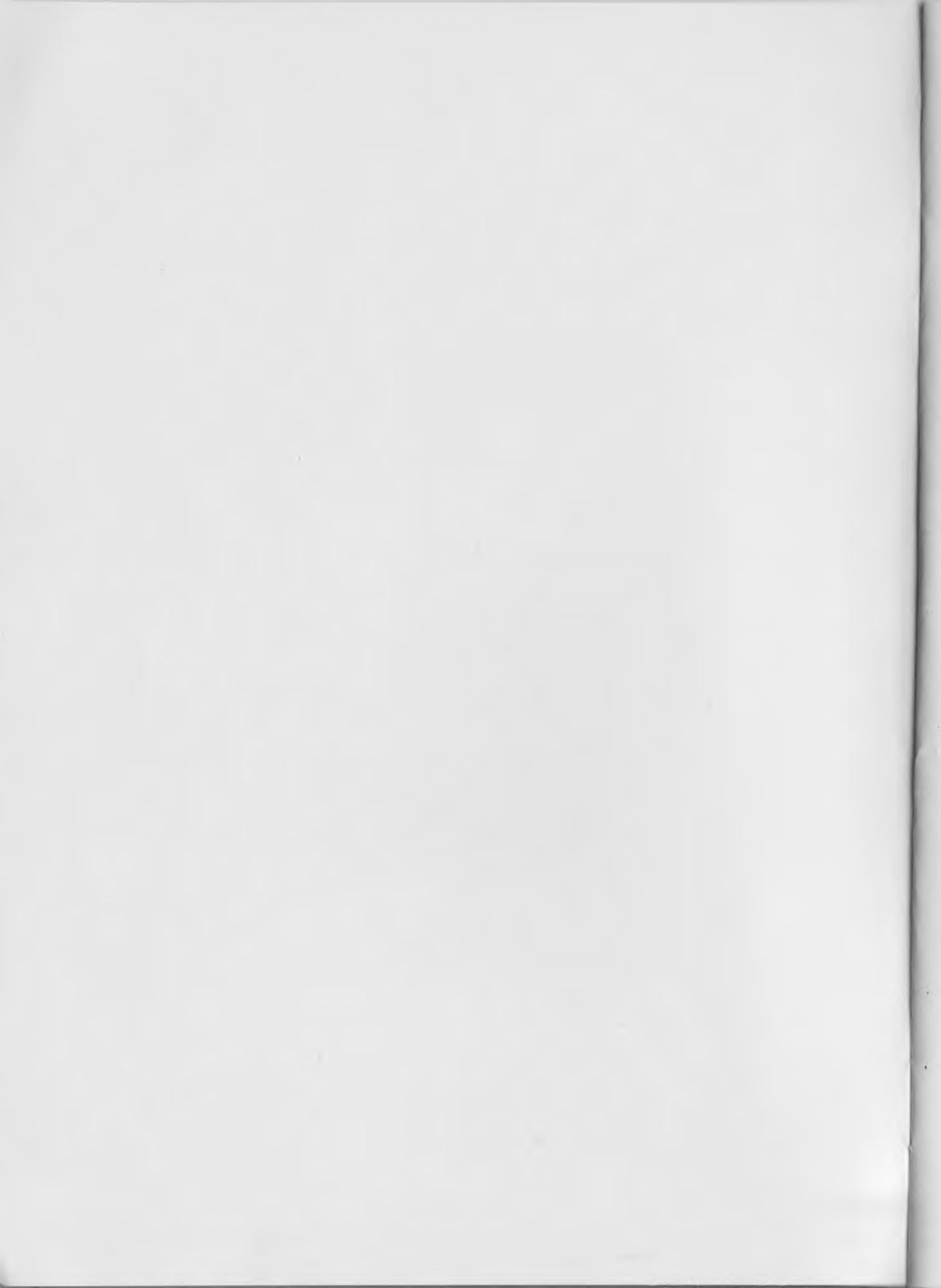


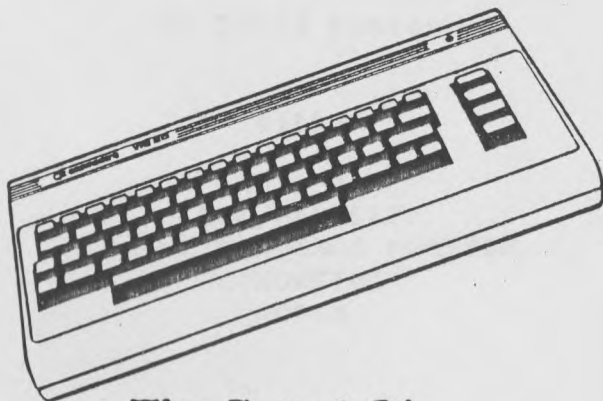
# C64 LINK



**RICHVALE  
TELECOMMUNICATIONS**



**RTC**  
**C64-LINK**  
by David Foster



**The Smart 64**



***Richvale Telecommunications***

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**RTC C64-LINK**  
**CARTRIDGE FOR THE**  
**COMMODORE 64**

**by David Foster**

**with:**

**BASIC 4.0**  
**IEEE/PARALLEL**  
**MACHINE LANGUAGE MONITOR**  
**NETWORKING**  
**MODEM**

**Manual by Marc Swanson**

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# TABLE OF CONTENTS

SECTION 1	BASICS	PAGE
1.1	C64-LINK Features .....	4
1.2	Installing the LINK .....	5
1.3	Disk Drive/Printer Connections .....	5
1.4	Cleaning Your LINK .....	9
SECTION 2 BASIC 4.0		
2.1	BASIC 4.0 vs BASIC 2.0 .....	10
2.2	Using BASIC .....	10
2.3	The Commands .....	12
2.4	Disk Maintenance Commands ..	12
2.4.1	<u>Disk Level Commands</u> .....	12
	1. HEADER	
	2. DIRECTORY/CATALOG	
	3. BACKUP	
	4. COLLECT	
2.4.2	<u>File Level Commands</u> .....	15
	1. CONCAT	
	2. COPY	
	3. RENAME	
	4. SCRATCH	
2.5	<u>File Handling Commands</u> ....	17
	1. APPEND	
	2. DOPEN	
	3. DCLOSE	
	4. DLOAD	
	5. DSAVE	
	6. RECORD#	
2.6	Disk Status .....	20

### SECTION 3 THE C64-LINK MONITOR

3.1	Machine Language Monitor ..	22
3.2	Monitor Commands .....	22
3.2.1	Display Memory .....	23
3.2.2	Display Registers .....	24
3.2.3	Execute Code .....	24
3.2.4	Load File to Memory .....	24
3.2.5	Save Code .....	25
3.2.6	Patch to Monitor .....	25

### SECTION 4 MODEM

4.1	The C64-LINK Modem .....	26
4.2	Setting Up .....	26
4.3	Sending and Receiving .....	29

### SECTION 5 DAISYCHAINING 64's

5.1	Networking with the LINK ..	30
5.2	Setting Up a Chain .....	30

### SECTION 6 RELOCATING THE LINK

6.1	The Relocator Programs ....	31
6.2	Turning Off the LINK .....	32

### SECTION 7 COMMODORE 64 MEMORY USE



## SECTION 1    BASICS

### 1.1    C64-LINK FEATURES

The C64-LINK adds 5 major new features to the Commodore 64. Each of these features expands the capacities of the 64 to allow you to do more and better programming and give you even more ways to use your computer.

