THE

GENERAL DEVELOPMENT SYSTEM

VERSION 1.2

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by

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and the staff of

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1. Preface

1.1 Introduction to the GDS Manual

This is a tutorial, introductory document on how to use the General Development System. It is designed for musicians who have never used a GDS. It should also be helpful to those who are interested in purchasing a GDS and wish to know more about it.

This book is also a reference document for those who have already worked with the GDS. The material has been organized into chapters and sections, with an index to provide easy access to material which the user might not use on an everyday basis, and thus might forget.

Since many of the people who will be using the GDS have never used a computer before, this manual has been written in a fairly simple style. Many cross-references to specific sections of the manual are included, so that you will not have to remember where important details are located. In fact, for most of the manual, we have assumed that the reader is a musician with at least a little experience with analog synthesizers. Those readers who have already implemented MUSIC11 in PDP-15 assembly language will find some of the explanations in this manual simplistic. English and American readers will also note that we have avoided long, complicated sentences and obscure slang, for the sake of users of the GDS for whom English is a second language.

Figures have been included in this manual wherever appropriate. Each figure is numbered according to the section of the text in which it occurs. The figures should be especially helpful to those who are considering acquiring a GDS, but who have not yet had the opportunity to see one.

1.2 How to Read this Manual

This manual starts with instructions on how to connect all of the hardware devices which make up a GDS. If the GDS which you are using has already been set up, read the rest of this Preface and Sections 2.1 and 2.2; then skip to Section 3 ("Fundamentals").

"Fundamentals" is a short introduction to the GDS. The GDS is not just a synthesizer; it contains a computer and is much more flexible and powerful than analog synthesizers. In order to be able to explore the capabilities of the GDS, and in order to fully understand and use even this introductory manual, it will be necessary to define and use certain ideas and terms. This is handled in the Fundamentals section. If you are completely new to digital synthesizers (and especially if you have never used a computer before), study the Fundamentals section before going on to the rest of the manual.

Since the GDS is a digital synthesizer, it is controlled by computer programs. The GDS is supplied with two main programs. One is called "PERFORM", and the other is called "VOICE". This manual will take you through both programs, step by step. You will not have to program the computer yourself; this has already been done for you.

The PERFORM program is used whenever the GDS is being played as a keyboard instrument. It controls the selection of voices to be played on the keyboard, the sequencer, and mixing from the keyboard and sequencer.

The best way to use this manual (after you have read the Fundamentals section) is to start at the beginning of the explanation of the PERFORM program. Follow the directions closely; after reading about each new feature, stop reading the manual and play around for a while with what you've learned. After you have learned the PERFORM program, take some time off and make some music. Don't try to learn the entire PERFORM program in just one day, either. It may take several different readings of this manual in order to absorb all of the details.

The VOICE program gives the musician access to what would be called a "patch" on an analog synthesizer. With the VOICE program, you can define and modify your own sounds. Wait until you've gotten a good feel for the PERFORM program before jumping into the VOICE program. There are enough voices supplied with the GDS that you can make a lot of music without having to worry about voicing the GDS yourself. But don't forget that the power of the GDS comes from the fact that you can define your own voices; once you have started your own voicing, you will find a whole range of possibilities which were unavailable on analog synthesizers.

There are some items which are included in this manual but which can be skipped on first reading, or which are included only to explain problems which may be occurring. Such information is included in specially designated sections; skip these sections when reading the manual the first time.

1.3 Changes to the manual

This manual is written for the users of the GDS. We've tried to make it as clear and readable as possible. If you have suggestions for additions or improvements, please send them to us. We'll try to incorporate your suggestions into later versions.

We recommend that you use a loose-leaf binder for storing this manual. The manual will be periodically updated to include information on new features in the programs for the GDS. The updates will be provided in the form of pages which will replace pages from the earlier version of the manual. In addition, a vertical bar will be placed to the right of the lines of text which are changed or added in the updated pages, so that it will be easy to review what the changes involve without reading through the entire manual. The bar will look something like this:

The versions of the manual will be numbered according to a decimal system, starting with 1.0. When minor updates have been prepared, the number to the right of the decimal point will be incremented. When the manual is thoroughly revised (and especially when the pages are re-arranged), the number to the left of the decimal point will be incremented.

