Lt. Kernal®

Operating Manual

LIMITED WARRANTY

Xetec, Inc. warrants this Xetec hard disk drive known as the Lt. Kernal, to be in good working order for a period of one year from the date of purchase from Xetec, Inc. or an authorized Xetec dealer. Should this product fail to be in good working order at any time during this one year warranty period, Xetec will at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts and products become the property of Xetec, Inc. This limited warranty does not include service to repair damage to the product resulting from accident, disaster, misuse, abuse, or non-Xetec modification of the product.

Limited warranty service may be obtained by delivering the product during the one year warranty period to an authorized Xetec dealer or to Xetec, Inc., and by providing proof of purchase date. Warranty will be valid for registered owners only. If this product is delivered by mail, you agree to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to Xetec, Inc., and to use the original shipping container or equivalant. Contact Xetec, Inc., 2804 Arnold Rd., Salina, Ks. 67401, (913)827-0685 for further information.

All express and implied warranties for this product including the warranties of merchantability and fitness for a particular purpose, are limited in duration to a period of one year from the date of purchase, and no warranties, whether expressed or implied, will apply after this period. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

If this product is not in good working order as warranted above, your sole remedy shall be repair or replacement as provided above. In no event will Xetec be liable to you for any damages including any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use such product, even if Xetec or an authorized Xetec dealer has been advised of the possibility of such damages, or for any claim by any other party.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

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The Lt. Kernal®

Welcome to the world of Serious Computing!

PLEASE READ THIS MANUAL CAREFULLY
BEFORE ATTEMPTING TO INSTALL YOUR LT. KERNAL!

If the first few pages of section II of this manual seem a little stern, please understand — we want you to have the BEST possible service from your Lt. Kernal. The only way to let you know about the potential for damage you could do to your system is to tell it like it is!

You've invested in the most advanced disk system available for Commodore™ computers, and an incorrect installation **may damage the Lt. Kernal, your computer, or both.** Read the installation portion of this manual carefully before connecting together any parts of the system.

The Lt. Kernal results from eighteen years of experience in designing large multi-user, multi-tasking mini-computer systems. We have applied the technology used in those larger systems to improve the operating characteristics and speed of the C-64® and C-128® .

Thank you for purchasing the Lt. Kernal. You now have at your fingertips really high speed computing power and a comfortable, user-friendly disk operating system that significantly upgrades the functions and usability of your Commodore computer. Quality software written with the user in mind, and rugged, conservatively designed hardware are combined to produce the best accessory ever for Commodore computers.

FCC STATEMENT

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Move the computer away from the receiver
- Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4.

MANUFACTURER'S WARNING: Using a cable between the "Host Adaptor" and the "Hard Drive Assembly", other than that provided by Xetec Inc. may result in interference to radio and television reception.

I.

The Lt. Kernal Disk Operating System V7.0

DOS FEATURES

- Runs certain copy-protected software
- Built-in KEYED INDEXED-RANDOM ACCESS METHOD
- Supports both C-64 and 128 modes of operation and CP/M®
- 57 additional or enhanced system commands and features
- Disk access speed more than 100 times faster than the 1541 floppy
- Automatic power-up execution of any application program
- Built in CP/M™ - like command-line features in C-64 and 128 modes
- User configurable system characteristics such as screen and character colors, and logical drive sizes
- Up to eleven logical drives may be defined on the hard disk
- Up to 7 hard drives in one system
- DOS allows up to seven files to be OPEN for reading and writing simultaneously in addition to the command/error channel
- DOS differentiates between BASIC and machine language programs
- Built-in backup and restore facilities
- Direct invocation of programs from the READY prompt
- Standard capacity of 20 Megabytes configurable up to 180 Meg.
- Optional Multiplexer allows up to 16 computers to share 1 Lt. Kernal system

TECHNICAL SPECIFICATIONS

Standard capacities, Formatted	20 Megabytes
Bytes per sector	512
Sectors per track	17
Tracks per cylinder	4
Number of cylinders	626
Media size	5¼'' (13.3 cm)
Recording density	10,200 Bits/inch
Track density	300 tracks/inch
Transfer rate to C-64 memory	38,000 Bytes/sec
Transfer rate to C-128 memory	65,000 Bytes/sec
Rotational speed	3,600 RPM
Average latency time	8.3 ms
Positioning time	18 ms min. 192 ms max.
Power consumption	
20 Meg. SCSI Drive unit	
117 Volts A.C. 60 Hertz	30 w typical 40 w max.
Host Adaptor	
+5 Volts D.C.	250 ma typical
Size	
20 Meg. SCSI Drive unit	12'' x 14'' x 2.5''
Weight	
20 Meg.SCSI Drive unit	10.80 lbs.

II.

INSTALLATION

CAUTION!

Unless your Lt. Kernal hard disk system is specifically labeled otherwise, your system has been factory wired for:

115 volts A.C. 60 hertz only

Do not plug the power cord into any other voltage or frequency outlet.

For domestic American systems, the correct outlet type is the three prong grounded variety. Use of a three prong adapter in a two prong ungrounded outlet is strongly discouraged since such use presents a high shock hazard and may damage your system.

CAUTION!

Always handle your hard disk/power supply assembly with the utmost care. Mechanical bumps and shocks to the drive could irrepairably damage it.

Never move or ship the drive without first conditioning it for shipping via the "ship" system command, described later in this manual.

Never move the drive unless power has been off for at least 30 seconds.

Never ship the drive in any container except it's original carton.

INSTALLING THE LT. KERNAL

Installation of the Lt. Kernal hardware takes only a few moments, but MUST be done carefully to avoid damage. For a typical system setup refer to FIG 1. Be gentle, and work slowly and deliberately, referring to the text frequently as you go.

Typical System

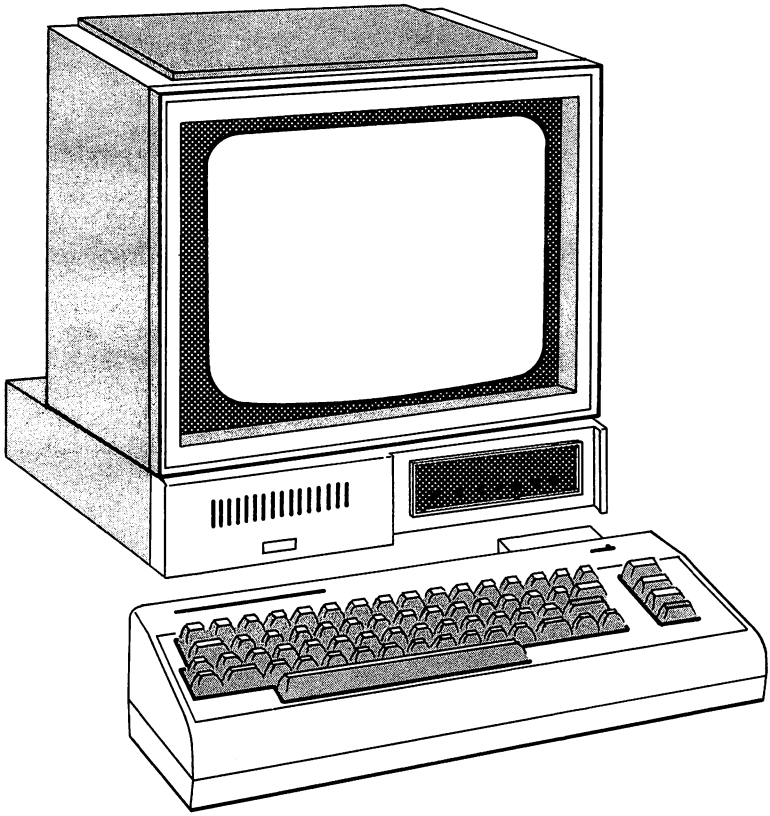


FIG. 1

FIRST
Make sure power is completely turned off to all components of your computer and the Lt. Kernal!!

SECOND
NEVER, NEVER, plug or unplug any interconnection of the system with power applied!!

THIRD
Always remember the second rule or you will eventually destroy some component of your system.

BEFORE BEGINNING YOUR INSTALLATION OF THE LT. KERNAL, CAREFULLY CHECK YOUR COMPUTER FOR PROPER OPERATION WITHOUT THE LT. KERNAL INSTALLED. THIS WILL PREVENT FALSE INDICATIONS OF TROUBLE LATER.

There are two possible installations of the Lt. Kernal. One is for the C-64 computer, and the other for the C-128. To utilize the 128 mode in the C-128, the C-128 adaptor board must be installed. Both installations will void your computer's warranty, as you will be required to open the computer case to install clips and/or an adaptor board. If you do not feel competent to do this installation properly, seek the assistance of a qualified computer technician. **CAUTION: Read each step thoroughly first before proceeding.**

TOOLS REQUIRED: A #1 phillips screwdriver and possibly a T-10 TORX driver plus needle nose pliers for the 64C inner shield and a small flat blade screwdriver.

C-64 or C-64C INSTALLATION

Step 1 - Remove screws on the bottom of the computer case, un-snap the upper keyboard section and carefully unplug the keyboard and indicator LED cables. Place this section aside for now.

Step 2 - Locate the HIRAM and CAEC cable assemblies. Refer to FIGS 2 and 3 to find your model and attach the HIRAM clip to the lead indicated of resistor R44 and attach the CAEC clip to PIN 6 of chip U27. Be sure that the clip is not shorting to any of the adjacent pins of either chip. Secure both leads with small pieces of scotch tape and dress each end out the opening for the expansion slot on rear of computer. NOTE: On some models, the metal shield must first be lifted by removing the TORX screws as needed, and then un-twist the small metal tabs around the perimeter of the shield. Replace this shield after the above clips are installed.

Step 3 - Install the keyboard section by first connecting the keyboard and LED cables and their lower section into place, snap case shut and install bottom screws into case.

Step 4 - Locate the HOST ADAPTOR and push the HIRAM connector onto the leftmost pair of pins of plug P1 as shown in FIGS 2 and 3. Push the CAEC connector onto the 4th set of pins from the left on plug P1 again as shown in FIGS 2 and 3. The jumpers on the 3rd and 5th sets of pins must also be in position as shown. The Host adaptor may now be inserted into the EXPANSION connector on the rear of the computer.

C-64 cable connections version 1

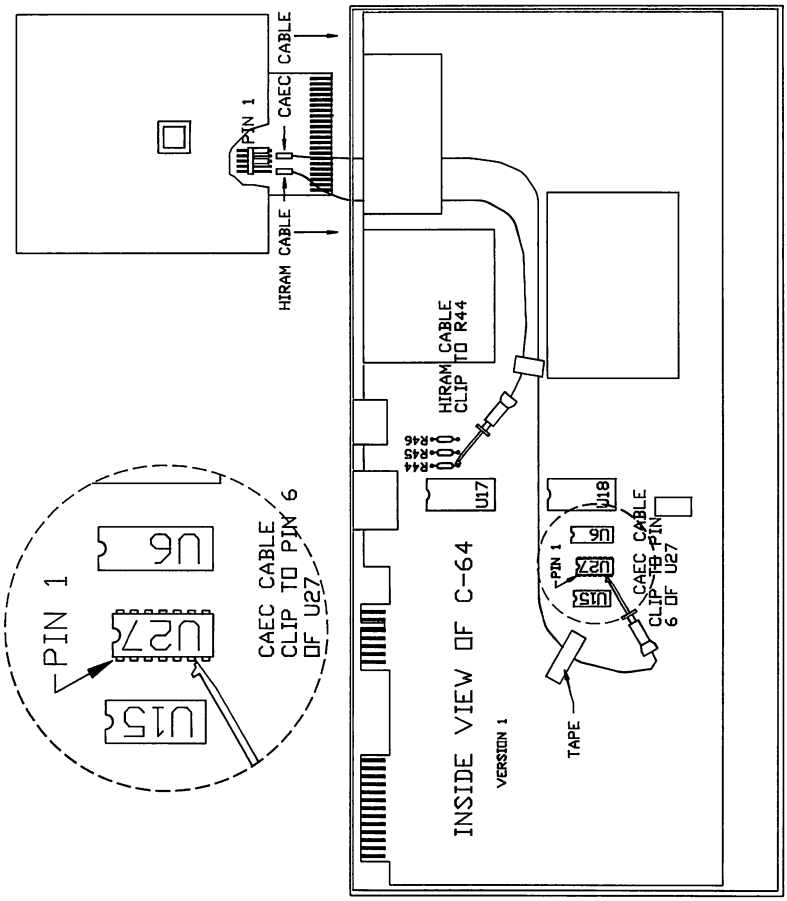


FIG. 2

C-64 cable connections version 2

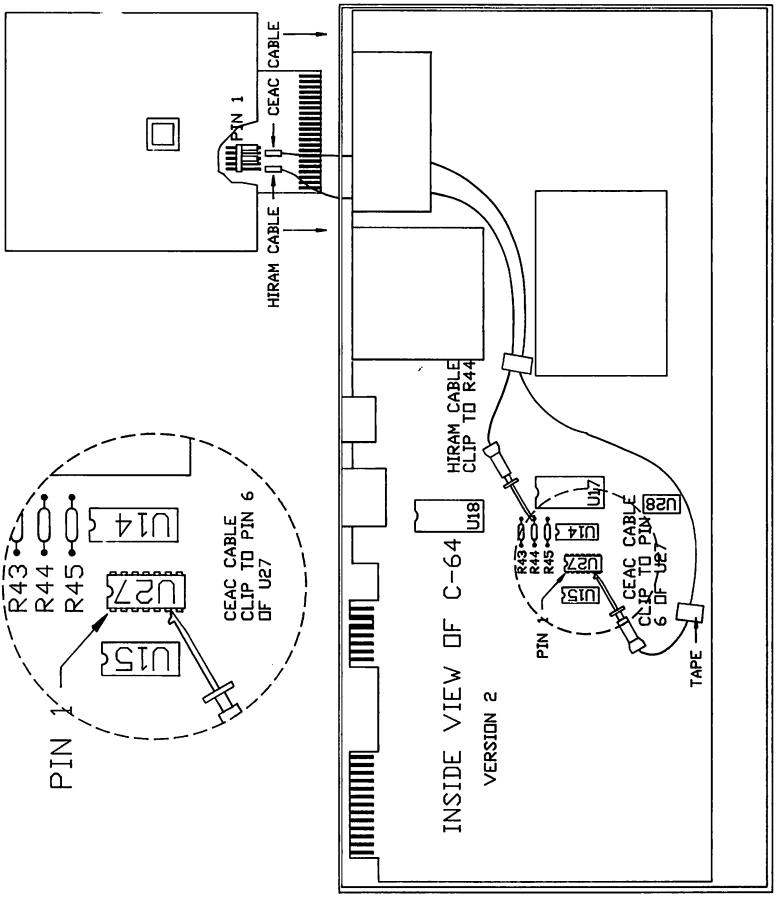
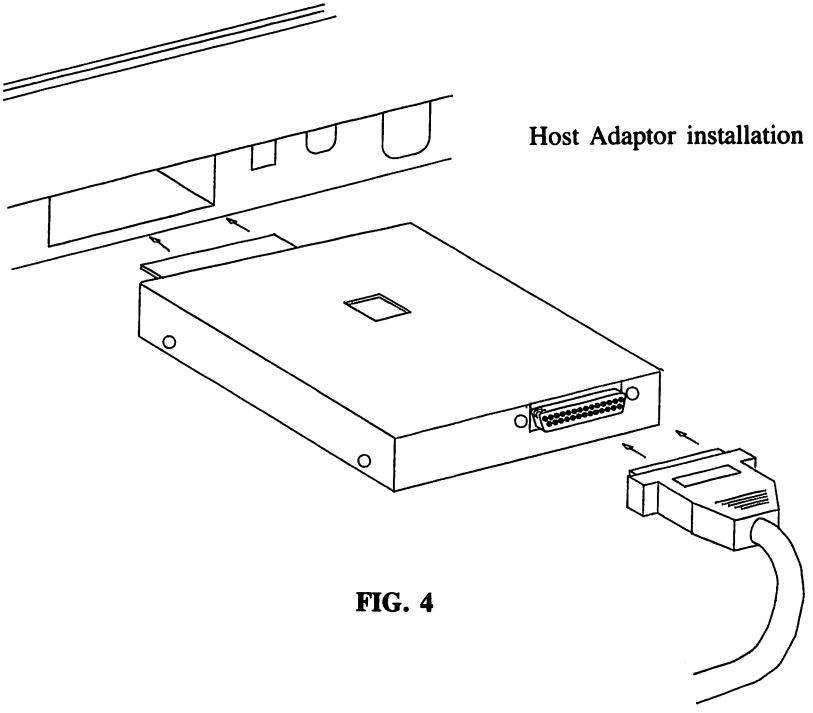


FIG. 3

Step 5 - Locate the 25 pin SIGNAL cable, plug one end into the connector on the rear of the Host Adaptor and secure the cable with the attached screws. Refer to FIG 4.



Host Adaptor installation

FIG. 4

Step 6 - Attach remaining end of the 25 PIN SIGNAL cable to the HOST ADAPTOR INPUT connector of the HARD DISK enclosure. Again, secure the cable with the attached screws. Refer to FIG 5.

Step 7 - Locate the AC POWER CABLE and plug female end into the AC POWER receptable of the HARD DISK enclosure. Make sure the Power Switch is in the OFF position and plug the male end into a properly grounded 115 volt AC, 60 Hz outlet. Refer to FIG 5.

Step 8 - Re-connect any other components to your system such as printers, floppy disk and other accessories.

Step 9 - Refer to Power Application Sequence page 2-20.

Rear view of Lt. Kernal hard disk enclosure

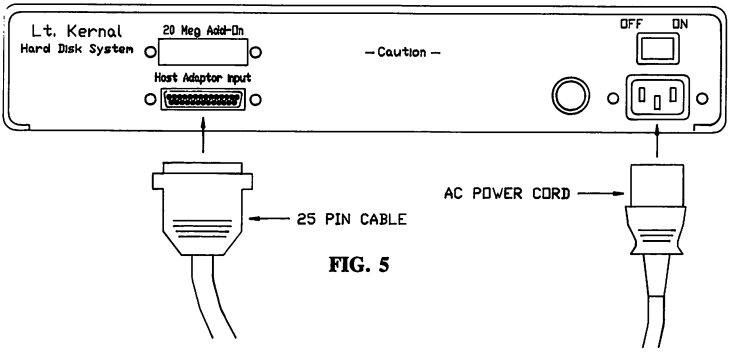


FIG. 5

C-128 INSTALLATION

Step 1 - Remove screws on the bottom of the computer case, un-snap the upper keyboard section and carefully unplug the keyboard and indicator LED cables. Place this section aside for now.

Step 2 - Lift the metal shield by removing the TORX screws and untwisting the metal tabs around the perimeter of the circuit board shield. Lay this shield aside for now.

Step 3 - Locate the C-128 ADAPTOR and lay on top of the SHIELD as shown in FIG 7. CAUTION: Discharge yourself from potential static electricity by touching the metal SHIELD before proceeding to the next step.

Step 4 - Locate chip U7 in FIG 6. Gently remove this chip from its socket by inserting a small flat blade screwdriver as shown and then carefully rotate or twist the blade left and right. DO NOT USE A PRYING ACTION! Once removed, check all pins for straightness, and proceed to next step.

Step 5 - Carefully insert chip U7 into the socket provided on the C-128 ADAPTOR. CAUTION: Be sure PIN 1 of chip matches PIN 1 of socket or indented end of chip matches indented end of socket. Refer to FIG 7.

Removal of chip U7 in C-128

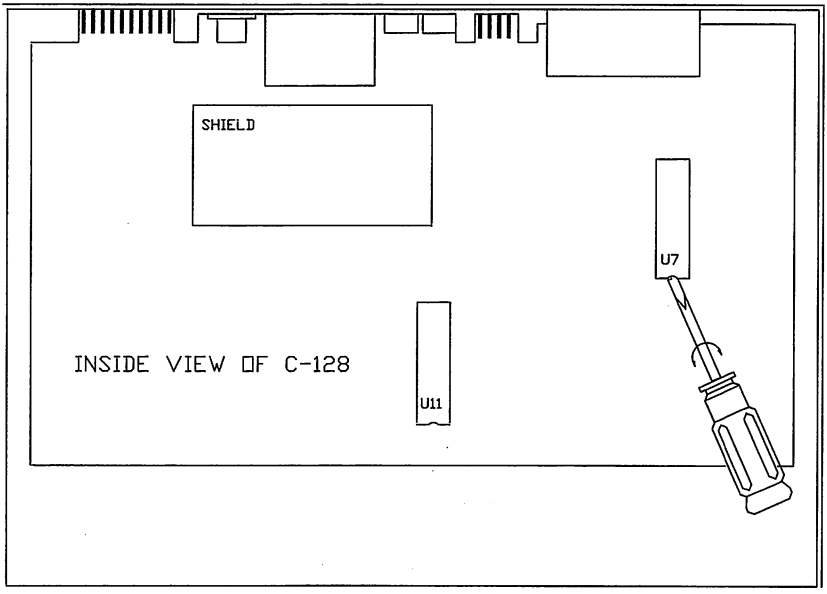


FIG. 6

C-128 adaptor board installation

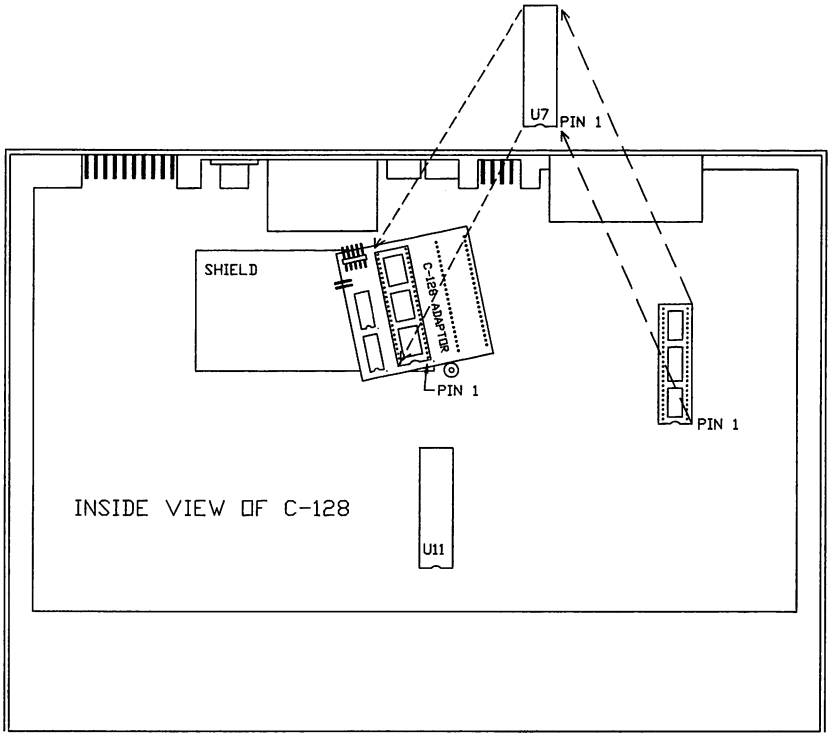


FIG. 7

C-128 cable connections with Rev C adaptor board

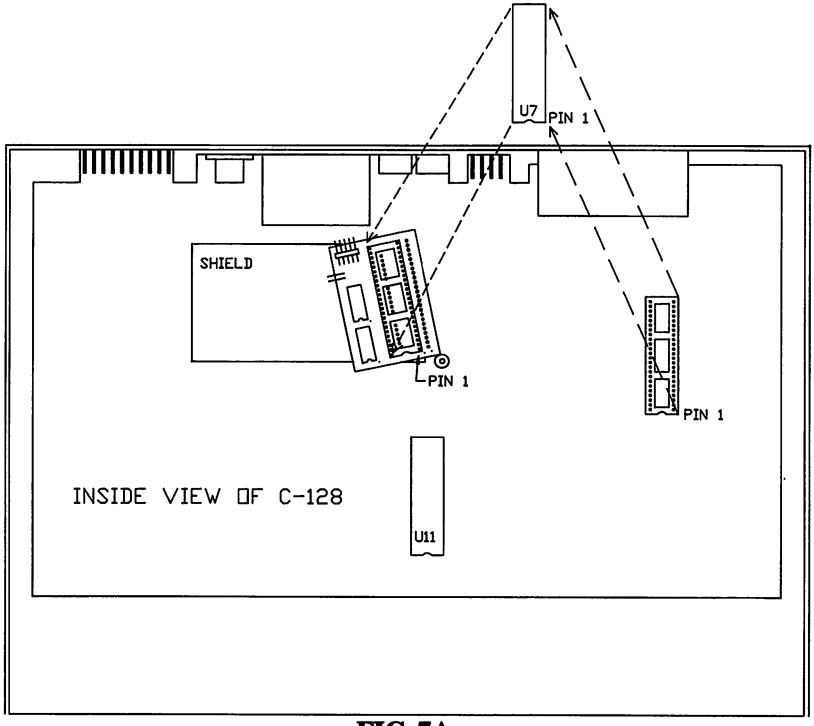


FIG 7A

The Rev B and Rev C adaptor boards are functionally identical. They vary only in size. Your Lt. Kernal 128 system may contain either Rev board.

