

# PIL storage drive

**On USB stick**, with screen, **instead of cassette drive**  
(for HP41. First. HP71 and HP75 next). Allschwil 2022.

# PIL storage drive

- Terms
  - USB stick [https://en.wikipedia.org/wiki/USB\\_flash\\_drive](https://en.wikipedia.org/wiki/USB_flash_drive)
  - PIL = “Peripheral Interface Loop” (no naming protection known; please advise if otherwise).
  - Digital cassette drive  
[https://de.wikipedia.org/wiki/Datei:Digital\\_cassette\\_drive\\_HP82161A\\_connected\\_to\\_calculator\\_HP-41CX.jpg](https://de.wikipedia.org/wiki/Datei:Digital_cassette_drive_HP82161A_connected_to_calculator_HP-41CX.jpg)

# PIL storage drive

- Presentation author Pascaldagornet at gmail dot com
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- The described project could NOT have been undertaken without the profound expertise of several smart Raspberry PI enthusiasts and the HP41 forums on the internet (no naming here since it would be a pity to forget the name of one of the helpers). A few are present at the Allshwil meeting 2022. All credit to all these persons.
- 2022 Oct 27

# PIL storage drive

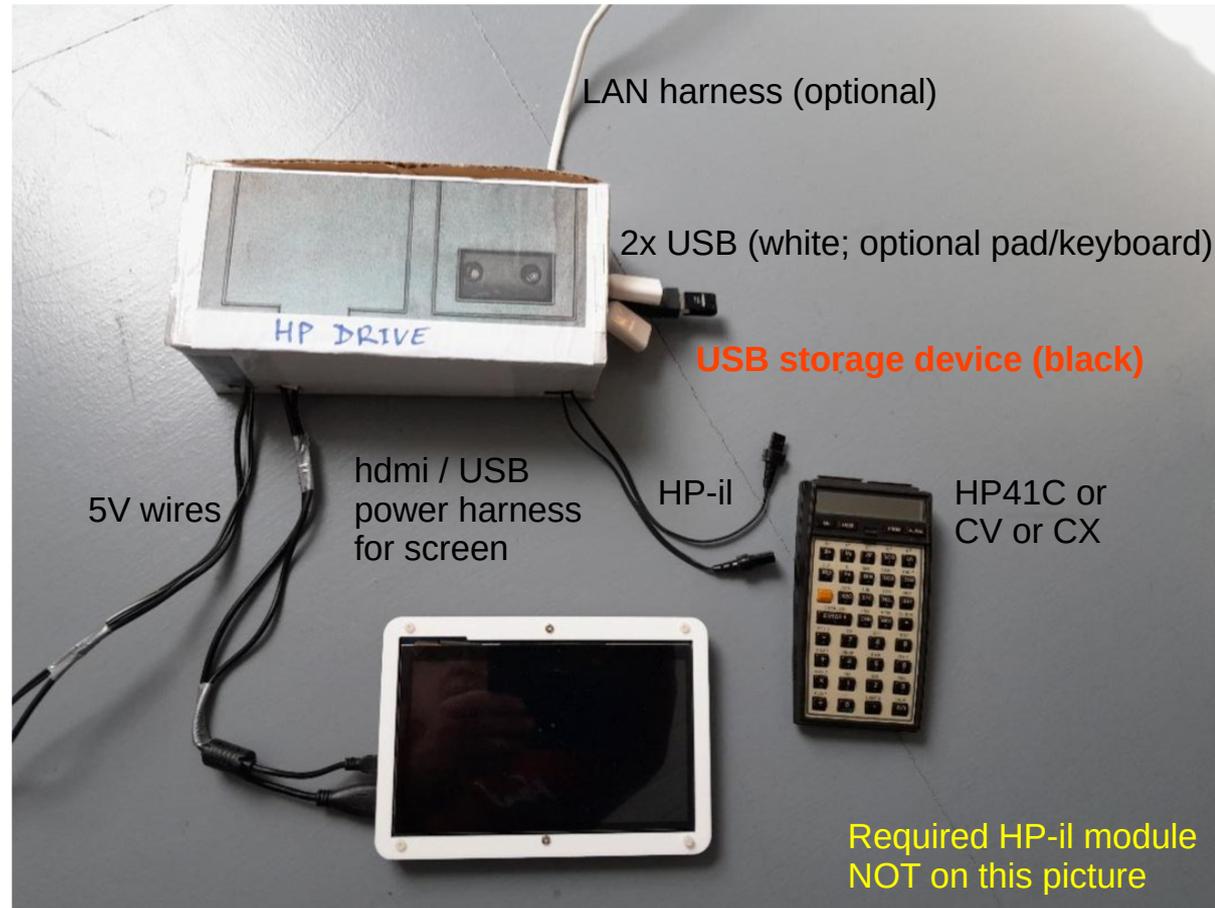
- Motivation:
  - (Anno 1984) The author used magnetic cards for program storage of HP41; cassette type storage evaluated as expensive / temporary technology due to the high dynamic in PC evolution (= the author stopped using the HP41 as a programming device due to low-level storage technology; sporadic use only as a calculator).
  - (Anno 2021) The author finds the „PIL-Box“ for connecting HP41(+HP-IL Module) via USB-serial to a PC virtual drive for data storage.