#### 1.    INPUT/OUTPUT COMMANDS

The Commodore 64 normally sends and receives data using the "serial" bus, through cables that plug into the back of the computer, disk drive and printer. The C64-LINK adds IEEE and parallel data transmission to your computer. With the LINK, you can use any Commodore disk drive, giving your 64 the added power of dual, IEEE drives. The additional input/output commands also allow you to use your 64 with the many models of parallel printers or with Commodore's IEEE printers.

#### 2.    BASIC 4.0

The Commodore 64 works with a version of the BASIC computer language called "Commodore BASIC Version 2.0". The LINK upgrades your 64 to use BASIC Version 4.0, adding 16 disk commands.

#### 3.    MACHINE LANGUAGE MONITOR

Using the LINK's built-in machine language monitor, you can display the 64's memory and program in machine language.

#### 4.    MODEM

The LINK also has a built-in interactive MODEM program that allows you to use a modem and the telephone to "talk" through your 64 to another computer or a bulletin board system such as CompuServe or the Source. To use this LINK feature, you require a modem and the connecting cables.

#### 5.    NETWORKING

With the appropriate cables, you can use a set of LINKS to

"daisychain" up to 8 Commodore 64's to the same disk drive or printer. All the computers in the chain can use the same disk drive and the same printer at the same time.

## 6. RELOCATORS

Without a LINK, the power-up message on your 64's screen reads, "38911 BYTES FREE". The LINK takes up 8K of BASIC memory. When you power up with a LINK in your 64, this message reads, "30719 BYTES FREE". There are some programs that need that 8K of memory to load, such as WordPro 3+/64 or some games programs. Use the Relocator programs included with your C64-LINK to move the LINK to different locations in memory, recover the 8K of BASIC memory and run more software with the LINK.

### 1.2 INSTALLING THE C64-LINK

To install your C64-LINK:

1. Turn off the computer. Never insert or remove the LINK without turning off your computer first.
2. Locate the expansion port in the back of the 64 on the side closest to the power switch. With the LINK label-side up, insert it into the expansion port. Do not force the LINK in.
3. When the LINK is all the way in, turn the computer on.

The screen display has changed. The top line on screen now reads, "COMMODORE 64 BASIC V4". Your computer now has Version 4.0 of the Commodore BASIC language instead of Version 2.0 (Section 2 covers using BASIC 4.0). The next line down shows the number of bytes free. This has been reduced from 38911 bytes to 30719 bytes. All of this memory can be recovered using the Relocator programs.

### 1.3 DISK DRIVE/PRINTER CONNECTIONS

There are several ways to transmit data between a computer and a peripheral device such as a disk drive, modem or

printer. The main modes of data transmission used with Commodore computers are:

SERIAL	The mode used with the Commodore 1541 disk drive and 1525/1526 printers. This is the only mode normally available to interface the 64 and peripherals
RS-232	RS-232 serial is most commonly used with modems and some printers
PARALLEL	Most commonly used to send data from computer to a printer, eg. Epson, Spinwriter, Gemini
IEEE	IEEE is the mode of data transmission used between PET/CBM computers and Commodore disk drives and printers

Without a C64-LINK, your Commodore 64 can only send or receive data "serially". This feature limits the 64 to using the 1541 model disk drive and the 1525/26 printers. But with a C64-LINK, you may use any serial, IEEE or parallel peripheral device.

Before you can use any command to address a printer or disk drive, you must first type in a keyword telling the computer what type of printer or disk drive you have. For example, before you send any command to a parallel printer, you must first enter "PARALLEL". These commands are not recognized in BASIC, but by the LINK itself. Follow the instructions in this Section for more on using different peripheral devices with your 64.

#### 1. IEEE

The C64-LINK allows you to use any Commodore disk drive or Commodore printer. With a LINK in your 64, you may use the single disk drive, Model 2031, or the dual disk drives, Models 4040, 8050 and 8250 as well as hard disk drives. You may also use the Commodore printers Models 6400, 4023, 4022, 8300 and 8023. All of these devices send and receive data using the IEEE mode of data transmission.

When you first power up your 64 with a LINK in the back, the computer "defaults" to IEEE data transmission, that is, the LINK causes the 64 to assume it is in IEEE mode as soon as you turn it on. When you address any peripheral using

commands such as "LOAD" or "OPEN", the computer will assume you are addressing an IEEE device.

There are two types of IEEE cables: the PET-to-IEEE cable; and the IEEE-to-IEEE cable. Slide one end of a PET-to-IEEE cable onto the back of the LINK itself. Plug the other end of the cable into the back of a disk drive. Use an IEEE-to-IEEE cable to connect the disk drive to an IEEE printer.

## 2. SERIAL

To use the Commodore 1541 Model disk drive and the 1525/1526 printers with your 64, you do not need to buy any extra cables. Data is sent and received from these devices through the 64's built-in mode of data transmission, the Commodore "serial" bus.

But the C64-LINK powers your computer up into IEEE mode, not serial mode. If you are trying to load a program from a serial disk drive, your computer may hang up, or display the error message "DEVICE NOT PRESENT".

To use serial drives or printers, type "SERIAL" and press the <RETURN> key. The 64 is now ready to send and receive data through the serial bus. To return to IEEE mode, type "IEEE" and press <RETURN>.

NOTE: If you want to power up with your 64 in serial mode instead of IEEE, hold down the <C=> key as you turn on the computer.

## 3. PARALLEL

Many non-Commodore printers are "parallel" printers, for example, EPSON, NEC and Centronics printers. Parallel is similar to IEEE but requires a different cable, such as the VL-3 cable (available from Richvale Telecommunications). The VL-3 cable allows you to use a parallel printer with either an IEEE or serial disk drive.

To address a parallel printer, type "PARALLEL" and press <RETURN>. Your 64 is now able to send data to a parallel printer.

NOTE: With some parallel interfaces, for example, the CARD? interface, you cannot use the PARALLEL command. Treat such printers as if they were SERIAL.

#### 4. RS-232

The user port on the back of the 64 is the RS-232 port. RS-232 is a form of data transmission similar to Commodore serial. Most modems and some printers are RS-232 (though most Commodore modems are IEEE).

To address an RS-232 printer, you will need a cable such as the VL-8 cable. To connect the 64 to an RS-232 modem, you will need a cable such as the VL-4 cable. Both of these cables are available from Richvale Telecommunications.

There is no extra LINK command for addressing RS-232 devices. See Section 4 for more on how to use the built-in modem program in the C64-LINK.

#### 5. COMBINATIONS OF EQUIPMENT

When you enter, "IEEE", the Commodore 64 is set up to send and receive data only to and from IEEE devices. If the peripherals connected to your 64 are all serial devices, or IEEE devices, you may address all of them by typing in "SERIAL", or "IEEE". But if your equipment is mixed, serial and IEEE or parallel and serial devices, you will need to adjust the 64 to send and receive data from different peripherals.

##### Serial/IEEE

If you have a serial disk drive and an IEEE printer (or vice versa), then you will have to relocate the LINK using one of the Relocator programs described in Section 6.

##### Serial/Parallel

If you have a serial disk drive and a parallel printer connected to the 64, type "SERIAL" first, and press <RETURN>. Then type "PARALLEL" and press <RETURN>.

### IEEE/Parallel

If you have an IEEE disk drive and a parallel printer connected to the 64, type "IEEE" first and press <RETURN>. Then type "PARALLEL" and press <RETURN>. When you first power up, your 64 is already in IEEE mode and you only need to type "PARALLEL".