Step 6 - Install the C-128 ADAPTOR into the socket vacated in Step 4 as shown in FIG 8. CAUTION: Make sure pins on the bottom of adaptor board are in their proper positions before firmly seating into place. Press down firmly in the area shown to firmly seat the ADAPTOR board in place.

C-128 cable connections

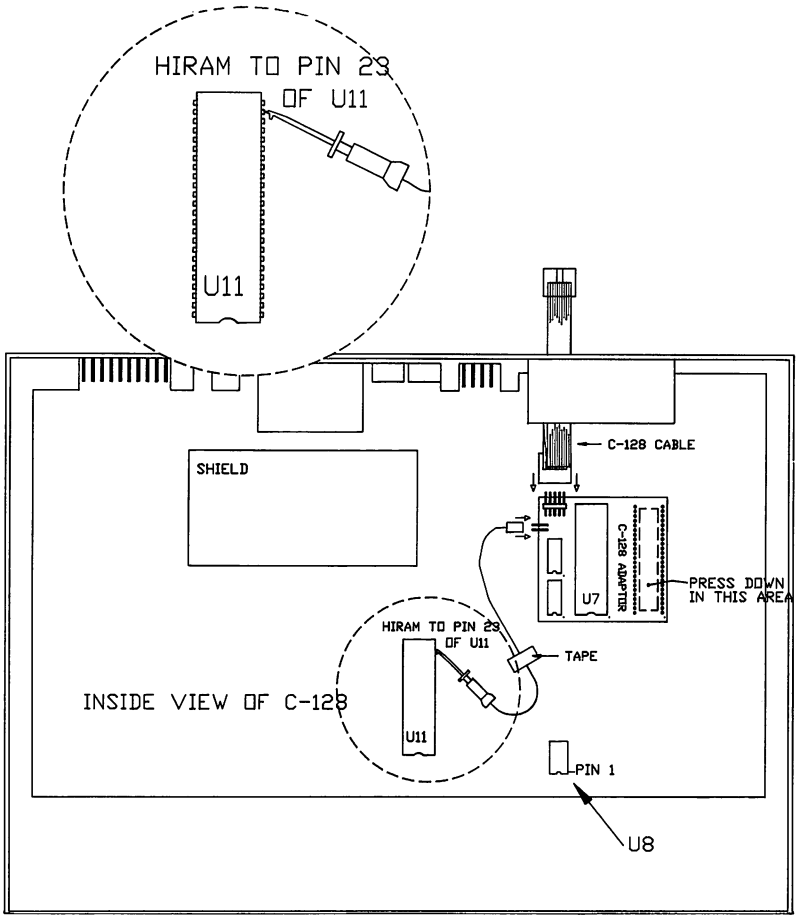


FIG. 8

C-128 adaptor board (Rev C) installation

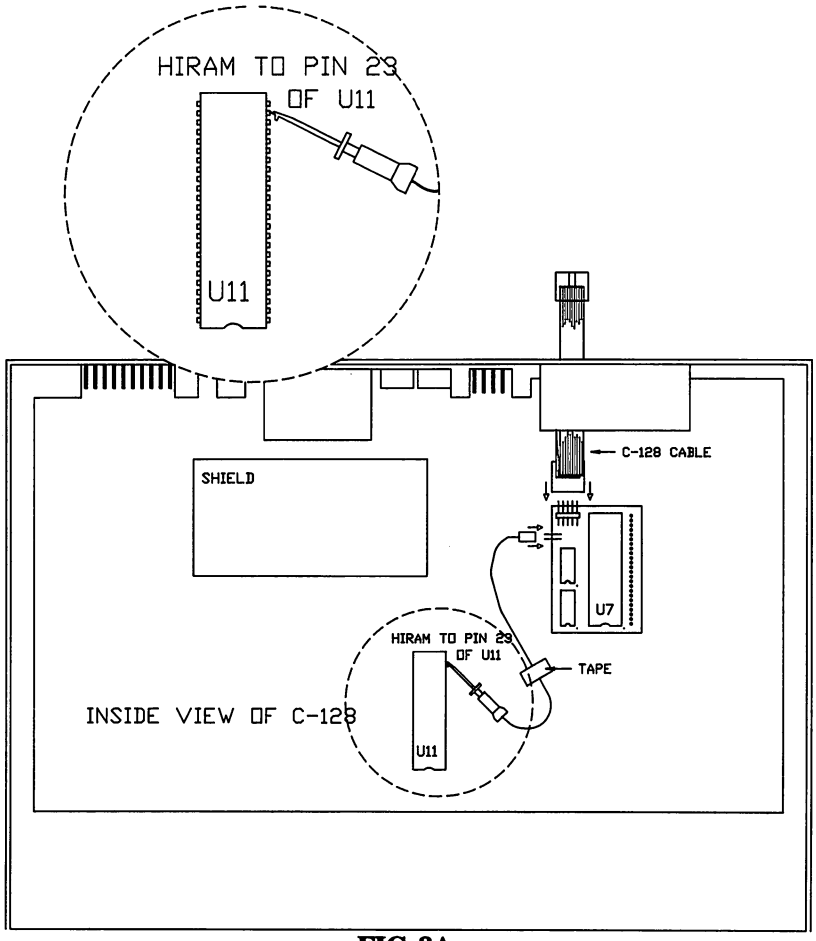


FIG 8A

Step 7 - Refer to FIG 8 and locate HIRAM CABLE. Clip this cable to PIN 23 of U11 as shown and secure with a piece of scotch tape. Be sure that the clip is not shorting to any of the adjacent pins of Chip U11. Plug the remaining end onto plug P2 of the C-128 ADAPTOR board as shown. (NOTE: The CAEC CABLE is not used in the C-128 installation)

Step 8 - Again refer to FIG 8 and locate the C-128 cable and take either one of the ends and position it so the flat ribbon is coming out of the top side of the connector. Now push this connector onto plug P1 of the C-128 ADAPTOR board as shown making sure all ten pins are properly entering each hole on the socket.

Step 9 - Locate the HOST ADAPTOR and remove the two jumpers on plug P1 as they will not be used in your C-128 installation. Push the remaining end of the C-128 CABLE onto plug P1 again with the flat ribbon coming out on the top side of the connector. The HOST ADAPTOR may now be inserted into the EXPANSION connector on the rear of your C-128. Dress or position the flat cable so it will allow you enough slack to remove your HOST ADAPTOR if necessary. Refer to FIG 9.

Host Adaptor cable connections for C-128

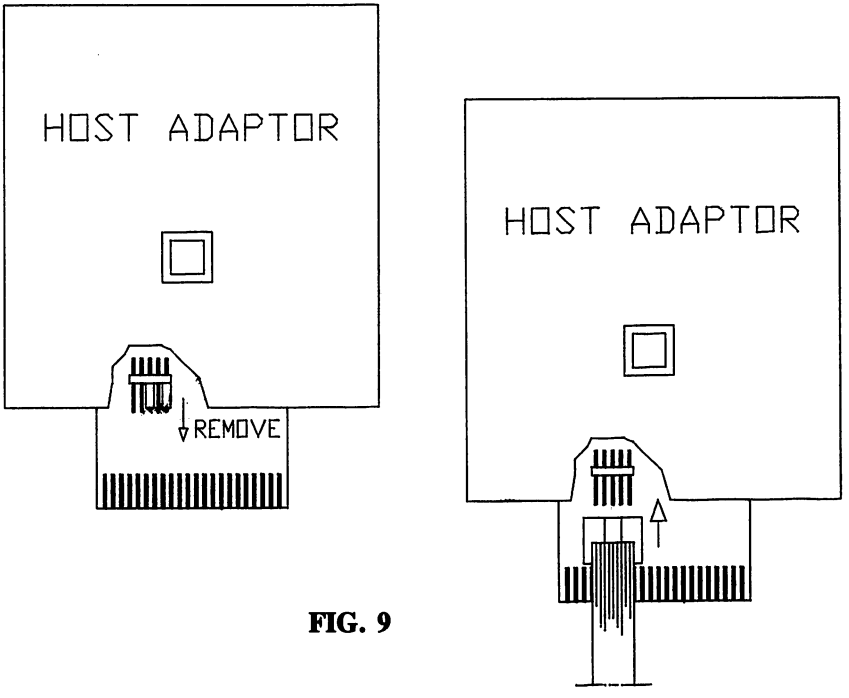


FIG. 9

Step 10 - Replace the metal shield on the C-128 main board being careful not to pinch or bind the C-128 CABLE.

Step 11 - Install the keyboard sections by re-connecting the cables, snap case halves together, and install bottom screws in case.

Step 12 - Locate the 25 pin SIGNAL cable, plug one end into the connector on the rear of the Host Adaptor and secure the cable with the attached screws. Refer to FIG 4.

Step 13 - Attach remaining end of the 25 PIN SIGNAL cable to the HOST ADAPTOR INPUT connector of the HARD DISK enclosure. Again, secure the cable with the attached screws. Refer to FIG 5.

Step 14 - Locate the AC POWER CABLE and plug female end into the AC POWER receptable of the HARD DISK enclosure. Make sure the Power Switch is in the OFF position and plug the male end into a properly grounded 115 volt AC, 60 Hz outlet. Refer to FIG 5.

Step 15 - Re-connect any other components to your system such as printers, floppy disk and other accessories.

Step 16 - Refer to Power Application Sequence page 2-20.

128D INSTALLATION

Step 1 - Unplug power, keyboard, and all other connections from the 128D computer.

Step 2 - Remove the 2 screws on the bottom and the 3 screws on the back of the computer case. Slide top back and lift up to remove. Place this aside for now.

Step 3 - Locate the 128D Adaptor Board and place it on a firm, flat surface. CAUTION: Discharge yourself from potential static electricity by touching the metal case of the computer before proceeding to the next step.

Step 4 - Locate U7 on the mother computer board. Refer to FIG 10. Gently remove this chip from its socket by inserting a small flat blade screwdriver as shown and then carefully rotate or twist the blade left and right. DO NOT USE A PRYING ACTION! Once removed. check all pins for straightness, and proceed to the next step.

Step 5 - Carefully insert chip U7 into the socket provided on the 128D Adaptor Board. CAUTION: Be sure pin 1 of chip matches pin 1 of socket or indented end of chip matches indented end of socket. Refer to FIG 11.

Step 6 - Install the 128D Adaptor Board into the socket vacated in Step 4 as shown in FIG 12. CAUTION: Make sure pins on bottom of adaptor board are in their proper positions before firmly seating into place.

Removal of chip U7 in 128D

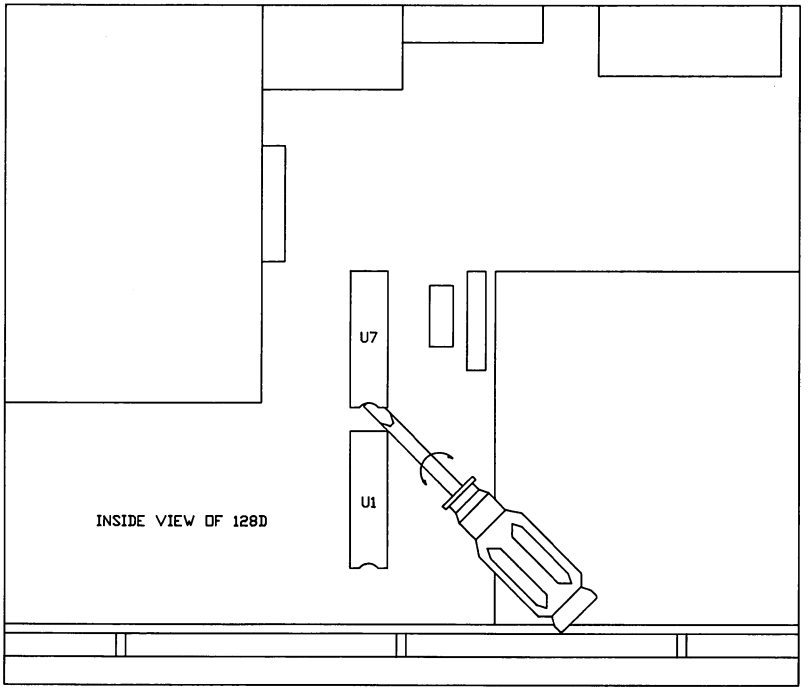


FIG 10

128D adaptor board installation

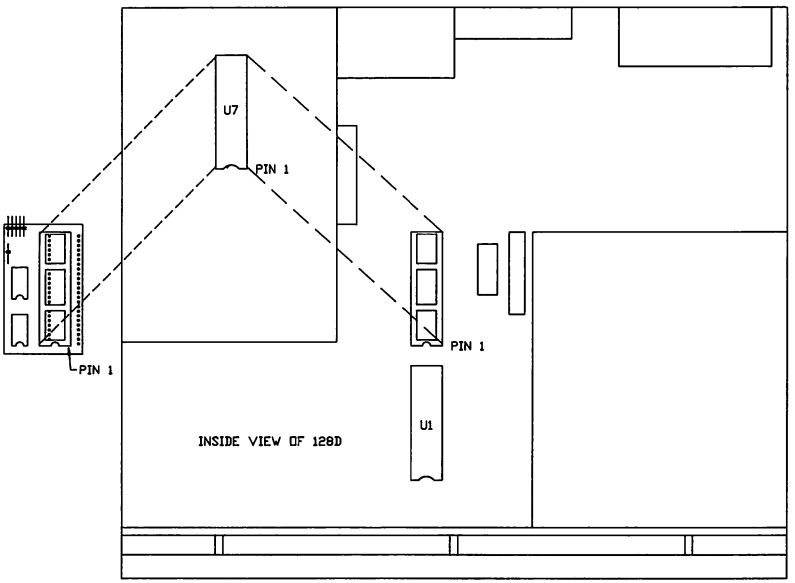


FIG 11

128D cable connections

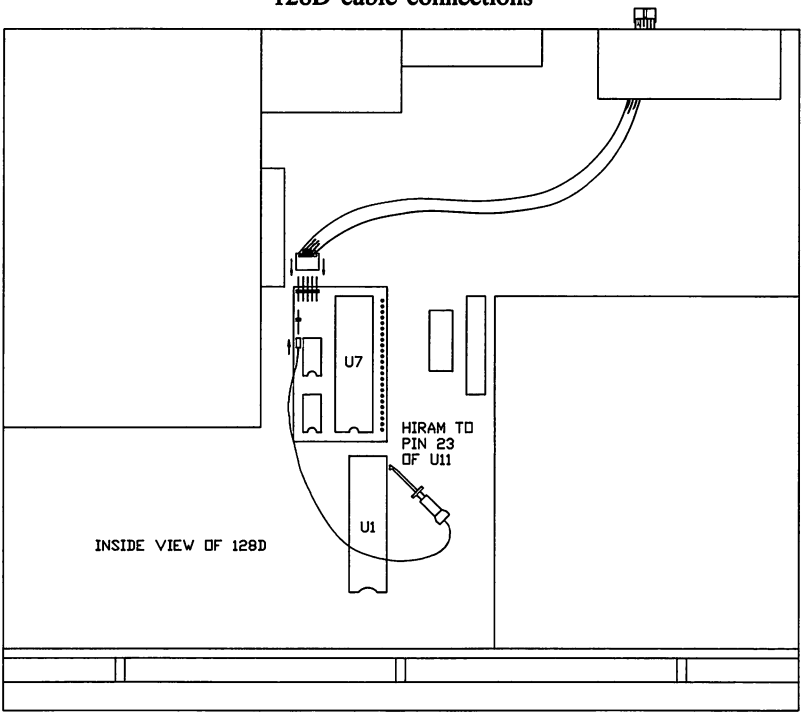


FIG 12

Step 7 - Refer to FIG 12 again and locate HIRAM Cable. Clip this cable to Pin 23 of U11 as shown. Be sure that the clip is not shorting to any adjacent pins of chip U11. Plug the remaining end onto plug P2 of the 128D Adaptor Board as shown. (Note: The CAEC Cable is not used in the 128D installation)

Step 8 - Again refer to FIG 12 and locate the 128 cable. Take either one of the ends and position it so the flat ribbon is coming out of the top side of the connector. Now push this connector onto the plug P1 of the 128D Adaptor Board as shown making sure all ten pins are properly entering each hole on the connector.

Step 9 - Repeat the applicable steps 9 through 16 of the C-128 Installation starting at page 2-11.

Burst Mode Modification

The Lt. Kernal does not support the "FAST" modes of the 1571 drive. If using a 1571 with a 128 computer, you must use the serial cable included with the Lt. Kernal, or else directory listings, programs, etc. will not load without being scrambled. With this cable, your 1571 will operate at the speed of a 1541.

The following steps instruct how to modify your 128 computer to take advantage of the burst mode. If you do not have a need for the burst mode, we suggest that you do not perform this modification. It will VIOLATE your Commodore warranty. If you do not have any technical skills and yet would like to make this modification, we suggest you have a qualified person perform it.

Step 1 - Remove screws on the bottom of the computer case, unsnap the upper keyboard section and carefully unplug the keyboard and indicator LED cables. Place this section aside for now.

Step 2 - Lift the metal shield by removing the TORX screws and untwisting the metal tabs around the perimeter of the circuit board shield. Lay this shield aside for now.

Step 3 - Locate chip U8 on the circuit board. Refer to FIG 13 for the C-128 computer and FIG 14 for the 128D computer. For the C-128, cut pin 9 of U8 and for the 128D, cut pin 13 of U8 as close as possible to the circuit board and CAREFULLY bend the pin upward so that it is parallel to the circuit board. Refer to FIG 15.

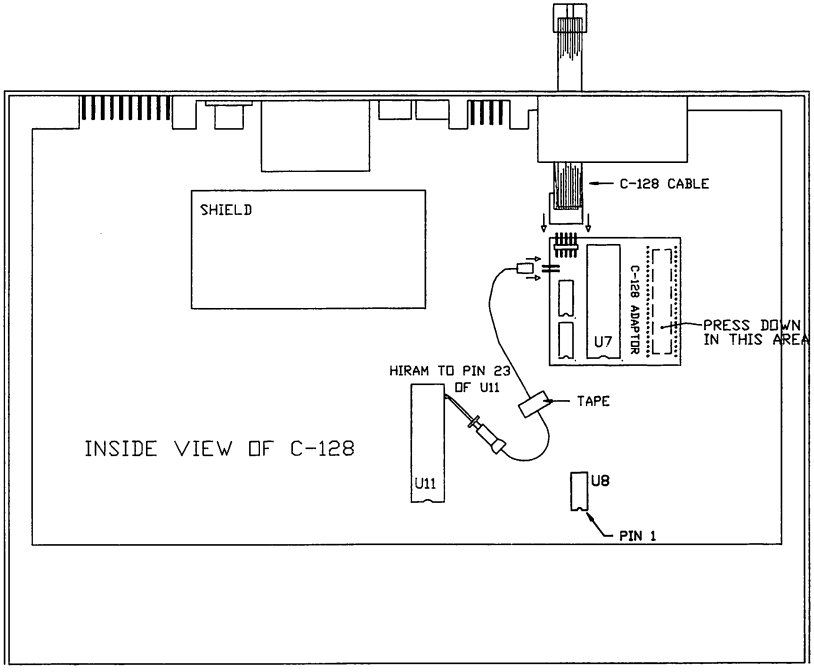


FIG 13

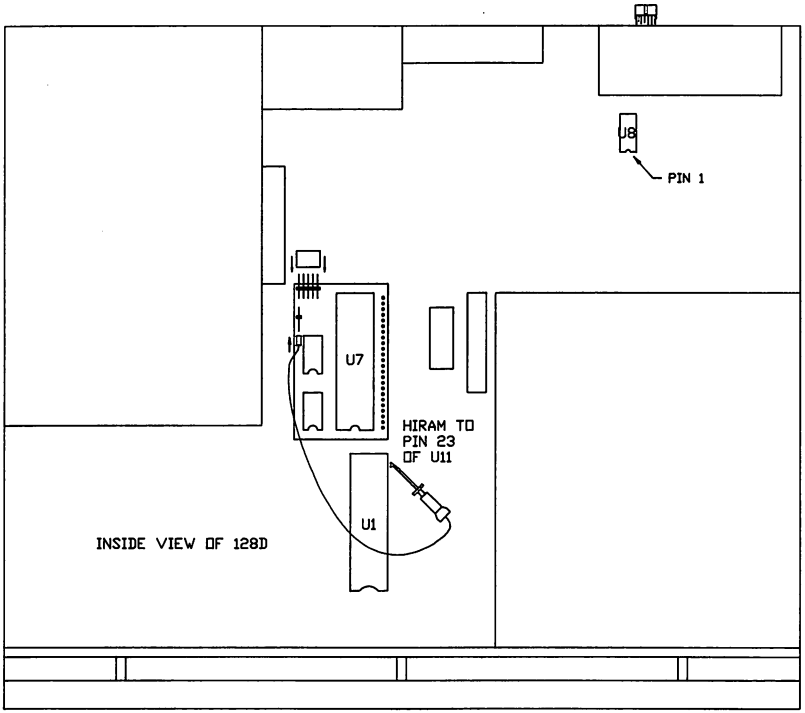


FIG 14

Step 4 - Solder one end of an insulated wire to the pin of U8 modified in step 3. Refer to FIG 16. Be careful NOT to solder bridge adjacent pins of U8.