1.4 Version 1.0

Version 1.0 is the first version of the manual for the GDS. The sections on the Sequencer and the VOICE Program are still in draft form. Several fairly minor sections have yet to be written; some figures are still missing, as is the index. Space has been allocated in this first version of the manual for many of these, so that the omissions should be obvious.

1.5 Version 1.1

The sections on the Sequencer and on the VOICE program have been extensively revised; many illustrations have been added as well.

1.6 Version 1.2

The entire manual has been proofread from cover to cover. Many additions and corrections have been made; several sections have been renumbered or their order has been changed. An index and a list of illustrations has been added. This will presumably be the last large-scale rewrite before Version 2.0.

2. Introduction to the GDS

2.1 Hardware

The GDS consists of three main pieces of hardware: console, computer, and terminal.

2.1.1 Console

The console is self-contained, and includes a 61-note keyboard, 32 sliders, one two-axis joystick, a spring-return pitch bend, 12 rotary pots, and 16 switches. Two foot switches and a user-assignable foot pedal are connected to this console.

Each of the controls on the console can take on a different function, depending on how the computer is programmed. For each of the programs supplied with the GDS, an overlay is provided (see Figures 4.1.1 and 6.2). The overlay fits on top of the console while the program is being used, and the labels on the overlay indicate the functions of the knobs and switches on the console.

2.1.2 Computer

The computer is an Industrial Micro Systems Z-8Ø computer with two double-density 8-inch floppy disk drives. The 32-oscillator digital synthesis card and a digital-to-analog converter are installed inside of the computer case.

2.1.3 Terminal

The terminal supplied with the GDS is the Applied Digital Data Systems Regent 2Ø; it consists of a keyboard and a CRT (cathode ray tube) screen.

2.2 Software (Computer Programs)

The following software is supplied with the GDS.

2.2.1 Operating System

1. The operating system is CP/M, from Industrial Micro Systems. If you are interested in using the Z-8Ø for writing your own programs, manuals for CP/M are available from _____. Compilers for various languages are available from _____ as well.

2.2.2 PERFORM

PERFORM controls the GDS as a keyboard performance instrument. It includes

sophisticated and innovative features for assigning voices to notes depressed (including split keyboard),

automatic or manual distribution of the oscillators among the voices,

keyboard control of amplitude and timbre

various types of portamento

vibrato

control over filters included in voices, and the

sequencer.

2.2.3 VOICE

VOICE is a flexible, interactive program used to "patch" the GDS for both additive synthesis and frequency modulation, and to specify control parameters for creating unique timbres under user control.

2.2.4 Diagnostic software

The OSCTEST program provided with the GDS can be used to test the bank of 32 digital oscillators. The KPTEST program checks the keys on the console keyboard as well as the knobs and switches on the console. Finally, the MEMTEST program checks for malfunctions in the computer memory.

2.2.5 Utility Programs

A number of programs are provided for formatting disks, copying files, examining file directories, etc.

2.3 Connecting the Hardware

A diagram of the interconnections is given in Figure 2.3. The rest of this section consists of a step-by-step guide for connecting all of the hardware together. The plugs and cables have been carefully selected to avoid confusion as much as possible.

2.3.1. Console.

a. The cable attached to the foot pedal terminates in a 5-pin (DIN) connector which fits into a socket on the back of the console.

b. The cables attached to the foot switches terminate in phono plugs which fit into the jacks next to the connector for the foot pedal.

c. On the other side of the back of the console, above and to the left of the "C" of "CRUMAR", is a blue socket. The GDS is delivered with a long, flat, blue cable with a connector which will fit into this socket. Notice that the plug will only fit one way; if the plug does not seem to fit, then turn it upside down and try again.

d. There is no separate power cable for the console. The console gets all the electrical power it needs from the computer through the blue cable.

