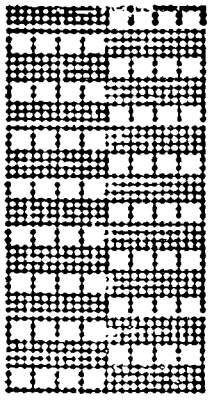
35



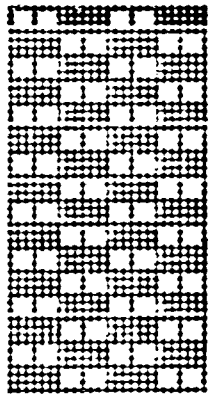
36



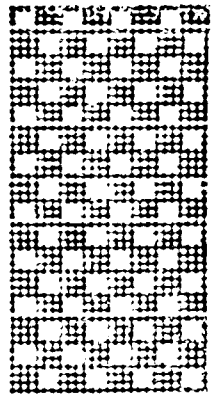
37



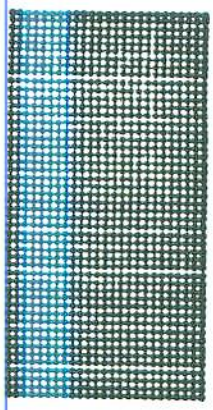
38



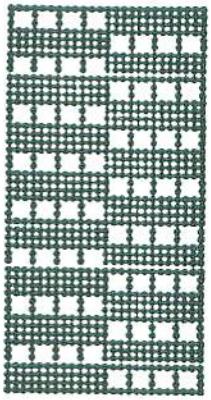
39



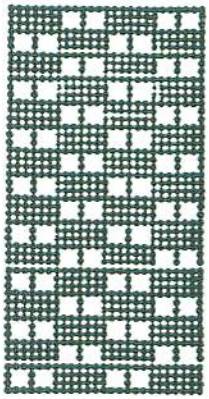
40



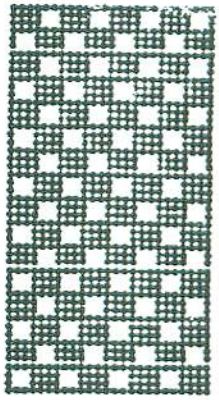
41



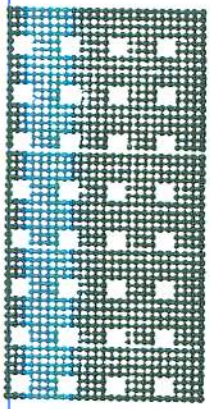
42



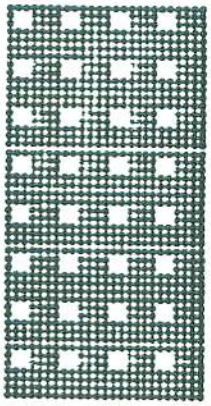
43



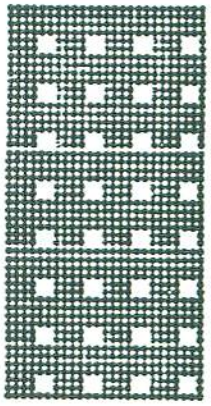
44



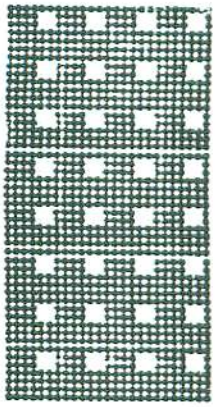
45



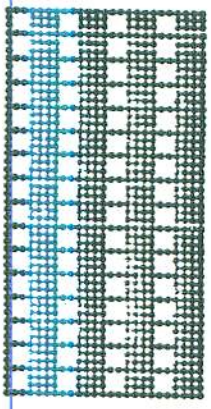
46



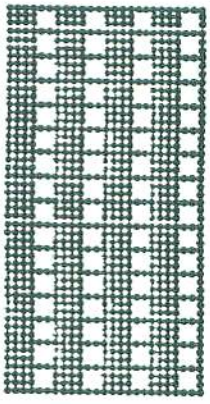
47



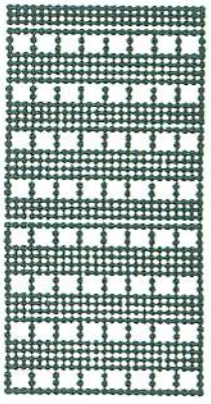
48



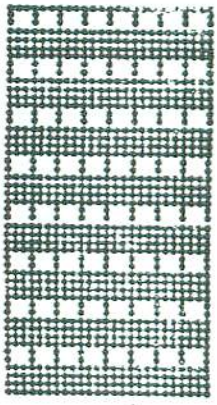
49



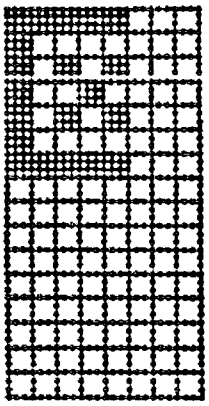
50



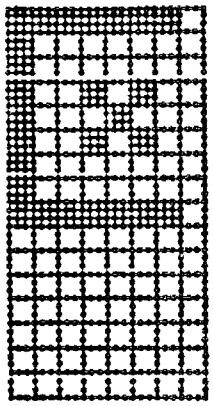
51



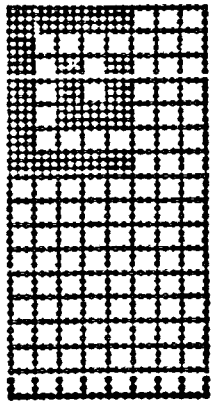
52



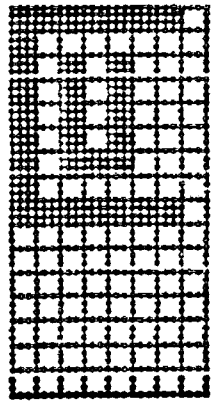
53



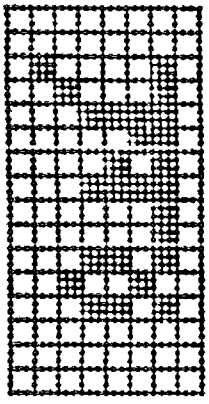
54



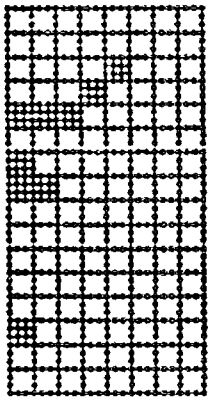
55



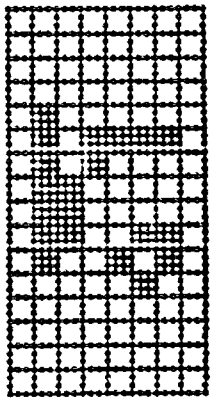
56



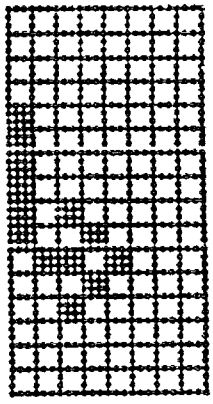
57



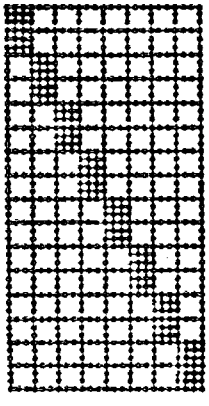
58



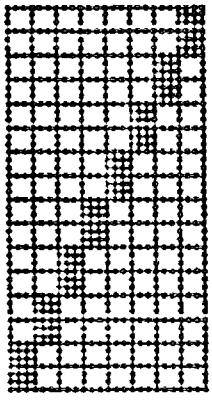
59



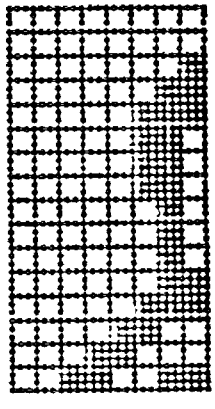
60



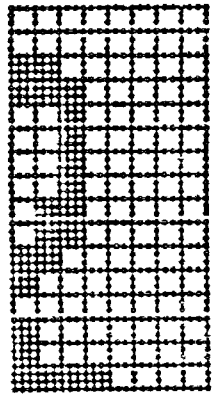
61



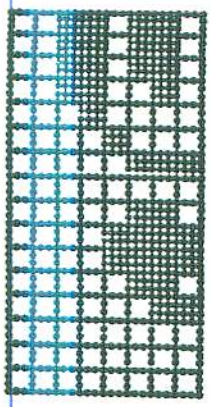
62



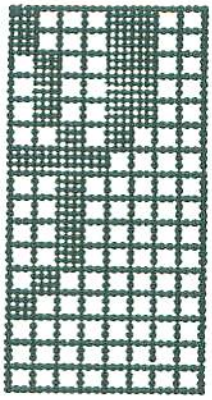
63



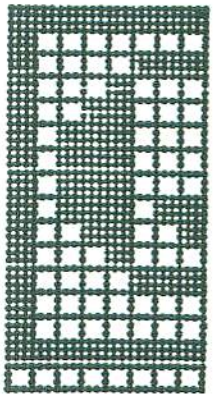
64



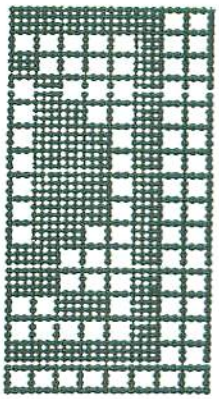
65



66



67



APPENDIX C

Character Library Modification

The character library consists of a total of 68 characters: four characters stored in CMOS RAM plus sixty-four characters stored in EMPROM.

The four characters stored in CMOS RAM are modified using the matrix (M) key located on the front panel of the generator.

To modify the remaining sixty-four characters (stored in EPROM), one must open the generator and re-program a portion of the 2716 EPROM installed at location Z22. The following procedure outlines the steps that need to be taken to accomplish this:

STEP 1: Open the generator using the instructions given in Appendix E.

STEP 2: Remove the 2716 EPROM located at position Z22.

STEP 3: From this EPROM, transfer (verbatim) all of the information from address 0000_H thru address $036C_H$ as well as the information from address $076D_H$ thru address $07FF_H$ to another 2716 EPROM.

Notes: The EPROM (to which this information is transferred) should have an access time of 470 nanoseconds or less.

During the transfer, be sure that the block of 1024 bytes beginning at address $036D_H$ and ending with address $076C_H$ is left unprogrammed.

The memory map for this EPROM is shown in figure C-1.

STEP 4: Using the standard character library listing as a guide, create a new character library source file containing the desired characters. Assemble this file and place the resultant code into the 1024 byte window left in the EPROM that was programmed in step 3.

STEP 5: Take the EPROM that was created in steps 3 & 4 and insert it into the socket located at position Z22 inside the generator.

STEP 6: Save the EPROM that originally came with the generator for future reference.

STEP 7: Close the generator using the instructions given in appendix E.