Step 5 - Locate and unplug the Adaptor Board from the computer circuit board. Carefully remove U7 from the adaptor board. Solder the other end of the wire to the bottom of the Adaptor Board at pin 47 of the U7 socket being careful NOT to solder bridge pin 47 to pin 46 or 48. Refer to FIG 17.

Step 6 - Re-install U7 into the socket. CAUTION: Be sure pin 1 of chip matches pin 1 of socket. Re-Install the Adaptor Board into the computer circuit board making sure pins on the bottom of the adaptor board are in their proper positions before firmly seating into place. Refer to C-128 and 128D INSTALLATION—pages 2-7 through 2-14.

Step 7 - Re-assemble the computer as previously outlined refering to pages 2-7 through 2-14.

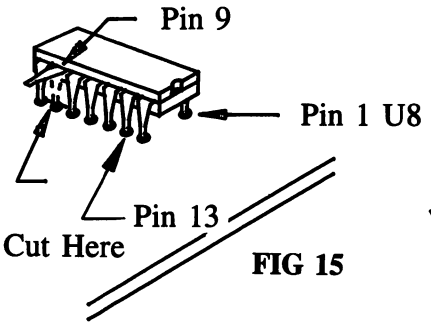


FIG 15

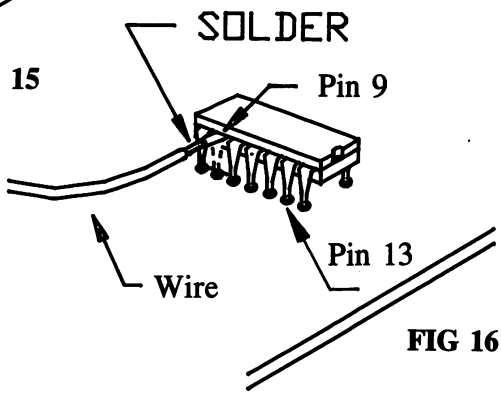
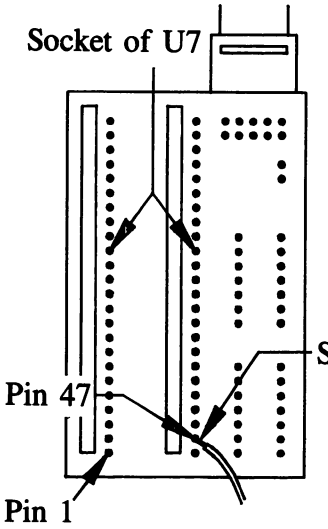
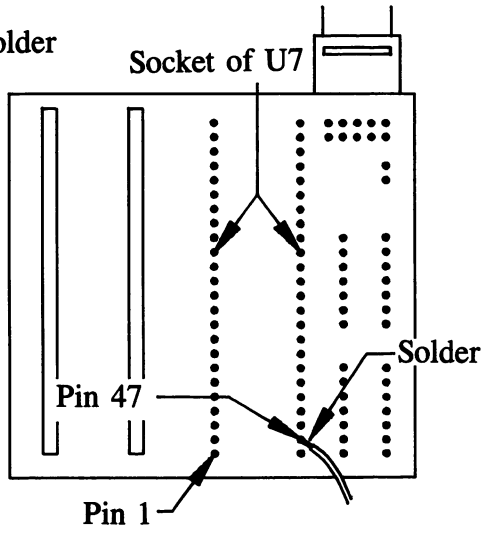


FIG 16



128 Rev. C Adaptor Board
Bottom View

FIG 17



128 Rev. B Adaptor Board Bottom View

I/O Modification for CP/M

CP/M operation requires the Host Adaptor to be set for I/O-1. The current version of the Lt. Kernal should already be set for I/O-1. Refer to FIG 18. The current version Host Adaptor (Rev. C) is the only one that has the I/O selectable pins. If you have an older version system, you will have to do a slight modification to the Host Adaptor. Refer to FIGs 19 and 20.

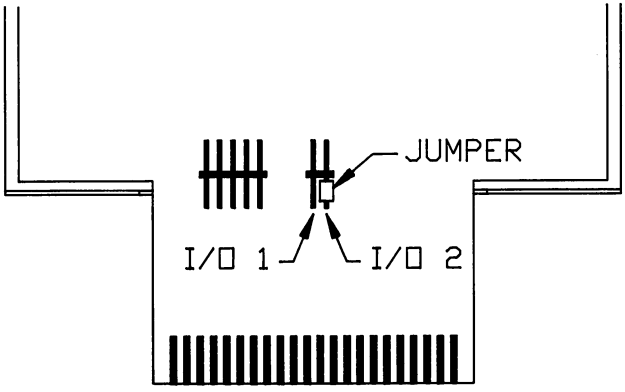


FIG 18
Host Adaptor Rev. C

To select I/O-1, remove the jumper from I/O-2 pins and slide on I/O-1 pins.

The Rev. B Host Adaptor is manufactured to operate in I/O-2 mode. To convert to I/O-1 follow the steps below. If you do not have technical skills, we suggest you have a qualified person perform this modification.

Step 1 - Cut trace on component side of Host Adaptor as shown that connects gold pad 10 with feed through hole.

Step 2 - Solder an insulated wire (approx. 22 ga.) as shown from feed through hole to gold pad 7. Be careful not to solder 'bridge' the wire to any other surrounding pads.

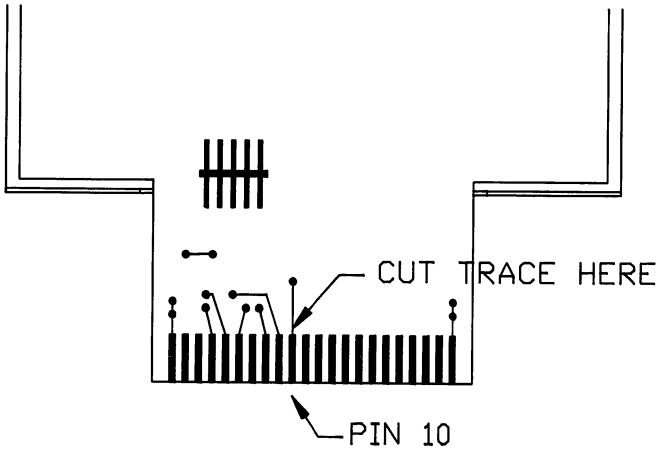


FIG 19
Host Adaptor Rev. B

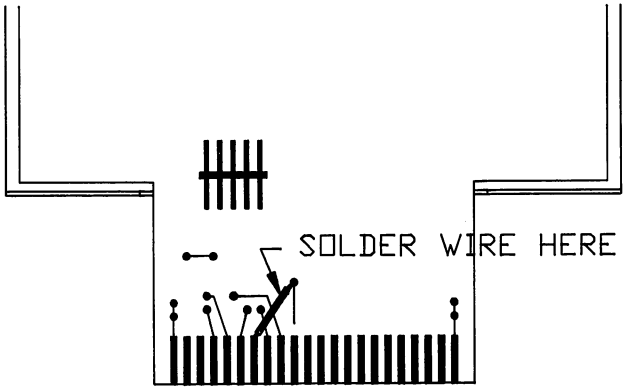


FIG 20
Host Adaptor Rev. B

POWER APPLICATION SEQUENCE

Power should be applied to your Lt. Kernal/Commodore combination in a specific manner.

Before you do power up your system, please remember that things are going to act a little differently than what you accustomed to seeing, so read this whole section before actually applying power. We want you to know what to expect BEFORE it happens.

Follow the steps in this order:

1. Monitor or television set.
2. Printers, floppy disks, and any other accessories EXCEPT the Lt. Kernel hard-disk.
3. The Lt. Kernal hard disk system.
4. Finally, the Commodore computer itself.

POWER REMOVAL SEQUENCE

1. The Lt. Kernal hard disk system
2. Printers, floppy disks, and any other still powered accessories, including your monitor or TV set.
3. The computer.

Read Section IX before continuing.

You may still do floppy-to-Lt. Kernal transfers (and vice versa) by using the program COPY—ALL.64L that resides on LU10, USER0, compliments of Jim Butterfield.

A demo program called PXE is located on LU0, USER00, and may be run in the C-64 mode by simply typing PXE and then press the "RETURN" key. Ignore the message "HIT ANY KEY WITHIN 5 SECONDS" or it will take you to an un-documented editor of the demo program. ENJOY!

III.

ACTIVATING THE SYSTEM

The Lt. Kernal is configured to come up in the 64 mode. (This can be changed). As a result, your computer system must be ready to use the 64 mode which is a 40 column screen. With the 128 computer, DO NOT HOLD the C= key down during power-up. The Lt. Kernal will automatically take control and place the 128 in a 64 mode. If you do not see any results at this point, you are probably in an 80 column condition.

NOW IT ALL COMES TOGETHER! When you apply power to your system without the Lt. Kernal present, you ordinarily would expect to see the Commodore BASIC power-up messages and then the BASIC ready prompt within just a couple of seconds of turn-on.

That's not going to happen with the Lt. Kernal ... at least not instantly. What will happen instead is this:

As soon as the drive has run up to speed, you should see the red indicator on the front of the drive blink twice, just briefly. About three seconds after that, the light will come on solidly for one second while the Lt. Kernal copyright messages appear. If the volume control on your monitor or TV is turned up, you'll hear a beep and see the new READY prompt with the drive's device number and logical drive number included. On a C-128, you may see even more activity. If the Lt. Kernal is configured to power up as a C-64, you'll see the screen blank again. The whole process repeats, finally to arrive at the C-64 mode of operation.

A lot went on to get to this point, and that's why there's a delay after you turn on the system. While you were waiting for the system sign-on message, and while the disk drive was running up to speed, a long series of system diagnostics took place — checking the Lt. Kernal Host Adaptor — testing the drive's controller electronics — and finally, even testing the Disk Operating System software installed on your drive.

If any one of the diagnostics along the way should fail, you'll just see the regular Commodore sign-on without the Lt. Kernal message, and without the beep. If the tests do fail, please TURN THE SYSTEM OFF and turn directly to "TROUBLE-SHOOTING" in this manual.

NOW CHECK YOUR CABLING AND WIRING — AND TURN ON YOUR SYSTEM.

Then we'll introduce you to your new DOS.

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IV.

OPERATING CONCEPTS

HOW IT WORKS

The Lt. Kernal DOS was written with the business user in mind. Many comfortable and easy-to-use new features have been added to your Commodore disk operating system while still supporting most of the existing 1541 floppy commands. The only commands not supported have no appropriate use in this environment. Most existing applications written in BASIC will run unmodified under the Lt. Kernal DOS. Many machine language applications and utilities such as assemblers, editors, and 'wedges' will also operate normally under the Lt. Kernal's control — but some programs will not run in cooperation with the Lt. Kernal. The reason lies in how the Lt. Kernal got its name, and in how it operates.

In order to support the tremendous speed at which the Lt. Kernal operates, it was essential that the cartridge/expansion port be used to communicate with the hard disk. To do that, there has to be a body of programs run by the Commodore computer to control the cartridge port and the Lt. Kernal Host Adaptor itself. But we wanted the Lt. Kernal to operate without making you sacrifice any of the memory you were accustomed to using. That has been accomplished by making the DOS support programs run in RAM (a modified Kernal) on the Lt. Kernal Host Adaptor. Since the Commodore computer itself is running the DOS, a few "programming considerations" (discussed in a later section) must be observed in order not to disrupt the always-running DOS.

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V.

COMMANDS OVERVIEW and DOS FEATURES (review)

RUN MODE Features or Enhanced Commands

↑↑
autoaccess
autostart
bell
BUILDKEY file
COPY
DELETE key
INPUT#
INSERT key
LDLU
LOAD
OPEN
PRINT#
SAVE
SCRATCH
SEARCH key
SHUFFLE

DIRECT MODE Features or Enhanced Commands

ACTIVATE
AUTOCOPY
AUTODEL
AUTOMOVE
BUILD
BUILDCPM
BUILDINDEX
CHANGE
CHECKSUM
CLEAR
CONFIG
COPY
D
DEL
DI
DIR
DUMP
ERA
FASTCOPY
FETCH
FIND
GO64
GO128
GOCPM
ICQUB
invoke
L
LOAD
LKREV
LU
MERGE
OOPS
QUERY
RENUM
S
SHIP
TYPE
UPDATEDOS
USER

DOS FEATURES

- Runs certain copy-protected software
- Built-in KEYED INDEXED-RANDOM ACCESS METHOD
- Supports both C-64 and 128 modes of operation and CP/M®
- 57 additional or enhanced system commands and features
- Disk access speed more than 100 times faster than the 1541 floppy
- Automatic power-up execution of any application program
- Built in CP/M™ - like command-line features in C-64 and 128 modes
- User configurable system characteristics such as screen and character colors, and logical drive sizes
- Up to eleven logical drives may be defined on the hard disk
- Up to 7 hard drives in one system
- DOS allows up to seven files to be OPEN for reading and writing simultaneously in addition to the command/error channel
- DOS differentiates between BASIC and machine language programs
- Built-in backup and restore facilities
- Direct invocation of programs from the READY prompt
- Standard capacity of 20 Megabytes configurable up to 180 Meg.
- Optional Multiplexer allows up to 16 computers to share 1 Lt. Kernal system

VI.

COMMAND SYNTAX DEFINITIONS

Throughout the descriptions of the commands which follow, we will use certain conventions to describe the command syntaxes and responses. Here are the definitions of those conventions.

- COMMANDS are always noted in UPPER-CASE. You enter commands from the keyboard, or include them in programs.
- FEATURES are noted in LOWER-CASE. A feature is an enhanced or added mode of operation, not a command.
- Within a command's syntax description, capital letters indicate the COMMAND name as you must enter it.
- Within a command's syntax description, lower-case letters indicate FILE-names or parameters for the command.
- A "_" symbol indicates_a_REQUIRED_space_in_the_command_syntax.
- Text within brackets indicates [optional parameters or file names].
- A "—" symbol indicates—a—REQUIRED—hyphen—in—the—command—syntax.
- A term "<range>" indicates a save range for the SAVE command where the range may be expressed either in decimal or hexidecimal as

hexadecimal range	<$hex start-hex end> inclusive
decimal range	<dec. start-dec. end> inclusive

- An exclamation mark (!) appended to the end of a DIRectory listing line indicates that the file has been changed or modified since the last CLEAR or FASTCOPY was executed.
- lfn is the Commodore 'logical file number' convention
- dev refers to the hardware device number of the drive selected
- sa is the Commodore 'secondary address or channel number'
- lu refers to the logical drive number (not to be confused with hardware device number) which may accompany a LOAD, SAVE, or OPEN command.

- When used in the context of LUs or Logical Drives, a DIRECTORY is a list of the files stored on that LU.
- user refers to a logical sub-directory number within a logical drive's (LU's) directory.
- When used in the context of KEY files, a DIRECTORY is one of up to five LISTS of KEYS stored in a KEY file.
- A KEY is a fixed length string stored in a KEY file which is associated with a RECORD NUMBER for use in indexing records within RELative files.

VII.

RUN-Mode Features and Commands

autoaccess feature

Autoaccess allows transfer of a load request to the floppy disk when a file-not-found condition arises on the hard disk.

If the hard disk is defined as device #8 (this is user definable), and the floppy is also defined as device #8, then all Commodore syntax LOAD's will first be referred to the hard disk. If the file is not found, than an attempt to LOAD that same file from the floppy will be made.

This feature may be disabled via CONFIG if it interferes with your application software.

autostart feature

Mode: Power-up or hardware reset

Autostart is almost self-explanatory. Simply stated, any program saved under the name "AUTOSTART" will be automatically loaded and run upon power-up or after a hardware reset. Autostart functions for both BASIC and machine language programs, and is one of the best features any turn-key business system can have available.

Autostart may be overridden by holding down the space bar during a power-up or reset start.

Mode: Direct or Run

Bell offers programmers a method of issuing an audible prompt in the C-64 (or 64 mode of the C-128) without having to maintain SID drivers in their programs. Any PRINT from BASIC or CHROUT from machine language of the ASCII Bell character [CHR$(7) or hex. 07] will cause a beep on the monitor or television set if the BEEPER option is selected by the user in the CONFIG mode described later.

BUILDKEY file command

From BASIC

Syntax: SYS 64628:0,lfn,directory,Stringvar,recl,rech,status

lfn is not used, but a dummy variable must be provided
directory is the NUMBER OF DIRECTORIES you wish to have built in the new KEY file
Stingvar contains the KEY FILE NAME and the KEY LENGTHS for each directory you wish to create
recl and **rech** are not used, but you must provide dummy variables
status is the value returned from the SYS indicating the success or failure of the BUILDKEY operation

Please see the KEY file usage examples in Section IX of this manual for detailed examples of BUILDKEY.

For further descriptions of KEY file operations, refer to Section IX, page 9-16 for information on machine language calls.

From BASIC

Syntax: SYS 64628:2,lfn,directory,Stringvar,recl,rech,status

lfn is the logical file number of a KEY file already OPENed on the hard drive.
directory is the number (1-5) of the selected key DIRECTORY within the KEY file.
Stringvar contains the EXACT key you wish to delete.
Recl and rech are the Low and High bytes of the EXACT double-precision record number associated with the key to be deleted.
Status is the value returned from the SYS to indicate the success or failure of the DELETE to occur.

Please see the KEY files usage examples in Section IX of this manual for detailed examples of DELETE key.

For further descriptions of KEY file operations, refer to Section IX, page 9-16 for information on machine language calls.

INPUT
command

Syntax: INPUT# lfn,stringvar

lfn is the number of the desired file from which input will occur. **stringvar** is a string type variable into which the file data will be read.

The syntax above is identical to the Commodore conventions. INPUT # has been enhanced to fix the 'string too long' error problem which occurs when strings longer than 88 characters are read from a file via the INPUT# command.

On the HARD DISK ONLY it is now possible to input strings longer than 88 characters (up to 254 characters, maximum) from disk files. It is, however, up to the programmer to accommodate this process in a special manner.

When INPUT# is requested of a string within a file which is longer than 88 characters, EACH INPUT# request will read the NEXT 88 characters into stringvar. It will be up to the programmer to concatenate subsequent INPUT# strings to reconstruct the original string written to the file.

This 'fix' allows BASIC programmers to use the much faster INPUT# command in preference to GET# when reading data from disk files.

From BASIC

Syntax: SYS 64628:1,lfn,directory,Stringvar,recl,rech,status

lfn is the logical file number of a KEY file already OPENed on the hard drive.
directory is the number (1-5) of the selected key DIRECTORY within the KEY file.
Stringvar contains the EXACT key you wish to insert.
Recl and rech are the Low and High bytes of the EXACT double-precision record number to be associated with the key being inserted.
Status is a value returned from the SYS to indicate the success or failure of the INSERT to occur.

For further descriptions of KEY file operations, refer to Section IX, page 9-16 for information on machine language calls.

LDLU command

Syntax: OPEN #lfn,dev,sa,"Ldev#LU#USR#"
Mode: Direct or RUN via channel 15

dev# is a single hexidecimal digit expressing the NEW Lt. Kernal device number.
LU# is a single HEXIDECIMAL digit expressing the NEW Lt. Kernal operating LU.
USR# is a single HEXIDECIMAL digit expressing the NEW Lt. Kernal operating USER partition.

LDLU permits you to change the operating characteristics of the Lt. Kernal *on the fly*. Any values provided which are illegal will be ignored. There is NO error status returned from the LDLU command except SYNTAX ERROR. A syntax error will be returned if ANY of the values are illegal, or not provided. BUT THE VALUES WHICH WERE LEGAL, will be acted upon, even if a syntax error exists.

Example:
To change the operation of the Lt. Kernal from

```
Device  #8
LU      0
USER    2
  to
Device  #9
LU      10
USER    15   issue
```

```
OPEN 15,8,15,"L9AF":CLOSE15
```

Always remember that if you change the operating DEVICE number of the Lt. Kernal , all files OPENed under the OLD device will still remain OPEN, but now under the NEW number.

The LDLU command will permit you to open files across LU and USER boundaries then to switch back to your 'normal' operating LU, keep those files OPEN.

There is no DEFAULT setting for LDLU, nor is there any way at the present to READ your current operating values, so your applications will have to 'know' your default parameters.

Syntax: LOAD "[lu:][user:]filename",dev[,sa]

dev is the drive selected
sa is the secondary address where

0 or none	=	BASIC load
and 1	=	machine-language load

Mode: Director or Run
on the hard drive, LOAD may be abbreviated to

L_["][lu:][user:]filename["]

with optional quotation marks about the name and without specifying either device number or secondary address.

when used in this abbreviated syntax, LOAD will load the file at its correct load address depending on the filetype.

Example: L 1:MYFILE - LOADs the program MYFILE from the hard disk logical unit #1.

OPEN command

Syntax: OPEN lfn,dev,sa,"[lu:]filename"

lfn is the logical file number
dev is the physical address (number) of the disk accessed
sa is the DOS channel associated with this logical file (channel 15 is reserved for the command/error channel).

Mode: Direct or Run

OPEN retains exactly the same syntax as when used with the 1541 floppy disk, but now allows up to SEVEN logical FILES regardless of type, to be OPEN for reading and writing simultaneously on the hard disk. The Commodore ROM operating system will allow you to have as many as three more files open on a floppy disk, as well, for a total of ten open files.

