

flashx20

**Floppy and Screen
for the HX-20**

by Norbert Kehrer

Contents

Thank you for trying out flashx20. By reading this document you will learn

- what the program does,
- how to build a cable to connect the HX-20 to a PC,
- how to activate Disk BASIC on the HX-20,
- how to install the flashx20 program,
- how to work with the flashx20 program, and
- how to use the graphics commands to draw pictures.

Getting an overview of flashx20

With the “flashx20” program a normal Windows PC or notebook computer can be connected to an Epson HX-20 handheld computer, where the PC emulates the following peripheral devices for the HX-20:

- an external display controller with graphics capabilities
- two external dual floppy disk drives

The HX-20 has a small built-in LCD screen supporting a resolution of 4 x 20 characters in text mode or 32 x 160 pixels in graphics mode. The small display makes it cumbersome to edit large BASIC programs or text. Therefore, Epson provided the possibility to connect the HX-20 with an external display controller via its serial port. Through a specific protocol the handheld communicates with the controller telling it what to show on the connected external monitor. In flashx20 this controller is emulated in software. Like a display controller, it interprets the commands from the HX-20 and displays the corresponding text or graphics on the screen of the PC.

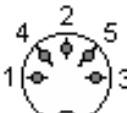
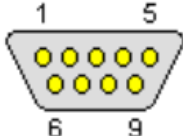
Similarly, it is possible to connect up to four floppy disk drives to the serial port of the Epson HX-20. There was e.g. Epson’s dual disk drive called TF-20, which supported loading and saving of programs and data on floppy disks. When the TF-20 was connected during the boot-up of the HX-20, a special BASIC extension called “Disk BASIC” was loaded into the HX-20, and provided additional commands to work with floppy disks, e.g. the command “FILES” to display the disk directory. For the communication between the external floppy drive and the HX-20 a special protocol was used. Like in the real drives, the flashx20 program on the PC interprets this protocol and stores and loads programs and data from the HX-20 on the PC’s hard disk.

Please note, that there was a very similar commercial product called “HXLINK” on the market back in the eighties. At the website <http://www.alle.webrausch.de/hxlink/> you can read more about this German software. The flashx20 software has more or less the same functionality as HXLINK, but has the additional capability to display graphics.

Building a cable

The flashx20 program talks to the HX-20 via the serial RS-232 port of the PC. As modern PCs and notebooks usually do not have an RS-232 port any more, you might need a USB-to-RS232 adapter. These are easily available and usually quite cheap.

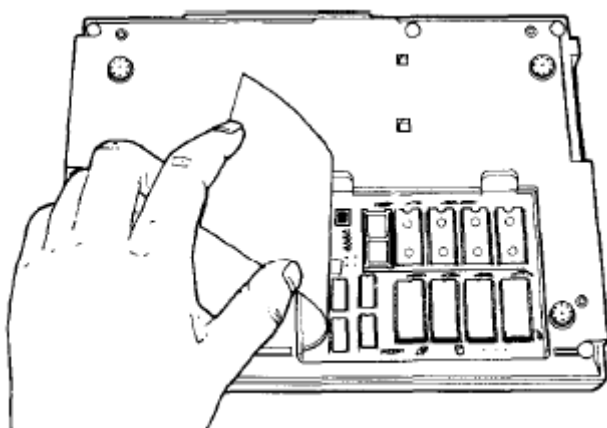
The RS-232 plug on the PC side has to be connected to the high-speed serial port of the HX-20. In order to do this, you will first have to build a cable. The wiring of such cable is like this (without any guarantee or liability):

Epson serial port plug	PC RS-232 port (DB9 female plug)	Epson – PC connection
		1 – 5 ... GND 2 – 3 ... RXD 3 – 2 ... TXD
1 ... GND 2 ... TXD 3 ... RXD 4 ... POUT 5 ... PIN	2 ... TXD 3 ... RXD 5 ... GND	