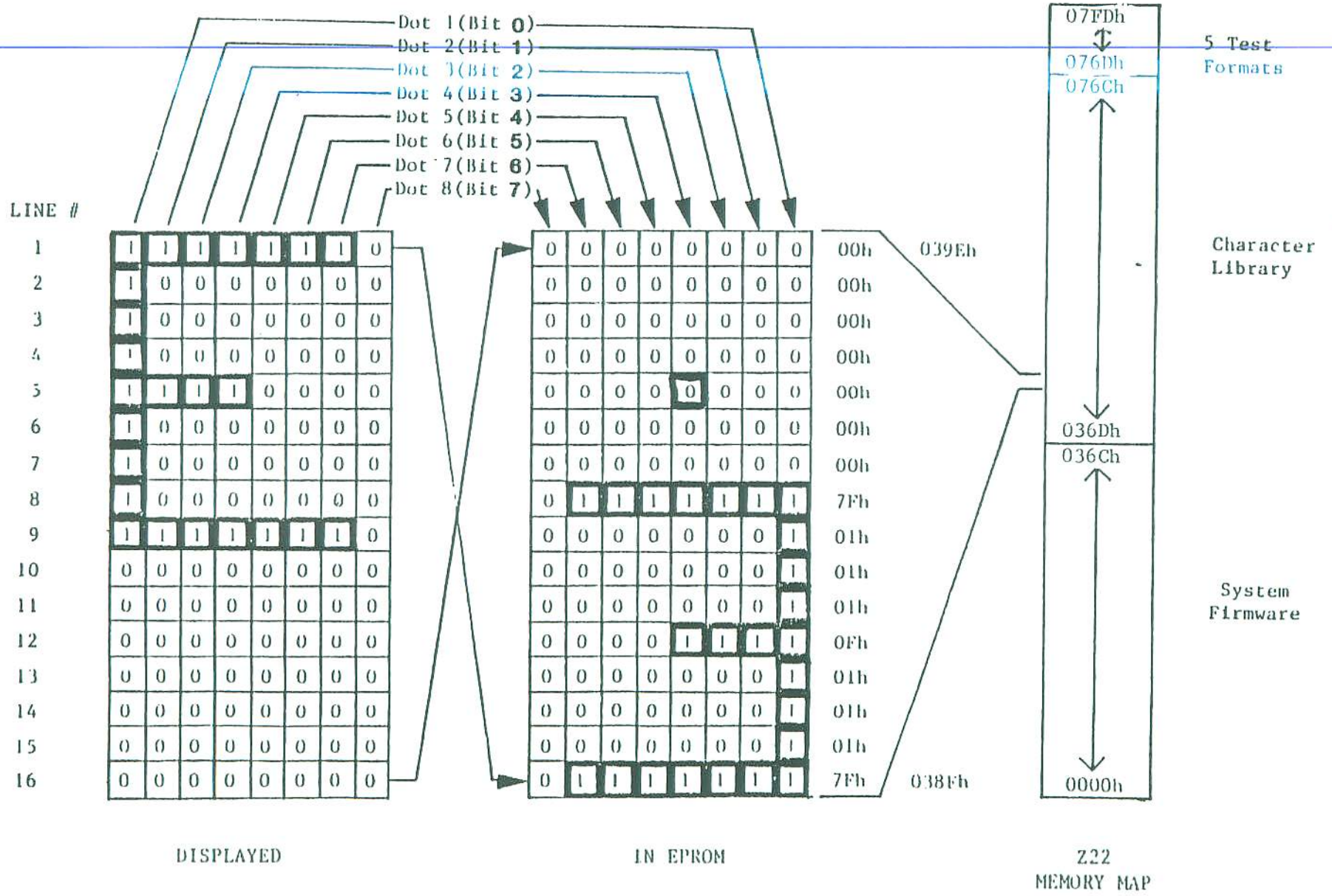

Dot 1(Bit 0)
Dot 2(Bit 1)
Dot 3(Bit 2)
Dot 4(Bit 3)
Dot 5(Bit 4)
Dot 6(Bit 5)
Dot 7(Bit 6)
Dot 8(Bit 7)
LINE #
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
00h
00h
00h
00h
00h
00h
00h
7Fh
01h
01h
01h
0Fh
01h
01h
01h
7Fh
039Eh
038Fh
07FDh
076Dh
076Ch
036Dh
036Ch
0000h
5 Test Formats
Character Library
System Firmware
DISPLAYED
IN EPROM
Z22 MEMORY MAP

Figure C-1

Character Library Programming Notes

The 2716 EPROM located at position Z22 inside the generator contains 1024 bytes of character information (see Figure C-1).

The first byte of the first character (character code 4) is located at address $036D_H$. The last byte of the last character (character code 67) is located at address 0769_H.

Each character that is stored occupies a 16 byte block of EPROM.

Each byte contains the pixel information for one line of video.

The byte located at the lowest address of each character block corresponds to the top line of the same character as it appears on the face of the CRT. The balance of the bytes are arranged so that the higher the address in EPROM, the lower the line appears on the face of the CRT.

The bits in each byte indicate which pixels are to be "on" and which ones are to be "off". A logic "1" is used to represent a pixel that is "on". Conversely, a logic "0" is used to indicate a pixel that is "off".

Bit 0 represents the left-most pixel in the character as it is displayed on the face of the CRT.

Character codes are determined by the order in which the various character matrices are loaded into EPROM.

```
                        0002  ;
                        0003  ;   This code produces the standard character set
                        0004  ;   that is shipped with every generator.
                        0005  ;
0000                    0006      ORG   036FH                 ;   The first character
                        0007                                  ;   (select code 4) is
                        0008                                  ;   located at address
                        0009                                  ;   036FH.
                        0010  ;
036D    00000000        0011      DB    0,0,0,0               ;4
0371    00000000        0012      DB    0,0,0,0
0375    00000000        0013      DB    0,0,0,0
0379    00000000        0014      DB    0,0,0,0
                        0015  ;
037D    1F010107        0016      DB    1FH,01H,01H,07H       ;5
0381    01011F00        0017      DB    01H,01H,1FH,0
0385    00000000        0018      DB    0,0,0,0
0389    00000000        0019      DB    0,0,0,0
                        0020  ;
038D    7F010101        0021      DB    7FH,01H,01H,01H,      ;6
0391    0F010101        0022      DB    0FH,01H,01H,01H
0395    7F000000        0023      DB    7FH,0,0,0
0399    00000000        0024      DB    0,0,0,0
                        0025  ;
039D    1111111F        0026      DB    11H,11H,11H,1FH       ;7
03A1    11111100        0027      DB    11H,11H,11H,0
03A5    00000000        0028      DB    0,0,0,0
03A9    00000000        0029      DB    0,0,0,0
                        0030  ;
03AD    41414141        0031      DB    41H,41H,41H,41H       ;8
03B1    7F414141        0032      DB    7FH,41H,41H,41H
03B5    41000000        0033      DB    41H,0,0,0
03B9    00000000        0034      DB    0,0,0,0
                        0035  ;
03BD    01010101        0036      DB    01H,01H,01H,01H       ;9
03C1    01011F00        0037      DB    01H,01H,1FH,0
03C5    00000000        0038      DB    0,0,0,0
03C9    00000000        0039      DB    0,0,0,0
                        0040  ;
03CD    01010101        0041      DB    01H,01H,01H,01H       ;10
03D1    01010101        0042      DB    01H,01H,01H,01H
03D5    7F000000        0043      DB    7FH,0,0,0
03D9    00000000        0044      DB    0,0,0,0
                        0045  ;
03DD    0E111111        0046      DB    0EH,11H,11H,11H       ;11
```

```
03E1  11110E00  0047      DB    11H,11H,0EH,0
03E5  00000000  0048      DB    0,0,0,0
03E9  00000000  0049      DB    0,0,0,0
                0050  ;
03ED  1C224141  0051      DB    1CH,22H,41H,41H          ;12
03F1  41414122  0052      DB    41H,41H,41H,22H
03F5  1C000000  0053      DB    1CH,0,0,0
03F9  00000000  0054      DB    0,0,0,0
03FD  11110A04  0056      DB    11H,11H,0AH,04H          ;13
0401  0A111100  0057      DB    0AH,11H,11H,0
0405  00000000  0058      DB    0,0,0,0
0409  00000000  0059      DB    0,0,0,0
                0060  ;
040D  41412214  0061      DB    41H,41H,22H,14H          ;14
0411  08142241  0062      DB    08H,14H,22H,41H
0415  41000000  0063      DB    41H,0,0,0
0419  00000000  0064      DB    0,0,0,0
                0065  ;
041D  111B1515  0066      DB    11H,1BH,15H,15H          ;15
0421  11111100  0067      DB    11H,11H,11H,0
0425  00000000  0068      DB    0,0,0,0
0429  00000000  0069      DB    0,0,0,0
                0070  ;
042D  00000037  0071      DB    0,0,0,37H                ;16
0431  49494949  0072      DB    49H,49H,49H,49H
0435  49000000  0073      DB    49H,0,0,0
0439  00000000  0074      DB    0,0,0,0
                0075  ;
043D  0A0A1F0A  0076      DB    0AH,0AH,1FH,0AH          ;17
0441  1F0A0A00  0077      DB    1FH,0AH,0AH,0
0445  00000000  0078      DB    0,0,0,0
0449  00000000  0079      DB    0,0,0,0
                0080  ;
044D  1414147F  0081      DB    14H,14H,14H,7FH          ;18
0451  147F1414  0082      DB    14H,7FH,14H,14H
0455  14000000  0083      DB    14H,0,0,0
0459  00000000  0084      DB    0,0,0,0
                0085  ;
045D  03130804  0086      DB    03H,13H,08H,04H          ;19
0461  02191800  0087      DB    02H,19H,18H,0
0465  00000000  0088      DB    0,0,0,0
0469  00000000  0089      DB    0,0,0,0
                0090  ;
046D  07452710  0091      DB    07H,45H,27H,10H          ;20
0471  08047251  0092      DB    08H,04H,72H,51H
```

```
0475  70000000  0093      DB    70H,0,0,0
0479  00000000  0094      DB    0,0,0,0
                0095  ;
047D  041E050E  0096      DB    04H,1EH,05H,0EH          ;21
0481  140F0400  0097      DB    14H,0FH,04H,0
0485  00000000  0098      DB    0,0,0,0
0489  00000000  0099      DB    0,0,0,0
                0100  ;
048D  087E0909  0101      DB    08H,7EH,09H,09H          ;22
0491  3E48483F  0102      DB    3EH,48H,48H,3FH
0495  08000000  0103      DB    08H,0,0,0
0499  00000000  0104      DB    0,0,0,0
049D  04150E1B  0106      DB    04H,15H,0EH,1BH          ;23
04A1  0E150400  0107      DB    0EH,15H,04H,0
04A5  00000000  0108      DB    0,0,0,0
04A9  00000000  0109      DB    0,0,0,0
                0110  ;
04AD  08492A1C  0111      DB    08H,49H,2AH,1CH          ;24
04B1  141C2A49  0112      DB    14H,1CH,2AH,49H
04B5  08000000  0113      DB    08H,0,0,0
04B9  00000000  0114      DB    0,0,0,0
                0115  ;
04BD  0004041B  0116      DB    0,04H,04H,1BH            ;25
04C1  04040000  0117      DB    04H,04H,0,0
04C5  00000000  0118      DB    0,0,0,0
04C9  00000000  0119      DB    0,0,0,0
                0120  ;
04CD  00080808  0121      DB    0,08H,08H,08H            ;26
04D1  77080808  0122      DB    77H,08H,08H,08H
04D5  00000000  0123      DB    0,0,0,0
04D9  00000000  0124      DB    0,0,0,0
                0125  ;
04DD  0E111016  0126      DB    0EH,11H,10H,16H          ;27
04E1  15150E00  0127      DB    15H,15H,0EH,0
04E5  00000000  0128      DB    0,0,0,0
04E9  00000000  0129      DB    0,0,0,0
                0130  ;
04ED  3E414159  0131      DB    3EH,41H,41H,59H          ;28
04F1  553D0101  0132      DB    55H,3DH,01H,01H
04F5  3E000000  0133      DB    3EH,0,0,0
04F9  00000000  0134      DB    0,0,0,0
                0135  ;
04FD  00010204  0136      DB    0,01H,02H,04H            ;29
0501  08100000  0137      DB    08H,10H,0,0
0505  00000000  0138      DB    0,0,0,0
```

```
0509  00000000  0139      DB   0,0,0,0
                0140  ;
050D  00010204  0141      DB   0,01H,02H,04H          ;30
0511  08102040  0142      DB   08H,10H,20H,40H
0515  00000000  0143      DB   0,0,0,0
0519  00000000  0144      DB   0,0,0,0
                0145  ;
051D  1F111111  0146      DB   1FH,11H,11H,11H        ;31
0521  11111F00  0147      DB   11H,11H,1FH,0
0525  00000000  0148      DB   0,0,0,0
0529  00000000  0149      DB   0,0,0,0
                0150  ;
052D  7F414141" 0151      DB   7FH,41H,41H,41H        ;32
0531  41414141  0152      DB   41H,41H,41H,41H
0535  7F000000  0153      DB   7FH,0,0,0
0539  00000000  0154      DB   0,0,0,0
053D  00000004  0156      DB   0,0,0,04H              ;33
0541  00000000  0157      DB   0,0,0,0
0545  00000000  0158      DB   0,0,0,0
0549  00000000  0159      DB   0,0,0,0
                0160  ;
054D  00000000  0161      DB   0,0,0,0                ;34
0551  08000000  0162      DB   08H,0,0,0
0555  00000000  0163      DB   0,0,0,0
0559  00000000  0164      DB   0,0,0,0
                0165  ;
055D  00040E1B  0166      DB   0,04H,0EH,1BH          ;35
0561  0E040000  0167      DB   0EH,04H,0,0
0565  00000000  0168      DB   0,0,0,0
0569  00000000  0169      DB   0,0,0,0
                0170  ;
056D  00081C3E  0171      DB   0,08H,1CH,3EH          ;36
0571  773E1C08  0172      DB   77H,3EH,1CH,08H
0575  00000000  0173      DB   0,0,0,0
0579  00000000  0174      DB   0,0,0,0
                0175  ;
057D  0FF00FF0  0176      DB   0FH,0F0H,0FH,0F0H      ;37
0581  0FF00FF0  0177      DB   0FH,0F0H,0FH,0F0H
0585  0FF00FF0  0178      DB   0FH,0F0H,0FH,0F0H
0589  0FF00FF0  0179      DB   0FH,0F0H,0FH,0F0H
                0180  ;
058D  CC33CC33  0181      DB   0CCH,33H,0CCH,33H      ;38
0591  CC33CC33  0182      DB   0CCH,33H,0CCH,33H
0595  CC33CC33  0183      DB   0CCH,33H,0CCH,33H
0599  CC33CC33  0184      DB   0CCH,33H,0CCH,33H
```

```
                        0185  ;
059D    AA55AA55        0186      DB    0AAH,55H,0AAH,55H          ;39
05A1    AA55AA55        0187      DB    OAAH,55H,0AAH,55H
05A5    AA55AA55        0188      DB    0AAH,55H,0AAH,55H
05A9    AA55AA55        0189      DB    0AAH,55H,0AAH,55H
                        0190  ;
05AD    FFFFFFFF        0191      DB    0FFH,0FFH,0FFH,0FFH        ;40
05B1    FFFFFFFF        0192      DB    0FFH,0FFH,0FFH,0FFH
05B5    FFFFFFFF        0193      DB    OFFH,0FFH,0FFH,0FFH
05B9    FFFFFFFF        0194      DB    0FFH,0FFH,0FFH,0FFH
                        0195  ;
05BD    F00FF00F        0196      DB    0F0H,0FH,0F0H,0FH          ;41
05C1    F00FF00F        0197      DB    0F0H,0FH,0F0H,0FH
05C5    F00FF00F        0198      DB    0F0H,0FH,0F0H,0FH
0BC9    F00FF00F        0199      DB    0F0H,0FH,0F0H,0FH
                        0200  ;
05CD    33CC33CC        0201      DB    33H,0CCH,33H,0CCH          ;42
05D1    33CC33CC        0202      DB    33H,0CCH,33H,0CCH
05D5    33CC33CC        0203      DB    33H,0CCH,33H,0CCH
05D9    33CC33CC        0204      DB    33H,0CCH,33H,0CCH
05DD    55AA55AA        0206      DB    55H,0AAH,55H,0AAH          ;43
05E1    55AA55AA        0207      DB    55H,0AAH,55H,0AAH
05E5    55AA55AA        0208      DB    55H,0AAH,55H,0AAH
05E9    55AA55AA        0209      DB    55H,0AAH,55H,0AHH
                        0210  ;
05ED    FFAAFFAA        0211      DB    0FFH,0AAH,0FFH,0AAH        ;44
05F1    FFAAFFAA        0212      DB    0FFH,0AAH,0FFH,0AAH
05F5    FFAAFFAA        0213      DB    0FFH,0AAH,0FFH,0AAH
05F9    FFAAFFAA        0214      DB    0FFH,0AAH,0FFH,0AAH
                        0215  ;
05FD    AAFFAAFF        0216      DB    0AAH,0FFH,0AAH,0FFH        ;45
0601    AAFFAAFF        0217      DB    0AAH,0FFH,0AAH,0FFH
0605    AAFFAAFF        0218      DB    OAAH,0FFH,0AAH,0FFH
0609    AAFFAAFF        0219      DB    OAAH,0FFH,0AAH,0FFH
                        0220  ;
060D    FF55FF55        0221      DB    0FFH,55H,0FFH,55H          ;46
0611    FF55FF55        0222      DB    0FFH,55H,0FFH,55H
0615    FF55FF55        0223      DB    0FFH,55H,0FFH,55H
0619    FF55FF55        0224      DB    0FFH,55H,0FFH,55H
                        0225  ;
061D    55FF55FF        0226      DB    55H,0FFH,55H,0FFH          ;47
0621    55FF55FF        0227      DB    55H,0FFH,55H,0FFH
0625    55FF55FF        0228      DB    55H,0FFH,55H,0FFH
0629    55FF55FF        0229      DB    55H,0FFH,55H,0FFH
                        0230  ;
```

```
062D  AAAAAAAA    0231      DB    0AAH,0AAH,0AAH,0AAH       ;48
0631  AAAAAAAA    0232      DB    0AAH,0AAH,0AAH,0AAH
0635  AAAAAAAA    0233      DB    0AAH,0AAH,0AAH,0AAH
0639  AAAAAAAA    0234      DB    0AAH,0AAH,0AAH,0AAH
                  0235  ;
063D  55555555    0236      DB    55H,55H,55H,55H           ;49
0641  55555555    0237      DB    55H,55H,55H,55H
0645  55555555    0238      DB    55H,55H,55H,55H
0649  55555555    0239      DB    55H,55H,55H,55H
                  0240  ;
064D  FF00FF00    0241      DB    0FFH,0,0FFH,0             ;50
0651  FF00FF00    0242      DB    0FFH,0,0FFH,0
0655  FF00FF00    0243      DB    0FFH,0,0FFH,0
0659  FF00FF00    0244      DB    0FFH,0,0FFH,0
                  0245  ;
065D  00FF00FF    0246      DB    0,0FFH,0,0FFH             ;51
0661  00FF00FF    0247      DB    0,0FFH,0,0FFH
0665  00FF00FF    0248      DB    0,0FFH,0,0FFH
0669  00FF00FF    0249      DB    0,0FFH,0,0FFH
                  0250  ;
066D  1F011509    0251      DB    1FH,01H,15H,09H           ;52
0671  15011F00    0252      DB    15H,01H,1FH,0
0675  00000000    0253      DB    0,0,0,0
0679  00000000    0254      DB    0,0,0,0
067D  7F010129    0256      DB    7FH,01H,01H,29H           ;53
0681  11290101    0257      DB    11H,29H,01H,01H
0685  7F000000    0258      DB    7FH,0,0,0
0689  00000000    0259      DB    0,0,0,0
                  0260  ;
068D  1F011515    0261      DB    1FH,01H,15H,15H           ;54
0691  1D011F00    0262      DB    1DH,01H,1FH,0
0695  00000000    0263      DB    0,0,0,0
0699  00000000    0264      DB    0,0,0,0
                  0265  ;
069D  7F011515    0266      DB    7FH,01H,15H,15H           ;55
06A1  15151D01    0267      DB    15H,15H,1DH,01H
06A5  7F000000    0268      DB    7FH,0,0,0
06A9  00000000    0269      DB    0,0,0,0
                  0270  ;
06AD  0000FEFE    0271      DB    0,0,0FEH,0FEH             ;56
06B1  3C181898    0272      DB    3CH,18H,18H,98H
06B5  98989898    0273      DB    98H,98H,98H,98H
06B9  FE000000    0274      DB    0FEH,0,0,0
                  0275  ;
06BD  00003F3F    0276      DB    0,0,3FH,3FH               ;57
06C1  3C383020    0277      DB    3CH,38H,30H,20H
06C5  20010307    0278      DB    20H,1,3,7
06C9  1F000000    0279      DB    1FH,0,0,0
                  0280  ;
```

```
06CD  98989898  0281      DB   98H,98H,98H,98H          ;58
06D1  9818183C  0282      DB   98H,18H,18H,3CH
06D5  FEFE0000  0283      DB   0FEH,0FEH,0,0
06D9  00000000  0284      DB   0,0,0,0
                0285  ;
06DD  07030120  0286      DB   7,3,1,20H                ;59
06E1  2030383C  0287      DB   20H,30H,38H,3CH
06E5  3F3F0000  0288      DB   3FH,3FH,0,0
06E9  00000000  0289      DB   0,0,0,0
                0290  ;
06ED  00384482  0291      DB   0,38H,44H,82H            ;60
06F1  02020438  0292      DB   02H,02H,04H,38H
06F5  40808082  0293      DB   40H,80H,80H,82H
06F9  44380000  0294      DB   44H,38H,0,0
                0295  ;
06FD  00000000  0296      DB   0,0,0,0                  ;61
0701  00000057  0297      DB   0,0,0,57H
0705  51512351  0298      DB   51H,51H,23H,51H
0709  51570000  0299      DB   51H,57H,0,0
                0300  ;
070D  00008000  0301      DB   0,0,80H,0C0H             ;62
0711  E0606060  0302      DB   0E0H,60H,60H,60H
0715  404040C0  0303      DB   40H,40H,40H,0C0H
0719  E03018CC  0304      DB   0E0H,30H,18H,0CCH
071D  00000307  0306      DB   0,0,3,7                  ;63
0721  04040404  0307      DB   4,4,4,4
0725  06060301  0308      DB   6,6,3,1
0729  0001010F  0309      DB   0,1,1,0FH
                0310  ;
072D  6C6C6C4C  0311      DB   6CH,6CH,6CH,4CH          ;64
0731  0810E000  0312      DB   08H,10H,0E0H,0
0735  60F0F060  0313      DB   60H,0F0H,0F0H,60H
0739  C0000000  0314      DB   0C0H,0,0,0
                0315  ;
073D  31313232  0316      DB   31H,31H,32H,32H          ;65
0741  32140F04  0317      DB   32H,14H,0FH,4
0745  04040402  0318      DB   4,4,4,2
0749  01000000  0319      DB   1,0,0,0
                0320  ;
074D  FF01E111  0321      DB   0FFH,1,0E1H,11H          ;66
0751  191D1D1D  0322      DB   19H,1DH,1DH,1DH
0755  DD9911E1  0323      DB   0DDH,99H,11H,0E1H
0759  0101FF00  0324      DB   1,1,0FFH,0
                0325  ;
075D  3F202122  0326      DB   3FH,20H,21H,22H          ;67
```

```
0761   262E2E2E    0327      DB    26H,2EH,2EH,2EH
0765   2E262323    0328      DB    2EH,26H,23H,23H
0769   2C203F00    0329      DB    2CH,20H,3FH,0
                   0330  ;
076F   (0000)      0331      END

Errors             0
```