Some 1541 file types occupy more than one channel when OPENed. All Lt. Kernal files use only one channel. This enhancement does NOT increase the open channel capability of the 1541 floppy disk.

Note that the "user" number is NOT an option in OPEN.

Syntax: Identical to Commodore conventions

Due to the enhancement to INPUT# it is now feasible to write BASIC programs which write strings as long as 254 characters to disk files. See INPUT#.

SAVE command

Syntax: SAVE ''[<range>][lu:]filename'',dev

where dev is the disk selected onto which to save the file
Mode: Direct or Run

SAVE may be abbreviated on the hard disk (only in the Direct Mode) to

S_['']['<range>][lu:]filename['']

without optional quotation marks about the filename and range, and without specifying the disk's device number.

Where <range> is specified, the range may be stated either in hexadecimal or decimal and is an INCLUSIVE range.

Examples:

S <$2000-3FFF>MYFILE - saves the area of memory from Hex 2000 through and including Hex 3FFF to the hard disk.

SAVE ''<1024-4096>MYFILE'', 8 - Saves the area of memory from decimal address 1024 through and including location 4096 to drive #8.

Note that USER# is NOT presently a SAVE operation.

Syntax: OPEN lfn,dev,sa,"S[lu][user:]:filename"

Mode: Direct or Run via channel 15

The SCRATCH command is available in the Run mode only via the command/error channel.

Note that the colon following the LU number is NOT optional.

In the Direct mode, the ERA command discussed later in this manual performs the SCRATCH function.

SCRATCH deletes the NEXT file encountered on the hard disk which qualifies according to the filename. This mode differs from the 1541 floppy disk equivalent in that the 1541 SCRATCH command deletes ALL filenames qualifying according to the filename given.

This limitation may be overridden via CONFIG for applications which require pattern-match scratching capabilities.

SEARCH key command

From BASIC
Syntax: match search SYS
64628:3,lfn,directory,Stringvar,recl,rech,status

greater-than search
SYS 64628:4,lfn,directory,Stringvar,recl,rech,status

less-than search
SYS 64628:5,lfn,directory,Stringvar,recl,rech,status

lfn is the logical file number of a KEY file already OPENed on the hard drive.
directory is the number (1-5) of the selected key DIRECTORY within the KEY file.
Stringvar contains the key for which you wish to search.

On return from the SYS

Recl and rech will contain the double-precision record number associated with the first key to satisfy the SEARCH criteria.
Status will contain a value to indicate the success or failure of the SEARCH.

Please see the KEY files usage examples in Section IX of this manual for detailed examples of SEARCH key.

For further descriptions of KEY file operations. refer to Section IX, page 9-16 for information on machine language calls.

From BASIC
Syntax: SYS 64628:7,lfn,directory,Stringvar,recl,rech,status

lfn is the logical file number of a KEY file already OPENed on the hard drive.
directory is the number (1-5) of the selected key DIRECTORY you wish to SHUFFLE.

On return from the SYS

Status will contain a value to indicate the success or failure of the SHUFFLE.

Please see the KEY files usage examples in Section IX of this manual for detailed examples of SHUFFLE.

For further descriptions of KEY file operations, refer to Section IX, page 9-16 for information on machine language calls.

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VIII.

DIRECT-MODE FEATURES and COMMANDS

↑↑

command

Sysntax:

The ↑↑ command restores all your CONFIG'd DEFAULTS for the CPU mode under which you are presently operating.

This is provided as a quick and easy way to return to your 'home' LU/User and colors when you have moved elsewhere on the system, or when a 'break' has changed your screen colors.

ACTIVATE command

Syntax: ACTIVATE

ACTIVATE totally erases an existing logical unit and creates a new 'BAM' and 'INDEX'. **ACTIVATE** also gives you the opportunity to create a DOS IMAGE FILE to enhance operating speed on LU's physically distant from the DOS LU (lu 10).

DO NOT USE THIS COMMAND UNTIL YOU HAVE THOROUGHLY READ AND COMPLETELY UNDERSTAND THE **ACTIVATE** and **CONFIG** PROCESSES.

ACTIVATE must be run ONLY AFTER the LU 'type' has been assigned via CONFIG.

ACTIVATE and CONFIG are discussed in detail in the 'PROGRAMMING CONSIDERATIONS' chapter (section IX) of this manual.

Syntax: AUTOCOPY

This self-documenting command allows you to rapidly copy multiple files across LU and USER boundaries.

AUTODEL command

Syntax: AUTODEL

AUTODEL is self-documenting, and allows you to rapidly delete multiple files from a specified lu/user area. If you wish to delete ALL files from an existing LU, ACTIVATE is faster.

Syntax: AUTOMOVE

AUTOMOVE is a self-documenting command which allows you to rapidly MOVE files from one USER sub-directory of an LU to another USER sub-directory of the same LU.

BUILD command

Syntax: BUILD_filename,nrecs,recl

filename is any legal 1541 filename
nrecs indicates the number of records to be formatted (65535 max)
recl indicates the length in bytes of each record (3072. max)

The maximum allowable size of any one file on the Lt. Kernal system is 32768 hard disk blocks of 512 bytes, or 16.78 mega-bytes.

BUILD is similar to the 1541 RELative-file formatting function in that it creates a relative file 'formatted' with a number of fixed length records. Unlike the 1541 which requires that you OPEN and POSITION within a relative file to format it, **BUILD** is a direct mode command, and is EXTREMELY FAST.

The Lt. Kernal will also format a relative file using the 1541 OPEN and POSITION syntaxes, but more slowly than when using **BUILD**.

Syntax: BUILDCPM

BUILDCPM sets up necessary machine status to construct a CP/M operating system on the CP/M DEFAULT LU you have previously defined via CONFIG.

You must have previously defined a CP/M default LU, and MUST have ACTIVATEd it prior to invoking BUILDCPM.

You must be in the 128 mode to invoke BUILDCPM.Please refer to Section 'Using CP/M on the Lt. Kernal' prior to using this command.

Refer to Section XIII, page 13-1 for the installation of CP/M on the Lt. Kernal.

BUILDINDEX command

Syntax: BUILDINDEX

BUILDINDEX builds a KEY file with up to five DIRECTORIES of keys. Necessary information about the file will be requested by BUILDINDEX as required.

You will first be requested to supply the name of the new KEY file to be built.

You will then be requested to specify how many DIRECTORIES (lists of keys) the file will hold. Once a KEY file is built, the number of directories within it may not be changed. You must build at least one directory, and you are limited to five within any one KEY file.

You will be requested to supply the KEY LENGTH for each directory. This specifies the permanently fixed length of the key strings contained within each of the directories. Each directory's key length may be different and may range from 1 to 30 characters.

Once you have supplied the key length for the last directory specified, BUILDINDEX will create the KEY file.

Please see the KEY file usage examples in Section IX of this manual for detailed examples **BUILDINDEX**.

Syntax: CHANGE_[lu:][user:]filename

CHANGE allows you to change several characteristics of a file. You may CHANGE the:

Filename
User number
Load address
'Dirty flag' (archiving bit)

CHECKSUM command

Syntax: CHECKSUM

CHECKSUM totally checks the intergrity of the DOS on LU 10 and forces an UPDATEDOS of all LU's on which Lt. Kernal DOS image files exist.

Syntax: CLEAR

CLEAR permits you to clear the 'dirty-flags' of all files in a specified LU/USER area. CLEAR will request the LU and USER parameters from you at the appropriate time. To clear the dirty-flag for a single file, use the CHANGE command.

Dirty-flags (archiving bits) are the mechanism the Lt. Kernal uses to do archival backups to floppy disk. Whenever a file is either created or modified, the Lt. Kernal sets a 'flag' bit in that file's directory entry saying that the file has been modified. Only performing a backup copy of the file via FASTCOPY, or executing the CLEAR command will erase that bit. Files with the archiving bit set may be selectively listed with DIR by using the C option.

CONFIG command

Syntax: CONFIG

CONFIG allows the user to establish custom system characteristics for the Lt. Kernal.

System characteristics affected are

CONFIG menu colors
Logical Drive sizes
Logical Drive 'types' (regular or CP/M)
C-64 Screen color
C-64 Border color
C-64 Character color
128 40 column Screen color
128 40 column Character color
128 40 column Border color
128 80 column Screen color
128 80 column Character color
Default device #
Default LU #
Default USER partition
Beep enable
Printer Codes
Autoaccess enable
Scratch override
CPU reset mode (C-64, 128, or CP/M)
CPU speed in 128 mode
C-64 mode KEYPAD enable on 128
Interrupt Traps
Multi-user index locking
CP/M Default LU

In addition to all these things, in a multi-user system, the 'master' user may configure these items for EACH of up to 16 separate CPU's connected to the system. CPU's OTHER than the 'master' may only change their OWN CONFIG parameters.

The following is a list of the default parameters:

LU#	Beg. Cyl	# of Cyl
DOS	0000	30
0	0030	200
1	0230	200
2	0430	166

Syntax: COPY_['']\[lu:][user:][newfilename]=[lu:][user:]oldfilename['']

Mode: Direct or Run

COPY creates a new file copied from oldfilename into newfilename. Copy will copy files across logical unit (logical drive) boundaries to the currently active subdirectory (user #).

COPY is available in the RUN Mode only through the Command/Error channel (15) using the standard Commodore 1541 syntax. COPY does not support copies with concatenation of multiple source files. The syntax in RUN mode is:

OPEN lfn,dev,15,"C[lu]:destfile=[lu:]sourcefile"

Note that almost all the COPY parameters are optional. Several syntaxes will accomplish a COPY of a file.

1. COPY THISFILE=THATFILE
   will copy the file named THATFILE into a new file called THISFILE on the logical drive on which you are currently working.

Now assume that you are 'logged' (working) on LOGICAL DRIVE #1 and working in User sub-directory 12 (1:12:).

2. COPY 2:THISFILE=THATFILE
   will copy the file named THATFILE from logical drive 1 into a new file called THISFILE on logical drive #2, User #12 (2:12:).
3. COPY 2:=THATFILE
   will copy the file named THATFILE from logical drive 1 into a new file of the SAME name on logical drive #2, subdirectory 12.
4. COPY 2:10:=3:5:THATFILE
   will demonstrate the ability to copy from and to logical drives on which you are NOT logged. The syntax above will copy THATFILE from logical drive #3 subdirectory #5 to logical drive #2, subdirectory #10 even though you are currently working on logical drive #1, user 12.
5. COPY =3:THATFILE
   will copy THATFILE from logical drive #3 to your currently logged logical unit (2) and currently working subdirectory (12).

The optional quotation marks in the syntax definition for COPY are allowed so that graphics characters may be included in the filenames.

D command

Syntax: D[_drvnum]

drvnum is the desired hardware device number of the hard disk

D is used to temporarily change the device number of the hard disk from the CONFIGured default. D typed without a drive number will cause the device number to revert to the power-on default.

Syntax: DEL_line number or
DEL_[beg.line]-[end.line]

DEL deletes BASIC program lines in memory. When the hyphen is used to indicate a range-delete, at least one line number must be given, (either beginning or end) to satisfy the range calculation.

DI command

Syntax: DI

DI (display index) is a self-documenting command. DI displays all of the active keys in the directories of a KEY file.

Please see the examples of KEY file usage in section IX of this manual for detailed use of **DI**.

FILE TYPE DEFINITIONS

The Lt. Kernal DOS supports the Commodore conventions for file type, such as "SEQ", "REL", etc., but uses within its own operations a more finely divided set of file definitions. Each Lt. Kernal file type is assigned a numeric type. The types are:

TYPE	DEFINITIONS
1	CONTIGUOUS DOS system file (i.e. INDEX and DISCBITMAP)
2	CONTIGUOUS DOS system processor (i.e. DIR)
3	RANDOM DOS external system processor (i.e. RENUM)
4	KEY file for indexed RELative files (supports 5 key directories)
5-10	UNASSIGNED
11	BASIC language program file stored block-list random
12	MACHINE LANGUAGE program file stored block-list random
13	SEQUENTIAL FILE (i.e. editor text) stored block-list random
14	USER FILE
15	RELATIVE FILE

Syntax: DIR_[[lu:[user:]]:[Tfiltyp][P][S][A][G][C]_][filename]

DIR is a powerful directory command that allows a directory of the hard disk to be listed or optionally printed. Listings based on file type or file name matches with wild-cards and don't-care characters are supported. You may use either trailing OR leading wildcards in the filename specification. The options are:

lu requests the logical drive # from which the DIRectory will be read
user requests the subdirectory on the requested lu.
Tfiltyp (type) filtyp is the numeric hard disk file type.
P (print) causes the listing to be printed
S (sort) causes the listing to be alphabetized
A (all users) lists from all subdirectories on the requested LU
G (global) lists from all subdirectories of ALL LU's
C (changed) lists only those files Changed or Created since the last backup or CLEAR command was issued. The directory listing for any file which reflects a 'changed' status will have an exclamation mark (!) appended to the end.

The options may be used singly or combined in any order except that the ':options' field must precede the file name specification, and that the G and A options override the optional user #, and G automatically implies the A option.

Examples:

DIR - causes a screen listing of all hard disk files in the current LU/USER area in which you are operating.

DIR :P - causes a printed directory of all hard disk files in the current subdirectory and LU.

DIR 1:4: MYFI - causes a directory of all files on LU 1 under sub-directory #4 whose names begin with the sequence 'MYFI'. Note that the trailing '*' is IMPLIED, and does not need to be entered.

DIR :T4A - causes a directory of all type 4 (KEY) files in all sub-directories of the current LU.

DIR :SG - causes a directory of ALL files on ALL LU's to be listed in alphabetic order.

DIR *.ASM - causes a directory of all files whose names contain the string '.ASM' anywhere after the first character.

DIR :C - causes a directory from the currently active LU and USER subdirectory of all files which have been Created or Changed since the last backup or CLEAR.

——FULL OPTIONS EXAMPLE——

This example uses all the options which may be meaningfully combined.

Example:

DIR :T11SPGC ?YFIL* - causes an alphabetized, printed directory of all BASIC programs on the hard disk which were created or modified since the last backup or CLEAR, the first character of whose names we do not care and whose names' next four characters are 'YFIL'.

Syntax: DUMP__[range__][lu:]seqfile

range is the range of basic lines to dump in the form startline#-endline#.
seqfil is the filename of the desired new text file to be created.

DUMP causes a new sequential file to be created then writes the detokenized version of the BASIC program in memory into the sequential file.

DUMP turns BASIC programs into editable text files and also functions in both C-64 and 128 modes.

Example:

```
DUMP 200-250 1:myfile
```

would cause current BASIC lines 200 through and including 250 to be written to the SEQuential file MYFILE on hard disk logical unit 1.

ERA command

Syntax: ERA_[lu:[user:]]filename

ERA erases (scratches) the NEXT file from the hard disk which qualifies according to the filename given. If the user: field is not supplied, then the file MUST exist on the currently active subdirectory, or the message "FILE BELONGS TO ANOTHER USER" will be issued, and the ERAse will be aborted.

The 'pattern-match scratch override' discussed in CONFIG will not cause ERA to delete multiple files. If you wish to delete several files at once, then the AUTODEL command should be used.

Syntax: FASTCOPY

FASTCOPY is a self-documenting, menu driven file copy and backup/restore utility. FASTCOPY will only work properly on a Commodore 1541/1571 disk drive (or fully compatible clone). The FASTCOPY "format" and "duplicate" features are presently unimplemented.

FASTCOPY will allow you to

- fast-format diskettes
- perform multiple copies of diskettes rapidly
- BACKUP your hard disk or an LU/USER area of your disk to diskettes rapidly
- RESTORE your hard disk or an LU/USER area from diskettes rapidly.

FASTCOPY will report any floppy diskette errors encountered during the copy process, but DOES NOT REPRODUCE DISKETTE ERRORS ON THE DESTINATION DISKETTES. It is not intended for use as a 'protected-disk' copier.

The 1541/1571 disk drive MUST be assigned Drive #8 for FASTCOPY to function.

FETCH command

Syntax: FETCH [lu:]filename

filename is a SEQuential text file image of a BASIC program (created via DUMP).

FETCH causes a text image of a BASIC program to be reloaded into memory in tokenized form for SAVEing as an actual program file. FETCH is the reciprocal command to DUMP.

The use of these two commands in conjunction with one another allows the programmer to utilize the features of a text editor to revise and edit BASIC programs. The FETCH command functions for both the C-64 and 128 BASIC.

Syntax: FIND delimSTRINGdelim[<line-range>

Both **delim** characters are the same and NOT included in **STRING**.

FIND searches for and lists lines of BASIC in which the STRING is found.

FIND will find combinations of TEXT and TOKENIZED BASIC and ignores useless space embedded in BASIC command.

For example: FIND /GOTO 650/,100-650 will find any occurance of GOTO650 between and including lines 100 and 650.

GO64 command

Syntax: GO64 or GO 64
Mode: 128 direct

GO64 sneds the CPU to the C-64 mode of operation, and sets the system parameters to the CONFIGed defaults for the C-64 mode.

Refer to Section XIII, page 13-1 for the installation of CP/M on the Lt. Kernal.

Syntax: GO128 or GO 128
Mode: C-64 direct on 128's only

GO128 sends the CPU to the 128 mode of operation., and sets the system parameters to the CONFIGed defaults for the 128 mode.

Refer to Section XIII, page 13-1 for the installation of CP/M on the Lt. Kernal.

GOCPM command

Syntax: GOCPM
Mode: C-64 or 128 direct on 128;s only

GOCPM sends the CPU to the CPM mode of operation IF a CP/M LU has been deifined and activated, and IF a CP/M operating system has been built on the LU.

Refer to Section XIII, page 13-1 for the installation of CP/M on the Lt. Kernal.

Syntax: ICQUB or filename

filename is the name of an auto-loader built by the ICQUB utility.

ICQUB (pronounced 'icecube') permits you to capture and save to the hard disk certain copy protected software.

SOFTWARE CAPTURED BY ICQUB CANNOT BE USED ON ANY OTHER COMMODORE COMPATIBLE DISK DRIVES.

ICQUB presently functions only for the C-64 mode. ICQUB is designed NOT to be a 'pirating tool'. The 'copies' it creates of protected software require the Lt. Kernal hardware to be present in order for them to run.

ICQUB does allow you to back up many of your own(ed) copy protected software packages on the Lt. Kernal. It does so by allowing you to load protected software into your computer from a floppy disk, then capturing a running image of the program. This technique will not allow you to run software which periodically re-checks its protection scheme, unless you are willing to have the protected disk in your floppy disk drive continually while using the captured copy.

Since ICQUB actually snap shots a running program, some software which appears not to work when ICQUB'd may work if you choose another time or stage of operation at which to capture the copy. Once a working copy is captured, it should work every time. Don't give up on a package just because your first try didn't produce a working program. Most software will ICQUB on the first try - but not all packages will.

ICQUB is simple to use, and for the most part it is self-documenting. Be sure that you are logged on to the LU on which you wish the capture to take place before invoking ICQUB.

When you type the ICQUB command, you will be presented with a menu. You may:

- Select from ICQUB files already on any LU
- Run the 'current' (last) capture file on this LU
- Assign a new name to the current capture file on this LU
- Capture a new program via ICQUB on this LU
- Return to Basic

OPTION #1

You will be presented with a files list similar to that which AUTODEL and AUTOCOPY produce from which to select your program. From this list you will also be permitted to select a file for which to build an 'auto-loader'. Once built, the auto-loader may be directly invoked just by typing its name at the READY prompt.

OPTION #2

You can test the current ICQUBCAPTUREFILE without bothering to search the list above.

OPTION #3

You may give ICQUBCAPTUREFILE a new name. Actually, ICQUBCAPTUREFILE is copied into the new file so that ICQUBCAPTUREFILE will not have to be re-built for option #4. The new filename will be your own selected 12 character name followed by the suffix ".ICQ" (i.e. MYFILECAPTUR.ICQ).

OPTION #4

You may capture a new program into ICQUBCAPTUREFILE. If ICQUBCAPTUREFILE does not exist on the currently logged LU when you select this option, it will be built. It may take as long as a minute to allocate capture space. Once the space is allocated, the computer will seem to 'reset'. and return to a normal power-up screen, as if the Lt. Kernal were NOT present.

This is the point at which you LOAD your protected software from the floppy disk. When the program has progressed to the point at which you wish to capture it, press the ICQUB button on your Lt. Kernal Host Adaptor. When the capture is complete, the Lt. Kernal will return to control.

Here's a brief hint on capturing. The ICQUB button performs much the same function as the RESTORE key on your computer. An example will show you how that affects captures.

Let's say you have a wordprocessor running which always returns to its 'main menu' when you press RUN/STOP and RESTORE simultaneously. The proper way to capture that software would be to allow it to get to a point where you COULD return to the main menu, then to hold down RUN/STOP and instead of pressing RESTORE, to then press the ICQUB button.

When the captured version is run, it will go directly to the main menu! You will have to experiment. Each software package ICQUB's a little differently.

OPTION #5

You may return to BASIC. Things will be a little 'messed-up' if you attempt to get back to BASIC any way other than via option #5, and you'll probably have to reset your computer to get back to proper operation.

In an effort to expedite your order for the Lt. Kernal, the ICQUB module supports only the C-64 at this time. The 128 version will be sent to you as soon as it is available.

Syntax: [lu:][user:]filename

Any legal filename typed beginning in the first column of the screen will cause the system to attempt to load and execute that file. The **INVOKE** feature works for both BASIC and machine language programs. Simply type the program's name, followed by a carriage return.

L or LOAD command

Syntax: LOAD "[lu:][user:]filename",dev[,sa]
dev is the drive selected
sa is the secondary address where

0 or none = BASIC load
and 1 = machine-language load

in the Direct-Mode, **LOAD** may be abbreviated to

L_["][lu:]filename["]

with optional quotation marks about the name and without specifying either device number or secondary address.

when used in this abbreviated syntax, LOAD will load the file at its correct load address depending on the file type.

Example: L 1:MYFILE - LOADs the program MYFILE from the hard disk logical unit #1.

Syntax: LKREV

LKREV reports the Lt. Kernal DOS Version number and release date.

LU command

Syntax: LU[_lunumb]

lunumb is the number of the logical unit on which you wish to begin operation.
lunumb may range from 0-10 decimal.

LU typed without a number following will log you onto the power-on default logical unit specified in CONFIG.

Syntax: MERGE__[lu:]filename

filename is the name of any disk-resident BASIC program file.

MERGE can actually merge or interleave the lines of the specified BASIC file on disk with the BASIC program currently in memory. If you wish to append basic files using MERGE, RENUMber one or both programs first so that the line numbers of the two do not conflict with or interleave one another.