NOTE: You must select "IEEE" or "SERIAL" before selecting "PARALLEL".

### 6. DEVICE NUMBERS

Taken together, the commands discussed above are "I/O" (Input/Output) commands. These commands control the way the computer receives and sends data to peripheral devices such as printers, modems and disk drives. The BASIC language has many commands to address such devices.

In order to tell which device is which, Commodore has assigned numbers to certain devices, called "device numbers" or "unit numbers". Usually, the printer is device 4 and the disk drive is device 8. To open a channel to the printer, for example, you could type: OPEN4,4.

Any command using a device number greater than "3" will be sent to IEEE, serial or parallel devices, depending on which I/O command you have entered. If you use the parallel option, then the printer will be device "4" and commands sent to any devices above "4" will go to serial or IEEE devices..

### 1.4 CLEANING YOUR LINK

As you use your LINK, the gold-plated edge connectors will tend to become dirty. This can cause some problems in operation. To clean the edge connectors, buff them lightly with a soft rubber pencil eraser.

NOTE: Do not use an abrasive pen eraser.

## SECTION 2 BASIC 4.0

### 2.1 BASIC 4.0 VS BASIC 2.0

BASIC ("Beginner's All-purpose Symbolic Instruction Code") is a computer programming language that was designed to be simple and close to English. The version of the BASIC language normally available with the Commodore 64 is Commodore BASIC 2.0. The C64-LINK upgrades the computer to work with Commodore BASIC Version 4.0.

BASIC 2 and BASIC 4 have one major difference: disk commands. Many single disk commands available in BASIC 4.0 take the place of several lines of programming in BASIC 2.0.

### 2.2 USING BASIC

This section briefly describes the BASIC 4.0 commands available through the LINK. For more on the BASIC language and for in-depth discussions of the commands covered in this section, consult Commodore disk drive manuals and BASIC manuals.

In this section, the function of each command is given first, followed by the SYNTAX, one or two EXAMPLES and what those examples will do.

To help you enter commands correctly:

1. Enter capital letters exactly as they are shown in the SYNTAX line of each command, but do not hold down the <SHIFT> key while typing these letters. Enter commas, quotation marks and the number symbol ("0") as they are shown.
2. The small letters shown in the SYNTAX lines refer to variable file names or expressions which are explained with each command.
3. Expressions shown inside brackets - "(" and ")" - are

optional. The command will work differently depending on whether or not you include the expressions as part of the command.

4. Most BASIC 4.0 disk commands default to Drive 0. If you have the Model 1541 disk drive, you only have drive 0 and will not need to specify a drive number for most commands.
5. Unit numbers/Device numbers, which are options in BASIC 4.0, are not shown in the SYNTAX. All BASIC 4.0 disk commands default to Unit (Device) #8, the disk drive. If you have two disk drives, you may use the copy all program provided with your drive to assign one drive the Device number of "8" and the other drive a Device number of "9". To address Unit 9, enter ",U9" after a disk command.

When programming in BASIC, remember:

1. All BASIC keywords may be abbreviated, usually by typing the first letter, then the second letter shifted. For example, the "catalog" command may be entered as "cA".
2. In all versions of BASIC, there are two modes of programming: immediate mode and program mode. In immediate mode, the computer carries out a command as soon as you press <RETURN> on the command. In program mode, you assign a line number to each line of BASIC code, and the execution of the BASIC instructions is delayed until you enter the "RUN" command. You can use most BASIC commands in either mode.



## 2.3 THE COMMANDS

The new commands provided through the LINK may be broken into two groups:

### 1. DISK MAINTENANCE COMMANDS

#### A. AT THE DISK LEVEL

HEADER  
DIRECTORY  
BACKUP  
COLLECT

#### B. AT THE FILE LEVEL

COPY  
CONCAT  
RENAME  
SCRATCH

### 2. DATA HANDLING COMMANDS

APPEND  
DOPEN  
DCLOSE  
DLOAD  
DSAVE  
RECORD

The LINK also adds the variables "DS" and "DS\$".

## 2.4 DISK MAINTENANCE COMMANDS

### 2.4.1 DISK LEVEL COMMANDS

#### 1. HEADER

The HEADER command prepares a disk for use with a disk drive. Use HEADER to format a disk, dividing it into tracks and sectors where data will be stored and read back into memory. The HEADER command also lays down a directory track where the name of the disk, the individual filenames and information about the type and length of files is stored.

SYNTAX:      HEADER "fn", Dx, Ixx

fn = file name

x = drive number (0 or 1)

I = a two character, alphanumeric Identifier

EXAMPLE:       HEADER "TEST DISK", D0, I62

formats the disk in drive 0, gives it the name "TEST DISK" and an identifier of "62".

NOTE 1: Before the drive will start to HEADER a disk, the question "ARE YOU SURE?" appears on screen. To stop the procedure, enter "N". To continue with formatting, enter "Y" and press <RETURN>. Formatting a disk takes between 3 and 13 minutes, depending on the type of disk drive you have.

NOTE 2: Headering a disk erases any data that you may have previously saved to this disk. If you have a headered disk with programs that you want to erase completely and quickly, use the HEADER command without including an identifier. Be careful using the command in this way.

## 2. DIRECTORY (Or - CATALOG)

Use either the DIRECTORY command to display the contents of a disk to the screen. The CATALOG command is identical to the DIRECTORY command.

SYNTAX:       DIRECTORY (Dx)   or   CATALOG (Dx)

x = drive number (0 or 1)

EXAMPLE:       CATALOG D0

will list the contents of the disk in drive 0.

If you do not specify a drive number with a dual disk drive, DIRECTORY or CATALOG will display a catalog of disks in both drives. With a single disk drive you do not need to specify a drive number.

When the disk directory appears on screen, the top line is printed in reverse field. This line shows the number of the disk drive, the name of the disk and the disk identifier. Below that line appear the names of the files on this disk, shown inside quotation marks. To the left of each filename

appears the number of blocks that file occupies on the disk. To the right of each filename is the type of file: sequential, relative or program. In the space to the left of the file type, the C64-LINK puts a colon (":"). The last line of a disk directory shows the number of blocks on the disk that have not yet been assigned to a file.

### 3. BACKUP

Use the BACKUP command with a dual disk drive (IEEE) to create an exact duplicate of one disk on another disk. The BACKUP command first formats the destination disk, then copies each block of information from the source disk to the destination disk.

NOTE: The BACKUP command will not work with a single disk drive. It will also not work with two single disk drives set up as Unit 8 and Unit 9.

SYNTAX:        BACKUP Dsdr TO Dddr  
                 sdr = source drive number (0 or 1)  
                 ddr = destination drive number (1 or 0)

EXAMPLE:       BACKUP D1 TO D0

copies the entire contents of the disk in drive 1 to the disk in drive 0.

### 4. COLLECT

The "directory" track is created with the HEADER command. In this track, the drive stores information about the files on each disk: the name of each file; the type of file and the number of blocks used by that file. When the drive reads information from the disk or writes information to the disk, the directory track tells the drive where the information is and in what form it has been stored.

If a file is opened but never closed, or if a block has been allocated but not used, the directory track will not record this information accurately. The number of blocks available on the disk may be shown incorrectly in a disk

directory. Use the COLLECT command to rewrite the directory and show the proper number of free blocks.

SYNTAX: COLLECT Dx  
x = drive number (0 or 1)

EXAMPLE: COLLECT D0

will collect the disk in drive 0.

NOTE: If you do not specify a drive, COLLECT defaults to the last drive used.

