C64 User's Manual

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Welcome

Your VIXEN-32 has a Commodore 64 inside it. Not a program pretending to be one: the VIXEN-32 has the C64's own chips built in – its processor, its VIC-II picture chip, its SID sound chip, its two CIA chips for the keyboard, the joysticks and the timers, and the PLA that lays out its memory. They run the C64's own BASIC and KERNAL at the speed of a real PAL C64, so C64 games and programs behave exactly as they did in 1982.

This manual shows you, step by step:

- what you must put on your SD card first,
- how to start the C64,
- how to choose and start a game from the game menu,
- how to use disks (.D64 files) in drive 8, and tapes (.TAP files),
- how to use the Amiga mouse as paddles or as a C64 mouse,
- how to move the picture, and how to go back to C64 BASIC.

You do not need to know anything about the C64 to use it. If you do, you will feel at home at once: it is the same machine.

1. What you need

The C64's ROMs

A C64 cannot start without its three ROMs – the chips that hold C64 BASIC, the KERNAL (the part that runs the screen, the keyboard and loading) and the character set. **They are not included with the VIXEN-32.** The ROMs are Commodore's software and still under copyright, so you must get your own copy: for example read them out of your own C64, or get them from a source that is allowed to give them to you.

You need three files. Give them exactly these names:

File	Size	What it is
KERNAL.ROM	8 KBytes (8192 bytes)	the KERNAL (Commodore part 901227-03)
BASIC.ROM	8 KBytes (8192 bytes)	C64 BASIC V2 (901226-01)
CHAR.ROM	4 KBytes (4096 bytes)	the character set (901225-01)

Copies found on the internet often have names like `kernal.901227-03.bin` – just rename them. Use Commodore's own KERNAL: the game menu starts games and runs drive 8 with it. A changed KERNAL (a fast-loader KERNAL, for example) may not start games from the menu.

Games

The C64 understands four kinds of game files:

- **.PRG** – a program, as it would load from tape or disk;
- **.CRT** – a cartridge, as it would sit in the cartridge slot;
- **.D64** – a whole floppy disk, as it would sit in a 1541 disk drive;
- **.TAP** – a whole cassette tape, as it would sit in the Datasette (with core v0.98 or newer).

Like the ROMs, games are not included: use your own, or the many free games people still write for the C64 today.

A game that came on two disks, or on both sides of one, comes as two .D64 files. Keep them together, in a folder of their own.

Where everything goes on the SD card

Copy the files to your SD card (with a card reader on your PC), like this:

```
/VIXEN-32/C64/
    KERNAL.ROM
    BASIC.ROM
    CHAR.ROM
    GAMES/
        Arkanoid.d64
        Fred's Back 1.prg
        Ghostbusters.crt
        Cartridges/
        Demos/
```

Inside **GAMES** you may make as many folders as you like – by year, by publisher, one per game.

Joysticks

Plug your joysticks into the VIXEN-32's two joystick ports. They are the C64's control ports 1 and 2, exactly as on a C64. Most C64 games are played with the joystick in **port 2**; a few want port 1, and games for two players use both. If a game wants its joystick in the other port, you need not move the plug: **SHIFT+F3** in the game menu swaps the two ports (chapter 3).

The Amiga mouse

An Amiga mouse in **port 1** can be the C64's paddles or its 1351 mouse (chapter 6). Left as it is, port 1 is a joystick port, as on a real C64: a mouse left in it can look like a joystick to a game, or even press keys. Unplug it, or switch it to paddles or a 1351 with **F3** in the game menu.

2. Starting the C64

GO 64

Switch your VIXEN-32 on. When the VIXEN-32's BASIC says **Ready**, type

```
GO 64
```

and press RETURN (**GO64** works too). The machine asks **ARE YOU SURE (Y/N)?** – because the C64 takes over the whole machine, a program you had typed into the VIXEN-32's BASIC is lost. Press **Y**. (**N** takes you back to Ready.)