# PIL storage drive

- Idea due to existing knowledge of the autor:
  - Use of notebook and PC as virtual drive for HP41 (Linux 32 and 64 bits, x86 binaries) with „pyilper“ and „ilper“ (accessing different virtual drive).
  - Experience in making setup and use of Raspberry PI raspbian (linux) 32 and 64bits ARM binaries.
  - .. lets use a raspberry PI & „PIL-Box“ for data storage.
  - ***initial thoughts* = ? use „pyilper“ on 64bits ARM ? Start 64bits ARM „qemu“ for nesting „DOSBOX“ or small linux x86 32bits for a nested „emu41“ or wine/windows x86 „ilper“ or „pyilper“ 32bits? use the windows x86 binaries on ARM via x86-ARM adapter ? Several ways were tried and checked.**

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- Result (1 / 2):  
generation v1



# PIL storage drive

- Result (2 / 2):  
generation v1



# PIL storage drive

- Final result:



# PIL storage drive

- Hardware list; High-Spec version (1 / 4):
  - Raspberry pi4 (1 / 2)
    - Raspberry Pi® 4 B 4 GB 4 x 1.5 GHz Raspberry Pi®.
    - SanDisk microSDHC Ultra + Adapter "Mobile" microSDHC-Karte 32 GB Class 10, UHS-I inkl. SD-Adapter (temporary boot use during setup).
    - Pcooler-Set for chip cooling.
    - Joy-it M-CAB SBC-housing Raspberry Pi Aluminium Silver (optional).

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- Hardware list; High-Spec version (2 / 4):
  - Raspberry pi4 (2 / 2)
    - Raspberry Pi® voltage supply KSA-15E-051300HE Black.
  - screen
    - Joy-it RB-LCD7.2 Touchscreen-Modul 17.8 cm 7" 1024 x 600 Pixel (activ window 15.5cm x 8cm).
    - Joy-it RB-LCD-7-2Case Display.
  - Renkforce Capacitive Stylus Touchpen.

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- Hardware list; High-Spec version (3 / 4):
  - SSD USB3 drive for the final pi4 boot (SanDisk ExtremePRO 128GB) & USB3 cable 90°.
  - „PIL-Box“ (USB version) & HP-IL cable & USB-cable (male USB-2.0-Mini-B to USB-2.0-Type A).
  - USB hub (Digitus Slim Spider USB-Hub).
  - Profitec Netzteil 5V (powering the USB hub above).
  - USB3.1 / USB-C 32GB Philips storage device (& extension cable USB3 10cm).

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- Hardware list; High-Spec version (4 / 4):
  - 220V double-connector.
  - USB keyboard & mouse / combined version here:  
[https://www.amazon.de/gp/product/B09LQSJWZQ/ref=ppx\\_yo\\_dt\\_b\\_asin\\_title\\_o00\\_s00?ie=UTF8&psc=1](https://www.amazon.de/gp/product/B09LQSJWZQ/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1)
  - HP41 / emulator V41.
  - HP-IL HP-82160A / none if use of emulator V41.
  - Box size length 16,5cm x wide 12cm x high 7cm.

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- Setup HowTo (1 / 8):
  - Install raspbian LXDE on the SD card; boot the raspberry PI4 from the SD slot (then update the packages).
  - Activate the automatic login within the user „pi“ (no password asked anymore).
  - Activate the keyboard on screen application in case touchscreen capability is required.
  - Move the boot procedure from the SD card to the SSD USB3 drive (reason: a SD card can become corrupted with time or in case of a suddent voltage drop).

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- Setup HowTo (2 / 8):
  - Connect the USB3 storage on the PI4 with parameter setup for automatic mounting of it at boot.
  - Install Box86 on the raspberry PI4 via the application „pi-apps“ (makes x86 binaries working on the ARM device).
  - Install the wine application x86 linux binaries 32bits on the PI (will make later working the existing required windows x86 binaries).