#### 2.4.2 FILE LEVEL COMMANDS

##### 1. CONCAT

Use the CONCAT (concatenate) command to combine two files into one file containing all the information from the original files.

SYNTAX: CONCAT Dsdr,"sfn" TO Dddr,"dfn"  
sdr = source drive number (0 or 1)  
sfn = source file name  
ddr = destination drive number (0 or 1)  
dfn = destination file name

EXAMPLE: CONCAT D0,"ADDRESSES1" TO D1,"ADDRESSES2"

will combine the files, "ADDRESSES1" and "ADDRESSES2" into one file called "ADDRESSES2".

##### 2. COPY

Use the COPY command to transfer selected files from one disk to another, or to recopy a file on the same disk. (The file must be renamed if you are recopying it on the same disk.) If you have a dual disk drive, you can use COPY to copy the entire contents of one disk to another headered disk.

SYNTAX: COPY Dsdr, "sfn" TO Dddr, "dfn"

sdr = source drive number (0 or 1)  
sfn = source file name  
ddr = destination drive number (0 or 1)  
dfn = destination file name

EXAMPLE 1: COPY D1, "ADDRESSES1" TO D0, "ADDRESSES1"

copies the file called "ADDRESSES1" from the disk in drive 0 to the disk in drive 1, where it will have the name "ADDRESSES1".

EXAMPLE 2: COPY D0 TO D1

copies the contents of the disk in drive 0 to the disk in drive 1, without affecting the files on the disk in drive 1.

### 3. RENAME

Use the RENAME command to change the name of any file on a disk.

SYNTAX: RENAME Dx, "ofn" TO "nfn"

x = drive number (0 or 1)  
ofn = old file name  
nfn = new file name

EXAMPLE: RENAME D0, "OLD NAME" TO "NEW NAME"

changes the name of the file called "OLD NAME" to "NEW NAME".

### 4. SCRATCH

Use the SCRATCH command to delete or erase unwanted files from a disk.

SYNTAX: SCRATCH "fn" ,Dx

fn = file name  
x = drive number (0 or 1)

EXAMPLE: SCRATCH "UNWANTED FILE", D1

will scratch the file called "UNWANTED FILE" from the disk in drive 1.

NOTE: Before the drive scratches a file, the question "ARE YOU SURE?" appears on screen. To continue, enter "Y" and press <RETURN>. The disk drive activity light will come on while the file is being scratched.

## 2.5 DATA HANDLING COMMANDS

### 1. APPEND

Use the APPEND command to reopen a closed sequential file. You may then expand the file by writing information to the end of that file.

SYNTAX: APPEND#lfn,"fn",Dx  
  
lfn = logical file number  
fn = file name  
x = drive number (0 or 1)

EXAMPLE: APPEND#3,"MASTERFILE",D0

opens logical file #3 to the sequential file called "MASTERFILE" on the disk in drive 0.

### 2. DOPEN

The DOPEN command opens a channel to the disk drive to read or create a relative or sequential file of a fixed length. Any file may be opened for reading, but only sequential and relative files may be opened for writing.

Use the DCLOSE command to close the channel opened with DOPEN.

SYNTAX:        DOPEN#lfn,"fn" (,Dx)(,Lrl)(,W)

lfn = logical file number  
fn = file name  
x = drive number (0 or 1)  
rl = record length  
W = write

If "W" for "write" is not specified, the file will be opened for reading.

EXAMPLE 1: DOPEN#2,"SUBFILE",W

opens logical file number 2 to the disk in drive 0 for writing a file called "SUBFILE".

EXAMPLE 2: DOPEN#2,"SUBFILE",D1

opens logical file number 2 to the disk in drive 1 for reading the file called "SUBFILE".

### 3. DCLOSE

The DCLOSE command closes the file specified after the command. If no file is specified, DCLOSE closes all files currently open to the disk drive.

SYNTAX:        DCLOSE (#lfn)

lfn = logical file number opened with DOPEN

EXAMPLE 1: DCLOSE#2

closes logical file number 2.

EXAMPLE 2: DCLOSE

closes all files currently open to Unit 8.

### 4. DLOAD

The DLOAD command loads a specified program from disk.

If you hold down the <SHIFT> key and press <RUN/STOP>, the C64-LINK will load the first program from the disk (equivalent to dL"" on the PET/CBM.)

SYNTAX:        DLOAD "fn" (,Dx)  
  
              fn = program name  
              x = drive number (0 or 1)

EXAMPLE:       DLOAD"SCRIPT 64"

loads the program called "SCRIPT 64" into memory from the disk in drive 0. If no drive number is specified, the DLOAD command defaults to drive 0.

NOTE: When you DLOAD a program from a directory, you do not need to put a colon after the filename, or erase the file type. The LINK has already placed a colon after each filename on a disk directory.

## 5. DSAVE

Use the DSAVE command to save the program in memory to the disk.

SYNTAX:        DSAVE "fn" (,Dx)  
  
              fn = the program name  
              x = drive number (0 or 1)

EXAMPLE 1:     DSAVE"PROG",D1

saves the program called PROG to the disk in drive 1.

EXAMPLE 2:     DSAVE"@PROG"

resaves the program called PROG over an existing program that also has the name PROG. If you try to save a program using a filename that already exists on this disk, the disk drive will prevent the save. The message "FILE EXISTS ERROR" will appear on screen. To resave a program, put an "at" sign ("@" ) before the filename.



NOTE: You can use the DLOAD and DSAVE commands to "backup" on a single disk drive. Use DLOAD to load the first program from one disk into the computer's memory. Then use DSAVE to write that program to another, headered disk. Continue loading programs from the first disk and saving them to the second disk until you have copied all the programs.

## 6. RECORD

The RECORD command positions the file counter to a specific record (and byte) in a relative file. Use RECORD before other commands, such as GET, INPUT and PRINT to select the desired record.

SYNTAX: RECORD file number, r (,b)

r = desired record

b = desired byte position within record

The record number ("r") can be either a variable name or a value between 0 and 65535. If "r" is a name, it must appear in parentheses: "(" and ")". The byte position ("b"), which is optional, has a value between 1 and 254.

EXAMPLE 1: RECORD file number, 200

positions file number 3 to record number 200.

EXAMPLE 2: RECORD file number, 200, 6

positions file number 3 to record number 200 at byte number 6.

EXAMPLE 3: RECORD file number, (J)

positions file number 3 to record J.

## 2.6 DISK STATUS

If the disk drive detects a problem, either with the drive itself or with the data disk you are using, then the error light will begin to flash (on the 1541 disk drive) or turn

red (on other Commodore disk drives). The problem can be as simple as not having inserted the disk in the drive. It can also be a more complex problem such as a scratch on the surface of the disk.

Use the variables DS and DS\$ to check the Disk Status. DS and DS\$ are not commands, they are variables. To view the disk status, you will have to print DS or DS\$.

SYNTAX:     PRINT DS  
              PRINT DS\$

NOTE: You may use the BASIC short form for PRINT: "?"

When you print DS, a number appears on screen. When you print DS\$, then the same number appears, but with a short error message and additional numbers.

For example, if your disk drive error light begins flashing, enter "PRINT DS" and the computer would return a number, "21" for example. If you then enter "PRINT DS\$", the message would read: "21,READ ERROR,XX,YY".

This message contains a "DOS (Disk Operating System) Error". The first number, 21, is the number of the error. (An error with a number of "19" or less is not significant.) Next comes a short description of the nature of the error, in this case, it is a "READ ERROR", which means that the disk drive was unable to read the requested information from the disk. The last two numbers, separated by commas, show the track and sector numbers where the error occurred.