APPENDIX D

Format Library Modification

PROGRAMMING THE FORMAT LIBRARY EPROM

The format library feature of the model 801C allows you store up to 141 different formats in a 2532 EPROM installed at position U1 inside the generator. A 2716 EPROM may be used in place of the 2532 EPROM but doing so will limit the format storage to 70 different formats.

Each format occupies 29 contiguous bytes of EPROM. The first format begins at address 0000_H, the second at $001D_H$, the third at $003A_H$, and so on. Unused locations in the format library should contain FF hex. The parameters for each format are to be encoded as follows:

Bytes 1 & 2 — The first two bytes of each format are used to store a 4-digit serial number. This number is used for format identification. It is encoded as a 16-bit binary number where:

byte 1 = the least significant byte of the serial number

byte 2 = the most significant byte of the serial number

Serial numbers 1 thru 9 are reserved for the four READ/WRITE formats stored in CMOS RAM and the five READ-ONLY test formats stored in the last 145 bytes of the EPROM located at position Z22. Formats having serial numbers that exceed 9999 cannot be recalled.

When revising a format, be sure to change the serial number. The old serial number should be permanently retired.

Formats do not need to be sequentially arranged (according to serial number) since the generator begins at one end of format library and proceeds to the other looking for the serial number requested.

Bytes 3 & 4 — The third and forth bytes contain the real-time reference frequency. This frequency can be either the dot rate in KHz, the line rate in Hz, or the field rate in tens of millihertz. The number is encoded in 16-bit binary where:

Byte 3 = the least significant byte of the reference frequency

Byte 4 = the most significant byte of the reference frequency

The reference frequency is interpreted in accordance with the information contained in the upper nibble of the 21st byte.

Byte 5 — The fifth byte contains the number of dots/character as expressed in 8-bit binary.

Byte 6 — The sixth byte contains the number of lines/character as expressed in 8-bit binary.

Byte 7 — The seventh byte contains the total number characters/line. The

horizontal total is encoded in 8-bit binary as one less than the actual total.

Bytes 8 & 9 The eight and nineth bytes contain the total number of lines in a frame. This total is encoded as a 16-bit binary number where:

Byte 8 = the least significant byte of the vertical total

Byte 9 = the most significant byte of the vertical total

Byte 10 The tenth byte contains the number of horizontally displayed characters as expressed in 8-bit binary.

Byte 11 The eleventh byte contains the number of vertically displayed rows as expressed in 8-bit binary.

Byte 12 The twelfth byte contains the number of character times in the delay between the beginning of video and the leading edge of horizontal drive. This number is encoded in 8-bit binary.

Byte 13 The thirteenth byte contains the number of row times in the delay between the beginning of video and the leading edge of vertical drive. This number is encoded in 8-bit binary.

Byte 14 The fourteenth byte contains the number of character times in the width of the horizontal drive pulse as expressed in 8-bit binary.

Byte 15 The fifthteenth byte contains the number of line times in the vertical drive pulse width. The number is encoded in 8-bit binary.

Byte 16 The sixteenth byte contains the number of character times in the width of the vertical step pulse. The number is encoded in 8-bit binary.

Byte 17 The seventeenth byte contains the character select code for C1. The number is encoded in 8-bit binary.

Byte 18 The eighteenth byte contains the character select code for C2. The number is encoded in 8-bit binary.

Byte 19 The nineteenth byte contains the character select code for C3. The number is encoded in 8-bit binary.

Byte 20 The twentieth byte contains the character select code for C4. The number is encoded in 8-bit binary.

Byte 21 The upper nibble of the twenty-first byte contains information as to how the reference frequency (located in bytes 3 and 4) is to be interpreted. There are three possibilities:

2_H = dot rate in KHz
1_H = line rate in Hz
0_H = the field rate in tens of millihertz

The lower nibble of the twenty-first byte contains a number that indicates which pattern is to be displayed. There are four possibilities:

1_H = P1
2_H = P2
4_H = P3
8_H = P4

Byte 22 — The lower and upper nibbles of the twenty-second byte contain the mode codes for options 1 and 2 respectively. The mode codes are encoded as 4-bit BCD.