# PIL storage drive

- Setup HowTo (3 / 8):
  - Install ILPER ILPILBOX windows x86 binaries (with wine) on the PI4. V41 installation recommended if screen attached.
  - Create scripts for starting automatically the ILPER etc. (create an icon on the Desktop; icon JPG available on-demand): one icon for an HP41 machine connected to the „storage drive“ and another icon for starting the V41 emulator (since 2 different scripts / setup required).

# PIL storage drive

- Setup HowTo (4 / 8):
  - Finalize the COM and/or TCP/IP setup of ILPER ILPILBOX V41 for proper communication between the hardware and the started applications.
  - start winecfg on pi4 then uncheck in „graphics“ „Allow the window manager to decorate the window“ (for using the full ILPER menues content and setups).

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- Setup HowTo (5 / 8):
  - both Drive field of the ILPER application menu must be filled with an existing dat file name at a correct recognized drive location; else the USB storage drive file will not be found automatically.
  - Make the application start immediately after double clicking on it; PCManFM file manager > Edit > Preferences > General Tick the box "Don't ask options on launch executable file".

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- Setup HowTo (6 / 8):
  - Update the fonts for using the hp-il VIDEO80 window x86 application  
`sudo apt update`  
`sudo apt-get dist-upgrade`  
`sudo apt-get install msttcorefonts`
  - Shutdown or reboot the HP storage device from a terminal via SSH  
`sudo shutdown -h 0` or `sudo reboot`



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- Setup HowTo (7 / 8):
  - Screen saver off.

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- Setup HowTo (8 / 8):
  - The virtual drive on the USB3 storage device can be used by other hp41 users:
    - unmount the USB3 (avoid data corruption) on the HP storage device, and move the USB3 to any another device (PC etc.) when formatted with „ntfs“.
    - Or start a browser on the screen and send by mail the virtual drive from the USB3 storage device.
    - Or transfer the virtual drive DAT file by FTP to other users.

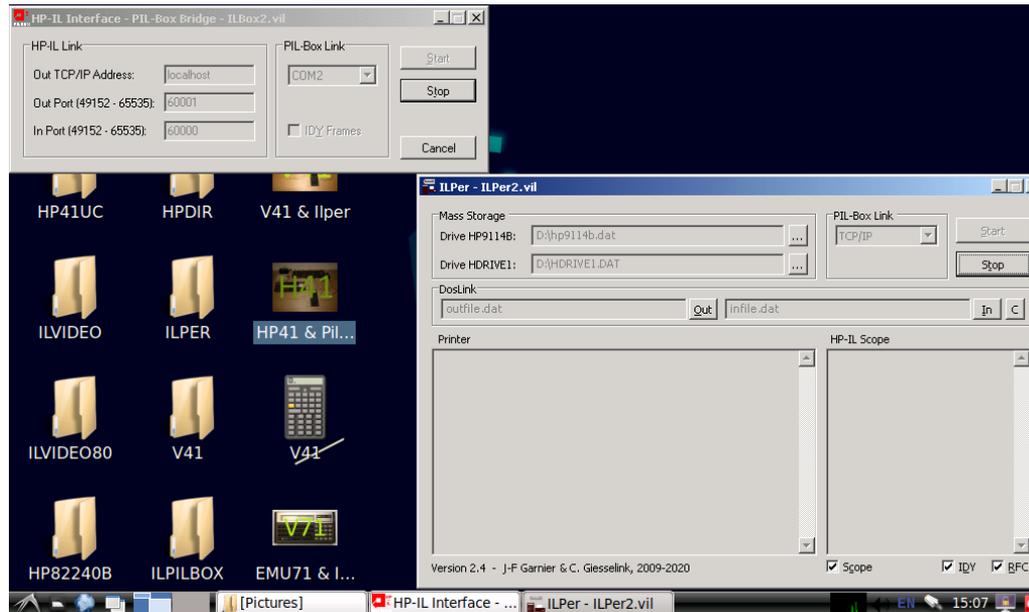
# PIL storage drive

- Use case (start screen after few seconds boot time = the connector was just connected to 220v)