In the case of lines of the disk based program duplicating line numbers of the program in memory, the lines from disk will replace lines of the same numbers in memory.

Merge presently functions only in the C-64 mode.

OOPS command

Syntax: OOPS

OOPS will attempt to recover the LAST file ERAsed, SCRATCHED or SAVEd with replacement on the currently logged logical unit into a new file named OOPSFILE#. The # character will be replaced with a digit from 1 to 9. Up to 9 OOPSFILEs may be created before you MUST rename or delete some of them.

If any disk activity has taken place that makes it impossible to recover the last file deleted, OOPS will report the file as unrecoverable. Only the LAST file deleted is ever OOPSable.

It is important to remember that any SAVE or OPEN for writing or appending AFTER a file is accidentally SCRATCHED or ERAsed will make it impossible to recover the file via OOPS.

Syntax: QUERY_[lu:]filename

QUERY will tell you all the pertinent information about the file requested. Depending on the file type of the file, the following file characteristics may be described:

File size (hard disk blocks)	LU #
USER #	Lt. Kernal numeric file type
Commodore convention file type	Hard disk file header address
# records (REL files)	Record length (REL files)
load address	# keys/directory (KEY files)
# directories (KEY files)	# of active keys (KEY files)

RENUM command

Syntax: RENUM[__incr[,newstart[,oldstart-oldend]]]

incr is the desired line increment over the RENUMbered range of lines.
newstart is the line number to be assigned to the first line of the RENUMbered range of lines.
oldstart-oldend is the range of OLD line numbers which you wish to be RENUMbered. At least the hyphen and one old line number are required to satisfy the range option.

i.e. 10-500 (all lines between and including 10 and 500)
or -350 (all lines from the start of the program up to and including line 350)
or 510- (all lines after and including line 510)

If you specify a SINGLE line number without the hyphen, the effect would be as if you had typed the range 'oldstart-63999'.

if no options are specified, the defaults will be set as if you had typed:

RENUM 10,10,0-63999

RENUM will renumber a BASIC program currently in memory. If no options are specified, the entire program will be renumbered. The renumbered program will begin with line 10 and line numbers will increment by 10.

The options provide extremely powerful editing capabilities to BASIC. Proper use of the options will even allow blocks of code to be moved within a BASIC program.

Any error in GOTO or GOSUB targets which would make renumbering impossible will cause an error message along with a listing of the line in which the error occurred. If any fatal renumbering error does occur, the BASIC program will be returned unmodified so that you may more easily debug the error. RENUM does not recognize the GO TO variant of GOTO.

RENUM is very fast. A typically organized BASIC program 24 Kbytes long takes about 14 seconds to renumber. Most BASIC programs are not nearly that long, and routine RENUMbering of short programs is almost instantaneous.

RENUM will NOT preserve a machine language tail on the end of a BASIC program. If you do RENUMber this sort of 'hybrid' program, you will have to manually re-link the machine lanaguage portion of it. Also, RENUM uses all of the BASIC space and parts of the memory under the BASIC ROM for line and target buffers. Any programs resident in those areas at RENUMber time will be destroyed.

The options are powerful enough to be somewhat dangerous if used improperly, so some examples of RENUMber's use are appropriate. Here is a review of the RENUM syntax.

Syntax: **RENUM[_incr[,newstart[,oldstart—oldend]]]**

example 1. **RENUM**

Typing just RENUM without options will renumber the entire BASIC program in memory to a beginning line number of 10 and with line numbers incrementing by 10.

example 2. **RENUM 1**

will renumber the entire program to a beginning line number of 10 and with line numbers incrementing by 1.

example 3. **RENUM 2,5000**

will renumber the entire program to a beginning line number of 5000 with line numbers incrementing by 2.

To demonstrate this command, the program:

```
10 REM THIS IS A LINE NUMBERING EXAMPLE
12 GOTO 15
15 PRINT "HELLO"
30 LET A=1:PRINT A:GOTO 10
```

would be renumbered to this:

```
5000 REM THIS IS A LINE NUMBERING EXAMPLE
5002 GOTO 5004
5004 PRINT "HELLO"
5006 LET A=1:PRINT A:GOTO 5000
```

example 4. **RENUM 1,10,5000-5004**

To demonstrate this command, the program:

```
5000 REM THIS IS A LINE NUMBERING EXAMPLE
5002 GOTO 5004
5004 PRINT "HELLO"
5006 LET A=PRINT A:GOTO 10
5008 END
```

would be renumbered to this:

```
10 REM THIS IS A LINE NUMBERING EXAMPLE
11 GOTO 12
12 PRINT "HELLO"
5006 LET A=1:PRINT A:GOTO 10
5008 END
```

EXACTLY the same effect could have been produced by typing:

RENUM 1,10,—5004

You could complete the renumbering of the last result by typing:

RENUM 1,13,5006—

which would yield:

```
10 REM THIS IS A LINE NUMBERING EXAMPLE
11 GOTO 12
12 PRINT "HELLO"
13 LET A=1:PRINT A:GOTO 10
14 END
```

EXACTLY the same effect could have been produced by typing

RENUM 1,13,5006-5008 or **RENUM 1,10**

Now on to the very powerful and somewhat DANGEROUS subject of moving lines via **RENUM.** You can actually edit your BASIC programs using the full options list of RENUM to cause groups of lines to be moved elsewhere in the program, but some cautions need to be kept in mind.

FIRST, if you plan to move lines about in your program, SAVE a current copy to disk before you start the changes. It is possible to accidently overwrite lines by mis-specifying options.

SECOND, if you actually PLAN to overwrite some lines, remember that the lines PHYSICALLY encountered LAST in the renumbering process will overwrite any lines of the same numbers which were encountered earlier. Some examples will clarify this process.

example 5. Take the following program:

```
10 GOSUB 70:PRINT A
20 PRINT "THIS IS A BLOCK-MOVE EXAMPLE"
30 INPUT A
40 PRINT A
50 IF A<10 THEN GOTO 110
60 GOTO 120:REM JUMP OVER SUBROUTINE
70 PRINT "THIS IS A FAVORITE SUBROUTINE OF
   MINE"
80 PRINT "WHICH I SHOULD REALLY MOVE
   OUT OF THIS"
90 PRINT "AREA OF THE PROGRAM"
100 A=0:RETURN
110 PRINT "A IS LESS THAN 10"
115 GOTO 130
120 PRINT "A IS GREATER THAN OR EQUAL TO 10"
130 END
```

typing **RENUM 1,5000,70-100** would yield:

```
10 GOSUB 5000:PRINT A
20 PRINT "THIS IS A BLOCK-MOVE EXAMPLE"
30 INPUT A
40 PRINT A
50 IF A<10 THEN GOTO 110
60 GOTO 120:REM JUMP OVER SUBROUTINE
110 PRINT "A IS LESS THAN 10"
115 GOTO 130
120 PRINT "A IS GREATER THAN OR EQUAL TO 10"
130 END
5000 PRINT "THIS IS A FAVORITE SUBROUTINE OF
     MINE"
5001 PRINT "WHICH I SHOULD REALLY MOVE OUT
     OF THIS"
5002 PRINT "AREA OF THIS PROGRAM"
5003 LET A=0:RETURN
```

The lines from 70 through 100 actually moved. Be careful, though, because this process could also modify your program's flow.

We could INTENTIONALLY overwrite part of the program like this:

Taking the same original program as above:

```
10 GOSUB 70:PRINT A
20 PRINT "THIS IS A BLOCK-MOVE EXAMPLE"
30 INPUT A
40 PRINT A
50 IF A<10 THEN GOTO 110
60 GOTO 120:REM JUMP OVER SUBROUTINE
70 PRINT "THIS IS A FAVORITE SUBROUTINE OF
   MINE"
80 PRINT "WHICH I SHOULD REALLY MOVE OUT
   OF THIS"
90 PRINT "AREA OF THE PROGRAM"
100 A=0:RETURN
110 PRINT "A IS LESS THAN 10"
115 GOTO 130
120 PRINT "A IS GREATER THAN OR EQUAL TO 10"
130 END
```

Typing **RENUM 10,10,70-100** would yield

```
10 PRINT "THIS IS A FAVORITE SUBROUTINE OF
   MINE"
20 PRINT "WHICH I SHOULD REALLY MOVE OUT
   OF THIS
30 PRINT "AREA OF THE PROGRAM"
40 A=0:RETURN
50 IF A<10 THEN GOTO 110
60 GOTO 120:REM JUMP OVER SUBROUTINE
110 PRINT "A IS LESS THAN 10"
115 GOTO 130
120 PRINT "A IS GREATER THAN OR EQUAL TO 10"
130 END
```

Note that the original lines 10-40 were overwritten by old lines 70-100. More specifically, since lines 70-100 were encountered LAST in the program with the new line numbers 10-40, they took precedence, and overwrote any earlier encountered lines of the same numbers.

As a final example of the same effect, let's take example 5 program once more:

```
10 GOSUB 70:PRINT A
20 PRINT "THIS IS A BLOCK-MOVE EXAMPLE"
30 INPUT A
40 PRINT A
50 IF A<10 THEN GOTO 110
60 GOTO 120:REM JUMP OVER SUBROUTINE
70 PRINT "THIS IS A FAVORITE SUBROUTINE OF
   MINE"
80 PRINT "WHICH I SHOULD REALLY MOVE OUT
   OF THIS"
90 PRINT "AREA OF THE PROGRAM"
100 A=0:RETURN
110 PRINT "A IS LESS THAN 10"
115 GOTO 130
120 PRINT "A IS GREATER THAN OR EQUAL TO 10"
130 END
```

Typing **RENUM 10,70,10-40** would yield:

```
50 IF A<10 THEN GOTO 110
60 GOTO 120:REM JUMP OVER SUBROUTINE
70 PRINT "THIS IS A FAVORITE SUBROUTINE OF
   MINE"
80 PRINT "WHICH I SHOULD REALLY MOVE OUT
   OF THIS"
90 PRINT "AREA OF THE PROGRAM"
100 A=0:RETURN
110 PRINT "A IS LESS THAN 10"
115 GOTO 130
120 PRINT "A IS GREATER THAN OR EQUAL TO 10"
130 END
```

The lines 10-40 WERE actually renumbered to the range 70-100, but since other lines of the same range were encountered LATER in the renumbering process, they were replaced.

We could have protected against accidential overwriting of lines, but the power of having that capability strongly outweighs the dangers. We do suggest, though, that you be VERY careful with the range option of **RENUM** until you become comfortable with what it can do.

Any time lines are moved with RENUM, the message

'RE-ORDERING DISPLACED LINES'

will appear. If the program is quite large and the lines have moved to very near the beginning of the program, the re-ordering process could take several minutes.

RENUM presently functions only in the C-64 mode. The 128 has a built-in renumber function.

S command

Syntax: S

The S command is a special direct-mode implementaion of SAVE. S allows easy and fast re-saving with replacment of a BASIC program presently being edited.

For any BASIC program which has been LOADed (via LOAD or the L command) and edited, merely typing S and carriage return will cause the program to be re-SAVEd under the original file name. Also see SAVE command for the abbreviated S syntax with a file name supplied.

Syntax: SAVE "[<range>][lu:]filename",dev

dev is the disk selected onto which to save the file.

SAVE may be abbreviated in the Direct-mode to:

S_["][<range>][lu:]filename["]

with optional quotation marks about the filename and without specifying the disk's device number.

Where <range> is specified, the range may be stated either in hexadecimal or decimal and is an INCLUSIVE range.

Examples:

S <$2000-4000>MYFILE
—saves the area memory from Hex 2000 through and including Hex 4000 to the hard-disk.

SAVE "<1024-4096>MYFILE",8
—saves the area of memory from decimal address 1024 through and including location 4096 to drive #8.

SHIP command

Syntax: SHIP

SHIP causes the hard disk's heads to be moved to the proper zone for shipping. THIS COMMAND MUST BE EXECUTED PRIOR TO MOVING OR SHIPPING YOUR HARD DRIVE.

Simply type SHIP and carriage return, and wait for the drive "PREPARED FOR SHIPPING" message. TURN YOUR LT. KERNAL HARD DISK OFF and wait thirty seconds for all mechanical activity to cease.

You may then transport the system.

In a multi-drive system, **SHIP** parks the heads of ALL drives.

Syntax: TYPE__[lu:]filename

TYPE causes any file specified in the filename to be listed to the screen WITHOUT disturbing the present contents of BASIC memory.

The TYPE command is very valuable for extracting portions of disk-resident BASIC programs for use in a program presently being edited.

Type is also useful for displaying the contents of relative and sequential files. Type will display Program and User fles, but usually their contents will be meaningless as displayed text.

UPDATEDOS feature

UPDATEDOS updates the DOS image files which you may have installed on various LUs. It is run after one or more LU partitions have been created via CONFIG. Please see the section CONFIG for more detail on this feature and DOS image files.

UPDATEDOS is *automatically* run whenever required.

Syntax: USER[__user#]

user# is a decimal number in the range 0-15

USER causes you to be 'logged' into the requested subdirectory of the LU on which you are currently working. Subsequent DIR's, SAVE's, or COPY's will be directed to/from the requested subdirectory supplied in the user# field. USER typed without a specified # will cause you to log into the CONFIGured power-up default subdirectory.

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IX

PROGRAMMING CONSIDERATIONS FOR THE LT. KERNAL DOS

The Lt. Kernal DOS was written specifically to satisfy the needs of the business or scientific software developer and to supply an excellent target system on which that new software might be run. In almost every instance, BASIC programs developed for the 1541 floppy disk will operate under control of the Lt. Kernal DOS. Machine language programs require some special precautions to be completely interchangable between the Lt. Kernal system and a 1541 environment.

Both BASIC and machine language programs can benefit from the 'speed tip' offered later in this section. Limitations on machine language and BASIC programs are few and well defined at the time of the writing of this manual.

Here are some general precautions to observe when programming the Lt. Kernal system:

1. BASIC programs should be modules which DO NOT contain machine language 'auto-boot' code at addresses lower than the 'normal' BASIC start address. Low memory auto-loaders can be used, but programs containing them CANNOT BE DIRECTLY INVOKED; they must be loaded via LOAD or L to function.

   Machine language 'tails' appended to the end of BASIC programs are perfectly acceptable. BE AWARE, however, that various commands such as RENUM, MERGE, and FETCH will destroy or modify the machine language parts of such 'hybrid' programs. The machine language portions of such software will have to be relinked to the BASIC portion after the BASIC portion has been edited. (This same limitation occurs in a 1541 environment)

2. Machine language programs should not modify the stack pointer. This practice, although frequently used, is generally considered by professionals to be a programming 'trick', and is not considered to be good programming practice. With the Lt. Kernal in control, modifying the stack pointer (other than by balanced pushes and pulls) will nearly guarantee that the Lt. Kernal cannot properly intercept disk service requests. There ARE ways around this and we encourage you to experiment CAREFULLY.

3. Machine language programs should always use the 'KERNAL VECTORS' to request system or disk service. The KERNAL VECTORS are a set of indirect jumps or JSR's to various KERNAL ROM routines. When the computer ROM operating system was written, it was intended that programmers use these vectors if they wished to use ROM subroutines. The Lt. Kernal DOS supports that convention.

   Although you are free to use ROM routines by JMPing or JSRing to undocumented entry points within ROM, we cannot guarantee that hard disk requests will be properly intercepted by the Lt. Kernal DOS unless you use ONLY the KERNAL VECTORS for such requests.

4. The Lt. Kernal DOS intentionally does NOT support RANDOM reads and writes to the hard disk by track and sector. The 'U' error channel commands are not supported to prevent damage to the DOS itself. We can provide other secure ways to protect proprietary software on the Lt. Kernal to authorized third-party software developers.

5. Presently, the Lt. Kernal DOES NOT support the *Serial Vectors* ($FF93-FFB4).

Backup Copying

Any system of software worth using is also worth protecting. Backup copying is the only method available to secure your programs and data against loss.

We have expended every effort to make sure that the Lt. Kernal DOS and the hard disk system hardware will be reliable. Even with that effort, WE CANNOT ASSURE that your system will not fail someday. If the system does fail, it is possible that any data or programs on the hard disk at the time of the failure will be lost.

COPY YOUR IMPORTANT FILES TO DISKETTE as often as necessary to enable you to recover in case your files are lost or accidentally erased. We have provided methods for you to perform backup copying.

For a moment, let's discuss the PROPER way to keep backups of your system in order to minimize the chances of losing any data. The correct process is sometimes known as 'DOUBLE GRANDFATHERING' or 'ALTERNATE' backup.

Say for discussion's sake that you do daily backup's (if you're keeping business data on your hard disk, you should!). On Monday evening, you copy your system and label the diskettes 'MONDAY'. After Tuesday's work, it's time for another copy to be done. On Tuesday evening, you MUST USE A NEW SET OF DISKETTES.

Rule 1

NEVER, NEVER, NEVER, NEVER DESTROY your MOST RECENTLY SUCESSFUL BACKUP!!!

Once you have completed Tuesday's copy, you label the diskettes 'TUESDAY' and store them as well in a different physical location than Monday's copy.

Rule 2

ALWAYS STORE ALTERNATE BACKUPS IN DIFFERENT PHYSICAL LOCATIONS (preferrably in different buildings).

This is simply to ensure that even a catastrophy like a fire would only lose for you at the most TWO working days of data.

On Wednesday, you can re-use Monday's diskettes; Tuesday's copy is now your most recent backup and is the one which must be protected most carefully. Each day you alternate sets of diskettes.

If you do serious business processing on your Lt. Kernal, make up two sets of labels for your two (at least two) backup copies. Make each set a different color. Next, make a calendar of your copying schedule, marking the COLOR of the set to be used on each data processing day. Make sure you truly alternate colors.

For instance: If you started this Monday with RED and you work five days a week, NEXT Monday had better be a BLUE day (no pun intended). Mark your calendar for about a month in advance then stick to it faithfully.

IF YOU HAVE A REAL DATA EMERGENCY AND HAVE FOLLOWED YOUR BACKUP SCHEDULE, YOU ARE RELATIVELY SAFE — BUT — IF A HARDWARE PROBLEM IS WHAT DESTROYED YOUR DATA — DON'T RISK A GOOD COPY OF YOUR DATA FOR ANY REASON UNTIL YOU ARE SURE THE PROBLEM IS COMPLETELY SOLVED AND THE SITUATION IS SAFE.

Floppy disk copying is just plain slow. To help relieve the slow disk pains, we have provided a program called FASTCOPY which is 1541/1571 specific to copy to and from floppy disks more quickly. FASTCOPY will copy a full diskette by filename in about two minutes. Even at that speed, and swapping diskettes as fast as your hands can move, it takes about four HOURS to copy a full twenty megabytes. Usually, though, your disk won't be completely full, so the copy will take less time than that. FASTCOPY is self documenting: Just follow its instructions. Remember, though that FASTCOPY is

designed just for Commodore 1541 and 1571 disk drives. If you own another brand or model, you may have to resort to a program such as 'COPY-ALL'.64L (supplied on the Lt. Kernal). COPY-ALL works fine but takes a
L O N G time to copy 20 megabytes (we won't scare you with HOW long).

If your Lt. Kernal disk system is full, our FASTCOPY utility offers a nice alternative copying feature which is safe as long as it is used with discretion. This feature is ARCHIVAL COPYING.

Archival copying is nothing more than the process of copying only those files which were modified since the last copy was done. Your copy takes less time because there are fewer files to copy. ARCHIVAL copying does have a pitfall.

Unless you keep EVERY consecutive archival copy you've ever made since the last COMPLETE copy of your system, you might not be able to recover from a major data loss. The solution is simple: Establish a regular schedule during which you normally do ARCHIVAL copies, but in which you also do COMPLETE copies at regular intervals.

A good regimen to follow is:

A COMPLETE copy of ALL FILES once a week (or two weeks according to the importance of your data

and

Archival copies every day or so between the complete copies.

Make sure to label and retain ALL the archival copies made until you have safely made a complete copy.

Again, FASTCOPY is self-documenting, and will take you through either a complete or archival copy automatically.

PLEASE BACK UP YOUR DATA AND PROGRAMS REGULARLY

With a hard disk's tremendous capacity, any data loss can be a HUGE data loss. Backing up regularly will protect you.

Directly Invoked Applications

With the Lt. Kernal DOS in effect, you can cause any program to be loaded and run simply by typing its name and pressing 'RETURN'. There are just a few precautions you must observe in order to make sure your programs may be directly invoked.

BASIC programs are no problem at all. Any BASIC program (and most compiled BASIC programs) will run unmodified under the direct invocation feature of the Lt. Kernal DOS. Machine language programs require that three constraints be observed.

1. Machine language routines must have the same LOAD address and ENTRY POINT (the address to which you would normally SYS). Even if a routine you wish to directly invoke does not meet this requirement, it is a simple task for any machine language (assembly language) programmer to 'patch' your program to meet this specification.
2. The routine MUST NOT over-write the 'stack' (memory addresses $0100-$01FF). Some 'AUTO-BOOT' loader programs do write over this area of the computer's memory, and they cannot be directly invoked. They will only work by LOADing them with the FULL Commodore LOAD syntax.

ANY routine must use the 'KERNAL VECTORS' (between $FFCO and $FFFF) for any system calls which require disk access. This requirement was set down by Commodore Business Machines when they provided the BASIC operating system in your computer and the Lt. Kernal DOS adheres to that standard.

AUTOSTART applications should follow the same guidelines as Directly Invoked applications.

'STACK' manipulation

It is usually considered a programming 'trick', and not good practice to alter the 6510's stack pointer in machine language routines. Sometimes, however, stack pointer manipulation is the most expedient way to assure that subroutines with multiple exit points stay in control. If your routines must alter the stack pointer, then you must preserve the return pointer residing on the stack when your routine first gets control. The Lt. Kernal DOS does a 'JSR' to any routine directly invoked, and expects the return address to be on the stack at the appropriate place when your routine does its final 'RTS' back to system control.

Reserved Memory Areas

Although the 'stack' should not be altered without observing the previously mentioned constraints, no other single byte of RAM is ever required or modifed by the Lt. Kernal DOS (without replacing its EXACT contents).

Speed Tips

The Lt. Kernal is faster than any other Commodore-compatible drive because of its rapid parallel transfer scheme. However, the 'KERNAL' operating system which Commodore provided with the computer does introduce substantial overhead which slows access to data that is read from files (even if you use the Lt. Kernal enhanced INPUT# command instead of GET#). The same holds true for machine language routines that use BASIN (Commodore's GET character routine) or BSOUT to write data to files. There is a TREMENDOUSLY FASTER method you may use in NEW applications.