2.3.2. Computer

a. The other end of the blue cable from the console should be connected to the blue socket on the back of the computer, marked "Ch. 4".

b. There is a cord which has connectors on both ends which look like the connectors on the blue cable. One of those connectors fits into the thin, flat socket labelled "Channel 1" on the back of the computer. This plug will only fit one way; if the plug does not seem to fit, turn it over and try again. The other end of this cable will be attached to the terminal (see below).

c. The Cannon connector provides a monaural audio output.

d. There is a power cable which can be disconnected from the computer. One end of this cable fits into the lower left-hand socket on the back of the computer.

2.3.3. Terminal

a. The power cord for the terminal fits into the socket on the back of the computer (above the power cord for the computer itself).

b. The cable attached to "Ch. 1" on the back of the computer should also be attached to the socket labelled "EIA Current Loop" on the back of the terminal.

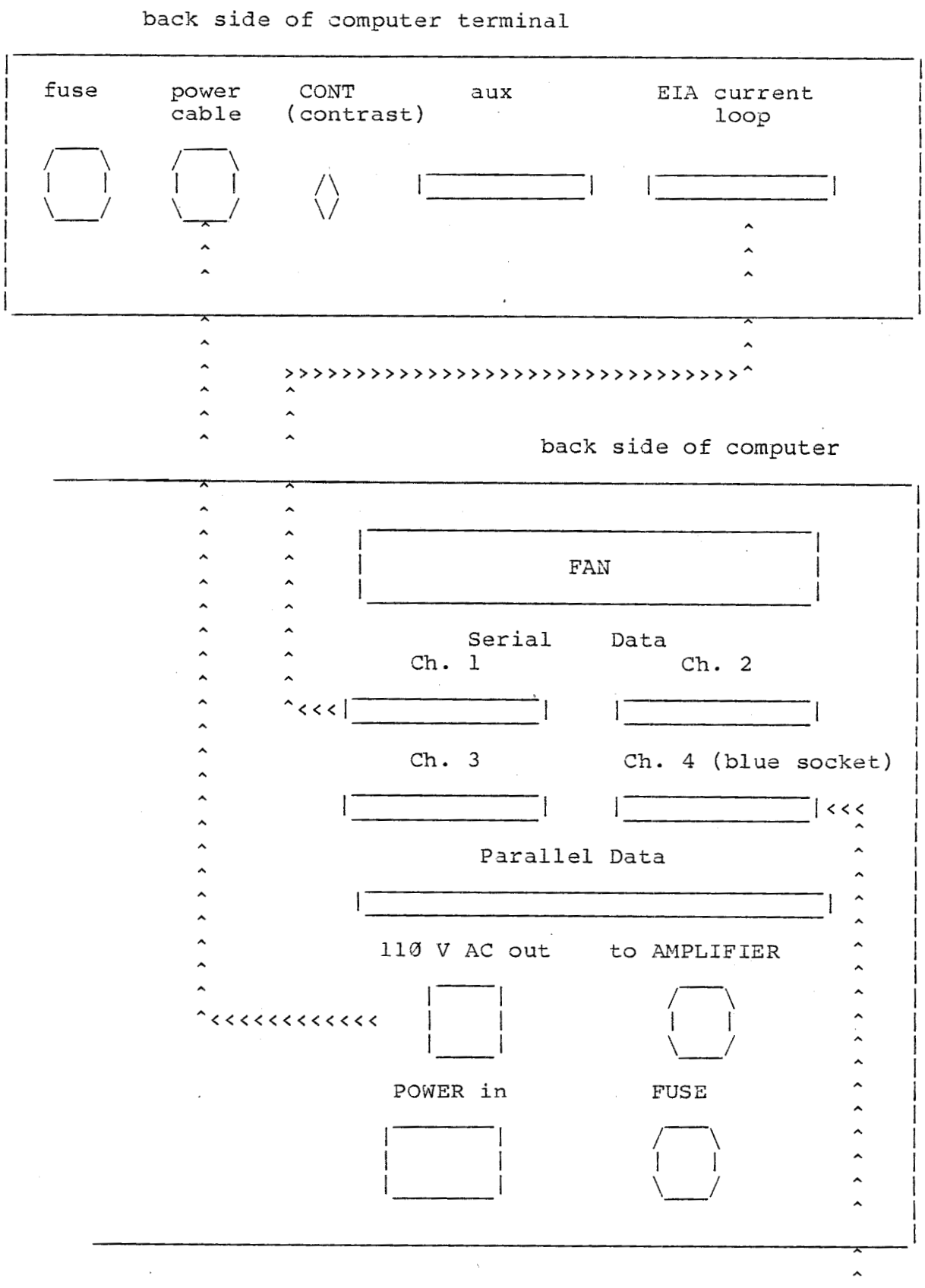

Figure 2.3 (continued on next page)