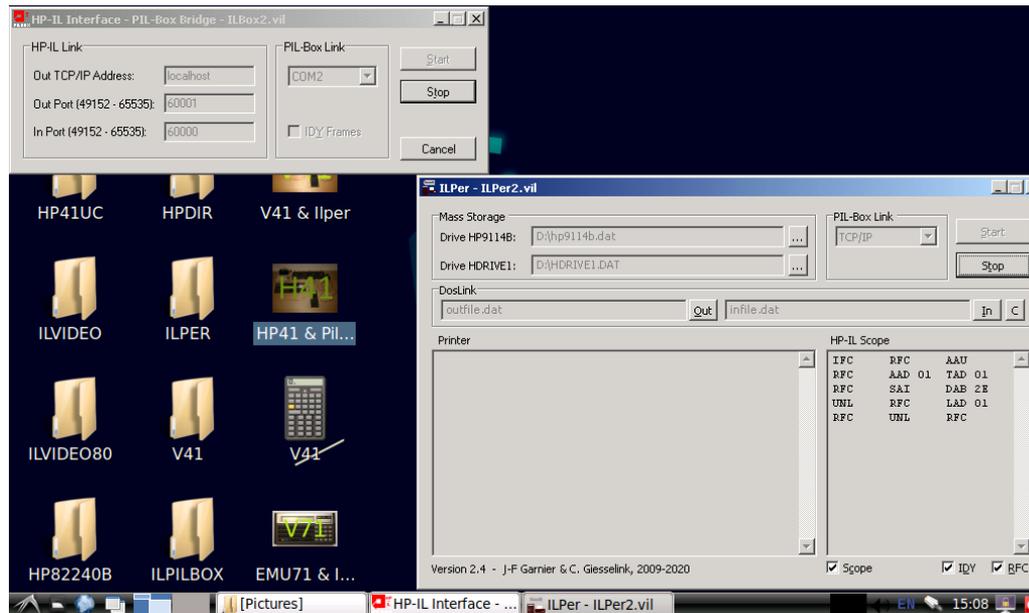
# PIL storage drive

- Use case (after start of the application „H41“ which happens automatically through the double clicking of the icon „H41“)



# PIL storage drive

- Use case (after on-switching a HP41 - C or CV or CX - machine connected via HP-IL to the „storage drive“)





# PIL storage drive

- Use case (picture of the test setup; see previous screen copies; the storage device is behind the screen on the table)



# PIL storage drive

- Scripts for icon creation (H41.jpg will be sent on demand)

File /home/pi/Desktop/HP41\_IL.desktop

[Desktop Entry]

Name=HP41 & Pilbox ILPer

Comment=this is an icon for starting all emulators with wine

Exec=bash /home/pi/hp41pc\_appli.sh

Type=Application

Terminal=false

Icon=/home/pi/H41.jpg

# PIL storage drive

- Scripts for programm start from icon

File /home/pi/hp41pc\_appli.sh

```
#!/bin/bash
```

```
echo "HP emulation interfacing tools"
```

```
wine '/home/pi/Desktop/ILPILBOX/ilpilbox.exe' '/start' 'C:\\users\\pi\\ILBox2.vil' &
```

```
wait 30
```

```
wine '/home/pi/Desktop/ILPER/ilper.exe' '/start' 'C:\\users\\pi\\ILPer2.vil' &
```

```
wait 30
```

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- Other ideas (1 / 4):
  - Low-Spec variant with a PI Model 2 or 3 (PI2 B V1.1 not tested positively *till now* at the author) and boot via the standard SD device port. PI Model 0 and 1 not working; see <https://ptitseb.github.io/box86/COMPILE.html>
  - Turn the screen; portrait instead of landscape (modify the screen boot parameter).
  - special implementation for HP71 & HP75 tbd (with green separate window in addition on the screen by installing ILVIDEO; more icons & adapted scripts).

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- Other ideas (2 / 4):
  - Implementation with ILPER-HP41-drive-1 and ILPER-HP71-drive-2 in the same start script.
  - Add 2x 90° connectors at the PI USB3 output for the USB storage stick → reducing the black extender length coming out of the box at the opposite side of the previous pictures.
  - Use the integrated pi4 board wifi instead of LAN (no harness for SSH administrator access).

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- Other ideas (3 / 4):
  - Use a bluetooth device connected to the pi4 (in the box) instead of the existing 2x white USBs for mouse/keypad access: however the 2x USB are part of a USB hub 3x (with separate voltage support) where 1 USB is used for the screen voltage connection.
  - Use a SD card for data storage instead of an USB storage.
  - Headless = no screen; button to be placed for shutdown of the pi. Direct access from an HP41 to the drive.

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- Other ideas (4 / 4):
  - Rework a defect cassette drive with a PI4 board inside.
  - Use a 5V voltage supply of the „pi4 with attached screen and usb-hub“ for portability (or 12v → 5v voltage supply).
  - bigger screen with the pi4 and pilbox PCBs screwed on the back of it.
  - .. any other idea?