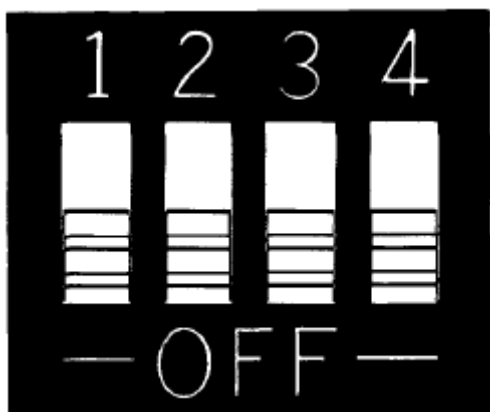
Usually, you will connect this self-built cable to the Epson HX-20 and then via a USB-to-RS232 adapter to your PC's or notebook's USB port.

Enabling Disk BASIC on the HX-20

The HX-20 will only recognize an external floppy disk and load the Disk BASIC extension, if a specific DIP switch on the back of the HX-20 is turned on. This DIP switch is located behind an approx. 9 x 13 cm big cover at the bottom side of the Epson HX-20. When you open it, you will see a shiny, flexible flap, which you can lift up in order to have access to the DIP switches. This looks like this:



There are actually four DIP switches in the computer:



To enable Disk BASIC set switch number 4 to "ON". Leave the other switches unchanged.

Installing flashx20

The "installation" of flashx20 is very easy. Just extract the zip file into a folder on your PC (e.g. C:\flashx20\). Then, this directory will contain the following file and directories:

a\	Directory containing the files of the Epson disk drive "A:".
b\	Directory containing the files of the Epson disk drive "B:".
c\	Directory containing the files of the Epson disk drive "C:".
d\	Directory containing the files of the Epson disk drive "D:".
flashx20.exe	The executable program
flashx20.pdf	This documentation

The "a\" directory already contains some sample BASIC programs to be loaded into the HX-20 for tests. The executable program is a Windows console application. It has to be started in a command shell on the PC.

Working with flashx20

Once the HX-20's DIP switch has been appropriately set, the PC has been connected to the HX-20, and the flashx20 program has been installed, you can start flashx20 in a console window on the PC or notebook. The syntax is the following

```
flashx20 [-g1 | -g2 | -g3] [-h] [<COM port name>]
```

By default, flashx20 will connect to the Epson HX-20 via the PC serial port "COM3", but this will most probably be a different COM port on your computer. Please check, which COM port name is assigned to your RS232 port or USB-to-RS232 adapter, and enter this name as parameter at program start.

If e.g. your USB-to-RS232 adapter provides the port "COM7", then you would start flashx20 with the following command:

flashx20 COM7

You can add the option “-g” plus a numeric code to define which resolution of graphics flashx20 will use in its high-resolution mode. There are three graphics options available:

- g1 High-resolution graphics has a resolution of 512 x 512 pixels. This is also the default, if you do not specify a “-g” option.
- g2 High-resolution graphics has a resolution of 1024 x 768.
- g3 High-resolution graphics has a resolution of 1800 x 1000.

In the low-resolution graphics mode (see below) the resolution is always 128 x 96 pixels.

Calling flashx20 with “-h” (for help) prints out information on how to start the program.

When the flashx20 program is running on your PC, you can switch on the connected Epson HX-20 computer. If all is properly set up, the boot process into BASIC will take longer than usual, because the Disk BASIC extension is loaded from the PC, and you should then see the following message on the LCD display:



Now you can start working with your HX-20 having at your disposal

- the “big” screen of your PC with high-resolution graphics,
- four disk drives “A:” to “D:”,
- additional BASIC commands for floppy disk access, “WHILE” loops, and others.

In the following, you find a few Epson HX-20 commands, that will be useful to switch the external screen on and off and to work with the floppy disk.

SCREEN 1 Switch external screen on. All subsequent text output will be on the PC’s screen.