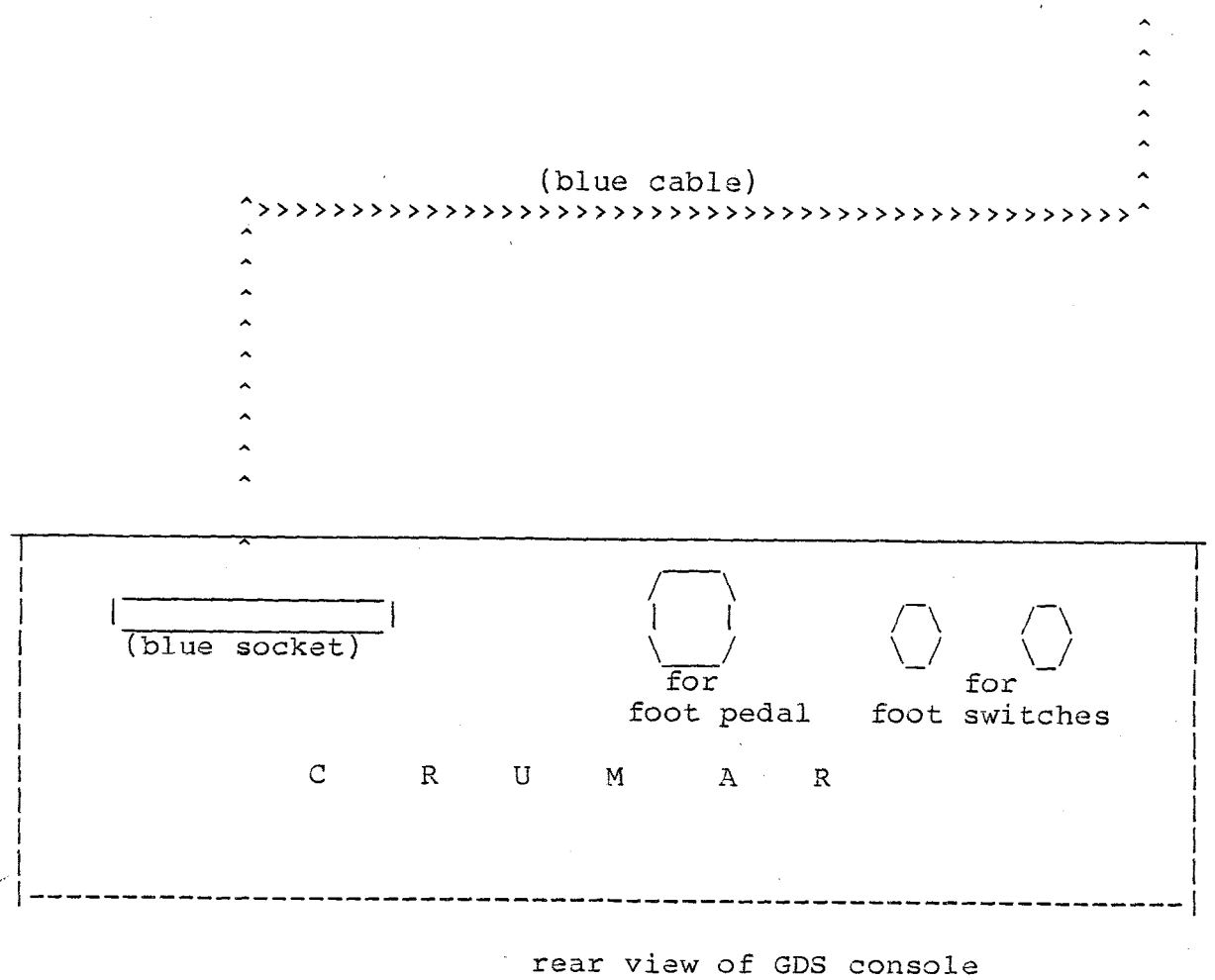

Figure 2.3 (continued from previous page). Interconnections between the various components of the General Development System. (Not drawn to scale)

Figure 2.3

3. Fundamentals

The GDS is a musical instrument which contains a computer. Anyone using the GDS will have to interact with the computer, at least to some extent. In this section, some necessary background information will be presented.