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- HowTo links (1 / 4)
  - <https://thepi.io/how-to-install-raspbian-on-the-raspberry-pi/>
  - Automatic mounting of the USB storage  
<https://www.elektronik-kompendium.de/sites/raspberry-pi/2012181.htm>
  - Install Pi-apps then Box86 <https://pi-apps.io/install.html>

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- HowTo links (2 / 4)
  - Install Wine  
<https://ptitseb.github.io/box86/X86WINE.html#examples>
  - SSD USB boot install  
<https://raspberrypexpert.com/raspberry-pi-boot-from-usb/>
  - <https://raspberrypi.stackexchange.com/questions/40415/how-to-enable-auto-login>

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- HowTo links (3 / 4)
  - Creating shortcuts on desktop  
<https://forums.raspberrypi.com/viewtopic.php?t=117035>
  - <https://www.ionos.com/digitalguide/server/configuration/provide-raspberry-pi-with-a-static-ip-address/>
  - ILPER V41 ILPILBOX windows binaries  
<https://hp.giesselink.com/hpil.htm>

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- HowTo links (4 / 4)
  - Screensaver off (chapter 3.2)  
<https://www.geeks3d.com/hacklab/20160108/how-to-disable-the-blank-screen-on-raspberry-pi-raspbian/>
  - Shutdown button (if headless setup)  
<https://www.stderr.nl/Blog/Hardware/RaspberryPi/PowerButton.html>
  - Virtual keyboard on screen (if no mouse/keyboard by hand)  
<https://forums.raspberrypi.com/viewtopic.php?t=113526>



# PIL storage drive

- ONE more topic
  - Order the „PIL-Box“ at the inventor  
<http://www.jeffcalc.hp41.eu/hpil/index.html#pilbox>

# PIL storage drive

- Budget estimate (high-spec variant; working time 5h-15h)
  - PI4 + (Alu-housing) + Alu-cooler + SD bootcard + power-supply, 82 + (12) + 3 + 8 + 12 EUR
  - USB powered hub + 220v/5v power-supply, 9 + 25 EUR
  - 220v triple connector, 9 EUR
  - Screen + frame + (Touchpen), 86 + 18 + (3) EUR
  - Combi keypad/mouse board, 30 (\*) EUR
  - SSD-USB3 final boot drive + 90° connector + USB3 storage device + USB3 cable 10cm, 47 + 14 + 13 + 11 EUR
  - HP41-CV, 150 EUR (\*)
  - „PIL-Box“ + HP-IL cable + cable USB-A to mini, 120 + 25 + 5 EUR (\*)
  - HP41 HP-IL interface + LAN cable 1m, 120 (\*) + 3 EUR
  - Plastic box, 13 EUR
  - = **ALL together**: (378)-818 EUR      (..): not mandatory      (\*) usually @ HP user

# PIL storage drive

- Budget estimate (Pi4 4GB RAM)
  - Pi4 + Alu-housing + Alu-cooler + SD bootcard + power-supply, 82 + 12 + 3 + 8 + 12 EUR
  - USB3 storage device + USB3 cable 10cm, 13 + 11 EUR
  - = **ALL together: 141 EUR**

# PIL storage drive

- Final word
  - **Key topic:** the application **Box86** makes possible x86 binaries running on an ARM raspberry pi board, therefore it turns the Raspberry PI4 becoming a storage device for HP41 with internet connection.
  - A second hand notebook, with linux on it, could be a money saving alternative to the (currently quite expensive) ARM board with additional screen.

# PI4 storage drive

- Layout

Storage drive at the USB3 lower port of the PI4.

Boot SSD at the USB3 upper port of the PI4.

USB2 hub (white; with voltage supply) at the USB2 lower port of the PI4.

1 USB from hub, reserved for the screen voltage supply.

2 free USBs at hub for optional mouse/keyboard.

1 free USB2, upper port of the PI4, for a 90° side connector harness to the left for turning the SSD by 180° (done in the final version with the plastic box; not in this picture). See connector below left.

2x 90° USB3 (see below right) so far possible for turning the storage USB by 180°, but not implemented due to a poor product quality.

LAN cable not connected to the PI4 on the picture.



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# PIL storage drive

- Question to Allschwil 2022 participants and others:
  - why the same virtual storage drive DAT file is not accessible by pyilper (Linux 64bits) AND ILPER (use on raspberry PI ARM 64bits)? (the same is observed with pyilper and ilper on Linux 64bits).
- Any **???Q???U???E???S???T???I???O???N???**
  - ask on site in Allschwil 2022.
  - contact the author of this presentation.

# PIL storage drive

- .. possible questions:
  - Need for the install command history?
  - Need for using a low-spec storage drive with, for example, a PI3 as headless device? (PI3 + SD card + USB-storage)
  - .. contact the autor who might help.