SCREEN 0 Switch external screen off. All subsequent text output will be on the Epson’s LCD display.

FILES List the directory of the floppy disk drive.

LOAD “filename” Load a BASIC program from the floppy drive (that is, for example from the “a\” directory on your PC).

SAVE "filename" Save the BASIC program currently present in the HX-20 to the floppy drive (that is, for example to the "a\" directory on your PC).

For the full set of additional commands in Disk BASIC you should have a look at the manual of the TF-20 floppy disk station, where they are all described in detail. The "SCREEN" command is described in more detail in the standard Epson BASIC manual and later in this document.

Flashx20 also has some limitations and differences at the moment, which you should be aware of. The following commands work differently:

WIDTH Only "WIDTH 80,24" is allowed at the moment. All other size specifications result in an error message.

LOCATE Only "LOCATE 0,0" is allowed at the moment. All other specifications result in an error message.

FORMAT, SYSGEN, DSKO\$, DSKI\$, DSKF These commands are ignored. They would be dangerous or senseless on the PC.

Drawing pictures in graphics mode

The Epson HX-20 offers graphics support via the external display controller. On the original hardware display controller there were two graphics modes available with quite low resolutions of 128 x 64 pixels with 4 colors and 128 x 96 pixels with 2 colors.

In flashx20 two graphics mode are implemented:

- Mode 1: a low-resolution mode at 128 x 96 pixels with 8 colors (similar to the hardware controller mode)
- Mode 2: an 8-color high-resolution mode at 512x512, 1024x768, or 1800x1000 pixels depending on the "-g" command-line option

To turn on the graphics mode, in Epson BASIC the SCREEN command is used. The first parameter of this command is 0 (text output on LCD) or 1 (text output on the external display). The second parameter is the graphics mode, where 0 means no graphics, 1 is low-resolution graphics mode, and 2 is high-resolution graphics.

The SCREEN command can for example be used as follows:

SCREEN 1,0 Switch external screen on. All subsequent text output will be on the PC's screen. The graphics is switched off.

SCREEN 1,1 Text output on external display (PC). Graphics switched on at 128 x 96 pixels with 8 colors.

SCREEN 0,1 Text output on LCD. Graphics switched on at high resolution. If flashx20 was started with "-g2", this means e.g. 1024 x 768 pixels with 8 colors.

Flashx20 will open a separate window for the graphics screen. The text is still shown in the console window on the PC or on the LCD display depending on the first parameter of SCREEN.

In graphics mode the following in Epson BASIC commands can be used to draw something:

GCLS	Clear the graphics screen.
COLOR fg,bg	Foreground and background colors are specified.
PSET (x,y) [,color]	Set a pixel at x/y with the specified color. If the color parameter is left out, then the standard foreground color specified with the COLOR command is used. Example: PSET (19,66),7
PRESET (x,y)	Clear the pixel at x/y.
LINE (x1,y1) - (x1,y1) ,PSET [,color]	Draw a line from x1/y1 to x2/y2. With PSET and an optional color code the line is drawn, with PRESET the line is cleared. Examples:
LINE (x1,y1) - (x1,y1) ,PRESET	LINE (19,66)-(70,87),PSET LINE (100,150)-(370,480),PSET,2 LINE (200,50)-(820,18),PRESET
POINT (x,y)	Get the pixel color at x/y. Example: C = POINT(19,84)

For the color parameter in these commands, in flashx20 the 8 color codes mentioned in the Epson documentation are provided. These are:

- 0 Green
- 1 Yellow
- 2 Blue
- 3 Red
- 4 White
- 5 Cyan
- 6 Magenta
- 7 Orange

There is no color code for black. You could use blue instead to draw with a rather dark color.