Byte 23 — The lower and upper nibbles of the twenty-third byte contain the mode codes for options 3 and 4 respectively. The mode codes are encoded as 4-bit BCD.

Byte 24 — The lower and upper nibbles of the twenty-forth byte contain the mode codes for options 5 and 6 respectively. The mode codes are encoded as 4-bit BCD.

Byte 25 — The lower and upper nibbles of the twenty-fifth byte contain the mode codes for options 7 and 8 respectively. The mode codes are encoded as 4-bit BCD.

Byte 26 — The lower and upper nibbles of the twenty-sixth byte contain the mode codes for options 9 and 10 respectively. The mode codes are encoded as 4-bit BCD.

Byte 27 — The lower and upper nibbles of the twenty-seventh byte contain the mode codes for options 11 and 12 respectively. The mode codes are encoded as 4-bit BCD.

Byte 28 — The lower and upper nibbles of the twenty-eighth byte contain the mode codes for options 13 and 14 respectively. The mode codes are encoded as 4-bit BCD.

Byte 29 — The lower and upper nibbles of the twenty-ninth byte contain the mode codes for options 15 and 16 respectively. The mode codes are encoded as 4-bit BCD.

EXAMPLE

The following listing can be used as an example for setting up your own format library EPROMs.

Note: Be careful that the assembler that you use to create your format library places the most significant byte of a 16-bit word at the higher address - assemblers for the Motorola 6800 and similar processors do not.

OPENING THE GENERATOR

Refer to appendix E for instructions.

```
0000                    0002            ORG     0000H   ;Starting address.
                        0003 ;
0000  0A00              0004 F10:       DW      10      ;Serial number.
0002  7017              0005            DW      6000    ;Reference frequency.
0004  07                0006            DB      7       ;Dots per character.
0005  0A                0007            DB      10      ;Lines per character.
0006  63                0008            DB      100-1   ;Horizontal total.
0007  0601              0009            DW      262     ;Vertical total.
0009  50                0010            DB      80      ;Displayed characters.
000A  18                0011            DB      24      ;Displayed rows.
000B  54                0012            DB      84      ;H. drive delay.
000C  18                0013            DB      24      ;V. drive delay.
000D  08                0014            DB      8       ;H. drive width.
000E  05                0015            DB      5       ;V. drive width.
000F  02                0016            DB      2       ;V. step width.
0010  05                0017            DB      5       ;C1 select code.
0011  05                0018            DB      5       ;C2 select code.
0012  21                0019            DB      33      ;C3 select code.
0013  07                0020            DB      7       ;C4 select code.
0014  01                0021            DB      01H     ;Reference/Pattern.
0015  11                0022            DB      11H     ;Options 2 and 1.
0016  11                0023            DB      11H     ;Options 4 and 3.
0017  00                0024            DB      00H     ;Options 6 and 5.
0018  00                0025            DB      00H     ;Options 8 and 7.
0019  00                0026            DB      00H     ;Options 10 and 9.
001A  00                0027            DB      00H     ;Options 12 and 11.
001B  00                0028            DB      00H     ;Options 14 and 13.
001C  00                0029            DB      00H     ;Options 16 and 15.
                        0030 ;
001D  0B00              0031 F11:       DW      11      ;Serial number.
001F  7017              0032            DW      6000    ;Reference frequency.
0021  09                0033            DB      9       ;Dots per character.
0022  0C                0034            DB      12      ;Lines per character.
0023  63                0035            DB      100-1   ;Horizontal total.
0024  0601              0036            DW      262     ;Vertical total.
0026  50                0037            DB      80      ;Displayed characters.
0027  14                0038            DB      20      ;Displayed rows.
0028  54                0039            DB      84      ;H. drive delay.
0029  14                0040            DB      20      ;V. drive delay.
002A  08                0041            DB      8       ;H. drive width.
002B  05                0042            DB      5       ;V. drive width.
002C  02                0043            DB      2       ;V. step width.
002D  06                0044            DB      6       ;C1 select code.
002E  06                0045            DB      6       ;C2 select code.
002F  22                0046            DB      34      ;C3 select code.
0030  08                0047            DB      8       ;C4 select code.
0031  01                0048            DB      01H     ;Reference/Pattern.
0032  11                0049            DB      11H     ;Options 2 and 1.
0033  11                0050            DB      11H     ;Options 4 and 3.
0034  00                0051            DB      00H     ;Options 6 and 5.
0035  00                0052            DB      00H     ;Options 8 and 7.
0036  00                0053            DB      00H     ;Options 10 and 9.
0037  00                0054            DB      00H     ;Options 12 and 11.
0038  00                0055            DB      00H     ;Options 14 and 13.
0039  00                0056            DB      00H     ;Options 16 and 15.
```

```
003A  0C00          0058 F12:    DW      12        ;Serial number.
003C  7017          0059         DW      6000      ;Reference frequency.
003E  09            0060         DB      9         ;Dots per character.
003F  0C            0061         DB      12        ;Lines per character.
0040  63            0062         DB      100-1     ;Horizontal total.
0041  3801          0063         DW      312       ;Vertical total.
0043  50            0064         DB      80        ;Displayed characters.
0044  18            0065         DB      24        ;Displayed rows.
0045  54            0066         DB      84        ;H. drive delay.
0046  18            0067         DB      24        ;V. drive delay.
0047  08            0068         DB      8         ;H. drive width.
0048  05            0069         DB      5         ;V. drive width.
0049  02            0070         DB      2         ;V. step width.
004A  06            0071         DB      6         ;C1 select code.
004B  06            0072         DB      6         ;C2 select code.
004C  22            0073         DB      34        ;C3 select code.
004D  08            0074         DB      8         ;C4 select code.
004E  01            0075         DB      01H       ;Reference/Pattern.
004F  11            0076         DB      11H       ;Options 2 and 1.
0050  11            0077         DB      11H       ;Options 4 and 3.
0051  00            0078         DB      00H       ;Options 6 and 5.
0052  00            0079         DB      00H       ;Options 8 and 7.
0053  00            0080         DB      00H       ;Options 10 and 9.
0054  00            0081         DB      00H       ;Options 12 and 11.
0055  00            0082         DB      00H       ;Options 14 and 13.
0056  00            0083         DB      00H       ;Options 16 and 15.
                    0084 ;
0057  0D00          0085 F13:    DW      13        ;Serial number.
0059  7017          0086         DW      6000      ;Reference frequency.
005B  09            0087         DB      9         ;Dots per character.
005C  0C            0088         DB      12        ;Lines per character.
005D  A1            0089         DB      162-1     ;Horizontal total.
005E  0601          0090         DW      262       ;Vertical total.
0060  84            0091         DB      132       ;Displayed characters.
0061  14            0092         DB      20        ;Displayed rows.
0062  88            0093         DB      136       ;H. drive delay.
0063  14            0094         DB      20        ;V. drive delay.
0064  08            0095         DB      8         ;H. drive width.
0065  05            0096         DB      5         ;V. drive width.
0066  02            0097         DB      2         ;V. step width.
0067  06            0098         DB      6         ;C1 select code.
0068  06            0099         DB      6         ;C2 select code.
0069  22            0100         DB      34        ;C3 select code.
006A  08            0101         DB      8         ;C4 select code.
006B  01            0102         DB      01H       ;Reference/Pattern.
006C  11            0103         DB      11H       ;Options 2 and 1.
006D  11            0104         DB      11H       ;Options 4 and 3.
006E  00            0105         DB      00H       ;Options 6 and 5.
006F  00            0106         DB      00H       ;Options 8 and 7.
0070  00            0107         DB      00H       ;Options 10 and 9.
0071  00            0108         DB      00H       ;Options 12 and 11.
0072  00            0109         DB      00H       ;Options 14 and 13.
0073  00            0110         DB      00H       ;Options 16 and 15.
```

```
0074  0E00          0112 F14:     DW      14        ;Serial number.
0076  6E17          0113          DW      5998      ;Reference frequency.
0078  09            0114          DB      9         ;Dots per character.
0079  0C            0115          DB      12        ;Lines per character.
007A  63            0116          DB      100-1     ;Horizontal total.
007B  0D02          0117          DW      525       ;Vertical total.
007D  50            0118          DB      80        ;Displayed characters.
007E  28            0119          DB      40        ;Displayed rows.
007F  54            0120          DB      84        ;H. drive delay.
0080  28            0121          DB      40        ;V. drive delay.
0081  08            0122          DB      8         ;H. drive width.
0082  05            0123          DB      5         ;V. drive width.
0083  02            0124          DB      2         ;V. step width.
0084  06            0125          DB      6         ;C1 select code.
0085  06            0126          DB      6         ;C2 select code.
0086  22            0127          DB      34        ;C3 select code.
0087  08            0128          DB      8         ;C4 select code.
0088  01            0129          DB      01H       ;Reference/Pattern.
0089  01            0130          DB      01H       ;Options 2 and 1.
008A  11            0131          DB      11H       ;Options 4 and 3.
008B  00            0132          DB      00H       ;Options 6 and 5.
008C  00            0133          DB      00H       ;Options 8 and 7.
008D  03            0134          DB      03H       ;Options 10 and 9.
008E  00            0135          DB      00H       ;Options 12 and 11.
008F  00            0136          DB      00H       ;Options 14 and 13.
0090  00            0137          DB      00H       ;Options 16 and 15.
                    0138 ;
0091  0F00          0139 F15:     DW      15        ;Serial number.
0093  7017          0140          DW      6000      ;Reference frequency.
0095  09            0141          DB      9         ;Dots per character.
0096  0E            0142          DB      14        ;Lines per character.
0097  2C            0143          DB      45-1      ;Horizontal total.
0098  0601          0144          DW      262       ;Vertical total.
009A  20            0145          DB      32        ;Displayed characters.
009B  11            0146          DB      17        ;Displayed rows.
009C  24            0147          DB      36        ;H. drive delay.
009D  11            0148          DB      17        ;V. drive delay.
009E  04            0149          DB      4         ;H. drive width.
009F  05            0150          DB      5         ;V. drive width.
00A0  B4            0151          DB      180       ;V. step width.
00A1  07            0152          DB      7         ;C1 select code.
00A2  05            0153          DB      5         ;C2 select code.
00A3  21            0154          DB      33        ;C3 select code.
00A4  23            0155          DB      35        ;C4 select code.
00A5  01            0156          DB      01H       ;Reference/Pattern.
00A6  11            0157          DB      11H       ;Options 2 and 1.
00A7  11            0158          DB      11H       ;Options 4 and 3.
00A8  00            0159          DB      00H       ;Options 6 and 5.
00A9  00            0160          DB      00H       ;Options 8 and 7.
00AA  10            0161          DB      10H       ;Options 10 and 9.
00AB  00            0162          DB      00H       ;Options 12 and 11.
00AC  20            0163          DB      20H       ;Options 14 and 13.
00AD  03            0164          DB      03H       ;Options 16 and 15.
```

```
00AE  1000      0166 F16:   DW      16      ;Serial number.
00B0  7017      0167        DW      6000    ;Reference frequency.
00B2  09        0168        DB      9       ;Dots per character.
00B3  0E        0169        DB      14      ;Lines per character.
00B4  2C        0170        DB      45-1    ;Horizontal total.
00B5  0601      0171        DW      262     ;Vertical total.
00B7  20        0172        DB      32      ;Displayed characters.
00B8  11        0173        DB      17      ;Displayed rows.
00B9  24        0174        DB      36      ;H. drive delay.
00BA  11        0175        DB      17      ;V. drive delay.
00BB  04        0176        DB      4       ;H. drive width.
00BC  05        0177        DB      5       ;V. drive width.
00BD  B4        0178        DB      180     ;V. step width.
00BE  07        0179        DB      7       ;C1 select code.
00BF  05        0180        DB      5       ;C2 select code.
00C0  21        0181        DB      33      ;C3 select code.
00C1  23        0182        DB      35      ;C4 select code.
00C2  01        0183        DB      01H     ;Reference/Pattern.
00C3  11        0184        DB      11H     ;Options 2 and 1.
00C4  11        0185        DB      11H     ;Options 4 and 3.
00C5  00        0186        DB      00H     ;Options 6 and 5.
00C6  00        0187        DB      00H     ;Options 8 and 7.
00C7  10        0188        DB      10H     ;Options 10 and 9.
00C8  00        0189        DB      00H     ;Options 12 and 11.
00C9  22        0190        DB      22H     ;Options 14 and 13.
00CA  03        0191        DB      03H     ;Options 16 and 15.
                0192 ;
00CB  1100      0193 F17:   DW      17      ;Serial number.
00CD  7017      0194        DW      6000    ;Reference frequency.
00CF  09        0195        DB      9       ;Dots per character.
00D0  07        0196        DB      7       ;Lines per character.
00D1  57        0197        DB      88-1    ;Horizontal total.
00D2  0601      0198        DW      262     ;Vertical total.
00D4  40        0199        DB      64      ;Displayed characters.
00D5  20        0200        DB      32      ;Displayed rows.
00D6  48        0201        DB      72      ;H. drive delay.
00D7  20        0202        DB      32      ;V. drive delay.
00D8  06        0203        DB      6       ;H. drive width.
00D9  05        0204        DB      5       ;V. drive width.
00DA  0A        0205        DB      10      ;V. step width.
00DB  23        0206        DB      35      ;C1 select code.
00DC  23        0207        DB      35      ;C2 select code.
00DD  23        0208        DB      35      ;C3 select code.
00DE  23        0209        DB      35      ;C4 select code.
00DF  01        0210        DB      01H     ;Reference/Pattern.
00E0  11        0211        DB      11H     ;Options 2 and 1.
00E1  11        0212        DB      11H     ;Options 4 and 3.
00E2  00        0213        DB      00H     ;Options 6 and 5.
00E3  00        0214        DB      00H     ;Options 8 and 7.
00E4  10        0215        DB      10H     ;Options 10 and 9.
00E5  00        0216        DB      00H     ;Options 12 and 11.
00E6  10        0217        DB      10H     ;Options 14 and 13.
00E7  00        0218        DB      00H     ;Options 16 and 15.
```

```
00E8  1200          0220 F18:    DW      18        ;Serial number.
00EA  7017          0221         DW      6000      ;Reference frequency.
00EC  08            0222         DB      8         ;Dots per character.
00ED  0E            0223         DB      14        ;Lines per character.
00EE  2B            0224         DB      44-1      ;Horizontal total.
00EF  0601          0225         DW      262       ;Vertical total.
00F1  1F            0226         DB      31        ;Displayed characters.
00F2  11            0227         DB      17        ;Displayed rows.
00F3  23            0228         DB      35        ;H. drive delay.
00F4  11            0229         DB      17        ;V. drive delay.
00F5  04            0230         DB      4         ;H. drive width.
00F6  05            0231         DB      5         ;V. drive width.
00F7  0A            0232         DB      10        ;V. step width.
00F8  07            0233         DB      7         ;C1 select code.
00F9  05            0234         DB      5         ;C2 select code.
00FA  21            0235         DB      33        ;C3 select code.
00FB  23            0236         DB      35        ;C4 select code.
00FC  08            0237         DB      08H       ;Reference/Pattern.
00FD  11            0238         DB      11H       ;Options 2 and 1.
00FE  11            0239         DB      11H       ;Options 4 and 3.
00FF  00            0240         DB      00H       ;Options 6 and 5.
0100  00            0241         DB      00H       ;Options 8 and 7.
0101  10            0242         DB      10H       ;Options 10 and 9.
0102  00            0243         DB      00H       ;Options 12 and 11.
0103  00            0244         DB      00H       ;Options 14 and 13.
0104  00            0245         DB      00H       ;Options 16 and 15.
                    0246 ;
0105  (0000)        0247         END

Errors              0
```