Since the Lt. Kernal can access data files so rapidly, it is in the best interest of speed that you save DATA as PRoGram files rather than as SEQuential or RELative files. By LOADing or SAVEing data, you may realize the full increase in speed that the Lt. Kernal offers over the 1541 Commodore disk drive.

Even if you can't save data as PRoGram type files, the Lt. Kernal DOS provides extremely fast access to records of data in RELative files, and you may create indexes to individual records within RELative files using the KEY file structure to further speed access. In every instance possible, the use of RELative files instead of SEQuential files will ensure that your application runs as F A S T as possible. The Lt. Kernal is faster than ANY other Commodore compatible disk drive on the market today. Make best use of its speed in your new programs.

Disk Partitioning

As you receive your new Lt. Kernal system, the disk will be set up with only four logical drives (LU 0, 1, 2, and 10). The Lt. Kernal DOS ALWAYS resides on LU 10. The rest of the possible eleven logical drives (LU 1 - LU 9) will not be configured.

When you require more space and more logical drives for your applications, we suggest that you initially CONFIGure the rest of the hard disk into equal sized partitions until you get a good feel for the space required by your applications.

You may subdivide the space beyond logical unit 10 (which always remains fixed in size) into as many as ten logical drives, or as few as one logical drive. The CONFIG processor is the method by which you may accomplish this. Study the CONFIG section of this manual carefully and make sure you understand it all before you attempt your first CONFIG. Be sure to RECORD AND SAVE your logical unit parameters on paper: You'll need those parameters in order to preserve files on logical units 0-9 if you ever do a SYSGEN to upgrade to a newer DOS.

KEY FILE usage

This is one of the most complex subjects dealt with in this manual. You do not have to be an expert computer programmer to use the Lt. Kernal KEY files system: If you aren't an expert, though, you are going to need to absorb a lot of new information in order to make full use of this wonderfully powerful feature of the Lt. Kernal DOS.

We will supply you with examples of KEY file use, but it would require another manual the size of this one to explore all the possible uses for KEY files. If you wish to use KEY files on the Lt. Kernal to their fullest potential, study one of the several fine DATABASE MANAGER software packages available for Commodore computers, then return to this section.

The KEY file system on the Lt. Kernal makes available from BASIC a complete KEYED INDEXED-RANDOM ACCESS METHOD for accessing data.

YOU WILL BE ABLE TO BUILD VERY COMPACT AND EXTREMELY POWERFUL CUSTOM DATABASE MANAGEMENT PROGRAMS in BASIC using this file access system.

The Lt. Kernal KEY file system consists of two utility commands and one system call (SYS) with seven modes of operation which can be used to very rapidly search for and find specific data based on varied and complex search criteria.

Originally the KEY file system was written for use in conjunction with RELative files. Its use is not restricted, though. You can use KEY files in any application where you need to associate TEXT STRINGS with specific numeric values.

In the very simplest of terms, the KEY file system allows you to supply a text string and associate a numeric value directly with that string. When you later SEARCH for that string in the file, the SEARCH command will return to you the value you previously associated with the string.

That may sound very simple, indeed, but the applications to which that can be put are amazing. Additionally, the Lt. Kernal KEY file operations are VERY fast. Some remarkable database management programs can be written in just a few lines of BASIC, and they operate at nearly the speed of machine language programs.

Let's **define** a few terms, then go on to actual uses of KEY files.

KEY - is a literal string or string variable containing from one to thirty characters. The KEY is the basic 'element' of KEY files. Keys are the strings for which you will SEARCH in your applications. Depen-

ding upon the methods you use, a KEY may end up being used to refer to specific data, or may be used to point to yet another list of KEYS.

DIRECTORY - When used in the context of KEY files, a directory is a list of UNIQUE keys within a KEY file. A KEY file may contain up to five DIRECTORIES of keys. Keys within a single directory must be UNIQUE.

Record Number - is the NUMERIC value in the range 0-65535 directly associated with each KEY within a DIRECTORY. This is the number returned to you when a SEARCH for a particular KEY is successful. It is supplied BY you when INSERTing a new KEY in a DIRECTORY, or when DELETEing a KEY.

Recl and **Rech** - are the low-byte and high-byte representation of the Record Number.

```
Rech = INT(Record Number / 256)
Recl = Record Number-(Rech * 256)
```

INSERT - means to place a new, unique KEY in a DIRECTORY.

DELETE - means to remove a KEY from a DIRECTORY.

SEARCH - means to attempt to find a particular KEY within a DIRECTORY.

lfn - refers to the logical file number of a KEY file already OPENed on the hard disk.

Status - is a single precision value returned as a result of the various KEY file commands and which reflects the success or failure of the command.

> For really advanced programmers, only:
>
> The structure of a KEY file is a B-tree with unidirectional links between each of three search levels: coarse, medium, and fine. The coarse and medium levels are NOT accessible via the KEY commands: only the results of the operation after passing to the fine level are passed back to your application. You can, however, create your own coarse-to-fine levels of search by utilizing multiple DIRECTORIES within KEY files.

A KEY file example

First, let's set up a purely literal example of how KEY files work. After that, we'll attack the actual commands, and give programming examples. If you are an advanced programmer, and are already familiar with keyed indexed-random file structures, you can skip this section, and refer to the programming examples now.

We'll use a simple catalog/cross-reference as an example.

Assume you have just three items to catalog: a camera, a dishwasher, and your pet dog.

First, in order to catalog these items, you need to decide what features about them are important enough that you can remember to refer to them by those characteristics in the future. Here's a list of unique features you decide to use, and the KEYS you wish to create to describe those features.

item	**characteristic**	**key**
camera	Uses film	film
	takes pictures	picture
	very small	small
dishwasher	holds dishes	dish
	washes them	wash
	very large	large
dog	eats	eat
	makes a mess of the yard	mess
	medium size	medium

The 'keys' we decided upon above are all single words, because they're easy to remember. They don't have to be, though. The whole statment ''makes a mess of the yard'' could be treated as a KEY also: any text string up to 30 characters long can be a KEY.

Look at the keys above. The longest is seven (7) characters in length. That becomes the 'key length', since all KEYs in a DIRECTORY must be the same length.

So what do we do with the keys which are shorter than seven characters? We 'pad' them with some known character that makes them all seven characters long. As an example, let's use spaces (noted by the ' ' character) to pad our keys. Padded, our keys look like this:

item	**characteristic**	**key**
camera	Uses film	film' '
	takes pictures	picture
	very small	small' '
dishwasher	holds dishes	dish' '
	washes them	wash' '
	very large	large' '
dog	eats	eat' '
	makes a mess of the yard	mess' '
	medium size	medium' '

Now, we'll leave it up to your imagination to create a lengthy and VERY complete description of each item above (no cheating, now; describe the camera down to the last screw!), and save your descriptions in three boxes (disk files). Place the description of the camera in BOX #1, the dishwasher description in BOX #2, and a loving description of your pet (including the cost of sod replacement last year) in BOX #3.

We're ready now to create a KEY file. We do it here with another box: a box labeled ITEMKEYS. We will INSERT keys into that box. We'll need nine slips of paper to handle the nine 'keys' we defined above.

On the left of each slip write the KEY (including any spaces padding it to 7 characters), and on the right of the slip note the RECORD NUMBER (the number of the item) to which the KEY applies (i.e. eats applies to item #3, the dog). As soon as you complete the first slip, drop it into the box. You've just INSERTed your first key.

One of the intentional constraints imposed on you when using KEY files is that no two identical KEYS may be present in the same DIRECTORY: every key must be unique. From now on, we're going to have to carefully check every KEY already in the ITEMKEYS box, to make sure we don't duplicate one, before we may INSERT another.

So write the next KEY slip, take ALL the slips already in the box out, check them to make sure none EXACTLY MATCH the one you're about to INSERT, and if the new key is unique, drop it and all the other older slips back into the box. Repeat that boring cycle until all nine keys are INSERTED.

Sound like a chore? It is, but in the Lt. Kernal KEY file system, that check is made for you, instantaneously, every time you attempt to INSERT a key in a KEY file directory.

Now that you've built a KEY file FORGET EVERYTHING YOU EVER KNEW ABOUT DOGS, DISHWASHERS, and CAMERAS. Remember only this —

You know you've got three boxes describing things, and one box with characteristics of things in it. Besides, you're not so forgetful that you don't remember what a mess, or a picture, or a picture of a mess is.

Hmmm... 'picture' - a seven letter word. Let's look in the characteristics box and see if there are any words spelled EXACTLY like that (exact-match SEARCH). Yep, and it says to look in box #1.

Now you have recovered your memory about cameras! So let's try 'mess', a four letter word (indeed). Nope? No, but there was one close: only it was seven characters long, padded with spaces. But 'mess' and 'mess ' MEAN the same thing, don't they? Sure, so

let's find the first KEY in that box higher alphabetically than 'MESS' and see where it takes us (greater-than SEARCH).

Well, we came up with 'mess ', and it pointed to box #3. By gosh, now that your memory returns about your pet, you remember the yard!

Now you're getting the feel of it. All the characteristics in that box are seven letters long. You remember the word 'dishes' and remember to pad it out to seven characters, then go searching for it. No 'dishes' slip is in there (exact-match failed). You do a 'greater-than' search, and come up with 'eat '. Hey! that sounds good - but when you look in the box it points to, you get the dog, again.

Next you look for the first slip LOWER alphabetically than 'dishes '(less than search), and this time you come up with 'dish ', pointing to box #2. That box describes the dishwasher, and you've completely recovered your memory.

That's a pretty simple example, sure, but imagine it with hundreds of items each with THOUSANDS of characteristics describing them. It would take quite a while to search all those boxes, wouldn't it?

That's where the KEY file comes in. It takes only a fraction of a second to search through any list of keys (DIRECTORY) using the Lt. Kernal KEY commands. You can single out a box (data record pointed to by a RECORD NUMBER) almost instantaneously, no matter how many keys you have to search.

Already, you're probably seeing potential applications for this technique —

You could build a list of all your friends and business acquaintances, and by building several DIRECTORIES of KEYS (a single KEY file will hold five DIRECTORIES), you could cross-reference them by hobby, birth month, city, state, and marital status—

and that is an almost trivial example!

Enough with rudiments. We know you want to get on to using KEY files, so some rules for use and the command descriptions follow.

As we said before, there are two utility programs, and one SYS with seven modes comprising the KEY files commands. The utilities are Direct-Mode commands, the SYS's are designed to be used primarily in the Run-Mode.

BUILDINDEX is the command which allows you to create a new KEY file, and establish the KEY characteristics for it. BUILDINDEX is self-documenting. There are just a few **constraints** to creating a KEY file.

- A KEY must be no longer than thirty characters long: All keys within a single DIRECTORY are built to the same length.
- The file may contain no more than five (5) DIRECTORIES of KEYS.
- ALL DIRECTORIES within a given KEY file will contain the same number of KEYS (max. 65535).

This needs explaining. Other than the fact that up to five KEY DIRECTORIES may exist within a single KEY file, there is no FUNCTIONAL relationship among them. They may contain KEYS which are entirely unrelated.

However, because of the way in which KEY files are built, all DIRECTORIES within a single KEY file will be built for the SAME NUMBER OF KEYS ... That's important, because the longest DIRECTORY you can create within a key file is directly dependent on the length of the LONGEST KEY defined for that file.

A brief example will suffice to illustrate. If you built a KEY file with FIVE DIRECTORIES, each with KEYS 13 characters long, you could request a 'number of keys' as large as 65535. That's the maximum number of KEYS you are ever allowed to build in any DIRECTORY.

At a key length of 14 characters, the number of KEYS PER DIRECTORY begins to diminish. If you defined the key length as thirty (30) characters, you could have no DIRECTORY longer than 6750 KEYS.

Now here's the rub. If four of the five defined DIRECTORIES within a KEY file had key lengths of only 13 characters (allowing 65535 keys/directory), but the fifth had a key length of thirty, then the maximum number of KEYS PER DIRECTORY will still be diminished to 6750 for ALL DIRECTORIES within that one file. That doesn't mean that any space is wasted in the file. It's just a functional limitation of BUILDINDEX.

Here's a table of maximum DIRECTORY lengths for different lengths of KEYS.

KEY length	Max KEYS DIRECTORY	KEY length	Max KEYS DIRECTORY
1-13	65535	22	18522
14	59582	23	16000
15	48778	24	13718
16	43904	25	11664
17	35152	26	11664
18	31250	27	9826
19	27648	28	8192
20	24334	29	8192
21	21296	30	6750

The table is computed from the formula —

$$Nkeys = (INT(507 / (L+))\uparrow 3) * 2$$

where L is the length in characters of the longest key, and Nkeys(max) = 65535.

Another constraint on KEY files.

- Because of the manner in which KEYS are INSERTed in a B-tree, a DIRECTORY should be constructed for about 20% MORE KEYS than you expect to use.

  This will GREATLY affect the speed of insertions when you have many similar KEYS in a single DIRECTORY. Be conservative in your estimates of needed keys: Twenty megabytes will hold a lot of data.

The last limitation of KEY files —

- The space required to build a KEY file must be available in CONTIGUOUS blocks on the LU on which it is to be built.

  If there is enough space, but not sufficient CONTIGUOUS space available on an LU for the KEY files you wish to build, the method to get it all contiguous is:

  AUTOCOPY all files to another LU.
  ACTIVATE the LU you wish to clean up.
  AUTOCOPY all the files back.

This performs a quick equivalent of the 1541 VALIDATE command.

Now a brief discussion of the other utility for KEY files. DI, then on to the Run-mode commands.

DI (dump index) is provided as a convenience to KEY-file programmers. The same function could be written in BASIC, as we will show later.

DI simply lists all active keys in a KEY file. DI will prompt you for the name of the KEY file you wish to dump.

Key-File Run-Mode Commands

The general form of the KEY commands is:

SYS 64628:mode,lfn,directory,Stringvar,recl,rech,status

The parameters list may consist of variables or literal values, or a mixture of both. The colon following the SYS address is required in order to maintain C-64/C-128 compatibility.

The mode parameter defines what KEY command will be performed. The modes are:

mode	function
0	BUILD new KEY file
1	INSERT key
2	DELETE key
3	exact-match SEARCH for key
4	greater-than SEARCH for key
5	less-than SEARCH for key
6	not used
7	SHUFFLE directory

general: SYS 64628:mode,lfn,directory,Stringvar,recl,rech,status

The other parameters are, again:

lfn - refers to the logical file number of a KEY file already OPENed on the hard disk.

directory - The number (1-5) of the directory within the file which you wish to access.

Stringvar - A literal or variable string containing the KEY with which you wish to operate. For SEARCH functions, this key should be padded to the KEY-LENGTH of the directory chosen (usually with spaces or nulls). INSERT will pad the KEY with nulls if you supply a Stringvar shorter than the KEY length for that directory.

Recl and **Rech** - are the low-byte and high-byte representation of the Record Number.

Rech = INT(Record Number / 256)
Recl = Record Number-(Rech * 256)

The Record Number is the NUMERIC value in the range 0-65535 directly associated with each KEY within a DIRECTORY. This is the number returned to you when a SEARCH for a particular KEY is successful. It is supplied BY you when INSERTing a new KEY in a DIRECTORY, or when DELETEing a KEY.

Status - is a single precision value returned as a result of the various KEY file commands and which reflects the success or failure of the command.

The status variable may change in meaning, depending upon which KEY command you are using. See each command below for specific status returns. The general definitions of the status values are:

status	meaning
0	command was successful (meaning of 'success' varies with each command)
1	invalid directory #
2	variable by command
3	DIRECTORY Links corrupted: !!!FATAL SYSTEM ERROR!!!! *or* File Already Exists (during BUILDKEY only)
4	variable by command
5	variable by command
6	file not open, or file opened is not a KEY file

Status value 3 should never be encountered except during BUILDKEY (mode-0). The only time links might be corrupted is when the computer is turned off (power failure) during an INSERT or DELETE operation. If a status of 3 is EVER returned during any key file operation *except* BUILDKEY, abort the application, and attempt to recover as many KEYS from the file as possible into a new KEY file. After recovery, ERAse the corrupted file.

In the command descriptions which follow, the GENERAL status returns always apply. Only the variable statuses will be discussed with each command.

The **BUILDKEY** file command -mode = 0

SYS 64628:0,lfn,directory,Stringvar,recl,rech,status

This command CREATES a new Key file. You must supply:

directory is the NUMBER OF DIRECTORIES (1-5) the new file is to have.

Stringvar is the filename of the new KEY file CONCATENATED with the ASCII STRING representation of the key lengths for each desired directory.

For example, to create NEWFILE with 3 directories with key lengths of 20,254, and 80, **Stringvar** would be:

'NEWFILE,20,254,80'

recl and **rech** are the number of keys the largest directory may hold.

For the above file, if you wished there to be 245 keys in each directory, then recl=245 and rech=0.

This is the only mode in which a status return of 3 is not FATAL!! Status indicates that the filename you supplied already existed and cannot be built.

Machine Language KEY file access

The generalized form of KEY file access from machine language is shown below. The process consists of establishing a *Descriptor Table* of parameters to feed to the KEY system, then setting a *Pointer* to the Table, and *JSR'ing* to the Lt. Kernal *BASIC Extensions* vector.

In both the C-64 and 128 modes of operation, the *Kernal ROM* must be enabled at the time of the JSR. In C-64 mode, the *Keystring* may be stored in either Bank0 or Bank1, but the Descriptor Table MUST be present in Bank0.

Here is the calling process for KEY file access from machine language:

```
          BASEXT=$FC74 (64628.)

KEYCAL    LDX #<DESTBL; low-byte of address of Decriptor Table
          LDY #>DESTBL; high-byte of address of Descriptor Table
          JSR BASEXT    ; execute KEY operation
          BCC GOOD      ; if carry clear, operation was sucessful
                        ;
                        ;
ERROR     STA ERRCOD    ; .ACC contains ERROR code if carry set
                        ; on return
                        ; process error
                        ;
                        ;
GOOD                    ; continue with KEY file operations
                        ;
                        ;
```

```
DESTBL   .byte MODE      ; same MODE values as BASIC version
         .byte LFN       ; logical file-number of OPENed KEY file
         .byte DIR#      ; DIRECTORY # of KEY file to acess
                         ; (see note below)
         .byte KEYLEN    ; length in bytes of KEY addressed next
         .word KEYADR    ; memory address of KEY string
                         ; (low/high order)
         .word REC#      ; RECORD NUMBER associated with KEY
                         ; (low/high order)
```

Just as in the BASIC versions of KEY file access, any portion of the Descriptor Table considered a 'return' value from the KEY operation will be filled in by the Lt. Kernal during Key operation.

The carry flag is cleared if there is no error, and set if an error occurred. If any error occurred, then the accumulator will contain an error value identical to the BASIC versions of the operation.

All registers are USED for communication to KEY operations, and you may consider that ALL REGISTERS ARE MODIFIED by KEY operations.

In C-64 operation, the Decsriptor Table MUST reside in BANK0, but the KEY string may reside in either bank.

By OR'ing the DIR# value with $80, the Lt. Kernal is directed to seek the KEY in ram-BANK1. A DIR# value less than $80 directs the KEY to be found in BANK0.

This is the general form of machine language KEY file access. The MODE value and expected returns will change from mode to mode, but will match those expected in the BASIC versions of KEY file access.

The **INSERT** key command - mode=1

SYS 64628:1,lfn,directory,Stringvar,recl,rech,status

This command inserts a new, unique key into the selected directory. In addition to the lfn # and directory #, you must supply:

The EXACT key to insert (length = key-len)

The record number in recl and rech to be associated with the KEY.

The variable status returns from INSERT are:

0	INSERT successful
2	invalid key length (key supplied is longer than key length for directory)
4	DIRECTORY full - insert cannot occur
5	KEY already exists, cannot duplicate keys

If directory full status (4) occurs, a SHUFFLE may fix the condition: more on that later.

If status 5 (key exists) is returned, you must either change the key you supply, or DELETE the key from the directory, then re-insert it.

The **DELETE** key command -mode=2

SYS 64628:2,lfn,directory,Stringvar,recl,rech,status

This command attempts to delete a key from the selected directory. In addition to the lfn # and directory #, you must supply:

The EXACT key to delete (length = key-len)
The EXACT record-number in recl and rech already associated with the KEY.

The variable status returns from DELETE are:

0	DELETE successful
2	invalid key length (key supplied is longer than key length for directory)
5	KEY not found, or record number supplied does not match record number already associated with KEY found.

The **SHUFFLE** directory command - mode=7

SYS 64628:7,lfn,directory,Stringvar,recl,rech,status

Because of the manner in which B-tree key insertions occur, sometimes there will not appear to be an available slot for a new key, even when sufficient space exists in a directory. SHUFFLE attempts to re-order the KEYS in an existing directory to make slots available.

If an attempt to INSERT a key returns a status of 4 (directory full), you should SHUFFLE the directory, and attempt the INSERT again. If, after TWO ATTEMPTS to SHUFFLE and INSERT, the directory full status is still returned, you may actually consider the directory to be full.

You must supply:

The logical file number of the KEY file already OPEN.
The directory number of the directory you wish to SHUFFLE.

There are only two variable status returns from SHUFFLE:

0	SHUFFLE completed (NOT an indication that slots were freed up)
2	No keys in directory (SHUFFLE not done)

The SEARCH commands

The SEARCH key command - mode=3, 4, or 5

exact-match SYS 64628:3,lfn,directory,Stringvar,recl,rech,status
greater-than SYS 64628:4,lfn,directory,Stringvar,recl,rech,status
less-than SYS 64628:5,lfn,directory,Stringvar,recl,rech,status

The SEARCH commands allow you to very rapidly search a directory for a particular key, based on variable criteria.

In addition to the logical file and directory numbers, you must supply:

The SEARCH mode
and
The KEY for which to search (length < =key-len)
for exact-match, length = key-len

The variable status returns from SEARCH are:

0	KEY satisfying criteria found
2	invalid key length (key supplied is longer than key length for directory)
5	KEY satisfying search criteria NOT found

SEARCH ALWAYS RETURNS THE KEY FOUND WHICH SATISFIES THE SEARCH CRITERIA IN Stringvar, and the record number associated with that key in recl and rech.

If no satisfactory key is found, Stringvar is unmodified, and recl and rech are meaningless.

An exact match is satisfied when the KEY (including pad characters) exactly matches the Stringvar in length, and character-by-character.

A greater-than match is satisfied when the first KEY logically greater than the supplied Stringvar is found.

A less-than match is satisfied when the first KEY which is logically less than the Stringvar supplied is found.

As an example of how to use KEY files on the Lt. Kernal, we're going to build a dictionary application in BASIC. The dictionary will hold up to 6750 words of up to 30 characters in length.