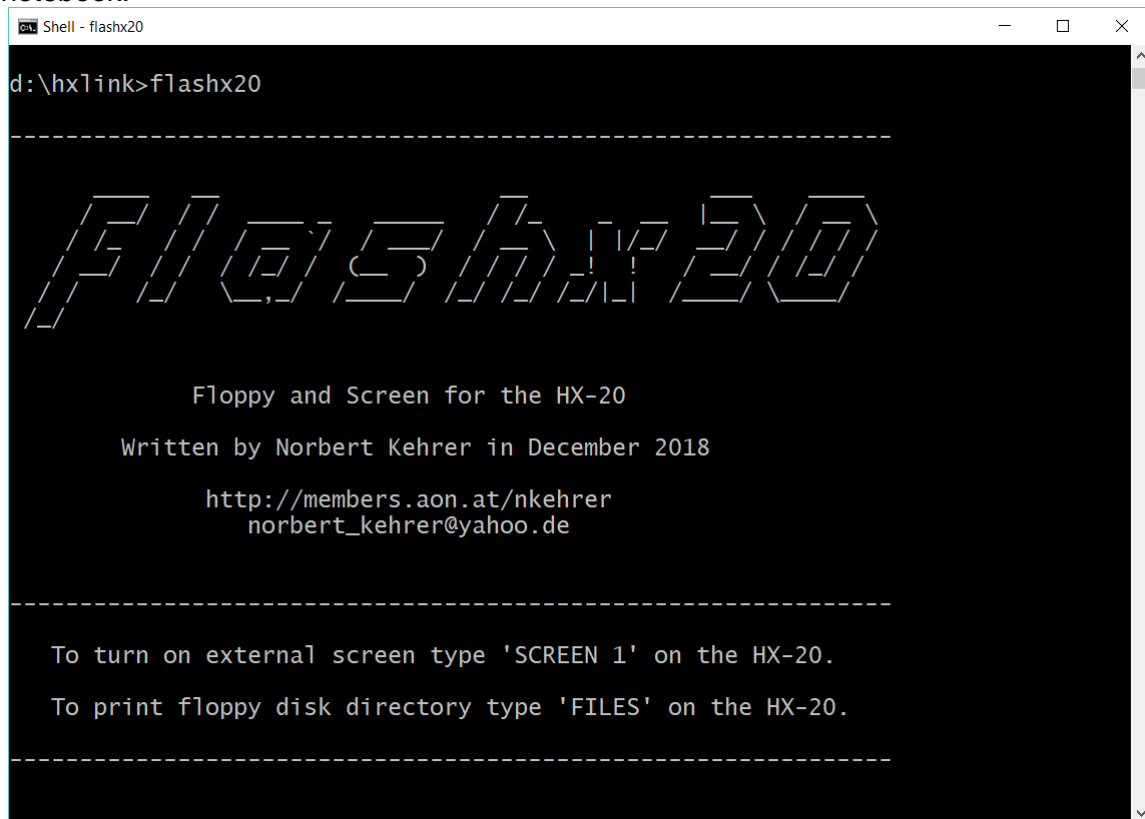
I wrote two little example programs to demonstrate the graphics capabilities of flashx20. They are in the "c\" directory of the flashx20 distribution and can be loaded from the C drive with the commands:

```
LOAD "C:DEMO.ASC"  
LOAD "C:MANDEL.ASC"
```

When you run these programs you will see a little line drawing demo or, with the second one, the the famous Mandelbrot set, which will take several hours on the HX-20, though.