Check your Commodore drive manuals for more on DOS Errors and how to recover from them.

## SECTION 3 THE C64-LINK MONITOR

### 3.1 MACHINE LANGUAGE MONITOR

The C64-LINK has a built-in machine language MONITOR that lets you view and alter the memory of the computer.

To access the MONITOR, type:

MONITOR <RETURN>.

The computer will display the state of the registers approximately at memory location \$8000.

The numbers on that appear on screen in the MONITOR are in "hexadecimal" or simply "hex". Hexadecimal numbers operate with a base of 16 instead of the more usual base of 10 ("decimal"). The characters in the hex numbering system run from "0" through to "9", then from "a" to "f". Hexadecimal numbers are usually shown with a "\$" in front of them to distinguish them from decimal numbers for example, \$045e. You do not need to type the "\$" when in the Monitor.

You may also break into the MONITOR by typing:

SYS #

where "#" is the address of a break instruction, for example, SYS8. Enter SYS 64738 to produce a machine reset, clearing memory and restoring your computer to the condition it was in when you first powered up.

### 3.2 MONITOR COMMANDS

The C64-LINK MONITOR provides six commands for machine language programming. For more on using these commands and programming in machine language, consult 6510 programming manuals.

The commands are:

COMMAND	PURPOSE
M	display Memory
R	display Registers
G	execute code ("Go")
L	Load file to memory
S	Save memory
X	eXit to BASIC

### 3.2.1 DISPLAY MEMORY

Enter:           M xxxx yyyy <RETURN>

Use the "M" command to display specified addresses. The first number, "xxxx", stands for the beginning address to be displayed. The second number, "yyyy", stands for the end address.

EXAMPLE:        M 8000 8010

will display memory locations starting at \$8000 through up \$8017. On screen, this will display something like this:

```
.:8000 09 80 8F 80 C3 C2 CD 38
.:8008 30 8E 16 D0 20 A3 FD 20
.:8010 50 FD 20 4F 80 8C 35 03
.
```

Each screen line displays 8 addresses in memory.

To alter memory, type the new values directly over the appropriate addresses and press <RETURN>. If you enter an unacceptable value, for example, writing to ROM, the computer will place a question mark on the line with the error.

### 3.2.2 DISPLAY REGISTERS

Enter            R <RETURN>

The "R" command displays the registers in the 64's memory. These registers are:

PC = Program Counter  
SR = Status Register  
AC = Accumulator  
XR = X Register  
YR = Y Register  
SP = Stack Pointer

To change the registers, type new values over the old addresses.

### 3.2.3 EXECUTE CODE

Enter:            G (xxxx) <RETURN>

The "G" command executes the program written with "xxxx" as the starting address of the code. If you do not specify a start address, then execution defaults to the Program Counter.

### 3.2.4 LOAD FILE TO MEMORY

ENTER:            L "I:fn", dn

    I = drive number (0 or 1)  
    fn = file name  
    dn = device number

EXAMPLE:          L "0:FILE",08

to load the program called "FILE" from drive 0 of device 8, the disk drive.

### 3.2.5 SAVE CODE

ENTER:           S "?:fn", dn, ba, ea

          ? = drive number (0 or 1)  
          fn = file name  
          dn = device number  
          ba = beginning address  
          ea = end address

EXAMPLE:        S "1:FILE", 08, B000, C000

saves the program starting at memory location \$B000 and ending at \$C000. This program will be saved under the name "FILE" on drive 1 of device number 8. To replace an existing program, put an "@" sign before the filename.

NOTE: Remember to include the drive number if you have a dual disk drive. Enter the drive number in the form: "0:" or "1:".

### 3.2.6 PATCH TO MONITOR

At memory location \$0336, the LINK allows you to patch into the MONITOR and define extra specific commands.

## SECTION 4 MODEM

### 4.1 THE C64-LINK MODEM

The C64-LINK has a built-in MODEM program that allows you to use the 64 to operate as a mainframe terminal, talk to bulletin boards or talk to other computers equipped with a modem.

Most modems send and receive data using the RS-232 bus, though there are still some IEEE modems in use. To use an RS-232 modem, you will require a cable such as the VL-4 cable, available from Richvale Telecommunications. To operate the Commodore VIC Modem, you require no extra cables. To send output to an IEEE modem, you will need the correct IEEE cable.

### 4.2 SETTING UP

1. Connect your computer and modem with the appropriate cables. With your 64 in BASIC, enter:

```
OPEN 2,2,0, CHR$(X) + CHR$(Y) <RETURN>
```

where -

"X" is a number from the Control Register Map and

"Y" is a number from the Command Register Map.

2. "X" defines the baud rate, word length and stop bits. "Y" defines handshaking, duplex and parity options. Check your modem manual for more on what these terms mean and what settings are correct for your modem. A common example, standard for many computers, would be:

```
OPEN 2,2,0, CHR$(6) + CHR$(0) or
```

```
OPEN 2,2,0, CHR$(6) + CHR$(2)
```

which is useful if the host computer does not "echo" data back to your computer.

3. The charts detailing these numbers can be found on pages 350 and 351 of the programmer's reference guide, or you may use the following charts:

CONTROL REGISTER - "X" VALUE:

<u>FUNCTION</u>	<u>VALUE</u>
<b>A. <u>STOP BITS</u></b>	
1 STOP BIT	0
2 STOP BITS	128
<b>B. <u>DATA WORD LENGTH</u></b>	
8 BITS	0
7 BITS	32
6 BITS	64
5 BITS	96
<b>C. <u>BAUD RATE</u></b>	
50	1
75	2
110	3
134.5	4
150	5
300	6
600	7
1200	8
1800	9
2400	10

4. Find the values that describe your printer from each of the three numbered sections above. Add those numbers together to derive a value for "X". For example, if your equipment required 1 stop bit (Value from chart = "0"), a word length of 7 bits (Value = "32") and a baud rate of 300 (Value = "6"), add 0 + 32 + 6 to get a value of "38" for "X".



5. Follow the same procedure to derive a value for "Y":

COMMAND REGISTER - Y VALUE:

	<u>FUNCTION</u>	<u>VALUE</u>
A.	<u>PARITY</u>	
	DISABLED	0
	ODD PARITY	32
	EVEN PARITY	96
	MARK	160
	SPACE	224
B.	<u>DUPLEX</u>	
	FULL	0
	HALF	16
C.	<u>HANDSHAKING</u>	
	3 LINE	0
	X LINE	1
D.	<u>ECHO</u>	
	HOST ECHOES DATA	0
	HOST DOES NOT ECHO	2

6. When you have entered the OPEN statement with correct values for 'X' and 'Y', enter:

MODEM <RETURN>

The cursor will disappear. When you enter a key, the letter will be displayed to the screen and sent out over the modem.

7. To start communication over the modem, dial the phone number of the bulletin board or other computer. When you hear a high pitched electronic squeal (called a "carrier" signal), set the modem to its data receive mode. Press <RETURN> several times.

8. A "logon" message from the bulletin board or mainframe

should appear on your screen. You may then log on to the bulletin board and start using your modem.

#### 4.3 SENDING AND RECEIVING

Data is sent and received in true ASCII, rather than Commodore ASCII. You may need to set your 64 to upper/lower case by holding down <SHIFT> and pressing <C=>.