APPENDIX E

Internal Maintenance

Internal maintenance of the generator by the customer should be limited to the following procedures:

1. Replacing the battery that supplies bias to non-volatile memory.
2. Replacing blown output circuitry.
3. Modifying either the character or format library EPROMs.

Consult the factory if additional maintenance procedures are required.

OPENING THE GENERATOR:

STEP 1 Disconnect all cables hooked to the generator (including the AC power cord).

STEP 2 Place the generator on a padded surface and turn it upside down. Position the generator so that the front panel faces you.

STEP 3 Using both hands, remove the prop by lifting up in the center and pushing down at the edges.

STEP 4 Using a #0 Phillips screwdriver, remove the four feet that are attached to the underside of the generator.

STEP 5 Right the generator. Position it so that the front panel faces you once again.

STEP 6 Slide the side moldings (on each side of the generator) as far down as they will go.

NOTE: In the next step you will open the cabinet just a crack. While opening the cabinet, make sure that the front panel remains with the top of the cabinet and the rear panel remains with the bottom.

STEP 7 Position your left hand so that your fingers are in the bezel of the five digit display and your thumb is on the top edge of the left side molding.

Position your right hand so that your fingers are just under the left rear lip of the top of the cabinet and your thumb is on the top edge of the left side molding.

Pry the cabinet apart so that the front panel is approximately 1/2 inch above the front lip of the bottom of the cabinet and the left rear corner of the top of the cabinet is 1/2 inch above the rear panel.

STEP 8 Position your left hand so that your fingers are under the front panel and your thumb rests on the top surface of the cabinet.

Grab the right hand corner of the top of the generator with your right hand and shake the top section of the generator loose from the bottom section.

STEP 9 With the top section of the generator still in your left hand, reach into the left side of the generator with your right hand and disconnect the two wires going to the AC power switch.

STEP 10 Open the generator (like you would a book) so that the top section of the generator lies to the right of the bottom section.

CHANGING THE BATTERY:

STEP 1 Locate the battery which is mounted on the left front side of the power supply board.

STEP 2 Replace the battery with a new one (Panasonic BR2325 lithium or equivalent).

Note Do not use metal pliers to insert the new coin cells into the holder. Doing so may damage the cell by placing a direct short across its poles.

REPLACING BLOWN OUTPUT CIRCUITS:

STEP 1 Determine which I.C. is defective by using Table E-1.

Table E-1 Color Generator Output Circuits

Signal	I.C. Type	Location
Horizontal Drive	74S140	Z46 (Large circuit board)
Vertical Drive	74S140	Z46 (Large circuit board)
Composite Sync	74S140	Z54 (Large circuit board)
Vertical Step	74S140	Z54 (Large circuit board)
Dot Rate	74S140	Z79 (Board with tin can)
TTL Video	74S140	Z79 (Board with tin can)
Red	74S140	U8 (Center circuit board)
Green	74S140	U8 (Center circuit board)
Blue	74S140	U9 (Center circuit board)
Gray	74S140	U9 (Center circuit board)
Composite Video	74S38	Z74 (Board with tin can)

NOTES: I.C. Z79 is located on the foil side of the board with the tin can.

I.C. Z74 is located on the component side of the board (with the tin can). To access Z74, one must remove the four screws that attach the board (with the tin can) to four standoffs.

STEP 2 Replace the defective I.C. with a new one.

MODIFYING THE EPROMS:

STEP 1 Remove the four screws that attach the board (with the tin can) to the standoffs.

STEP 2 Fold back the board (with the tin can) and disconnect J11 (center board) so that the five EPROMs (4 located on the large board & 1 located on the center board) are exposed.

STEP 3 Modify Z22 (large board) and (or) U1 (center board) as required. (See appendices C & D)

STEP 4 Reconnect J11 (center board) while folding the board (with the tin can) into it's original position.

STEP 5 Reposition the board (with the tin can) so that it again lies over the standoffs. Reinstall the four screws that attach the board (with the tin can) to the standoffs.

REASSEMBLING THE GENERATOR

STEP 1 Make sure that the following connectors are properly installed:

a. The black wire leaving the 3 pin connector on the front panel should exit from the side of the connector that is nearest the AC power switch.

b. J1 should be connected so that the ribbon cable exits away from the circuit board.

c. The green lead leaving J2 should exit from the side of the connector that is nearest to C78.

d. The red lead leaving J3 should exit from the side of the connector that is nearest the center of the board.

e. The flat side of J4 should face the edge of the board.

f. The side of J5 that has an open pin should be the side of the connector that is nearest the 20 pin header.

g. The violet lead leaving J6 should exit from the side of the connector that is nearest the tin can.

h. Both J7 and J8 should be connected so that their ribbon cables exit away from the large circuit board.

i. The red lead leaving J9 should exit from the side of the connector that is nearest R37.

STEP 2 Position your left hand so that your fingers are under the front panel and your thumb rests on the top surface of the cabinet.

Close the generator (like you would a book).

With your right hand, reach into the left hand side of the generator and reconnect the two wires that were disconnected from the two bottom tabs of the AC power switch when the generator was opened.

STEP 3 Slide the front panel into the grooves of the lower section of the cabinet. At the same time, slide the back panel into the grooves of the top section of the cabinet.

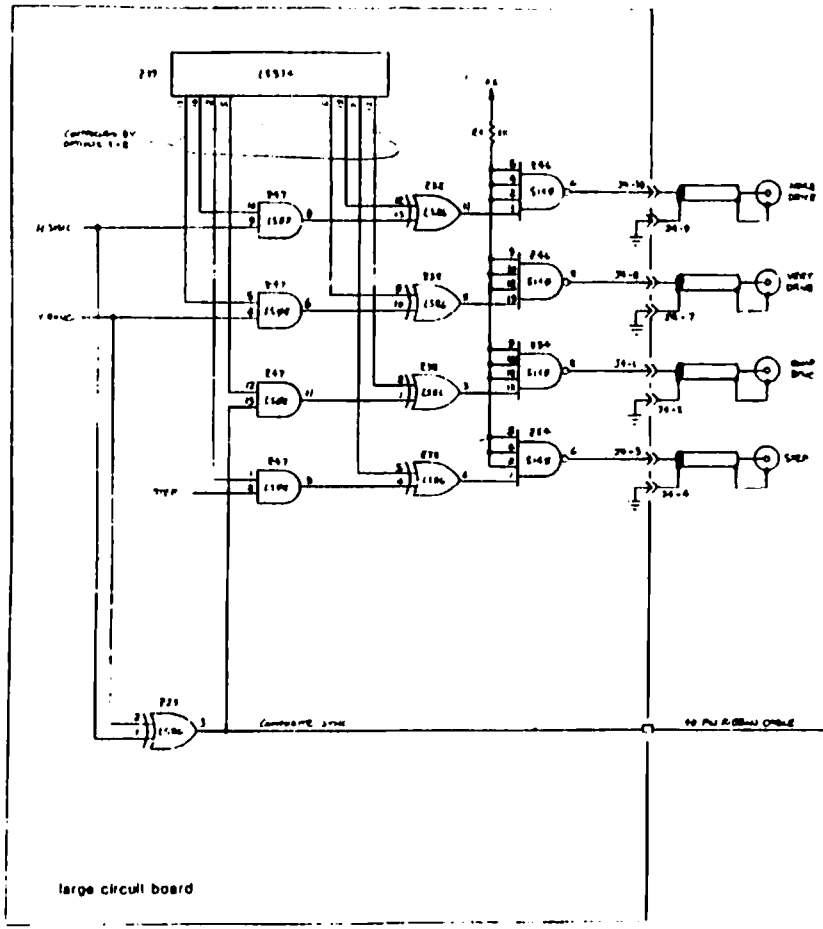
Press the top and bottom sections of the generator together until there are no visible gaps between the cabinet and the top and bottom edges of the front and back panels.

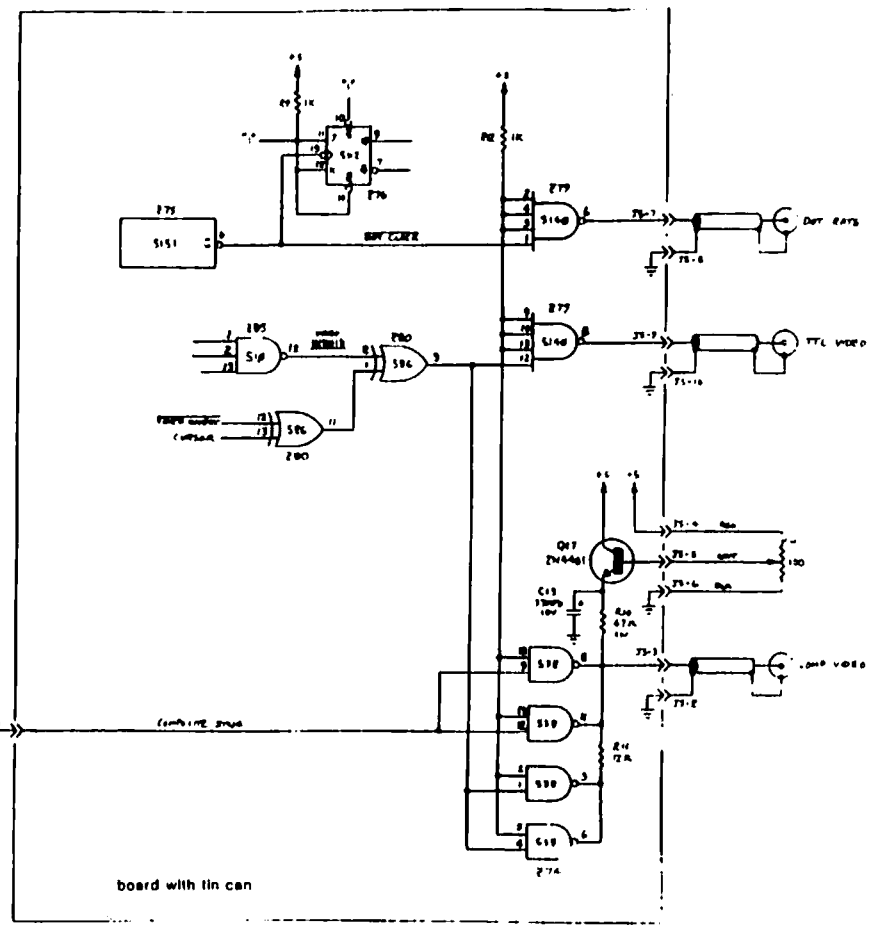
NOTE: In the next two steps, make certain that none of the wires inside the generator get pinched. Listen for the sound of metal hitting metal before tightening each screw.