Each word will have a text definition keyed to it. The dictionary will permit us to have a total of 65535 lines of 40 characters assigned to definitions of words. Any single word may use up to 20 forty-character lines for its definition.

When searching for a word in the dictionary, if the word is not found, the dictionary will display the words alphabetically surrounding it, and give you an opportunity to display the definition of one of them, or to enter the new word into the dictionary.

If all that sounds like it will take a pretty large, slow BASIC program to accomplish, you're in for a pleasant surprise! Not only does it take only 39 lines of program to build such a dictionary, but it takes less than one second to find any word already in it, or to determine that the word is not there!

Because of the length of the example, the actual program appears in APPENDIX i.

The CONFIG processor

CONFIG is a powerful (and potentially dangerous!) utility program which allows you to set many system defaults. DO NOT use CONFIG until you have become comfortable with the LU and User structure of the Lt. Kernal. You may change several power-on characteristics of the system including screen, border, and character colors, the hard disk device number, the logical unit (logical drive) and user (subdirectory) onto which the system first 'logs' or establishes operation, and the sizes of the various logical drives which the system may emulate.

For the most part, CONFIG is self-documenting, and will prompt you through the changes it can accomplish. Once you exit CONFIG properly, any characteristics of the system you have set will remain that way EVERY TIME you turn on the power to your system.

Only a few points of CONFIG need explaining. The first is the 'beep flag'. When the beep flag is set to 1 (one) the beeper is enabled. After that, any time you issue a CHR$(7) through a BASIC print statement or a byte of value 7 through the KERNAL's BSOUT routine, the Lt. Kernal will issue an audible 'beep' through the monitor's speaker. This feature is provided simply as a convenience to programmers so that you do not have to maintain SID drivers in your C-64 programs just to issue audible prompts.

When the beep flag is set to 0, CHR$(7) has no effect in the C-64 mode (the C-128 does its own beeps). This character is NOT reserved in the Commodore-64 character set for any special purpose and is not a printable character. Usually, it is desirable to keep the beep flag enabled because all Lt. Kernal DOS error messages use the beep, when enabled, to alert you that an error has occurred.

The second point of CONFIG explanation concerns the default logical unit number. This point is only critical inasmuch as it affects the AUTOSTART and CP/M features of the Lt. Kernal DOS.

When the Lt. Kernal first powers up, or after a hardware reset, it FIRST switches to the logical drive defined in CONFIG and THEN searches for a file by the name of AUTOSTART. If you wish to use the AUTOSTART feature of the Lt. Kernal, make sure that the program you have named 'AUTOSTART' resides on the same logical drive that you have named as the default in CONFIG.

The CP/M DEFAULT LU is that 'CP/M-type' LU which is presently accessible via the GOCPM command.

You may define several of these LU's on your system, but only ONE is accessible to GOCPM at a time.

The third point concerns the hard drive's default hardware device number. The only special situation here is when the hard disk and a floppy drive BOTH carry the same device number.

This is a special and very desirable situation, contrary to first appearances. In this situation, any COMMODORE-SYNTAX LOAD request directed to the system either through BASIC or the KERNAL vectors will be directed first to the hard disk. If the file requested is not found on the hard disk, the request will be AUTOMATICALLY referred to the floppy disk (neat, huh?). Requests to load a file via the Lt. Kernal's abbreviated 'L' load command, or by direct invocation will not be referred to the floppy disk. The automatic referral of LOAD commands only applies when both the hard disk and the floppy disk carry the SAME hardware device number (usually 8).

If this 'AUTOACCESS' feature interferes with a particular application, you may turn it off via CONFIG.

The last point of CONFIG to discuss is the most complex, and to a degree, somewhat hazardous. The point at issue is the CONFIGuration of logical unit (logical drive) parameters.

Briefly, let's discuss how the Lt. Kernal (and most hard disk systems) allocate space on the disk.

In a floppy disk environment, space on a diskette is usually parcelled out in units known as SECTORS or BLOCKS. A sector is the smallest unit of data which a floppy disk may read or write at one time.

A hard disk also may read or write as little as one SECTOR of data at one time: Hard disks, however, have HUGE numbers of sectors available. In order to make those numbers more managable, most hard disk systems allow you to allocate (set aside for future use) sectors in groups. The largest number of sectors which may be accessed on a hard disk without requiring any mechanical repositioning of the 'heads' (the part which physically reads and writes data) is known as a CYLINDER.

Thus, the CYLINDER becomes the smallest unit of storage which may be allocated on the Lt. Kernal. Remember that allocating space doesn't use it up; It only sets that space aside for use later. When programs or files use that space, they use it on a sector-by-sector basis.

On the Lt. Kernal system, a CYLINDER contains 68 SECTORS, each of which is twice the size of a 1541 sector (or block). The Lt. Kernal stores data in 512-byte sectors, and the 1541 in 256-byte sectors. Since a cylinder contains sixty-eight sectors, that is the minimum increment of space you may allocate to a logical drive (LU).

The Lt. Kernal DOS resides on LU 10, and that logical drive is always fixed in size at 30 cylinders; You may not change its size. All other LU's (0-9) sizes are user-definable via CONFIG.

An LU or logical drive must contain at least enough space for the 'BAM' and 'INDEX' which constitute the directory storage area for that LU. Since any Lt. Kernal LU may hold up to 4000 directory entries, the MINIMUM amount of space you must allocate for a new LU is 16 cylinders, or 1088 hard disk blocks. After the creation of the BAM and INDEX, which collectively use 272 blocks, that leaves 816 blocks available on the LU for your files. That works out to about as much space as 2-½ full 1541 diskettes.

That's the minimum space you may allocate to a new logical drive. You can allocate more space in CYLINDER increments, up to a maximum 911 cylinders. Since that's more than the number of cylinders available on a 20 megabyte drive, there is no practical limitation to the size of a single LU, other than the remaining un-allocated capacity of your drive.

CONFIG will not allow you to allocate less than 16 cylinders to a new LU, nor will it permit you to allocate more space than that which is available. Those restrictions are automatic - you don't need to do any math to use CONFIG.

When CONFIG is caused to enter the SET LU PARAMETERS mode, it will respond with the CURRENT logical unit boundaries in table form. You will be given the current total cylinders available on the hard disk, along with the current cylinder boundaries of any already defined logical units. CONFIG will allow you to establish new cylinder boundaries for any logical unit with the following constraints—

No logical unit may ever overlap an existing logical unit. CONFIG will prevent you from declaring any LU boundary which overlaps an existing LU boundary. If you wish to expand a logical unit to a point which will overlap an existing logical unit, you must first shrink the conflicting LU in the appropriate direction. To shrink an LU, you must first delete the LU's entry, then re-declare its boundaries.

IF YOU MOVE THE LOWER BOUNDARY OF AN ALREADY USED LU, ALL FILES ON THE LU WILL BE LOST. If you shrink an LU by moving its upper boundary, SOME files may be lost, depending on how full (and how old) the LU is, and a NEW LU created just above it may also be endangered.

The only safe way to re-define an LU's size is to AUTOCOPY all of its files to another LU, redefine its size, ACTIVATE the LU, then AUTOCOPY the files back.

The total cylinders ascribed to all logical units defined in CONFIG may not exceed the total cylinders available on the hard disk. CONFIG will prohibit this.

Now the one point of danger. CONFIG REQUIRES that YOU record the logical unit parameters you have established. You may direct your LU parameters to the printer or the screen, but once you have selected a destination for the parameters, you MUST record and save them for future reference!

RECORD AND SAVE your LU parameters list every time you change LU parameters —

THIS IS **YOUR** RESPONSIBILITY!!!

When you establish a NEW LU via CONFIG, you will be given the option to create a 'DOS image file'. The DOS image file is an optional feature of the Lt. Kernal which tremendously enhances the speed of file access on LU's physically distant from the DOS LU.

When the DOS is running, it must continually refer back to the DOS LU to bring in DOS overlays (the term we use to describe the various program modules of the DOS). Every time an overlay is required, the disk drive must physically reposition its 'heads' from the LU you are using to the DOS LU (lu 10), and then back again.

The further (in cylinders) your working LU is from the DOS, the longer that process takes. In order to speed it up, we offer you the ability to build a COPY of the run time modules of the DOS on each LU you create. The pay off is a dramatic increase in speed of Lt. Kernal file access. The cost is space.

A DOS image file uses 222 hard disk blocks. In most instances, you won't even miss this small (?!) amount of space. If your system is full right up to the gills, though, you may opt not to create DOS image files.

You may FORCE an update of the Lt. Kernal DOS image files on all LUs at any time. This is provided so that you may 'refresh' the DOS images if you ever suspect one of them may have been corrupted (by a power failure during a 'write' operation, as an example).

Simply issue the CHECKSUM command, and once it has been completed, reset your system. As soon as the system boots back up, all Lt. Kernal DOS image files will be updated automatically.

Once you have defined an LU, you may assign a 'type' to it. The types are *regular* and *CP/M*. Since the ACTIVATE process operates differently on the two types, you must assign a 'type' to an LU before you ACTIVATE it.

Once you have defined a new LU or changed the size of an old one, and exited CONFIG, you must run ACTIVATE which always totally erases all files except DOS image files, and creates a new BAM and INDEX on the LU. It is not safe to use an LU which has not been ACTIVATEd, since an old BAM and INDEX may still exist which do not properly reflect the new physical size of the LU. THIS COULD EVEN ENDANGER AN LU PHYSICALLY ADJACENT TO THE 'BAD' LU. The only exception to this is when the EXACT original parameters of an LU are re-established after a SYSGEN, as discussed below.

One final note about CONFIG concerning doing a SYSGEN. The files on LUs 0-9 will remain intact. Logical unit 10 is ALWAYS completely overwritten by a SYSGEN.

We do not prohibit your using logical unit 10. In fact, the utility programs you wish to be accessible from ALL other logical units should be placed on LU 10. Remember, however, that LU 10 is COMPLETELY ERASED AND REPLACED during a SYSGEN. Any programs you wish to preserve on LU 10 should be copied to another LU or to floppy disk before you do the SYSGEN.

THE SYSGEN UTILITY

SYSGEN is contained only on distribution diskette(s) supplied with the Lt. Kernal DOS upgrades. To receive the Sysgen disk, you must fill out the FISCAL INFORMATION registration card and mail to Fiscal Information, Inc.

Please note: Your floppy disk MUST be set as drive #8 to SYSGEN.

SYSGEN creates a new DOS on the hard disk. It completely replaces the area reserved for LU 10 with a NEW LU 10 which contains the DOS supplied on the distribution diskette(s).

The distribution diskette(s) you receive with your Lt. Kernal DOS update are produced on OUR floppy disk drives. That's important because your floppy disk drive may not be in exactly the same align-

ment, or run at exactly the same speed as ours. That's why we encourage you (read this as INSIST) to copy all the surfaces of your distribution diskette(s) to your OWN diskettes before attempting a SYSGEN.

Our distribution diskettes are not copy protected. You purchased them; you have the right to copy them as many times as necessary to protect their contents. They do not contain programs as such, however, so you MUST use some sort of 'image' copier like 'DISECTOR' or 'THE CLONE MACHINE' to copy them. Be sure to copy the WHOLE of each surface, NOT JUST 'ACTIVE' SECTORS.

Most image-copy routines like those mentioned report any errors encountered during the copy process. If you encounter ANY errors while copying a Lt. Kernal DOS diskette, there has been a problem and you should attempt the copy again. WE PLACED NO ERRORS on your diskettes intentionally. As you copy the surfaces of the Lt. Kernal SYSGEN diskette(s), label each new copy consecutively as 'A', 'B', 'C', etc.

When SYSGEN is run, it will ask for the insertion of diskettes 'A', 'B', 'C', and so on, as necessary. Keep your labels straight, and make sure that the copies are made on the disk drive you intend to use for SYSGENing a new system.

Doing the actual SYSGEN is simple. Place the 'A' diskette in your floppy drive and press the SPACE bar then type:

```
LOAD "*",8,1
```

Once SYSGEN starts, you must not attempt to interrupt the process except for the following: SYSGENing to upgrade your Lt. Kernal DOS from versions 6.0 to 7.0 REQUIRES that you record your LU parameters pior to the SYSGEN and manually re-establish them after the SYSGEN.

SYSGEN is simple. Just follow the prompts and insert each new disk ('A', 'B', 'C', etc.) as requested. When SYSGEN has completed, do a complete power-down and reset of your system before attempting any other functions. If SYSGEN passes all the CHECKSUM passes that it makes for both the floppy disk and the hard disk, you can feel CERTAIN that the SYSGEN was *completely* successful.

X

ADDENDA/ERRATA and BUG FIXES AND PATCHES

This section is reserved for addenda describing discovered software problems, the fixes, and DOS versions reflecting the fixes. Please insert addenda supplied with any DOS updates in this section.

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XI

TROUBLE-SHOOTING

We hope you never have to trouble-shoot your Lt. Kernal hard disk system, but shipping, even in the best of containers, can be hard on mechanical devices. Your Lt. Kernal system was fully tested and burned-in at the factory before it was shipped. It should arrive in perfect working order.

General Procedures

Trouble shooting any system should follow a strictly ordered procedure. Only after verifying that each prerequisite feature is in order should the next feature be checked. The following guide will step you from the most elemental causes of system failure through to some more complex possible causes. Usually the cause of failure WILL be one of the simpler ones.

Regardless of how ridiculously simple an item might seem, check each item carefully and in the order indicated. Doing so will lead you to a quick resolution of the problem. You may fail to find the problem if you skip steps, or be led down a long and fruitless path making you retrace many previously checked points.

TROUBLE—SHOOTING GUIDE

I. CABLING
- A. DATA CABLE and ADAPTOR BOARD
  1. Check cable connection at Lt. Kernal Host Adaptor and hard disk enclosure
     - a. Check for proper pin 1 alignment
     - b. Check for full and even insertion
  2. Check Lt. Kernal Host Adaptor insertion into computer
     - a. Check that Host Adaptor nose is properly aligned with expansion port slot inside computer
     - b. Check that Host Adaptor is fully and evenly inserted into computer expansion slot
     - c. Check for proper connections of jumpers, HIRAM and CAEC cables, and the C-128 cable.
- B. POWER CONNECTIONS
  1. Check cord entry to Lt. Kernal hard disk enclosure
     - a. Check that power cord is fully inserted
     - b. Check that power cord is plugged into a functional outlet for the correct voltage and frequency of power
     - c. Check that hard disk power switch is ON at appropriate point in power-up sequence

II. FUNCTIONAL TESTS

FIRST — Check your computer without the Lt. Kernal Host Adaptor plugged in. If it performs normally, then reinstall the Host Adaptor and proceed.

A. SYMPTOM — SCREEN remains blank indefinitely, or remains blank for about 1 minute then the normal Commodore sign-on messages appear WITHOUT the Lt. Kernal messages.

1. A blank screen is normal on the C-128 if the 2 mhz fast mode is selected in the C-64 mode. Remedy by returning to the 1 mhz mode.

1. Check the internal fan to see if the Lt. Kernal is running — IF NOT:
   a. Check that the Lt. Kernal power switch is ON
   b. Check that the POWER CORD is firmly seated in the receptacle on the rear of the Lt. Kernal hard disk enclosure
   c. Check that the POWER CORD is firmly seated in the outlet into which it is plugged
   d. Check with another device (such as a lamp) that the power outlet used for the Lt. Kernal IS ACTUALLY supplying power
   e. Check the Lt. Kernal's fuse
      - remove the power cord from the Lt. Kernal's power receptacle
      - gently unscrew the cap of the fuse holder until the cap and fuse together are removed
      - carefully pull the fuse and the cap apart
      - inspect the fuse. If necessary, check the fuse with a continuity checker. If it is blown, replace it ONLY with the exact original type.

2. Check the ribbon cable
   a. Check for full, FIRM, and even insertion of the cable into its connections at both ends
   b. Check that pin 1 of the cable corresponds to pin 1 of the connectors on both the Host Adaptor and the drive enclosure
   c. Check that the cable has not been torn or frayed at any point especially CLOSE to its connectors
   d. ONLY IF THE POINTS ABOVE CHECKED OK, then remove the ribbon cable from its connections and check the pins inside each connector to see that no pins have been bent or broken by improper insertion of the cable
      — if any pins are bent, GENTLY staighten them with a small, flat tool like a cosmetic 'orange stick' or a very small screw driver

— if any pins are broken, you may have to return your Lt. Kernal to Xetec, Inc. for repair. Call our technical support for service.

3. Check computer's power supply
   a. Check the red POWER indicator on your computer. If it seems dim or is not on at all, suspect either a bad computer power supply, or a defective Lt. Kernal Host Adaptor
   b. Test you computer / Lt. Kernal combination with another known-good computer power supply (preferrably one of the NEWER ones)
   c. If the above checks do not resolve the problem, check your computer and power supply with any large cartridge (i.e. Commodore's CP/M cartridge)

B. SYMPTOM — Your Lt. Kernal works properly for a time (seconds to hours), then begins to behave erratically, or screen colors begin to change for no apparent reason, or the system ceases to function entirely

THIS IS THE MOST COMMONLY REPORTED PROBLEM WITH THE LT. KERNAL SYSTEM (and all systems which use large, active cartridge modules)

The Lt. Kernal Host Adaptor has been designed very conservatively. It draws less than two-thirds the amount of power from the computer that Commodore specifies it may. Yet MANY power supplies do not meet even Commodore's own specifications for supplying extra power to accessory devices.

Try a different power supply. The newer 'potted' version seems a little better at supplying extra power than the original design. The IDEAL solution is to obtain one of the excellent third-party designed supplies which GUARANTEE to meet or exceed Commodore's specifications.

C. SYMPTOM — The Lt. Kernal does a 'double boot'. The screen briefly displays the sign-on message at the top, then it shrinks horizontally and returns to a NORMAL sign-on screen WITHOUT the Lt. Kernal messages.

Your DOS software resident on the hard disk HAS BEEN DAMAGED. The DOS loader has sensed the damage and turned itself and the Lt. Kernal Host Adaptor off.

AT THIS TIME YOU HAVE ONLY ONE METHOD OF RECOVERY AVAILABLE.

YOU MUST PERFORM THE 'SYSGEN' PROCESS. SYSGEN will not by itself destroy any of the software you have on logical drives 0—9, but will destroy all files on logical drive 10.

DEPENDING ON WHAT CAUSED your DOS to be corrupted, you may also have to perform a FORMAT of the hard disk. FORMAT will always DESTROY ALL DATA you have stored on the hard disk.

Turn to the section 'THE SYSGEN UTILITY' if your Lt. Kernal does a 'double-boot'.

D. SYMPTOM — The system displays the first couple of lines of sign-on messages, then just 'hangs' and never displays the 'READY' prompt.

Your DOS software has been corrupted, as previously described under 'double-boot'symptoms.

Turn to the section 'THE SYSGEN UTILITY' if your Lt. Kernal displays this symptom.

E. Your hard disk begins to make a high-pitched whistle which continues, but the system appears to behave normally otherwise.

This is an annoying symptom which is present to some degree on almost every brand of small hard disk. We have chosen a brand which is not inclined to 'squeal', but still, it might happen.

The whistle or squealing noise is caused by dust particles contaminating one of the rotating parts of the hard disk. It will not interfere with normal use and the noise will usually subside within minutes (to hours) after it begins. Drives allowed to sit for several hours between uses are most apt to display this symptom. Drives in continuous duty (like BBS systems) almost never make this sound.

F. SYMPTOM — Your hard disk enclosure gets very warm or hot to the touch.

QUICKLY, SHUT THE SYSTEM DOWN!! Your Lt. Kernal is fan-cooled. Normally, the only warm area will be around the ventilation exhaust slots. If the top or sides of the hard disk enclosure begin to get warm, it's a good indication that the ventilation slots in the enclosure have either been blocked, or that the fan has failed (possible due to dust accumulation).

NEVER RUN THE LT. KERNAL WITHOUT
THE FAN IN PROPER WORKING ORDER!

RETURN POLICY

Do not return any Lt. Kernal to Xetec without a RETURN MATERIAL AUTHORIZATION number (RMA#). If a RMA# is not clearly marked on the outside of the shipping carton, the product will be refused.

Call (913) 827-0685 to obtain a RMA#.

Prepare the drive for shipment using the "SHIP" command described on page 8-35.

Use the original carton or equivalent, insure shipment or assume the risk of loss or damage in transit, and pre-pay the shipping charges.

Send a letter with the Lt. Kernal detailing the specific problem. This will speed up the return of your unit.

If the unit is under warranty, include a copy of the proof of purchase. If this is not included, you will be billed for the repair.
NOTE: The limited warranty will be honored only if the XETEC, Inc. registration card is completed and mailed to Xetec.

REMEMBER, follow these steps:

1. Obtain a RMA #
2. Prepare drive for shipping using "SHIP" command
3. Use the original carton or equivalent.
4. Insure shipment.
5. Pre-pay shipping charges.
6. Include a letter describing the problem
7. Include proof of purchase, if under warranty

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XII

DOS SYSTEM UPDATES and ENHANCEMENTS

To qualify for DOS updates, you must have REGISTERED with FISCAL INFORMATION, Inc. by filling out the Fiscal registration card.

Certain enhancements are to follow and will carry charges. Notices will be sent to registered owners only.

The limited warranty will be honored only if the XETEC, Inc. registration card in completed and mailed to Xetec.

'BUG' REPORTING

Unfortunately, every system of software will eventually be discovered to contain 'bugs' or errors in programming. We have made every effort to ensure that the Lt. Kernal DOS is bug-free. If you do find a software defect, PLEASE REPORT THE PROBLEM AS SOON AS POSSIBLE to us on a copy of the form which follows. We truly wish to make the Lt. Kernal error free, and will give every formal 'bug' report close and careful consideration.

The bug reporting form appears separately on the next page so that you may photo copy it as necessary.

PLEASE LIMIT your trouble reports to ONE problem per form. You may, however, send more than one bug report per envelope.

LT. KERNAL DOS REPORT FORM

THANK YOU FOR YOUR ASSISTANCE IN IMPROVING THE LT. KERNAL!

Please report only ONE problem per form, however, you may send more than one form per envelope.

Please answer all questions, if possible.

SERIAL NUMBER _____

DOS VERSION/REVISON # _____

Date of problem / / Approx. time of day _____

C-64 or C-128 (circle one) & computer serial # _____

Approx. how long have you owned your Lt. Kernal system? _____

Does the problem occur under identical circumstances WITHOUT the Lt. Kernal Host Adaptor module plugged in? (circle) Y or N

Approx. how long had the system been turned on before the problem was detected? _____

Does the problem appear immediately with a cool system and power supply, or only after a period of warm up?