3.1 Disks

It is not yet practical to deliver the GDS with a computer that takes care of itself automatically every time the GDS is turned on. A computer can be turned on; but in order to run, the computer must have access to some sort of program.

There are various ways of providing such programs for the computer. The programs for the GDS are supplied on small disks (known in the computer trade as "floppy" disks, because they are flexible). The disk itself is a piece of plastic which has been coated with a magnetic material. You can think of it as being similar to a phonograph record, except that the information is stored magnetically on the disk instead of in record grooves. The disks supplied with the GDS contain programs which the computer needs for running at all, as well as programs developed specifically for the GDS by Music Technology. Users of the GDS will not need to write programs; the programs provided with the GDS can be used without any understanding of computer programming.

The rest of Section 3.1 covers the use, care, and handling of disks. Read this information carefully before inserting the disks into the computer.

3.1.1 Disk Drives

When the computer is using a disk, the disk will be located in a unit known as a disk drive. The GDS is delivered with two disk drives, both housed in the same cabinet which holds the computer. These disk drives look like long vertical slots in the front of the computer cabinet.

The disk drive holds the disk in place, and turns it at a high speed, so that the computer can quickly find various places on the disk. When the computer is not using a disk, then the computer turns the drive off automatically. When the disk is needed again, the computer will start the disk drive by itself. This is done to reduce wear and tear on the disks.

The left-hand drive will typically be used for the computer programs provided with the GDS; the disk which contains these programs is labelled "GDS System." The right-hand drive will hold a disk for voices and recorded sequences prepared by individual users. Different users will undoubtedly develop their own libraries of voices and recorded sequences as they use the machine. A voice prepared on one GDS can be saved on a disk and then used later, or passed on to another user; the same is true for recordings made with the sequencer. As voices are developed by MTI and the user community, they can be made available simply by sending disks through the mail.

3.1.2 Inserting a Disk

Remove the floppy disk from its paper envelope. Notice that the disk is contained inside a sealed, thick paper container, usually black. Do not remove the floppy disk from this container. The floppy disk must be inserted so that the side with the paper label faces away from the power switch on the front panel of the computer. There is a long slot in the side of the thick paper container of the floppy disk. The floppy disk is inserted into the disk drive so that the long slot goes in first, and the slot should be horizontal (see Figure 3.1.2). After the floppy disk has been pushed all the way into the slot, it should stay there; if the floppy disk has not been pushed in far enough, then a spring will attempt to push it back out. Once the floppy disk is inserted, the door for the disk drive is closed by moving it directly to the left. The door should click shut and stay shut.