STEP 4 Turn the generator upside down and reinstall the rear feet.

STEP 5 Reinstall the front feet making sure that the rounded side of each foot is positioned away from the center of the generator. (NOTE: the right and left feet are not the same)

STEP 6 Using both hands, reinsert the prop.





Quantum Data

Output Circuits

APPENDIX F

Implementing a Line-resolution Vertical Delay

There are three methods by which the vertical position of the displayed picture can be resolved in terms of line rather than row increments. Two of these are illustrated in Figure F-1.

The success of method 1 depends on the design of the monitor being tested. Method 2 works with all monitors; however, it requires a special interface.

METHOD 1

This method assumes that the unit under test receives vertical synchronizing information through a separate input. It also assumes that the unit under test is sensitive to either the rising or falling edge of the vertical drive pulse, but not both.

1. Invert the vertical drive pulse (using option 8) so that its width is included as part of the vertical drive delay.

2. Divide the desired delay (in lines) by the character block height and enter the resultant quotient (less the remainder) in the vertical drive delay register using the (VERTICAL) DRIVE DELAY key.

3. Enter the remainder into the vertical drive width register using the (VERTICAL) DRIVE WIDTH key.

METHOD 2

Method 2 involves the same procedure as method 1, except an external interface (containing a one-shot) is inserted between the Model 801C and the unit under test to decrease the width of the vertical drive pulse.

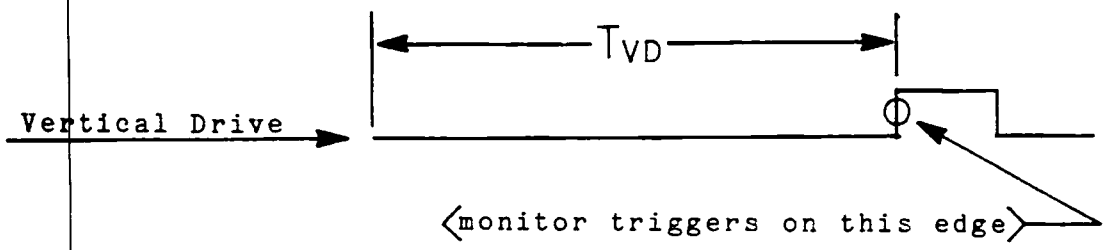
Figure F-2 shows a circuit that can be added to the one-shot interface to provide composite video capability.

METHOD 3

By using the vertical skew option, it is possible to skew the entire picture down a few lines. The idea here is to adjust the (VERTICAL) DRIVE DELAY so that the picture is raised a couple of lines, then to use the vertical skew option (OP15) to lower the picture into the correct position. The (VERTICAL) DRIVE DELAY should be set to the same value as that used in Method 1. In order for this method to work, you must have enough lines of inter-character spacing to support the amount of skew requested.

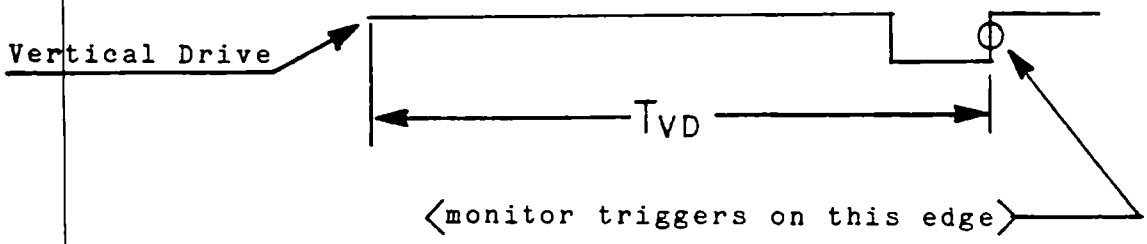
Figure F-1 Vertical Delay Schemes

A. Normal: Row resolution delay.



where: Tvd is the vertical drive delay

B. Method 1: Line resolution delay (edge triggered display).



C. Method 2: Line resolution delay (with external one-shot).

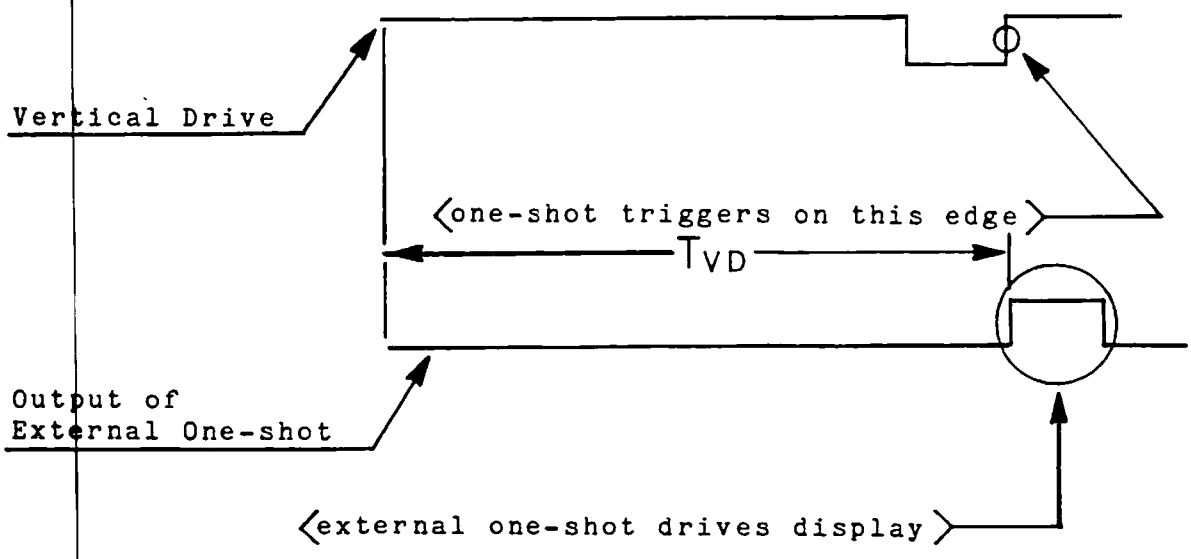
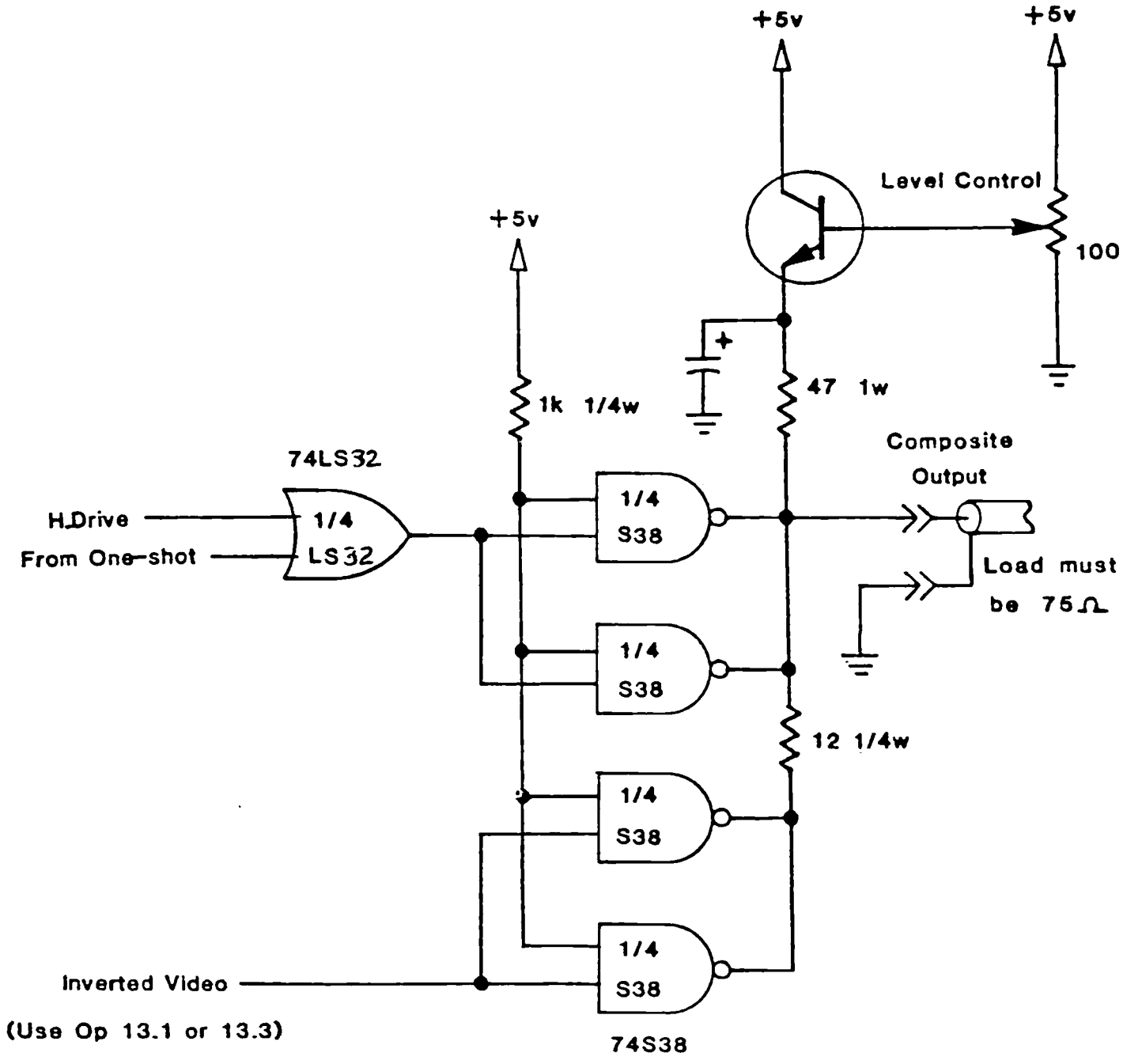


Figure F-2 Composite Video Circuit



APPENDIX G

Format Worksheet

Color Programmable Generator
Format Worksheet

Model # _____

Format F __ __ __ __

TIMING PARAMETERS:

Real Time Parameters

Dot Rate __ __ . __ __ __ MHz

Horizontal Rate __ __ __ . __ __ __ KHz

Vertical Rate __ __ __ . __ __ Hz

Non-Real Time Parameters

Horizontal		Vertical	
Dots/Character	__ __	Lines/Character	__ __
Total	__ __ __	Total	__ __ __ __
Characters	__ __ __	Rows	__ __ __
Drive Delay	__ __ __	Drive Delay	__ __ __
Drive Width	__ __ __	Drive Width	__ __ __
		Step Width	__ __ __

DISPLAY PARAMETERS:

	Description	Character Code
C1	_____	__ __ __
C2	_____	__ __ __
C3	_____	__ __ __
C4	_____	__ __ __

Pattern Number

P# _____

Model # _____

Format F __ __ __ __

OPTION PARAMETERS

Signal Gating

Composite Sync	OP 1.__	0=off 1=on
Vertical Step	OP 2.__	0=off 1=on
Horizontal Drive	OP 3.__	0=off 1=on
Vertical Drive	OP 4.__	0=off 1=on

Signal Polarity

Composite Sync	OP 5.__	0=non-inverted 1=inverted
Vertical Step	OP 6.__	0=non-inverted 1=inverted
Horizontal Drive	OP 7.__	0=non-inverted 1=inverted
Vertical Drive	OP 8.__	0=non-inverted 1=inverted
Video	OP 13.__	0=non-inverting/positive 1=inverted/positive 2=non-inverted/negative 3=inverted/negative
Interlace Mode	OP 9.__	0=non-interlace 1=interlaced sync only 3=interlaced sync & video
Video Mode	OP 10.__	0=monochrome 1=color
Duty Cycle	OP 11.__	0=50% 1=100% (OP 12.0) 0 or 1=100% (OP 12.2)
Character Clocking Mode	OP 12.__	0=single-phase 2=dual-phase
Horizontal Skew	OP 14.__	skew right 0-3 dots
Vertical Skew	OP 15.__	skew down 0-9 lines
Cursor	OP 16.__	0=off 1=fast blink 2=slow blink 3=on continuous

Model # _____
Format F ___ ___ ___ ___

FORMAT DEFINITION WORKSHEET

Fill in all the known parameters indicated in CAPITOL LETTERS and use the equations to calculate the rest. All parameters indicated in CAPITOL LETTERS are found on the front panel of your unit.