#### CONTROL CHARACTERS

ASCII values have been assigned to certain communications functions. Use the <CTRL> key to access these standardized functions. For example, to send a carriage return, you could hold down the <CTRL> key and press "m". A complete list of control codes can be found in any list of (true) ASCII codes.

The C64-LINK MODEM also has some specific keys set aside for control functions.

1. ESCAPE Use <CTRL> and "[" as an "escape" character.
2. BREAK Use <CTRL> and "e" (ASCII value = 0) to send a hardware break.
3. QUIT To quit the modem program and return to BASIC, press <RUN/STOP> and <RESTORE> at the same time.

## SECTION 5    DAISYCHAINING 64'S

### 5.1    NETWORKING WITH THE LINK

Built-in to the C64-LINK is a feature that allows you to "network" up to 8 computers to the same disk drive or printer or both. Any computer in the chain can send a command to the printer or disk drive at any time. The commands can even be sent at the same time.

If the printer is busy and one of the computers in the chain sends a command to the printer, the LINK will hold the second command up. As soon as the printer is free, the second command will go through. Commands are transmitted one at a time in the order they were sent.

### 5.2    SETTING UP A CHAIN

To set up a chain of 64's, you will require one VL-16 cable (available from Richvale Telecommunications) for each computer, plus one VL-16 to IEEE cable for the last computer in the chain.

Connect the computers together using the VL-16 cables. Connect the last computer in the chain to the disk drive and printer using the VL-16 to IEEE cable.

Each person in the chain who is writing or reading files should use a different secondary address for their file. Because the DOPEN command selects its own channel, you should use the BASIC 2.0 OPEN command to ensure that unique secondary addresses are chosen.

## SECTION 6 RELOCATING THE LINK

### 6.1 THE RELOCATOR PROGRAMS

When you power up your 64 with a LINK in it, the number of bytes free changes from 38,711 to 30,719. 8K worth of BASIC memory has been used up by the LINK, starting at memory address \$8000. However, some programs use the same area of memory to load and run. You can use the Relocator programs provided with your LINK to move the LINK out of this area to other locations in memory.

These Relocator programs allow you to:

- 1) Free 8K of BASIC used by the LINK
- 2) Run programs that the LINK would otherwise prevent you from loading
- 3) Use different printer and disk types together
- 4) Convert upper/lower case characters for true ASCII printers.

Using these Relocator programs, you can run such programs as EasyScript and WordPro 3+/64.

For a complete description of how to use each Relocator program, load and run the program called "LINK.INSTR" from your Relocator disk. This program also contains instructions on how and when to use each Relocator.

To load the instructions, put your computer in BASIC and type:

```
LOAD "LINK.INSTR",8 <RETURN>.
```

If you have your LINK in the 64, you may use the DLOAD command:

```
DLOAD "LINK.INSTR" <RETURN>.
```

Read the instructions first to find out which Relocator you require for each purpose. Then load and run the appropriate Relocator program.

The Relocator programs themselves are stored in the program

called "RELOCATOR 5.4". To load the Relocators, put your computer in BASIC and type:

DLOAD "RELOCATOR 5.4" <RETURN>

Follow the on-screen instructions to run the Relocator you want.

NOTE: Before you try to load and run the EASYSCRIPT word processor with a C64-LINK, first load the program called, "EASYSCRIPT/LINK". Run this program for instructions on Relocating the LINK with EASYSCRIPT.

## 6.2 TURNING OFF THE LINK

There are some programs which you cannot run with a LINK in place, but you may require the LINK to load them. For example, if you are loading a program from an IEEE disk drive but the program requires the LINK's memory locations, you will need to turn off the LINK. Before you RUN the program, LOAD it into memory with the LINK in place. Then turn off the LINK by entering:

```
SYS64789:SYS58451:POKE57090,253:SYS64863  
:POKE55,PEEK(193):POKE56,PEEK(194):CLR
```

This turns off the LINK and you may now RUN the program.

## SECTION 7 COMMODORE 64 MEMORY USE

<u>LOCATION</u> (in Hex)	<u>FUNCTION</u>	<u>C64-LINK SECTION</u>
0002	* Processor Status	MONITOR
0003	* Accumulator	MONITOR
0004	* X-Register	MONITOR
0005	* Y-Register	MONITOR
0006	* Stack Pointer	MONITOR
000B	Used in Tokenizing	BASIC 4.0
0019 - 001A	* Program Counter	MONITOR
001B	* Convert Hex Number	MONITOR
001C	* Input Hex Number	MONITOR
001D		MONITOR
0062 - 0063	* Line Number for Catalog	BASIC 4.0
0071	Used in Tokenizing	BASIC 4.0
0090	I/O Status	IEEE
0093	Load/verify Flag	IEEE
0094	Deferred Character Flag	IEEE
0095	Deferred Character	IEEE
0097	Used in Tokenizing	BASIC 4.0
0098	Number of Open Files	IEEE
0099	Input Device	IEEE
009A	Output Device	IEEE
00AC - 00AD	Save pointer	IEEE
00AE - 00AF	Load Pointer	IEEE
00AE	* Device # for Hard Copy of Catalog	BASIC 4.0
00AF	* Logical File Number for Hard Copy of Catalog	BASIC 4.0
00B7	# of Characters in Filename	IEEE
00B8	Current Logical File Number	IEEE
00B9	Current Secondary Address	IEEE
00BA	Current Device Number	IEEE
00BB - 00BC	Pointer to Filename	IEEE
00C1 - 00C4	* Used in Parsing 4.0 Command Input Hex Numbers	BASIC 4.0  MONITOR

00C3 -	Relocate location for LOAD	IEEE
00C4		
0334	* I/O Type:	IEEE
	2 = Serial	
	3 = IEEE	
	6 = Serial + Parallel	
	7 = IEEE + Parallel	
0335	* Check DS, DS\$ Flag	IEEE
0336 -	* Monitor LINK	MONITOR
0337		
033A -	* BASIC 4.0 Parsing	BASIC 4.0
0352	Flags	
0353 -	* BASIC 4.0 Command Area	BASIC 4.0
	DS\$ Input Area	BASIC 4.0
8000 -	* C64-LINK ROM	
8FFF		
9000 -	* C64-LINK Image	
9FFF		
DC00 -	* Timer for Timeouts	IEEE
DD00 -	* Used for Parallel	IEEE
DF00 -	* Used for IEEE	IEEE

NOTE: A "\*" indicates that the C64-LINK uses this location for purposes other than those originally assigned by Commodore.

DF00	Data Lines for IEEE
DF01	DDRA Select + ATN
DF02	NDAC
	NFRD
	DAV
	EOI
	IFC
	ROM Select
	Not Used
DF03	DDRB Select

NOTE 1: SRQ is used for deciding when disk is being used.

NOTE 2: IFC is always held high.

NOTE 3: Setting ROM Select to low disables ROM in memory location \$8000 to \$9FFF.

**PRODUCT SPECIFICATION SHEET**

**RICHVALE TELECOMMUNICATIONS**  
10610 BAYVIEW AVENUE  
RICHMOND HILL, ONTARIO  
CANADA L4C 3N8

**DATE:** AUGUST 25, 1983  
**PRODUCT:** COLOR 80  
**VERSION:** 1.0  
**COMPUTER:** COMMODORE 64

(416) 884-4165

**PRODUCT DESCRIPTION:**

COLOR 80 turns the Commodore 64 into an 80-column computer, without the expense of extra cartridges or boards.