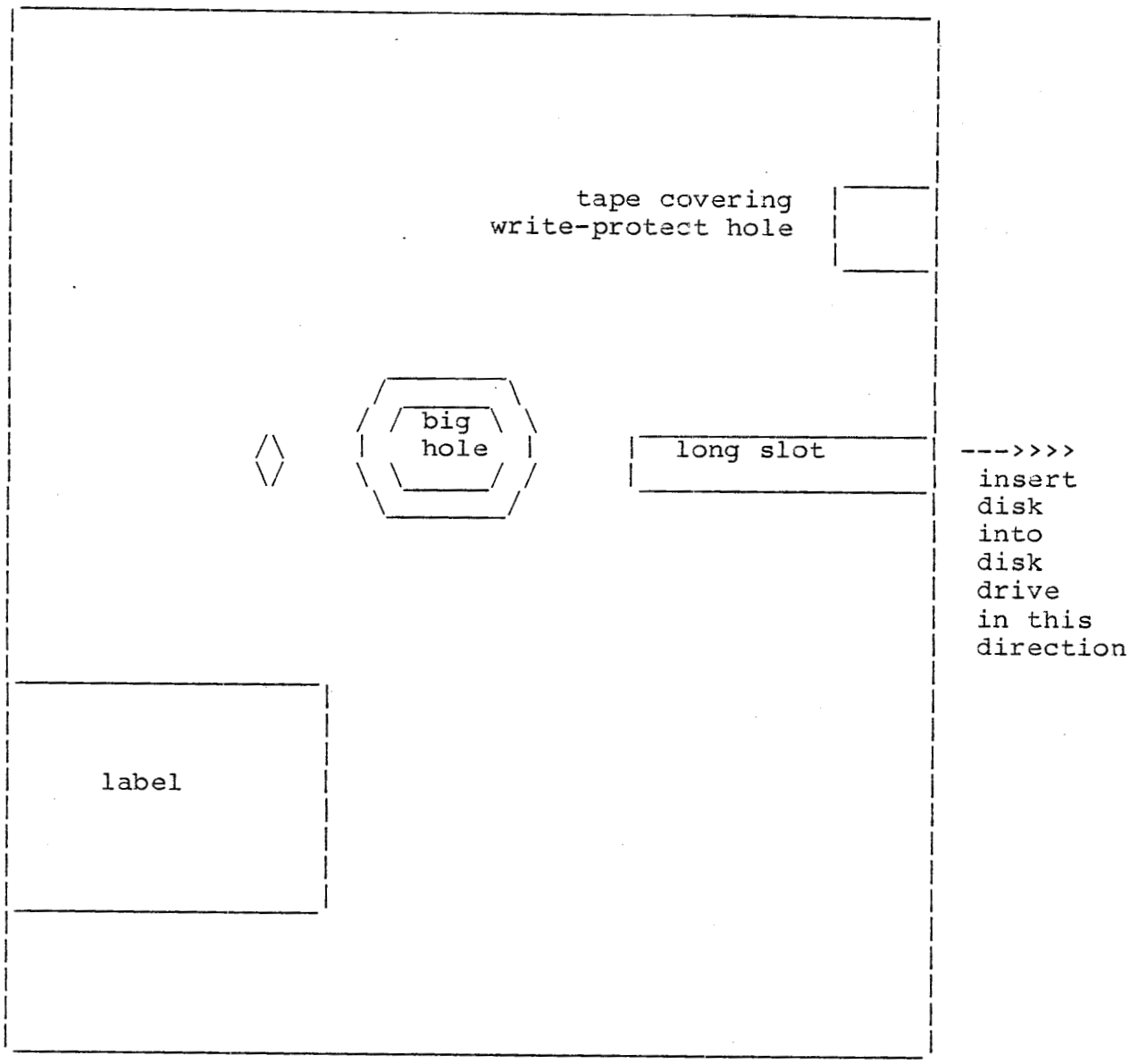

Figure 3.1.2. Side view of an 8" floppy disk, showing the side with the label (in the lower-left-hand corner of this illustration). The disk is inserted into the disk drive with the labelled side away from the power switch on the computer. The write-protect mechanism is explained in Section 3.4.7.3.

3.1.3 Removing a Disk

Generally the disk is left in the disk drive whenever the GDS is being used. The disk should be removed from the disk drive whenever the power will be turned on or off.

To remove the disk, push on the small rectangular piece of plastic in the middle of the disk drive. The disk drive door will move to the right, and the disk will spring out for removal. When you are turning the GDS on or off, the disk can be left in this "ejected" position; the disk does not have to be completely removed from the computer cabinet.

Removing the disk will not stop the computer, the PERFORM program, or the VOICE program. However, it will not be possible to save any voices or recorded sequences until the disk has been replaced (see also Section 4.2.1.6).

3.1.4 Care of Disks

These disks are sensitive devices. They should be stored in the envelopes when not in use in the GDS. A notebook insert can be purchased which is specially designed for storing disks. Keep them away from dust, extreme temperatures, and strong magnetic fields. Do not touch the parts of the disk which are visible through the disk's envelope. Do not spill liquids on the disk, either. Most importantly, do not turn the computer on or off with the disks inside the disk drives. If you do so, the disks may be damaged.