Figure 1: GO 64 at the VIXEN-32's Ready

A moment later the C64 starts, exactly as a real one does:

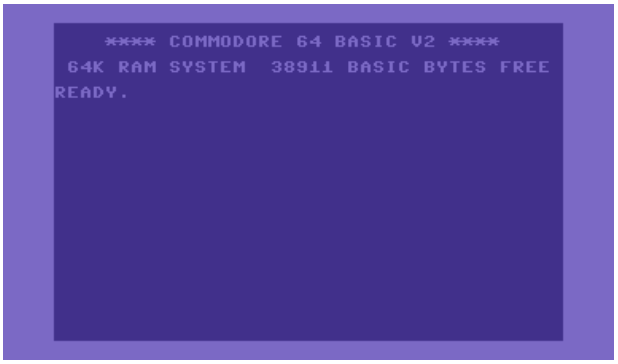


Figure 2: The C64 has started: 38911 BASIC bytes free

If a ROM is missing, the C64 does not start and the VIXEN-32 tells you which one, for example

```
?/VIXEN-32/C64/KERNAL.ROM NOT FOUND
?CHAR.ROM IS NOT 4 KBYTES
```

Check the name, the folder and the size of that file (chapter 1).

To leave the C64 and go back to the VIXEN-32, press the **reset button** on the side of the machine.

Try C64 BASIC

You are now in C64 BASIC. Type

```
PRINT "HELLO"
```

and press RETURN. Then type this little program, a line at a time:

```
10 PRINT "VIXEN-32 ";
20 GOTO 10
```

and type **RUN**. Press **RUN/STOP** to stop it.

The keyboard

The VIXEN-32's keyboard is the C64's keyboard, key for key, with a few extras:

- **F1, F3, F5, F7** are the C64's function keys; F2, F4, F6 and F8 are SHIFT with them, as on the C64.
- All four **cursor keys** work. (The C64 itself had two, with SHIFT for up and left.)
- **RESTORE** is the C64's RESTORE key. **RUN/STOP** and **RESTORE** together stop a program and clear the screen, as on a real C64.
- **C=** is the key with the Commodore sign (MEGA on the VIXEN-32).
- **HELP** opens the game menu. The C64 had no HELP key, so no game ever needs it.
- **ALT** with a cursor key moves the picture on the screen (chapter 7). The C64 had no ALT key either: the game never sees these presses.

LOAD without **,8** loads from tape. With no tape in (chapter 5) it waits for one, as a C64 does: press **RUN/STOP**.

3. The game menu

Press **HELP** at any time, in BASIC or in the middle of a game. The C64 stops where it is and its sound goes quiet, and the game menu opens over it:



Figure 3: The game menu

The menu has four parts:

- **The top line** shows the folder you are in, and on the right the version of the C64 program (**C64HW B20**).
- **The list** shows what is in that folder: folders first, marked **<DIR>**, then the games, by name. A .PRG or .CRT shows its size in **BLOCKS**, as the C64 counts them; a .D64 shows **DISK** and a .TAP **TAPE**.
- **The two key lines** under the list show the keys you need most, the mouse setting (**F3**), the mouse speed (**F5** / **F7**, chapter 6) and **SHIFT+F3**, which swaps the joystick ports.
- **The bottom line** shows how many games and folders this folder holds – and messages, when there is something to say. On its right it shows **PORTS SWAPPED** while the joystick ports are swapped, the disk in drive 8 and the tape, if they are in (chapter 5).

Moving around the menu

Key	What it does
Cursor up, cursor down	move the bar (held: on and on)
Cursor left, cursor right	a whole page up or down
CLR/HOME	the first line
a letter or a digit	jump to the next game starting with it
RETURN	open the folder, or start the game the bar is on

Key	What it does
SHIFT+RETURN	a .D64 or a .TAP: put it in drive 8 or the tape only (chapter 5)
INST/DEL or the left-arrow key (left of 1)	go back up one folder
F1	switch the C64 off and on: BASIC (chapter 8)
F3	the Amiga mouse: joystick, paddles or 1351 (chapter 6)
SHIFT+F3	swap the joystick ports: the VIXEN-32's port 1 is the C64's port 2, and port 2 its port 1; again: back
F5, F7	the mouse slower, faster (chapter 6)
HELP, ESC or RUN/STOP	close the menu: back to the C64 where it was

Closing the menu with HELP, ESC or RUN/STOP changes nothing: the game you were playing goes on from the very same moment.

The joystick ports stay swapped from game to game until you press SHIFT+F3 again or leave the C64.

4. Starting a game

Put the bar on a game and press **RETURN**. The C64 is switched off and on, and the game is started in it – a new machine for every game, just as if you had switched your C64 off and on before loading.

Programs (.PRG)

Most C64 games are a BASIC program: a short BASIC line that starts the machine code behind it. The menu puts such a game straight into the C64's memory and types **RUN** for you. There is no loading time.

A few programs are pure machine code that a C64 user started with **SYS** and an address. The menu loads such a program but cannot know where to start it; the bottom line of the menu says where it went in memory, for example **Loaded at $C000: start it with SYS**. Close the menu and type the SYS its instructions give.