Getting an impression of the program

In the following you will see some screenshots of flashx20 running on a Windows 10 notebook:



```
Shell - flashx20
d:\hxlink>flashx20

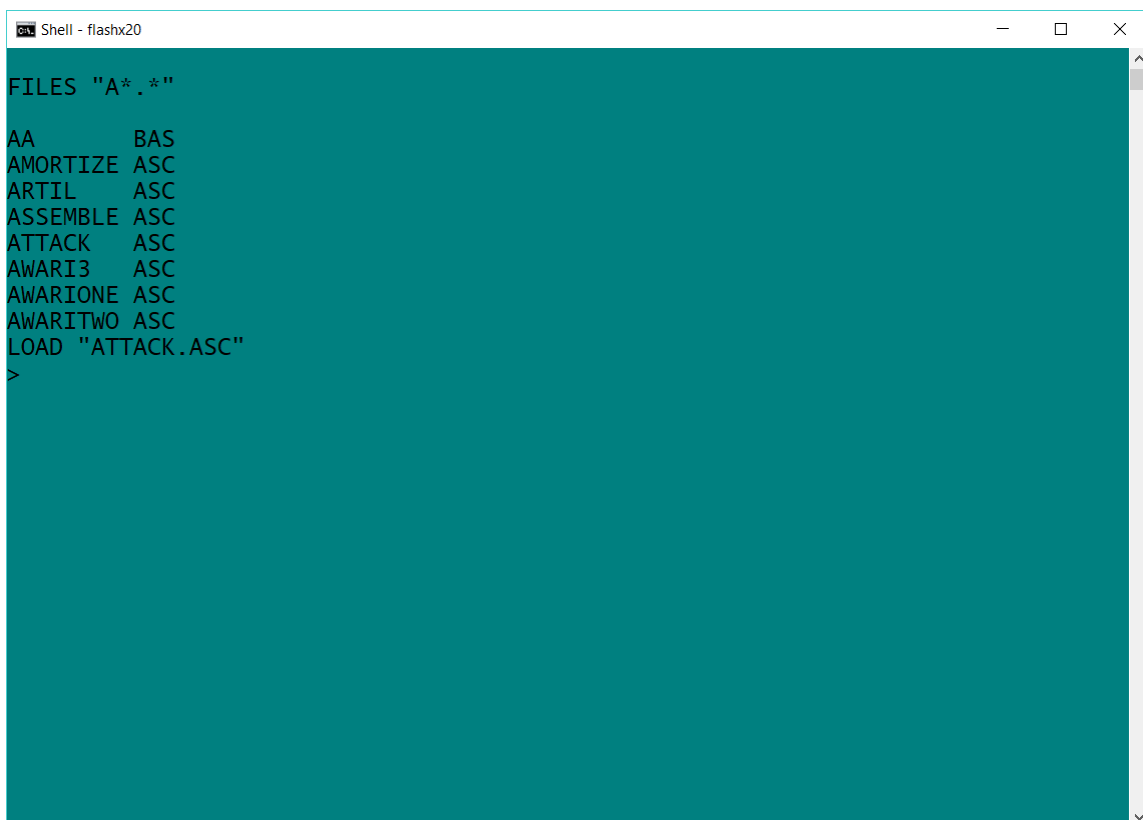
-----
Flashx20

Floppy and Screen for the HX-20
Written by Norbert Kehrer in December 2018
http://members.aon.at/nkehrer
norbert_kehrer@yahoo.de

-----

To turn on external screen type 'SCREEN 1' on the HX-20.
To print floppy disk directory type 'FILES' on the HX-20.

-----
```