3.1.5 Buying new disks

When you need new disks, you can buy them at computer or data processing stores, such as the Byte Shops (in the USA). A disk from any manufacturer can be used as long as it meets the following specifications:

double density
single-sided
soft-sectored
8" in diameter

Information on formatting new disks is given in Section 3.4.6.

3.1.6 Write Protection

Referring back to Figure 3.1.2, in the upper-right-hand corner of the disk pictured you will see a square labelled "tape covering write-protect hole." When you buy a new disk, that tape will not be there. Instead, you will see a small hole cut in the side of the black container for the disk. When this hole is uncovered, the computer cannot change any information on the disk. It can read information from the disk, but it cannot write information onto the disk.

If you want to use the disk for storing information, this hole must be covered. Usually, small squares of silver paper are supplied with the disk. These small squares can be folded down the middle and mounted on the black container for the disk so that the hole in the side of the container is covered, as shown in Figure 3.1.2. The disks supplied with the GDS are already prepared in this manner.

Some disks are manufactured without the write-protect hole. In this case, it is not necessary to use the small squares of paper for writing something on the disk.

It is sometimes advisable to remove the square of paper from the write-protect hole. If you have created the files for an entire performance and stored them onto the disk, then it would be a good idea to make a "safety" copy of the disk, and then remove the paper from the write-protect hole of the safety disk. This will prevent the disk from being accidentally erased, or modified.

If the computer tries to write something onto a write-protected disk, then the computer will type out an error message on the terminal screen. These messages are discussed in Section 3.4.7.3.

3.2 Turning on the GDS

3.2.1 Power

Assuming that all of the cables have been connected according to the instructions in Section 2.3, and that there are no disks in the disk drives, it is now time to turn on the computer. There is a power switch on the front panel of the computer. Turning it on will turn on the entire GDS, because the console and the terminal are both powered by the computer. There is a power switch for the terminal underneath the front right-hand corner of the terminal keyboard. If the terminal does not turn on when the computer is turned on, then try turning on the terminal with this switch.

3.2.2 Starting the computer

The GDS is delivered with a floppy disk labelled GDS SYSTEM. After the power has been turned on, the next step is to load this disk into the left-hand disk drive. (See Section 3.1.2).

A few seconds after the door for the disk drive on the left has been closed, the following should appear on the terminal screen:

```
CRUMAR General Development System
62K CP/M vers 2.2 of 8ØMar12
Double-density

A>
```

If this message (or one like it) does not appear on the screen, push the RESET button on the front of the computer. You cannot use the GDS until this message has appeared on the terminal screen.

3.2.3 How to Restart the Computer

Sometimes the computer will fail to respond. This can happen, for example, if the line voltage suddenly "surges." When this occurs, press the RESET button on the front panel of the computer. The disks should not be removed from the disk drives when you push the reset switch.

This paragraph can be skipped if you are reading this manual for the first time. After you push the RESET button, the same message shown in Section 3.2.2 will appear on the terminal screen. This means that the computer has started running again. Perhaps the entire terminal screen will not be erased, in which case see Section 3.3.9.2. Any programs which were running when you pushed the RESET button will have to be re-started; if there were voices or sequences which had not been saved on the disk, they will be lost by pushing the RESET button.

3.2.4 Stopping the Computer

You will not have to stop the computer, or to stop any computer programs which may be running, in order to turn off the GDS.

3.2.5 Turning off the GDS

As discussed in Section 3.1.4, the disks must be removed from the disk drives before turning off the GDS.

After the disks have been removed, the GDS is turned off simply by turning off the power switch on the front of the computer. The PERFORMANCE or VOICE program can still be running when the computer is turned off.

Since the PERFORMANCE and VOICE programs are already on the disk, they do not have to be saved. The PERFORMANCE and VOICE programs on the disk labelled "GDS SYSTEM" are not changed in any way by turning off the GDS.

However, if you have recorded some tracks in the Sequencer, and then you stop the computer, the tracks will be lost. Likewise, if you have created a new voice with the VOICE program, and then you stop the computer, the new voice will be lost. Such information must be explicitly saved on the disks before the computer is stopped. Instructions on doing this are included later in this manual (Sections 4.21, 5.16, 6.9, 6.1Ø).