Cartridges (.CRT)

A cartridge is plugged in, the C64 is switched on with it, and the cartridge starts itself as it did on a real C64. It stays plugged in until you start another game or press **F1**.

The menu knows these kinds of cartridge:

Type	Cartridge
0	normal 8K, 16K and Ultimax cartridges – most games
3	Final Cartridge III
4	Simons' Basic
5	Ocean
7	Fun Play, Power Play
8	Super Games
11	Westermann
12	Rex Utility
13	Final Cartridge I
15	C64 Game System
17	Dinamic
18	Zaxxon
19	Magic Desk
21	Comal 80
32	EasyFlash
60	GMod2 – newer games that save, such as Sam's Journey and Wormhole

Any other kind is not started: the bottom line says **Cartridge type 1 is not supported** (1 is Action Replay). There is no freeze button.

Saved games on GMod2 cartridges

A GMod2 cartridge has a small memory chip of its own where the game keeps its saved games and high scores. The VIXEN-32 keeps that memory on your SD card, in a file next to the cartridge, with **.EEP** at the end of its name: `Sams Journey.crt` saves into `Sams Journey.eep`.

The file is written a second after the game saves, and read again the next time you start the game – so a saved game is safe even if you press the reset button. Delete the .EEP file, and the game starts as new. A .EEP file made by the VICE emulator works too.

Disks (.D64) and tapes (.TAP)

A disk is put in drive 8, a tape in the tape drive, and the game on it is loaded and started for you. That is the next chapter.

5. Disks in drive 8, and tapes

The VIXEN-32's C64 has a drive 8 of its own for .D64 files. It is not a 1541 disk drive: the C64's KERNAL asks for the files, and the VIXEN-32 reads them from the .D64 on your SD card. LOAD, the directory and reading files work as with a 1541.

Starting the game on a disk: RETURN

Put the bar on a .D64 and press **RETURN**. The disk goes into drive 8, the C64 is switched off and on, and the menu types for you what you would type on a C64:

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

`LOAD"*",8,1` loads the first program on the disk, and once it has loaded, **RUN** starts it:



Figure 4: RETURN on a .D64: LOAD"*",8,1 and RUN, typed for you

The LOAD line looks odd on the screen – an **L** and a graphics sign where you expect LOAD. That is LOAD's short form, **L** and **SHIFT+O**, just as C64 users typed it: the whole line must fit into the C64's keyboard buffer of ten keys, and the C64 shows SHIFT+O as a graphics sign. Many games start themselves while they load; then no RUN is needed, and none is typed.

Only putting a disk in: SHIFT+RETURN

Put the bar on a .D64 and press **SHIFT+RETURN**. The disk goes into drive 8, and the C64 goes on exactly where it was – nothing is typed, nothing restarted. The bottom line of the menu shows the disk in drive 8 on its right, and on that disk the key line now says **SHIFT+RETURN out of drive 8**:



Figure 5: The disk in drive 8: the bottom line shows it

Use SHIFT+RETURN:

- **to look at a disk first.** Type `LOAD"$",8` and then `LIST`, as on a C64, to see what is on it:

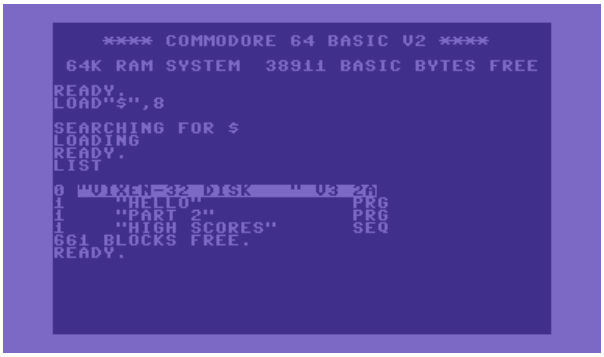


Figure 6: LOAD"$",8 and LIST: the disk's directory

  Then load the program you want, for example `LOAD"HELLO",8`, and type **RUN**.

- **for the second disk of a game.** When a game asks you to put in disk 2 or turn the disk over, press **HELP**, put the bar on the other .D64 and press **SHIFT+RETURN**. You are back in the game at once: press what the game asks for, as you would after changing the disk in a 1541.

- **to take the disk out.** SHIFT+RETURN on the disk that is in drive 8 takes it out again.

How long a disk stays in

The disk stays in drive 8 when you start a .PRG or a .CRT game and when **F1** switches the C64 off and on – as a disk stays in a 1541 when you switch the C64 off and on. It is forgotten when you leave the C64.