HORIZONTAL FREQUENCY = _____ = TOTAL LINES x VERTICAL FREQUENCY

VERTICAL FREQUENCY = _____ = HORIZONTAL FREQUENCY x TOTAL LINES

TOTAL LINES = _____ = $\frac{\text{HORIZONTAL FREQUENCY}}{\text{VERTICAL FREQUENCY}}$

DRIVE WIDTH (v) = _____ = vertical sync time x HORIZONTAL FREQUENCY

LINES/CHARACTER = _____ = > 0 < 17 (Non-Interlaced), 9 or 12 are typical

Resolution or data display or display format (usually given in displayed dots horizontally or displayed lines vertically)

DISPLAYED ROWS (v) = _____ = $\frac{\text{TOTAL LINES-[blanking time (v) x HORIZ FREQ]}}{\text{LINES/CHARACTER}}$

or

DISPLAYED ROWS (v) = _____ = $\frac{\text{resolution (v)}}{\text{LINES/CHARACTER}}$

DRIVE DELAY (v) = _____ = $\frac{\text{front porch time (v) x HORIZONTAL FREQ}}{\text{LINES/CHARACTER}}$ + DISPLAYED ROWS

DOTS/CHARACTER = _____ > 5 < 13 (9 in dual phase) 7 or 9 are typical

resolution (h) = _____ = displayed dots (h)

DISPLAYED CHARACTER = DISP CHAR

DISPLAYED CHARACTERS = _____ = $\frac{\text{resolution (h)}}{\text{DOTS/CHARACTER}}$

TOTAL CHARACTERS = _____ = DISP CHAR + $\frac{\text{blanking time (h) x DISP CHAR}}{\text{display time}}$

or

TOTAL CHARACTERS = _____ = $\frac{\text{bandwidth}}{\text{HORIZONTAL FREQUENCY x DOTS/CHARACTER}}$

DISPLAYED CHARACTERS = _____ = TOTAL CHAR - $\frac{\text{blanking time (h) x bandwidth}}{\text{DOTS/CHARACTER}}$

DRIVE DELAY (h) = _____ = DISP CHAR + $\frac{\text{front porch time (h) x bandwidth}}{\text{DOTS/CHARACTER}}$

DRIVE WIDTH (h) = _____ = $\frac{\text{horizontal sync time x bandwidth}}{\text{DOTS/CHARACTER}}$

SELECT C1, C2, C3 and C4 from the character library found in *Appendix B*. Select the desired options from table 2-2 on page 2-9 of this manual.

APPENDIX H

Character Worksheet

CHARACTER # 0

	DOT 1	2	3	4	5	6	7	8
M 1.0								
M 2.0								
M 3.0								
M 4.0								
M 5.0								
M 6.0								
M 7.0								
M 8.0								
M 9.0								
M 10.0								
M 11.0								
M 12.0								
M 13.0								
M 14.0								
M 15.0								
M 16.0								

CHARACTER # 1

	DOT 1	2	3	4	5	6	7	8
M 1.1								
M 2.1								
M 3.1								
M 4.1								
M 5.1								
M 6.1								
M 7.1								
M 8.1								
M 9.1								
M 10.1								
M 11.1								
M 12.1								
M 13.1								
M 14.1								
M 15.1								
M 16.1								

CHARACTER # 2

	DOT 1	2	3	4	5	6	7	8
M 1.2								
M 2.2								
M 3.2								
M 4.2								
M 5.2								
M 6.2								
M 7.2								
M 8.2								
M 9.2								
M 10.2								
M 11.2								
M 12.2								
M 13.2								
M 14.2								
M 15.2								
M 16.2								

CHARACTER # 3

	DOT 1	2	3	4	5	6	7	8
M 1.3								
M 2.3								
M 3.3								
M 4.3								
M 5.3								
M 6.3								
M 7.3								
M 8.3								
M 9.3								
M 10.3								
M 11.3								
M 12.3								
M 13.3								
M 14.3								
M 15.3								
M 16.3								

APPENDIX I

Performance Tests

Equipment Required:

Frequency Counter
Scope
15.720 Khz Monochrome Display
15.720 Khz Color Display
75 ohm terminater with BNC tee

Display Test:

1. Press the MHz key, then press:

   8 . 8 8 8 8

   Verify the all eight elements of each digit of the 5- digit display function.

2. Depress the parameter keys one at a time and make sure that all corresponding LEDs are functional.

3. Recall format #5. Check to see that the dual-phase LED functions.

4. Recall format #9. Check to see that both interface mode LEDs function.

Synthesizer Test:

1. Connect the DOT RATE output of the generator to a frequency counter (the input of the counter should terminate the coax in its characteristic impedance).

2. Set the gate time of the counter (if available) to 10 milliseconds.

3. Recall format #6 and enable the outputs of the generator (by depressing the OUT key if necessary).

4. Enter the following frequencies using the MHz key:

a.	2.184 MHz	(2.1837816 to 2.1842184)
b.	4.368 MHz	(4.3675632 to 4.3684368)
c.	8.736 Mhz	(8.7351264 to 8.7368736)
d.	17.472 MHz	(17.470253 to 17.473747)
e.	32.784 MHz	(32.780722 to 32.787278)
f.	34.944 MHz	(34.940506 to 34.947494)
g.	65.520 MHz	(65.513448 to 65.526552)

NOTE: At each frequency listed above, the measured frequency must not deviate from the value listed by more then 100 PPM.

5. Press the OUT key and verify that the DOT RATE output is disabled.

Monochrome Video Test:

1. Connect a monochrome monitor to the generator.

2. Recall format #5 and enable the outputs of the generator (by depressing the OUT key if necessary).

3. Verify that the picture that is displayed is a solid patch of white.

4. Enter the single-phase mode (OP 12.0) and verify that the 50% duty cycle feature is functional.

5. Select the 100% duty cycle mode (OP 11.1) and verify that this feature is functional.

6. Reselect the 50% duty cycle mode (OP 11.0) and enter character select code 60 into both locations C1 and C2.

7. Set the (HORIZONTAL) DOTS/CHARACTER parameter to the following values and verify that the dot count is correct:

    a. 6
    b. 7
    c. 8
    d. 9
    e. 10
    f. 11
    g. 12

8. Select the non-inverted/positive video mode (OP 13.0) and verify that this feature is operating correctly.

9. Turn on the cursor (OP 16.3) and check to see that it is displayed.

10. Recall format #5 and select the non-inverted/positive video mode (OP 13.0).

11. Set the brightness control on the monitor so that the raster is just visible. Set the contrast control on the monitor (if available) to maximum. Verify that there is no "snow" in the picture.

Color Video Test:

1. Connect a color monitor, via the color buffer, to the generator.

2. Recall format #8, then select "P1 2".

3. Verify all color combinations are being displayed. Background colors will be displayed as vertical bars. Foreground information will be displayed as rows.

4. Select option 13.2.

5. Again verify all color combinations. The background colors are now displayed as horizontal bars. Foreground colors are displayed in columns.

Sync Test:

1. Turn off the monitor and disconnect it from the generator.

2. Recall format #7.

3. Connect a scope to the HORZ DRIVE output.

4. Set the (HORIZONTAL) DRIVE WIDTH parameter to each of the drive widths listed in Table I-1 and verify that each width is obtained with the scope.

Table I-1 Pulse Widths

Scope Sweep Rate (Time/Div)	Width Entered	Divisions
1 microsecond/division	1	1
1 microsecond/division	2	2
1 microsecond/division	4	4
1 microsecond/division	8	8
2 microsecond/division	16	8
5 microsecond/division	35	7
10 microsecond/division	70	7
20 microsecond/division	140	7

5. Set the (HORIZONTAL) DRIVE WIDTH parameter to 1 and the horizontal sweep of the scope to 50 microseconds/division.

6. Select inverted horizontal drive (OP 7.1) and verify that the horizontal drive signal from the generator inverts.

7. Disable the HORZ DRIVE output (OP 3.0). Verify that the HORZ DRIVE output is disabled.

8. Connect the scope to the STEP output.

9. Set the STEP parameter to each of the values listed in Table I-1 and verify that each width is obtained with the scope.

10. Select inverted vertical step (OP 6.1) and verify that the vertical step output signal from the generator is inverted.

11. Disable the STEP output (OP 2.0). Verify that the STEP output is disabled.

12. Connect the scope to the VERT DRIVE output. Set the horizontal sweep rate on the scope for 0.2 milliseconds/division.

13. Set the (VERTICAL) DRIVE WIDTH parameter to 1 line. Verify that the width of the vertical drive pulse coming from the generator is 0.2 milliseconds (1 division).

14. Select the inverted vertical drive mode (OP 8.1) and verify that the vertical drive pulse coming from the generator is inverted.

15. Disable the VERT DRIVE output (OP 4.0). Verify that the VERT DRIVE output is disabled.

16. Connect the scope to the COMP SYNC output. Set the horizontal sweep rate on the scope for 1 millisecond/division.

17. Verify that the horizontal and vertical components of the composite sync signal are present.

18. Select inverted composite sync (OP 5.1) and verify that the composite sync signal coming from the generator is inverted.

19. Disable the COMP SYNC output (OP 1.0). Verify that the COMP SYNC output is disabled.

Composite Video Test:

1. Recall format #9.

2. Connect the scope to the COMP VIDEO output.

NOTE: The COMP VIDEO output must be terminated in 75 ohms.

3. Adjust the LEVEL control fully counterclockwise and verify that the composite video output signal is disabled.

4. Adjust the LEVEL control fully clockwise and verify that the composite video output signal is greater than or equal to 1.5 V_{p-p}.

5. Verify that the video to sync ratio is 2.5 to 1.

Lockout Test:

1. Enable the lockout function by sliding the switch on the real panel of the generator to the right.

2. Attempt to disable the COMP SYNC output (OP 1.0). Verify that the generator is locked out (by looking for the "SAFE " message).

APPENDIX J

Format Library Spread Sheet

APPENDIX J
Standard EPROM Format Library

	Format 10	Format 11	Format 12	Format 13	Format 14	Format 15	Format 16	Format 17	Format 18
TIMING PARAMETERS									
REAL TIME PARAMETERS									
Dot Rate	11.004 MHz	14.148 MHz	16.848 MHz	22.920 MHz	14.168 MHz	6.366 MHz	6.366 MHz	12.448 MHz	5.532 MHz
Horizontal Rate	15.720 KHz	15.720 KHz	18.720 KHz	15.720 KHz	15.742 KHz	15.719 KHz	15.719 KHz	15.717 KHz	15.716 KHz
Vertical Rate	60.00 Hz	60.00 Hz	60.00 Hz	60.00 Hz	59.96 Hz	60.00 Hz	60.00 Hz	59.99 Hz	59.98 Hz
NON-REAL TIME PARAMETERS									
Horizontal									
Dots/Character	7	9	9	9	9	9	9	9	8
Total	100	100	100	162	100	45	45	88	44
Characters	80	80	80	132	80	32	32	64	31
Drive Delay	84	84	84	136	84	36	36	72	35
Drive Width	8	8	8	8	8	4	4	6	4
Vertical									
Lines/Character	10	12	12	12	12	14	14	7	14
Total	262	262	312	262	525	262	262	262	262
Rows	24	20	24	20	40	17	17	32	17
Drive Delay	24	20	24	20	40	17	17	32	17
Drive Width	5	5	5	5	5	5	5	5	5
Step Width	2	2	2	2	2	180	180	10	10
DISPLAY PARAMETERS									
C1	5	6	6	6	6	7	7	35	7
C2	5	6	6	6	6	5	5	35	5
C3	33	34	34	34	34	33	33	35	33
C4	7	8	8	8	8	35	35	35	35
OPTION PARAMETERS									
SIGNAL GATING									
Option 1	1	1	1	1	1	1	1	1	1
Option 2	1	1	1	1	0	1	1	1	1
Option 3	1	1	1	1	1	1	1	1	1
Option 4	1	1	1	1	1	1	1	1	1
SIGNAL POLARITY									
Option 5	0	0	0	0	0	0	0	0	0
Option 6	0	0	0	0	0	0	0	0	0
Option 7	0	0	0	0	0	0	0	0	0
Option 8	0	0	0	0	0	0	0	0	0
Option 9	0	0	0	0	3	0	0	0	0
Option 10	0	0	0	0	0	1	1	1	1
Option 11	0	0	0	0	0	0	0	0	0
Option 12	0	0	0	0	0	0	0	0	0
Option 13	0	0	0	0	0	0	2	0	0
Option 14	0	0	0	0	0	2	2	1	0
Option 15	0	0	0	0	0	3	3	0	0
Option 16	0	0	0	0	0	0	0	0	0

APPENDIX K

Color Buffer Manual

CONTENTS

INTRODUCTION

The Color Buffer is a standard accessory of the Color Character Generator. It not only protects the outputs of the Generator from CRT arcs and cocked edge connectors, but also provides a digital-to-analog conversion that is necessary when driving analog RGB displays.

The Buffer has a total of six inputs: four TTL video inputs (red, green, blue, & gray) and two TTL sync inputs (horizontal & vertical). These six inputs are buffered and combined to form a total of five outputs: three analog video outputs (red, green, & blue) and two syncs (horizontal & vertical).

The four video inputs of the Buffer are used to select the color that appears on the display under test . Any one of fifteen different colors (or black) can be selected in this way. The Buffer produces seven saturated colors; namely, red, green, blue, yellow, cyan, magenta, and white. In addition to this, six non-saturated (pastel) colors (which are user programmable over a limited range) may also be selected.