**FEATURES INCLUDE:**

- \* 80-column display makes programming in BASIC easier
- \* requires no extra boards or cartridges much less expensive
- \* uses no BASIC memory in the 64
- \* use Hires screen for display
- \* create and run 80-column programs
- \* works with terminal programs



## PRODUCT SPECIFICATION SHEET

RICHVALE TELECOMMUNICATIONS

10610 BAYVIEW AVENUE

RICHMOND HILL, ONTARIO

CANADA L4C 3N8

TE: AUGUST 25, 1983

PRODUCT: BASIC AID 64

VERSION: 1.0

(416) 884-4165

MPUTER: COMMODORE 64

## PRODUCT DESCRIPTION:

RTC Basic Aid is a programmer's development tool for the Commodore BASIC language. Separate versions of Basic Aid are available for the entire line of Commodore computers. In the Commodore 64 version, Basic Aid adds 33 additional commands to the BASIC language.

## EDITING COMMANDS:

- \* scroll at top or bottom of screen
- \* trace through BASIC program, displaying each line as it is executed
- \* find any variable or string throughout program
- \* change any variable or string throughout program
- \* renumber a range of lines, including GOTO's and GOSUB's
- \* move a range of lines
- \* delete a range of lines
- \* merge two BASIC programs into one

## DISK COMMANDS:

- \* read sequential files to screen
- \* catalog command
- \* quickly load and run any BASIC program
- \* collect, initialize, header, rename, copy, scratch
- \* pattern matching in all commands

## PRINTER COMMANDS:

- \* list a program to printer
- \* dump single screens to printer
- \* set printer specifications

## OTHER FEATURES INCLUDE:

- \* Convert HEX, binary and decimal numbers
- \* Display size of any program or file
- \* HELP command finds syntax and other errors

## PRODUCT SPECIFICATION SHEET

RICHVALE TELECOMMUNICATIONS  
10610 BAYVIEW AVENUE  
RICHMOND HILL, ONTARIO  
CANADA L4C 3N8

DATE: AUGUST 25, 1983  
PRODUCT: SUPERCOPY 64  
VERSION: 1.0  
COMPUTER: COMMODORE 64

(416) 884-4165

## PRODUCT DESCRIPTION:

SuperCopy is a disk utilities program for the Commodore 1541 disk drive. Many disk operations are normally very difficult or time-consuming on a single drive. SuperCopy is extremely fast. The SuperCopy disk maintenance package reduces the time spent for a BACKUP on a single disk drive to about 7 minutes.

The program is menu-driven and very user-friendly, with frequent on-screen prompts and an attractive screen.

### \* Complete Disk Maintenance Commands

- Header
- Backup
- Copy
- Scratch
- Rename
- Catalog

- \* Complete pattern matching
- \* Full prompts
- \* Continuous displays of disk status, unit numbers and blocks free
- \* Change unit address to use 2 single drives
- \* Arrange files in alphabetical order or rearrange them in any order
- \* Check disk speed feature

## PRODUCT SPECIFICATION SHEET

RICHVALE TELECOMMUNICATIONS

10610 BAYVIEW AVENUE

RICHMOND HILL, ONTARIO

CANADA L4C 3N8

DATE: AUGUST 25, 1983

PRODUCT: SCRATCHPAD 64

VERSION: 2.0

(416) 884-4165

COMPUTER: COMMODORE 64

### PRODUCT DESCRIPTION:

Scratchpad 64 is a database/mail list program for the Commodore 64. It is fully C64-LINK compatible and suitable for both single and dual disk drives. Scratchpad data can be merged with Script 64 Word Processor data to produce hundreds of letters from a single document.

### FEATURES INCLUDE:

- \* Formats disk in series of Screens
- \* Each Screen has 20 lines with up to 30 characters on any one line
- \* Each line used for a different type of data
- \* Continuous display of line definitions
- \* Screens stored in alphabetic or numeric order around single, selected line
- \* Global search on any line
- \* Use parallel or serial printers
- \* IEEE printers (with C64-LINK)
- \* Print labels, envelopes, mail lists
- \* Backup feature with single disk drive
- \* Continuous record number display

## PRODUCT SPECIFICATION SHEET

RICHVALE TELECOMMUNICATIONS  
10610 BAYVIEW AVENUE  
RICHMOND HILL, ONTARIO  
CANADA L4C 3N8

DATE: AUGUST 25, 1983  
PRODUCT: SUPERBASIC 64  
VERSION: 1.0  
COMPUTER: COMMODORE 64

(416) 884-4165

## PRODUCT DESCRIPTION:

SuperBASIC for the Commodore 64 gives you three different versions of Commodore BASIC programming language Version 4, plus a built-in machine language monitor.

### BASIC 4.0

- \* Disk Maintenance Commands:
  - header, collect, backup, catalog
- \* File Maintenance Commands:
  - copy, concat, rename, scratch
- \* Data Handling Commands:
  - append, dopen, dclose, dload, dsave, record
- \* Full string handling and garbage collection

### BASIC 4.1 - GRAPHICS PLUS BASIC

- \* All the features of BASIC 4.0
- \* Three graphics modes
- \* Extra graphics commands
  - draw, box, locate, color, scale

### BASIC 4.2 - EXTENDED BASIC

- \* Fully compatible with Commodore's "B" series
- \* Full error trapping commands
  - trap, resume, err\$, er, el
- \* Load and save binary files
  - bload, bsave, brun
- \* Function keys display BASIC commands or may be user-defined
- \* Extra BASIC commands
  - else, print using, dispose, drun, dclear

### MACHINE LANGUAGE MONITOR

- \* display and alter 64's memory
- \* calls or breaks to monitor

**PRODUCT SPECIFICATION SHEET**

**RICHVALE TELECOMMUNICATIONS**  
10610 BAYVIEW AVENUE  
RICHMOND HILL, ONTARIO  
CANADA L4C 3N8

**DATE:** AUGUST 25, 1983  
**PRODUCT:** PRINTER INTERFACE CABLES  
**VERSION:**  
**COMPUTER:** COMMODORE 64

(416) 884-4165

**PRODUCT DESCRIPTION:**

**VL-3 CABLE**

- \* interfaces the 64 with any parallel printer

**VL-4 CABLE**

- \* connects the Commodore 64 to any standard RS-232 modem

**VL-8 CABLE**

- \* connects the Commodore 64 to any standard RS-232 printer

All cables are connected through the user port

## PRODUCT SPECIFICATION SHEET

RICHVALE TELECOMMUNICATIONS  
10610 BAYVIEW AVENUE  
RICHMOND HILL, ONTARIO  
CANADA L4C 3N8

DATE: AUGUST 29, 1983  
PRODUCT: DRAFT-AID CAD SYSTEM  
VERSION: 1.1  
COMPUTER: COMMODORE 8000 SERIES

(416) 884-4165

### PRODUCT DESCRIPTION:

The Draft-Aid Computer Aided Design System is one of the newest CAD Systems, and is designed for microcomputer operation. Draft-Aid goes from hand drawing to plotter quickly and easily through four user-friendly steps:

- 1) The MATRIX EDITOR lets you specify where you want the drawing to appear on the plotter's board.
- 2) The SEGMENT EDITOR is then used to draw on the screen the shapes that will appear in the final drawing.
- 3) The RELATION FILE EDITOR combines the drawing's shapes with their positions.
- 4) The RELATION FILE PLOTTER then performs the actual plot with one instruction, leaving the operator free to proceed to other work.