What drive 8 can do – and what it cannot

Works	Does not work
LOAD and LOAD"$",8 (the directory)	SAVE: the disk is read only
games that load their next part with the KERNAL	games with their own fast loader
reading files with OPEN, GET# and INPUT#	writing files, formatting, deleting
the error channel, OPEN 15,8,15	direct disk access (# buffers)
	drives 9, 10 and 11

- **The disk is read only.** Nothing is ever written to your .D64 file. SAVE seems to work but saves nothing, and the error channel says **26,WRITE PROTECT ON** – as a 1541 does with a write-protected disk.
- **Fast loaders do not load.** Many games and most demos read the disk with their own fast loader, which talks to the 1541's own processor. Drive 8 has none: such a game hangs at its loading screen or says **?DEVICE NOT PRESENT ERROR**. For these games, use a MEGA65 core with a full 1541 in it.
- **Drive 8 only.** LOAD from device 9, 10 or 11 says **?DEVICE NOT PRESENT ERROR** – and so does drive 8 when no disk has been put in since the C64 was switched on.

.D64 files of 35 and of 40 tracks are read, with or without the error bytes some copies carry at their end.

The error channel

Programs that ask the drive how it is doing get the 1541's own answers:

```
OPEN 15,8,15:INPUT#15,A,B$:PRINT A;B$:CLOSE 15
```

Number	Message	When
0	OK	all is well
73	CBM DOS V2.6 1541	the first time after the C64 was switched on
62	FILE NOT FOUND	there is no file of that name on the disk
26	WRITE PROTECT ON	something tried to write to the disk
74	DRIVE NOT READY	the disk was taken out of drive 8
70	NO CHANNEL	a program asked for direct disk access (a # buffer)

Number	Message	When
31, 34	SYNTAX ERROR	the drive does not know that command

Tapes (.TAP)

Many C64 games came on cassette tape. A .TAP file is such a tape, recorded pulse for pulse, and the VIXEN-32 plays it into the C64 exactly as the Datasette tape drive did, at the same speed. So games with their own fast ("turbo") loader – the way most tape games loaded – load as well. Tapes need core v0.98 or newer.

Put the bar on a .TAP and press **RETURN**. The tape goes in, PLAY is pressed for you, the C64 is switched off and on, and the menu types what SHIFT+RUN/STOP types on a C64:

```
LOAD
RUN
```

The C64 says SEARCHING, FOUND and LOADING; then, on most tapes, the game's own loader takes over, with its loading picture, music or stripes in the border, as on a real C64. Loading takes as long as it did then – often a few minutes.

Put the bar on a .TAP and press **SHIFT+RETURN** to put the tape in and press PLAY only, the C64 going on where it was: for side 2 of a game, or a game that asks you to press PLAY. SHIFT+RETURN on the tape that is in takes it out. The bottom line of the menu shows the tape on its right.

- The tape stands while the game menu is open, and goes on when you close it.
- The C64's motor control works: a game that stops the tape between its parts stops it, and starts it again when it wants the next one.
- Switching the C64 off and on (**F1**, or starting another game) rewinds the tape. It is forgotten when you leave the C64.
- At the end of the tape PLAY comes up, as the Datasette's keys did.
- Nothing is ever recorded onto a tape, and only C64 tapes (.TAP version 0 and 1) are read.

6. Paddles and the 1351 mouse

Some C64 games are played with paddles (the turning knobs of Pong-like games), and some with Commodore's 1351 mouse. The Amiga mouse in **port 1** can be either.

Press **HELP**, then **F3**, until the key line shows the one you want:

Setting	What the mouse is
JOYSTICK IN PORT 1	nothing: port 1 is a plain joystick port, as on a C64 (at first; with the ports swapped it reads JOYSTICK IN PORT 2)

Setting	What the mouse is
PADDLES IN PORT 1	two paddles in control port 1
PADDLES IN PORT 2	two paddles in control port 2
1351 MOUSE IN PORT 1	a 1351 mouse in control port 1
1351 MOUSE IN PORT 2	a 1351 mouse in control port 2

As paddles, moving the mouse left and right turns the first paddle, up and down the second; the left button is the first paddle's fire button, the right button the second's.

As a 1351, the mouse moves the pointer; the left button is fire, and the right button is the 1351's other button.

F5 makes the mouse slower and **F7** faster: 12%, 25%, 33%, 50%, 75%, 100% or 150%. It starts at 50%. The key line shows the speed.