(circle) COOL WARMED UP

If you circled WARMED UP, how long must the system warm up before the problem FIRST begins to occur? _____

Please describe the problem and all surrounding circumstances in as much detail a spossible. Include NAMES and VERSIONS if other commercial software/hardware products are involved. Use the back of this form if more space is required.

_____

_____

_____

_____

_____

XIII

Installing CP/M™ on the Lt. Kernal

Using CP/M™

CP/M operates EXACTLY the same on the Lt. Kernal as it does on floppy disks, except for the speed of disk access. Depending upon the model of Lt. Kernal system you own, CP/M will run on the hard drive at a speed of 80% to 103% the *speed of RAM disk!* That's FAST!

The Lt. Kernal defaults to the 'L' drive under CP/M and supports all existing floppy types as well as RAM disk. It is invoked simply by typing GOCPM from the C-64 or 128 modes, or by CONFIGuring CP/M as the default mode on power-up.

That's all you need to know to use CP/M on the Lt. Kernal. This is not intended to be a CP/M manual. If you do not already know CP/M, you need to study how to use it before attempting to BUILDCPM on your Lt. Kernal.

Building CP/M™

We cannot distribute CP/M on the Lt. Kernal without infringing on the copyrights of Digital Research, Inc., the authors of the product. However, what we can provide is a mechanism whereby you may copy the CP/M system to the hard disk and enable THAT disk to become the system's default drive.

FIRST OF ALL— because of the way Commodore chose to implement CP/M, the Lt. Kernal CP/M support modules are *version dependent.* There is only ONE version of Commodore's 128 CP/M which will run on the Lt. Kernal. It is the

December 1985 Release which supports RS-232 devices

You can only tell the Release Date by 'Booting' CP/M. This release is the most recent U.S. one of Commodore CP/M at the time of the writing of this manual, and is widely distributed. Again, it is the ONLY version which will work with the Lt. Kernal.

SECOND— you will have to enable the 'I/O-1 page' option on your Lt. Kernal Host Adaptor. CP/M expects RAM disk to be present in the 'I/O-2 page' which is the *other* way the Host Adaptor can be set. If you have not already enabled the 'I/O-1 page' option, do it now before proceeding.

THIRD— if you desire to use RAM disk with your Lt. Kernal CP/M, you MUST build it on the CP/M LU with RAM disk PRESENT. CP/M built without a RAM disk installed will not support one later. It is possible, however, to re-build CP/M on an LU at a later date WITHOUT disturbing any of the files already saved on that LU. CP/M built with RAM disk amy be used without it.

Steps for the building of a CP/M LU:

1. You will need to CONFIGure an LU for CP/M use and ACTIVATE it. That entirely erases the LU, and prepares it for the CP/M operating system. You may rebuild the CP/M system on that SAME LU later without ACTIVATEing the LU.
2. Create a CP/M diskette containing CP/M and the following additional files:

   PIP.COM
   SAVE.COM
   ERASE.COM

   The files CCP.COM and CPM+.SYS will have been placed on the diskette already by the COPYSYS command which create it.

   You may build CP/M on the Lt. Kernal using either a 1541 or a 1571 floppy drive. Even though it takes a bit longer on the 1541, it will not affect the final speed of the Lt. Kernal version.
3. From the 128 mode of operation, type BUILDCPM and press return. if you have prepared the LU and Host Adaptor properly, you will soon be prompted to insert your CP/M 3.0 diskette. Do so and press return again.
4. You will see the familiar CP/M boot message appear, and soon the system will issue the CP/M 'A' prompt. DO NOTHING ELSE EXCEPT EXACTLY the steps below:

type	SAVE <return>
wait for the 'A' prompt, then type	CCP <return>
wait for the 'A' prompt, then press	CONTROL and C keys down together

5. The SAVE processor will now be invoked, and will prompt you for:

prompt	you enter
FILE—NAME	T.COM <return>
Starting hex Address	4000 <return>
Ending hex Address	40ff <return>

   The floppy disk will churn awhile, then you will be returned to the 'A; prompt again.

Once the the Lt. Kernal has gone to CP/M, it then looks at the 40/80 key as a *speed switch*. If it is UP (40 column setting), the Lt. Kernal accesses the disk at 1 MHz. If it is in the 80 column position, the Lt. Kernal automatically shifts to 2 MHz during disk operations. The 40 column display cannot OPERATE at 2 MHz but the Lt. Kernal ONLY shifts speed DURING disk access, so 2 MHz operation causes violent screen flickering WHILE READING FILES. If you do not mind the flickering, you can make the Lt. Kernal go *Full Speed Ahead* even with a 40 column display.

Remember, you can BUILDCPM in either 40 or 80 column modes and still use it in either mode simply based upon the position of the 40/80 key when you issue the GOCPM command.

That is all there is to it! Enjoy your new CP/M power and speed — only on the *Lt. Kernal.*

Warning: We are approaching the only unreliable part of the process. Up until now, CP/M has been in *exclusive control* of the computer. Now we have to 'trap' it and place the Lt. Kernal back in control. If the following step fails, you will have to re-boot CP/M and return directly to THIS next step. You DO NOT have to re-SAVE the T.COM file above.

6. Now type T <return>

   The message will prompt you to press your I.C.Q.U.B. button located on your Host Adaptor. *Firmly* and *quickly* press and release the button. Within ten seconds you should see the Lt. Kernal hard disk access light come on almost solidly. If the light does not come on within that time, re-boot your system and try this step again.

   It works perfectly the first time 9 out of 10 tries, but occasionally CP/M just will not yield control to the Lt. Kernal. When that happens, we find it is MOST likely to work on the next try if you turn power to your 128 off for at least 10 seconds before trying again.

   If the Lt. Kernal has gained control of CP/M, you will see the access light stay on solidly for about five seconds and your system will respond with the 'L' (Lt. Kernal) drive prompt.

7. Follow the next few steps EXACTLY:

type	A: <return>
wait for 'A' prompt, then press	CONTROL and C keys together
wait for 'A' prompt, then type	PIP L:=*.*[rv]<return>

   All files will be copied from the 'A' drive to the 'L' drive, and they will be verified after copying.

If PIP returns without errors, you have successfully built a CP/M operating system on this LU. You may now PIP any files you choose to the 'L' drive. We suggest that you copy all your utility software to USER 0, and use SET.COM to make all your utilities *SYSTEM* type files. It is also a good idea to use SET.COM to force all utilities to RO (Read Only) so you cannot accidentally erase them.

Operating Speed

The Lt. Kernal cannot speed up the floppy disk, but you will be amazed at the speed of loading and copying files on the Lt. Kernal. You can even further speed up the operation of a 40-column system, if you do not mind a little (very unattractive) screen flickering.

The Lt. Kernal CP/M BIOS looks at the 40/80 column key on the 128 as a signal for which mode to boot in. If you wish to use CP/M in the 40 column mode, be in the 40 column mode when you GOCPM. Likewise for the 80 column mode.

APPENDIX I

KEY File Programming Example

The following program implements a complete 'dictionary' on the Lt. Kernal. This is NOT intended to be an example of good programming practice, or even to demonstrate the limits of the KEY file system, but rather to serve as a fairly good example of a (simple) KEY file application.

Lines 1-89 aren't even really part of the dictionary application. They comprise a BASIC full-screen editor to make your life a little easier when entering the word definitions into the dictionary's 'definitions' file.

Lines 91-249 actually demonstrate KEY files. The editor code is placed at the beginning only to make it run faster.

This is a very simple, single KEY system. The organization is:

- One KEY file with one directory of 6750, 30 character 'word' keys. The record numbers associated with the keys point directly to a specific record in the definitions (RELative) file.
- A definitions file. This RELative file is intially OPENed for a record length of 41 characters. Each screen line entered in a word's definition occupies a single record, with the leading character of each record set to ' " ' (quotation mark) to allow punctuation to be INPUT from BASIC.

The record number fetched from a SEARCH of the KEY file points to the FIRST record of definition. That record contains a single numeric value defining how many lines of text definition follows.

That means, of course, that one record is 'wasted' for every definition in the file. In a two-tiered KEY system, the definitions' lengths could be contained in yet another KEY file with keys of only 5 characters in length. Remember that KEYs may be ANY text, even print images of numeric values. With that in mind, the record number derived from the word search could BOTH point to the first line of definition in the RELative file, AND be used as a KEY to find the length of the definition in another KEY file. The multi-tiered keying can be carried on infinitely, for very complex search criteria.

An organization diagram for a short, theoretical version of our dictionary follows:

The file 'DICTKEYS' contains the words. The file 'DEFINITIONS' contains the text of the definitions. Record #1 of that file also contains a pointer to the NEXT available record in itself.

	KEY FILE	RELative file
name	'DICTKEYS'	'DEFINITIONS'
org.	6750 keys (words)	up to 65535 lines
	of 30 char.	of 41 char.

KEY	REC—NUM	RECORD	DEFINITION
APPLES	2	1	11 (next avail. rec.)
FIGS	4	2	1 (length in lines)
MONEY	9	3	"RED fruit"
ZEBRA	6	4	1
		5	"YELLOW fruit"
		6	2 (2 lines of def.)
		7	"A horse-like,"
		8	"African animal."
		9	1
		10	"coinage"

In order to use the program which follows, you must first build the KEYs file. This needs to be done only once.

Enter the command BUILDINDEX
Supply the file name 'DICTKEYS'
Request 6750 keys
Request ONE directory, and
a KEY length of 30.

The program will automatically create and intialize 'definitions', the RELative file. You will supply the words and the definition text when the program is run.

The program follows:

```
1 GOTO 173:REM SETUPS
3 REM BASIC FULL-SCREEN EDITOR
5 REM RETURNS UP TO 20 FULL LINES IN E$(1-20)
7 REMEMBER TO DIM E$(20) BEFORE CALLING
9 REM
11 REM
13 REM
15 PRINT"{clear}";:FORI=1TO20:E$(I)="{40 spaces}":
   PRINT
17 NEXT I:X=1:L=1
19 PRINT"    ENTER          PRESS 'RETURN' HERE
   ^";
21 PRINT" DEFINITION        WHEN DONE EDITING.
   {home}";
23 GETG$:IFG$=""THENGOSUB85:GOTO23
25 IFG$="{clear}"ORG$="{home}"THENX=1:L=1:
   PRINT"{home}";:GOTO23
27 IFG$="{insert}"THEN23
29 IFG$="{right}"ANDL=20ANDX=40THEN23
31 IFG$=CHR$(13)ANDL=20ANDX=40THENRETURN
33 IFG$="{right}"THENPRINTMID$(E$(L),X,1);:
   GOSUB67:GOTO23
35 IF G$="{up}"ORG$="{down}"THENPRINTMID$(E$(L),X,
   1)+"{left}";:GOSUB75:PRINTG$;:GOTO23
37 IFNOT(X=40ANDL=20)ANDG$<>"{left}"AND-
   G$<>CHR$(13)ORG$=CHR$(20)THEN PRINT" {left}";
   G$;
39 IF G$="{left}"ANDL=1ANDX=1THEN23
41 IF G$="{left}"THENPRINTMID$(E$(L),X,1);G$;
   "{left}";:GOSUB59:GOTO23
43 IFG$=CHR$(20)THENGOSUB55:GOTO23
45 IFG$=CHR$(13)ANDL=20THEN23
47 X1=0:IFG$=CHR$(13)THENPRINTMID$(E$(L),X,1);
   "{left}":X1=X:X=1
49 IFG$=CHR$(13)ANDX1=40 THENPRINT"{up}";
51 IFG$=CHR$(13)THENGOSUB77:GOTO23
53 GOSUB63:GOTO23
55 IFX=1THENE$(L)=" "+RIGHT$(E$(L),39):GOTO59
57 E$(L)=LEFT$(E$(L),X-1)+" "+RIGHT$(E$(L),40-X)
58 X=X-1:IFX<1THENX=40:L=L-1:GOTO79
61 RETURN
63 IFX=1THENE$(L)=G$+RIGHT$(E$(L),39):GOTO67
```

```
65 E$(L)=LEFT$(E$(L),X-1)+G$+RIGHT$(E$(L),40-X)
67 IFL=20THENIFX<40THENX=X+1:RETURN
69 IFL=20THENG$="":RETURN
71 IFL<20THEN X=X+1:IFX>40THENX=1:GOTO77
73 RETURN
75 IFG$="{up}"THENL=L-1:GOTO79
77 L=L+1
79 IFL<1THENL=1:G$=""
81 IFL>20THENL=20:G$=""
83 RETURN
85 B=B+1:IFB=10THENPRINTMID$(E$(L),X,1);+"{left}";
   :RETURN
87 IFB=20THENB=0:PRINT"{rvs on}"+MID$(E$(L),X,
   1)+"{rvs off}{left}";
89 RETURN
91 REM
93 REM
95 REM
97 REM PAD W$ TO 30 CHARS & SET IN K$
99 REM
101 REM
103 K$=LEFT$(W$+"{30 spaces}",30):RETURN
105 REM
107 REM
109 REM
111 REM ROUTINE TO FIND ONE WORD
113 REM
115 REM
117 GOSUB97:SYS64628:3,1,1,K$,L,H,S
119 IFS=0THENK$="FOUND {rvs on}"+W$:RETURN
121 K$="{rvs on}"+W$+"{rvs off} NOT FOUND":RETURN
123 REM
125 REM
127 REM
129 REM ENTER A NEW KEY IN DICTKEYS
131 REM
133 REM
135 GOSUB97:SYS64628:1,1,1,K$,L,H,S:IFS<>0THENSTOP
137 RETURN
139 REM
141 REM
143 REM ROUTINE TO FIND FOUR SURROUNDING WORDS
```

```
145 FORI=1TO5:W$(I)="{30 spaces}":NEXTI
147 REM
149 R=2:GOSUB97
151 SYS64628:5,1,1,K$,L,H,S
153 IFS=0THENW$(R)=K$
155 R=R-1:IFR<>0THEN151
157 R=4:GOSUB97
159 SYS64628:4,1,1,K$,L,H,S
161 IFS=0THENW$(R)=K$
163 R=R+1:IFR<>6THEN159
165 GOSUB111:W$(3)=K$:RETURN
167 REM
169 REM
171 REM
173 DIM E$(20):OPEN1,8,3,"DICTKEYS":OPEN2,8,2,
    "DEFINITIONS,L,"+CHR$(41)
175 OPEN 15,8,15
177 R1=1:GOSUB209:IFE<>0THENR1=1:GOSUB209:R2=2:
    PRINT#2,R2:REM INITIALIZE DEFS
179 R1=1:GOSUB209:INPUT#2,R2
181 REM
183 REM GET A WORD TO LOOK UP
185 REM
187 PRINT:PRINT:INPUT "WORD TO SEARCH OR {rvs
    on}Q{rvs off}UIT";W$:PRINT:IFW$="Q"THENSTOP
189 GOSUB 111:IFS<>0THENPRINT K$:GOSUB143:
    FORI=1TO5:PRINTI;" ";W$(I):NEXT
191 IFS=0THENU$="3":PRINTK$:GOTO203
193 IFS<>0 THEN PRINT"# OF WORD OR {rvs on}A{rvs
    off}DD WORD OR {rvs on}N{rvs off}EW WORD";
195 GETU$:IFU$=""THEN195
197 IFU$="N" THEN 187
199 IFU$="A" THEN PRINT:R1=R2:GOSUB209:GOSUB 129:
    GOSUB235:GOTO183
201 IFU$<"1"ORU$>"5"ORU$="3"THEN195
203 PRINT:U=VAL(U$):W$=W$(U):GOSUB111:R1=H*256+L:
    GOSUB209:GOSUB221:GOTO183
205 REM
207 REM
209 REM POSITION IN DEFS FILE
211 REM
213 REM
```

```
215 H=INT(R1/256):L=R1-(H*256)
217 PRINT#15,"P"+CHR$(2)+CHR$(L)+CHR$(H)+CHR$(1)
219 INPUT#15,E,T$,T,S:RETURN
221 REM
223 REM PRINT DEF FOR WORD
225 REM
227 PRINT
229 INPUT#2,L1:FORI=1TOL1:INPUT#2,P$:PRINTP$;:
    NEXT:RETURN
231 REM
233 REM
235 REM
237 REM
239 REM GET NEW DEFINITIONS
241 REM
243 R1=R2:GOSUB209:GOSUB3:PRINT#2,0:FORI=1TO20
245 IFE$(I)="{40 spaces}"GOTO249
247 PRINT#2,CHR$(34)+E$(I):R2=R2+1
249 NEXT:GOSUB209:PRINT#2,R2-R1:R1=1:GOSUB209:
    R2=R2+1:PRINT#2,R2:RETURN
```

APPENDIX II

Bulletin Board

Xetec, Inc. now has a bulletin board in operation to provide support for all Lt. Kernal owners. *Fiscal Information* also has a bulletin board and the two numbers are:

Xetec board number	913 827 1974
Fiscal board number	904 252 8179

We encourage your use of these boards and welcome any input as to how we can improve our service to you.

APPENDIX III

20 Meg Add-on Drive

Please use the following steps to connect your 20 Meg Add-on Drive enclosure to your Lt. Kernal.

Hardware connection

1. Remove 25 pin signal cable from the back of the Lt. Kernal and plug into the back of the Add-on enclosure (either slot).
2. Plug one end of second 25 pin cable (included with Add-on) into the second slot on the back of the Add-on Drive enclosure.
3. Plug the other end of the second cable into the slot on the back of the Lt. Kernal enclosure labeled *Host Adaptor*.

Setting up LU parameters

1. Type *CONFIG*
2. Select *F6* for DOS 6.3
   F1 for DOS 7.0
3. For physical controller answer *1.*
4. For physical drive answer *0.*

At this point, your screen should display the LU parameter set-up table. (NOTE: All the LUs on other drive(s) are not shown). Now you can add LUs that have NOT BEEN USED on the original drive.

The first LU assigned can use cylinders beginning with cylinder 0 (zero) and up.

5. UPDATE the new parameters.
6. Exit CONFIG by using *F8* for DOS 6.3
   F7 for DOS 7.0

ACTIVATE new LUs and perform a power down, power up sequence to Update all LUs.

This completes the process.

INDEX

Xetec Lt. Kernal operating manual

SECOND PRINTING

XETEC, Inc. 2804 Arnold Rd. Salina, Ks. 67401
(913) 827-0685

QUICK COMMANDS REFERENCE

DIRECT—MODE Commands

↑↑ restores defaults
p. 8-1

ACTIVATE erase and re-creates bam and index for existing LU
p. 8-2 ACTIVATE

AUTOCOPY copy file(s) between LUs
p. 8-3 AUTOCOPY

AUTODEL delete file(s) from LU
p. 8-4 AUTODEL

AUTOMOVE move files between USER partitions
p. 8-5 AUTOMOVE

BUILD create 'formatted' RELative file
p. 8-6 BUILD__filename,nrecs,recl

BUILDCPM construct CP/M on the CP/M LU
p. 8-7 BUILDCPM

BUILDINDEX builds a KEY file for indexed RELative files
p. 8-8 BUILDINDEX

CHANGE change file's characteristics
p. 8-9 CHANGE__[lu:[filename

CHECKSUM verify DOS integrity
p. 8-10 CHECKSUM

CLEAR clear archive bits for file(s)
p. 8-11 CLEAR

CONFIG change power-up default system settings and LU parmeters
p. 8-12 CONFIG

COPY copy oldfilename into newfilename
p. 8-13 COPY__[‘‘][lu:][newfilename]=[lu:]oldfileneme[‘‘]

D set temporary hardware device # for hard disk
p. 8-14 D[__drynum]

DEL delete lines of BASIC program in memory
p. 8-15 DEL__line number or DEL__[beg.line]—[end.line]

DI lists keys within the specified KEY file
p. 8-16 DI

DIR list directory of files on hard disk
p. 8-17 DIR__[[lu:[user:]]:[Tfiltyp][P][S][S][G][C]__][filename]

DUMP write editable text image of BASIC in memory to disk file
p. 8-19 DUMP__[range__][lu:]seqfile

DIRECT—MODE Commands continued

ERA erase one file from disk
p. 8-20 ERA__[lu:[user:]]filename

FASTCOPY fast 1541 back-up/restore utility
p. 8-21 FASTCOPY

FETCH create memory BASIC programs from disk resident text file
p. 8-22 FETCH [lu:]filename

FIND text or tokens in BASIC
p. 8-23 FIND__delimSTRINGdelim[,<line-range>

GO64 sends CPU to the C-64 mode
p. 8-24 GO64

GO128 sends CPU to 128 mode
p. 8-25 GO128

GOCPM sends CPU to the CPM mode
p. 8-26 GOCPM

ICQUB capture or run captured copy protected software
p. 8-27 ICQUB or filename

L abbreviated LOAD file from disk
p. 8-30 L__[‘‘][lu:]filename[‘‘]

LOAD load file from disk
p. 8-30 LOAD ‘‘[lu:]filename’’,dev[,sa]

LKREV reports DOS version
p. 8-31 LKREV

LU changed logged logical device #
p. 8-32 LU[__lunum]

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p. 8-33 MERGE__[lu:]filename

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p. 8-34 OOPS

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RENUM renumber BASIC program in memory
p. 8-36 RENUM[__incr[,newstart[,oldstart-oldend]]]

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p. 8-42 S

S abbreviated SAVE program or range of memory to disk
p. 8-42 S__[range][lu:filename

SAVE SAVE program or range of memory to disk
p. 8-43 SAVE ‘‘[range][lu;]filename’’,dev

DIRECT—MODE Commands continued

SHIP locks head in preparation to transport hard disk
p. 8-44 SHIP

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UPDATEDOS refresh all DOS image files with new version of DOS
p. 8-46 (automatic)

USER change logged subdirectory number
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p. 7-6 INPUT# lfn,stringvar

INSERT new key into specified directory of a KEY file
p. 7-7 SYS 64628:1,lfn,directory,Stringvar,recl,rech,status

LDLU change operating characteristics
p. 7-8 OPEN #lfn,dev,15,‘‘ldev#LU#USR#’’

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p. 7-9 LOAD ‘‘[lu:]filename’’,dev[,sa]

OPEN open disk file for i/o
p. 7-10 OPEN #lfn,dev,sa,‘‘[lu:]filename’’

PRINT# write string up to 254 chars to file
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SAVE save program (or memory range) to disk
p. 7-12 SAVE ‘‘[<range>][lu:]filename’’,dev

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Less-than SYS 64628:5,lfn,directory,Stringvar,recl,rech,status

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p. 7-15 optimum space usage within the file
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