Two TTL compatible sync channels are provided for separate horizontal and vertical drive. The Buffer may also be optionally strapped to output composite video on red, green, and (or) blue.

The Buffer has four controls. One control is used to vary the signal swing from all three guns simultaneously. The remaining three controls adjust the amount of red, green, and blue obtained when displaying non-saturated colors.

All controls and straps are accessible through a trap door in the bottom of the Buffer.

SETUP

Input-Output Connections

Two printed circuit tangs extend from opposite ends of the Buffer enclosure. All input and power related connections are made via a double readout connector at one end of the enclosure, while all output connections are made via a single readout connector at the other end of the enclosure.

The input cable assembly (supplied with the Buffer) should be attached to the double readout tang marked "H V Gy B Gn R Power". The edge connector should be oriented so that pin 1 is on the side of the tang that is marked "1". Reversing this connector will not damage the buffer or the input cable assembly; however, the outputs of the signal source will be shorted.

An output cable assembly should be constructed that is suitable to your specific requirements. This assembly consists of an edge connector (Amphenol 143-010-01 or equivalent single readout 0.156 ctr. type [supplied]), several feet of (50 to 75 ohm) coaxial cable, and whatever connector is appropriate for the display to be tested.

Once constructed, the output cable assembly should be attached to the single readout tang marked "R. G. B. V. H.". The output signals of the Buffer exit the buffer on the pads marked with a dot. The pad adjacent to each dotted pad

is the ground return associated with that signal. The pinout for both input and output edge connectors are as follows:

SIGNAL			INPUT	OUTPUT
TTL Horizontal Sync	signal	.	C	1
	ground		3	2
TTL Vertical Sync	signal	.	D	3
	ground		4	4
Gray	signal	.	E	na.
	ground		5	na.
Blue	signal	.	F	5
	ground		6	6
Green	signal	.	H	7
	ground		7	8
Red	signal	.	J	9
	ground		8	10
Power Supply	+9vdc	+	K,L	na.
	ground		9.10	na.

OPERATION

Connect the input and output cables to the signal source and the unit under test, respectively. Verify that pin 1 of each connector is oriented correctly.

Plug the power source into a 120 VAC outlet. The power indicator will light and you will have output signals. In case of difficulty refer to RESTORING NORMAL OPERATION.

Turn the Buffer over and remove the access door. Select the desired operating mode for each video output by placing the jumper associated with each output in the appropriate position.

If your display has separate color and sync inputs, place the jumpers in the non composite position.

If your display requires a composite video signal at one of its color inputs, place the jumper corresponding to that color in the composite with sync position. Place the remaining two jumpers in the composite without sync position. This will insure that an equal signal swing will be obtained from all three video outputs.

All video outputs of the Buffer are load-sensitive and must terminate in a 75 ohm resistive load in order to maintain tracking, proper video to sync ratios, and bandwidth.

Adjust the Signal Swing pot for the desired peak-to-peak swing. This pot controls the amplitude of all color outputs. Be sure that the output signal leads are terminated when making any adjustments.

Set the pastel levels by adjusting the Gray Level pot associated with each color. The gray level may be adjusted from 35% to 70% of the signal swing when using the non-composite mode or 10% to 60% of the signal swing when using either of the composite modes.

Note: Pattern 3, level 2 ("P3 2") on the Generator provides a good signal for setting levels. All colors are displayed as vertical bars with Gray active during the bottom half of the pattern.

RESTORING NORMAL OPERATION

Remove the output connector. Check the power indicator light. If it is still lit, refer to the REPLACEMENT TABLE given below.

If the power light is not lit, this may be an indication that the protective crowbar circuitry has been activated. Temporarily remove power from the unit (allowing a few seconds for discharge before reapplying power). Reapply power to the unit. If the light is lit, but the unit still fails to operate, refer to the REPLACEMENT TABLE given below.

Unplug the power source. Remove the four screws on the bottom of the enclosure (this will allow access to the printed circuit board). Replace the defective integrated circuits called out in the REPLACEMENT TABLE below.

Apply power and confirm normal operation before reassembling the unit. Replace the output connector.

REPLACEMENT TABLE

Inoperative Signal	Replace	
Horizontal	U7	74S140
Vertical	U6	74S140
Red Video	U1	74S38
Green Video	U3	74S38
Blue Video	U5	74S38

The above are the output chips for each signal. These are normally the only parts destroyed. If problems still exist after replacement of these parts, refer to the schematic at the end of this manual.

SPECIFICATIONS

INPUTS

Signals:
- TTL Red
- TTL Green
- TTL Blue
- TTL Gray
- TTL Vertical Sync
- TTL Horizontal Sync

Levels:
- 1 = 2 to 5 VDC
- 0 = 0 to 0.8 VDC

Loading: 75 ohm termination referenced to 2.5 VDC

LOGIC OUTPUTS

Signals: TTL Vertical Sync
TTL Horizontal Sync

Levels: 1 = 2 to 5 VDC (into 50 ohms or greater)
1 = typically 2.5V (into 75 ohms re. ground)
0 = 0 to 0.8 VDC (into 50 ohms or greater)
0 = typically 0.5V (into 75 ohms re. ground)

ANALOG OUTPUTS

Signals: Red Video
Green Video
Blue Video

Straps: Each video output may be independently strapped so as to produce either non-composite video, composite video without sync, or composite video with sync.

Levels:

Saturation	All video outputs produce the same saturation level; namely, 140 IEEE units.
Pastel	The pastel level produced by each video output is independently adjustable from 50 to 100 IEEE units and is not affected by the setting of the signal swing adjustment.
Black	The black level produced by a video output in the non-composite mode will be 0 IEEE units, while the black level produced by a video output in either composite mode will be 40 IEEE units.
Sync	When enabled, the sync level is always 0 IEEE units.
Signal Swing	The signal swings from all three video outputs of the CB-5 track each other. Signal swing is adjustable from 0 to 2.5 Vp-p, assuming all outputs are terminated in 75 ohms.

Controls:

Red pastel level	(50 to 100 IEEE units)
Green pastel level	(50 to 100 IEEE units)
Blue pastel level	(50 to 100 IEEE units)
Signal swing	(0 to 2.5 Vp-p)

CONNECTORS

Input: Amphenol 225-21021-101 or equivalent double readout 0.156" ctr.

Output: Amphenol 143-010-01 or equivalent single readout 0.156" ctr.

Color Buffer

POWER REQUIREMENTS

Line: 105 - 130 vac, 60 Hz.

OVERALL DIMENSIONS

Width: 6 3/4 inches

Height: 1 5/16 inches

Depth: 3 5/8 inches

ENVIRONMENT

Temp: 40 degrees fahrenheit (5 degrees celsius) to 100 degrees fahrenheit (38 degrees celsius).

Humidity: 20 to 80 percent (noncondensing)

WEIGHT

Shipping: 3 lbs.

PARTS LIST

Resistors	**O.E.M. Part #**
R1 thru R12 - 150 Ohm 1/4watt 5%	06B15005B05
R13 thru R15 - 1K Ohm 1/4watt 5%	06B10006B05
R16 thru R21 - 10 Ohm 1/4watt 5%	06B10004B05
R22 thru R24 - 47 Ohm 1 watt 5%	06D47004D05
R25 thru R28 - 100 Ohm Trimpots	18A10005A01
R29 - 680 Ohm 1/4watt 5%	06B68005B05
R30 - 220 Ohm 1/4watt 5%	06B22005B05
Capacitors	
C1 thru C9 - 0.1 Mfd. 50 WVDC, Mon.	21C10002F01
C10 - 4700 Mfd. 16 WVDC (Elna)	23S47006D01
C11,C12 - 33 Mfd. 10 WVDC, Tant.	23T33004C01
Semiconductors	
CR1 - Not used. (Jumper)	----------
CR2 - 1N5234A, 6.2V Zener	48C15234L01
CR3 - 2N6239 SCR	48W26237C01
CR4 - LED	52A05054S01
CR5 - 1N4001 Diode	48A14001L01

U1,3,5 - 74S38 quad open collector NAND gate . . 51S00038A09
U2,4 - 74S86 quad EXOR gate 51S00086A14
U4A - 74LS32 quad OR gate 51L00032A14
U6.7 - 74S140 line driver 51S00140A12
U8 - 7805 +5 volt regulator 51J07805S39

Q1 - TIP41A Transistor 48L00041C01

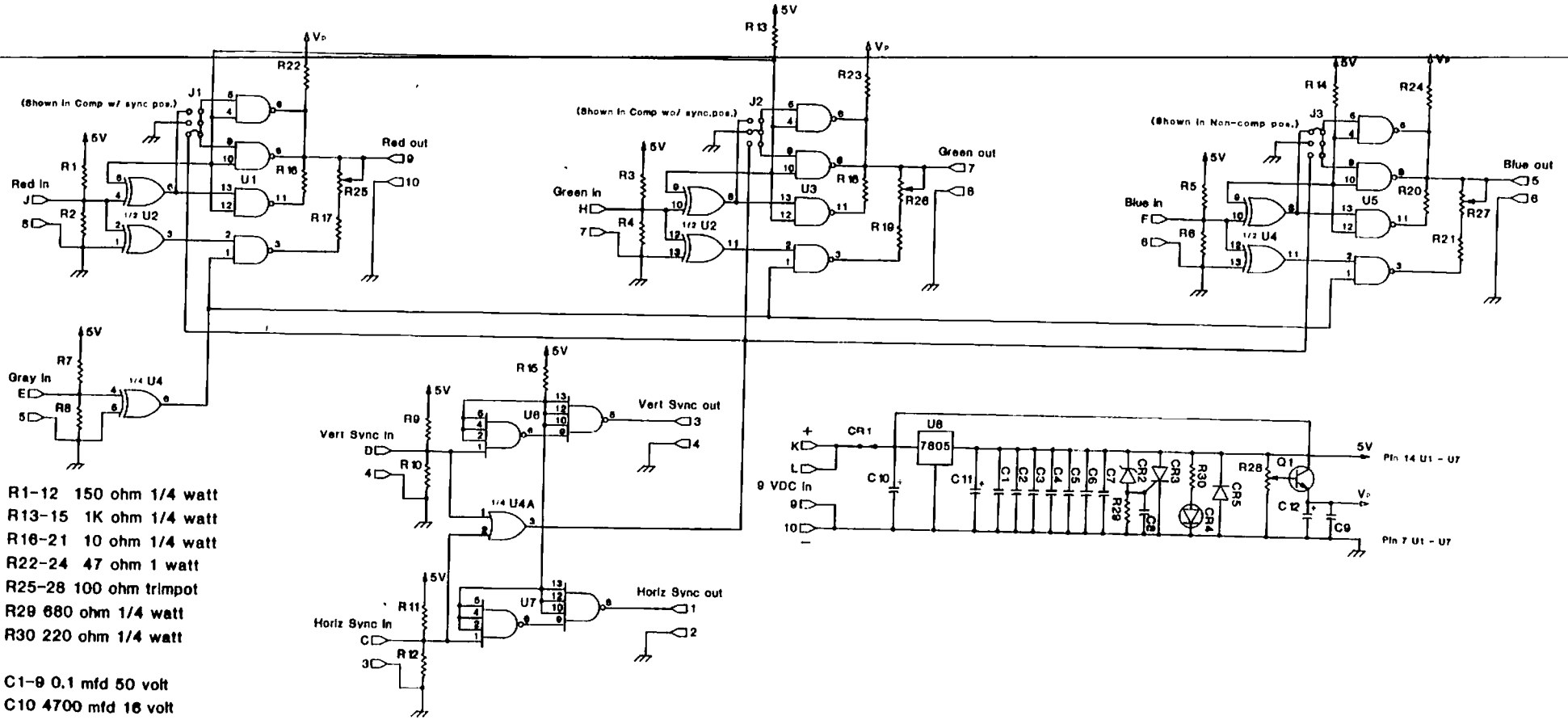
Mechanical

7 - 14 Pin IC Sockets, Amp type 09G00400A14
1 - Insulating hardware kit for TIP41A 14A00002A01
1 - Nameplate 54B00401A01
1 - Control label 54B00401A02
1 - PC Board 84F00440A01
3 - 0.1" Jumper Plug 09Z00001A01
3 - 0.025" Pin 2X6 Header 31A00001C06
1 - Cabinet 16V00401A01

Cabling

1 - Input cable assembly 30V00401A04

1 - Dual Readout 10 Pin edge connector . . 09D00401G20
1 - AC Adapter (9VDC 800 MA) 25A00430A01
6 - BNC Connectors (for RG174 Cable) . . . 09B00430A00
6 - 18" RG174 Cable 30A00400A04



R1-12 150 ohm 1/4 watt
R13-15 1K ohm 1/4 watt
R16-21 10 ohm 1/4 watt
R22-24 47 ohm 1 watt
R25-28 100 ohm trimpot
R29 680 ohm 1/4 watt
R30 220 ohm 1/4 watt

C1-9 0.1 mfd 50 volt
C10 4700 mfd 16 volt
C11-12 33 mfd 10 volt

Figure K-1

REVISION B PER ECO #80004

Quantum Data, Inc.
CB-5 Color Buffer
73-00012