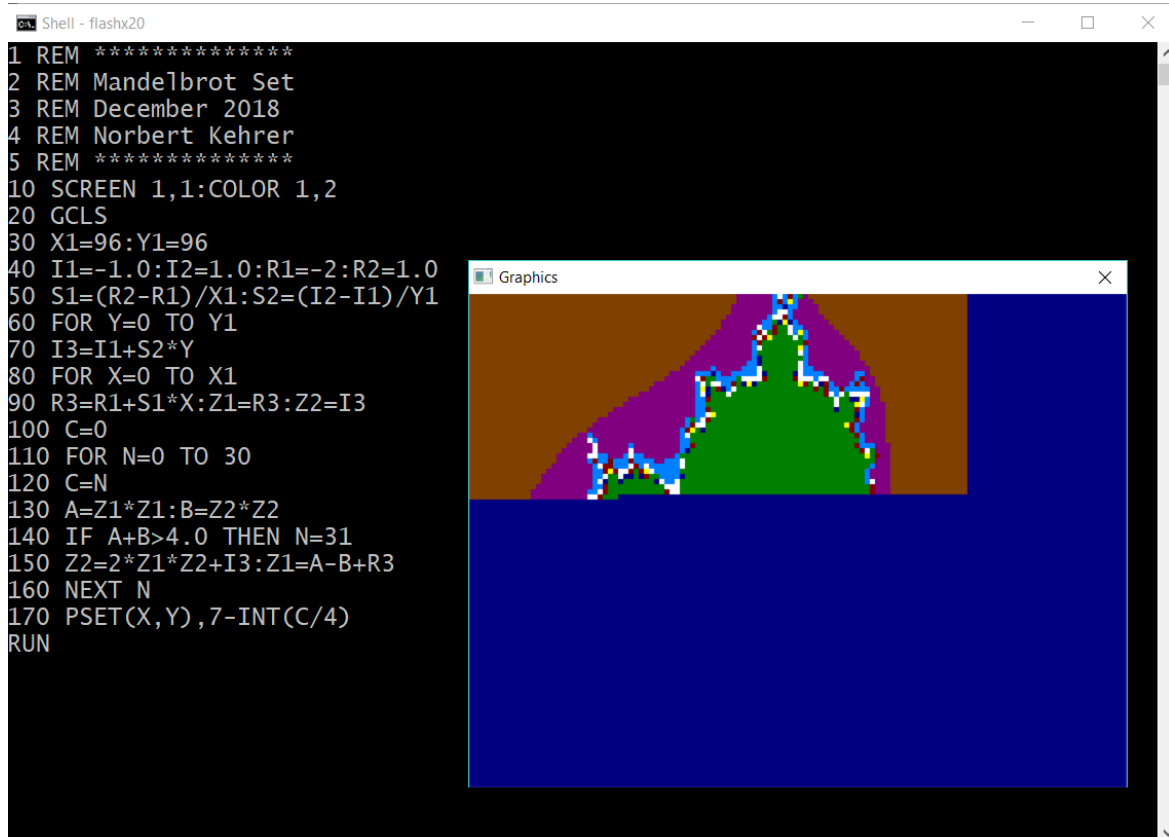
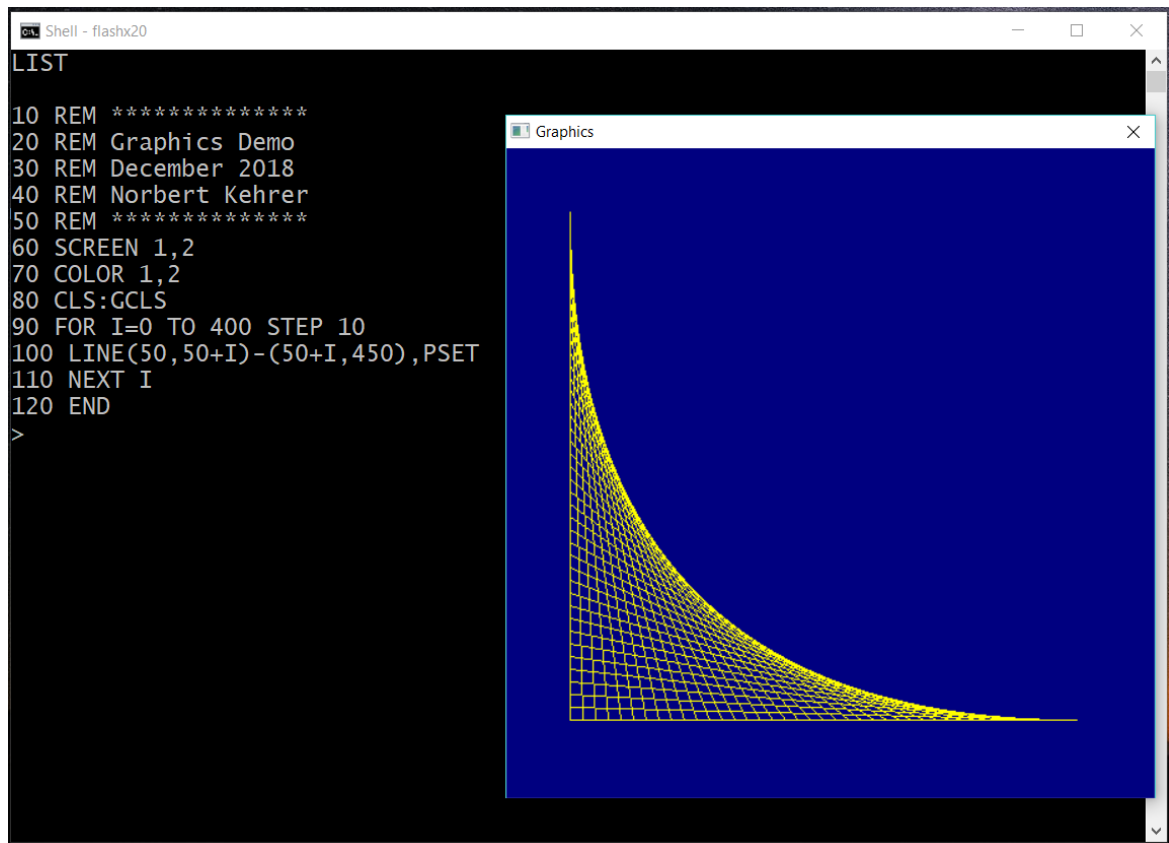
```
Shell - flashx20
FILES "A*.*)"

AA      BAS
AMORTIZE ASC
ARTIL   ASC
ASSEMBLE ASC
ATTACK  ASC
AWARI3  ASC
AWARIONE ASC
AWARITWO ASC
LOAD "ATTACK.ASC"
>
```



```
Shell - flashx20 -bw
40 CLS:LOCATE0,2,0:PRINT"A";:LOCATE19,1,0:PRINT"A";
50 LOCATE9,0,0:PRINT"E";:LOCATE10,3,0:PRINT"E";
60 Z=RND*16+.0625:PSET(0,16)
70 FORX=0TO119
80 Y=16-16*(SIN(X/Z)):LINE-(X,Y),PSET
90 A$=INKEY$:IFA$<>" "THEN160
100 W%=(W%+X+1)MOD56+1:SOUNDW%,1
110 NEXTX
120 FORI=1TO2:FORJ=56TO1STEP-4:SOUNDJ,1:SOUNDJ+1,1:NEXTJ,I
130 V%=V%-50
140 LOCATE0,3,0:PRINTV%;:IFV%>500ORV%<-500THEN230
150 GCLS:LOCATES0,0,0:GOTO60
160 LINE(2,19)-(X,Y),PSET:LINE(116,11)-(X,Y),PSET
170 IFPOINT(56,3)ORPOINT(62,27)THEN200
180 V%=V%-ABS(Y-16)-16
190 GOTO100
200 FORI=1TO3:FORJ=56TO51STEP-1:SOUNDJ,1:SOUND51,1:SOUND56,1:NEXTJ,I
210 V%=V%+ABS(X-60)+60
220 GOTO140
230 GCLS:LOCATES0,0,0
240 FORK=1TO2:FORL=1TO4:FORI=1TO112STEP4:J=ABS(I-56):SOUNDJ+31,1:SOUNDJ,1:NEXTI,
L
250 FORI=1TO112:J=I^2-56*(I^2\56):SOUNDJ,1:NEXTI,K:CLS:END
>
```

```
Shell - flashx20 -bw
LIST
10 X=1
20 WHILE X<5
30 PRINTX
40 X=X+1
50 WEND
RUN
1
2
3
4
>
```



Have fun!

Norbert, December 24, 2018