### PLOT FEATURES INCLUDE:

- ## creating arcs and circles
- ## rotating drawings through 360 degrees
- ## moving drawings anywhere on the plot surface
- ## enlarging or reducing drawings in either axis
- ## invert any drawing in either axis
- ## drawing up to 9,801 shapes with one instruction

### DATA ENTRY FEATURES INCLUDE:

- ## operational and error alarms
- ## full error checking - user and disk
- ## "escape" function to cancel last command
- ## fully menu-driven programs for ease of use
- ## built-in calculator, cross-referencing, file sorting
- ## formatted screen displays and many other features

## COMPLETE DISK MAINTENANCE:

- catalog, backup, copy, delete, format routines
- powerful pattern matching system

## APPLICATIONS:

- educational use
- printed circuit boards
- electronic drafting

## PRODUCT SPECIFICATION SHEET

DATE: AUGUST 25, 1983  
PRODUCT: INTEL TERMINAL 64  
VERSION: 1.0  
COMPUTER: COMMODORE 64

RICHVALE TELECOMMUNICATIONS  
10610 BAYVIEW AVENUE  
RICHMOND HILL, ONTARIO  
CANADA L4C 3N8

(416) 884-4165

## PRODUCT DESCRIPTION:

Intel Terminal 64 is an intelligent, menu-driven terminal program for the Commodore 64. It operates using RS-232 modems. Separate versions of the Intel Terminal program will be available for the entire line of Commodore computers.

## FEATURES INCLUDE:

- Store data to tape or disk
- Upload/Download Files
- 50K Buffer records data for output to printer, disk or tape
- Serial printers
- C64-LINK compatible
- IEEE printers (with LINK)
- Auto-dialing feature
- 4 Function keys user-definable
- Save Function key commands to disk or tape
- Continuous display of "Expected Input"
- Real-time clock with alarm features
- Set baud rate, stop bits, parity, bits per character, printer type, duplex, line feeds and delete/backspace character
- Full disk maintenance commands

**PRODUCT SPECIFICATION SHEET****RICHVALE TELECOMMUNICATIONS****10610 BAYVIEW AVENUE****RICHMOND HILL, ONTARIO****CANADA L4C 3N8****DATE: OCTOBER 26, 1983****PRODUCT: MULTI-LINK****VERSION: PROTOTYPE****(416) 884-4165****COMPUTER: COMMODORE 64****PRODUCT DESCRIPTION:**

The RTC Multi-LINK is a networking system for the Commodore 64. Multi-LINK allows up to 64 computers to chain to the same printer and disk drive, while also allowing one MASTER computer to control and monitor activities on the SATELLITE computers.

Each computer in the chain must be equipped with the Multi-LINK cartridge. All SATELLITE computers in the chain are assigned a number using dipswitch settings on the cartridge.

**FEATURES INCLUDE:**

- \* Commands spooled to printer and disk drive
- \* Work with BASIC or machine language programs
- \* Send messages to and from any computer
- \* MASTER computer has full control over all SATELLITES with these commands:

DISALLOW	prevents any or all SATELLITES from sending a command to the disk drive or printer or both
ALLOW	enables a DISALLOWed command
CATALOG	the disk drive
LOAD	program from disk or from a SATELLITE
LIST	the program in memory
QUERY	prevents a SATELLITE from using the disk or printer until OK'd from MASTER
SAVE	program to disk or send it to SATELLITE
SCREEN	reads any SATELLITE's screen to the MASTER screen
SEND	a message or command to any SATELLITE
RESET	any SATELLITE



\*\*\*\*\*  
\* Proper maintenance of \*  
\* your RTC product will \*  
\* prolong its service life. \*  
\* A light buffing of the \*  
\* gold card edge surfaces \*  
\* with a soft rubber pencil \*  
\* eraser periodically is \*  
\* recommended . DO NOT use \*  
\* an abrasive ink eraser. \*  
\*\*\*\*\*

For our U.S. Customers:  
To return any product manufactured  
by Richvale Telecommunications for  
repair, exchange, or refund, please  
address it to:

RICHVALE TELECOMMUNICATIONS  
c/o EMERY CUSTOMS BROKERS  
160 Sugg Road  
Buffalo, New York  
U.S.A., 14225

To avoid paying duty twice, attach  
a copy of the original invoice for  
the product you are returning on  
the outside of the package.

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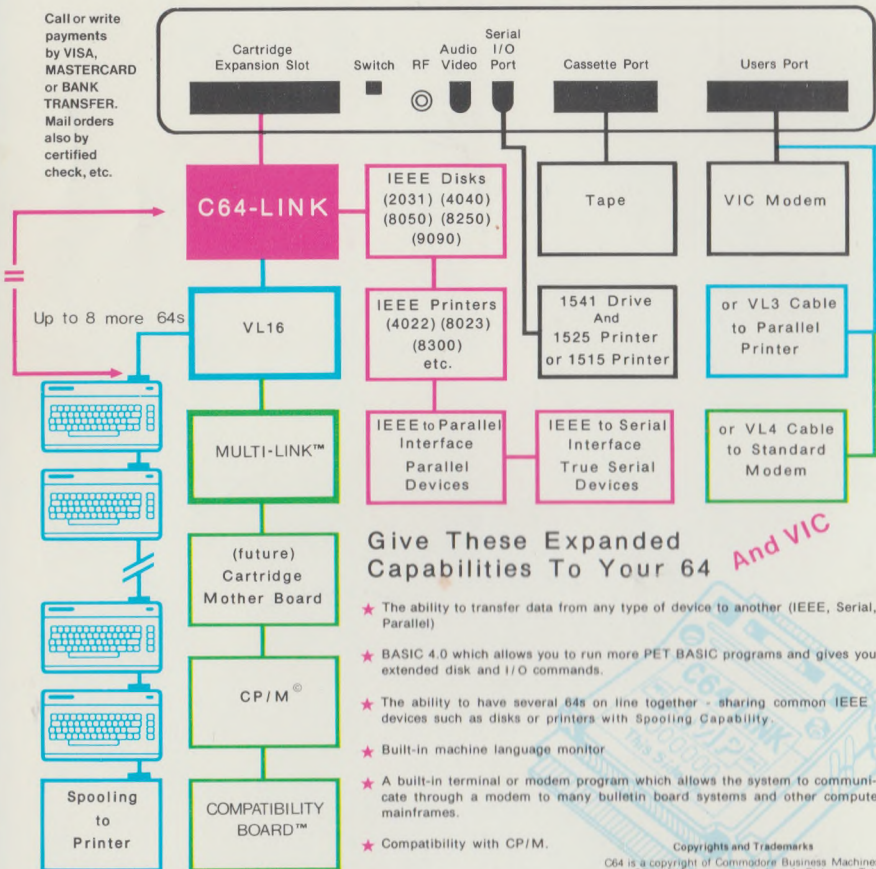
## C64-LINK<sup>®</sup> The Smart 64

Also available  
for VIC 20

RTC

RTC

Call or write  
payments  
by VISA,  
MASTERCARD  
or BANK  
TRANSFER.  
Mail orders  
also by  
certified  
check, etc.



### Give These Expanded Capabilities To Your 64 And VIC

- ★ The ability to transfer data from any type of device to another (IEEE, Serial, Parallel)
- ★ BASIC 4.0 which allows you to run more PET BASIC programs and gives you extended disk and I/O commands.
- ★ The ability to have several 64s on line together - sharing common IEEE devices such as disks or printers with Spooling Capability.
- ★ Built-in machine language monitor
- ★ A built-in terminal or modem program which allows the system to communicate through a modem to many bulletin board systems and other computer mainframes.
- ★ Compatibility with CP/M.

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