The settings stay from game to game until you leave the C64. A game still needs its own setting for paddles or a mouse, often in its menu, as on a real C64 – and most 1351 games want the mouse in port 1. Real paddles are not read. The PORT in these settings is always the C64's control port: swapping the joystick ports (SHIFT+F3) does not move the paddles or the 1351.

7. Moving the picture

The C64 shows its picture the way a TV of the time did: the C64's screen of 40 columns by 25 rows, with its border round it. Some demos and a few games draw sprites far out into the border, beyond what a TV showed. To see them, move the picture.

Hold down **ALT** and press a **cursor key**: the picture moves 4 dots sideways or 2 lines up or down. Hold the cursor key down too, and it goes on moving. **ALT** and **CLR/HOME** put it back where it was.

The C64 has no ALT key, so the game never sees these presses – you can move the picture in the middle of a game, and in C64 BASIC too.

The picture stays where you put it while the game runs. It is not remembered: every time the C64 is switched on – a game started from the menu, or F1 – the picture is back in its normal place.

8. Back to BASIC

Press **HELP**, then **F1**. The C64 is switched off and on, into C64 BASIC, as if you had pressed the power switch of a real one. The game that was running is gone, and so is a cartridge; a disk stays in drive 8.

To leave the C64 altogether and go back to the VIXEN-32, press the **reset button**.

Appendix A: All the keys

While the C64 runs

Key	What it does
HELP	open the game menu
ALT + cursor keys	move the picture (until the C64 is next switched on)
ALT + CLR/HOME	the picture back in its normal place
RUN/STOP + RESTORE	stop the program, as on a C64
the reset button	leave the C64: back to the VIXEN-32

In the game menu

Key	What it does
Cursor up, cursor down	move the bar
Cursor left, cursor right	a page up, down
CLR/HOME	the first line
a letter or a digit	the next game starting with it
RETURN	open the folder / start the game (a .D64 or .-TAP: LOAD and RUN)
SHIFT+RETURN	a .D64 into drive 8 / a .TAP into the tape only; on the one in: out
INST/DEL, left-arrow key	up one folder
F1	switch the C64 off and on: BASIC
F3	the mouse: joystick, paddles or 1351, port 1 or 2
SHIFT+F3	the joystick ports swapped, or back
F5, F7	the mouse slower, faster
HELP, ESC, RUN/STOP	back to the C64

Appendix B: Messages

When you type GO 64

Message	What to do
`?/VIXEN-32/C64/KERNAL.ROM NOT FOUND`	the file is not there: check its name and folder (BASIC.ROM and CHAR.ROM the same)
`?KERNAL.ROM IS NOT 8 KBYTES`	the file is the wrong size: it is not the right ROM (CHAR.ROM must be 4 KBytes)
`?UNMOUNT A: AND B: FIRST`	unmount the VIXEN-32's disk drives A: and B:, then try again

In the game menu

Message	What to do
There is no /VIXEN-32/C64/GAMES folder on the card	make the GAMES folder and put your games in it
The card cannot be read	check that the SD card is in
That folder cannot be read	the folder is damaged: check the card on your PC
The name is too long for the card's paths	give the folder or the file a shorter name
The game cannot be read	the file is damaged
The file holds nothing but its load address	the .PRG file is empty
Loaded at $C000: start it with SYS	machine code: type the SYS its instructions give (chapter 4)
Not loaded: the C64 never got to READY	the game could not be put in: is KERNAL.ROM Commodore's own?
Not a cartridge (.CRT) file	the file is not a C64 cartridge
Cartridge type 1 is not supported	a kind of cartridge the menu does not know (chapter 4)
The game's save could not be written to the card	the card is full or locked: free it, and the save is written a second later
The cartridge cannot be read / The cartridge file is damaged	the file is damaged
The cartridge file has a chip it cannot hold / holds no chips	the file is damaged or not a C64 cartridge
The disk cannot be read	the .D64 file is damaged
Not a .D64 disk (35 or 40 tracks)	the file is not a C64 disk, or a kind drive 8 does not read

Message	What to do
This KERNAL has no jump table drive 8 can use	use Commodore's own KERNAL.ROM (chapter 1)
Tapes need core v0.98 or newer	update the VIXEN-32 core
The tape cannot be read	the .TAP file is damaged
Not a .TAP tape	the file is not a C64 tape
A version 2 tape is a C16's, not a C64's	the tape is for another Commodore
The tape is larger than 8 MBytes	no C64 tape is that long: the file is damaged