

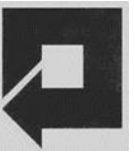
# Virtual Loops, PILs and LIF

An Update on HP-IL  
(HP Interface Loop )



# Intro Remarks

- Where am I coming from?
  - Just informing, not creating
  - Lovingly ignored HP-IL ~1986-2013
  - HHC 2013 comments spurred PIL-Box interest
  - HP-71B bias blatantly obvious
    - Learning HP-75 now, Re-learning HP-41 now
- HP-IL experience in audience? Ctrlr Types?
- Please ask topical questions during talk
- Interest in show-and-tell on Sunday?



# Today's Topics

- HP-IL Review
- LIF Volumes
- PIL-Box
- ILPer Client
- Virtual HP-IL Extensions
- Examples
- Resources and Credits



# HP-IL Review

- Serial Interface, Loop Config.
- Devices connected daisy-chain
- Each device has 1-In, 1-Out
- Only 1 controller active *at a time* on the Loop
- Devices can be addressed by current address, class, role, or exact type (lots of ways to talk)
- Devices can also send to each other, not just the controller (tell one to listen, another to talk)

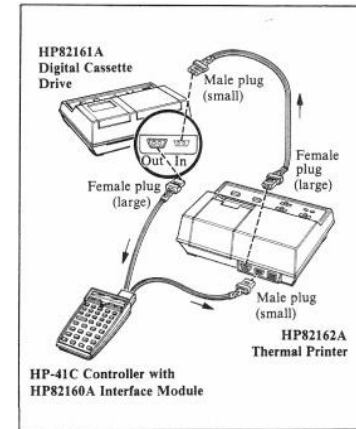


FIGURE 2-1. An HP-IL System configured from off-the-shelf HP-IL devices



# HP-IL Controllers

- Terminal-like device for issuing commands, collecting and processing data
- HP-71B most refined, plus it can also be an IL device
- HP-41 & HP-75 – Initial clients, slightly less flexibility
- HP-110 Portable and Portable Plus (integrated use)
- PC using HP-82973 ISA-slot Add-in Card (DOS)
- HP-80 series Personal Computers
- HP-150 Desktop PC



# HP-IL Devices

- Printers (and Plotters)
  - 82162A Thermal Printer – IL version of 82143A
  - 2225B ThinkJet – 80 column, graphics, fonts, etc.
- Mass Storage
  - 82161A Tape Drive – 128KB Micro Cassettes
    - Uses “Filbert” Protocol – presumes tape-like behavior
    - Most tapes are actually still good – pressure pad repairs
  - 9114B Diskette Drive (also 9114 aka 9114A)
    - Uses “SS/80” Protocol – presumes disk-like(and Filbert)
    - Today, frequently need eject mechanism cleaning



# HP-IL Devices

- Data Acquisition
  - HP3421A Data Acquisition Unit (30-chan AC/DC)
    - HP-41 IL Cnds (tedious) and 71B (with Data Acq Pac)
- Instruments
  - 3468A/B DMM
  - Logic analyzer, Freq counter, spectrum analyzer
  - Gas Chromatograph (!!)
- PCs slaved for special purposes
  - J-F Garnier's TERM71 – uses 110 as 71 terminal



# HP-IL Interface Options

- 40- and 80-column video
- Acoustic coupler (modem)
- 82164A – RS-232C (serial port)
- 82165A – GPIO (parallel port)
- 82169A – HP-IB
- 5061-3166 – SCSI
- Products for embedded use



# How Much Do I Need to Know?

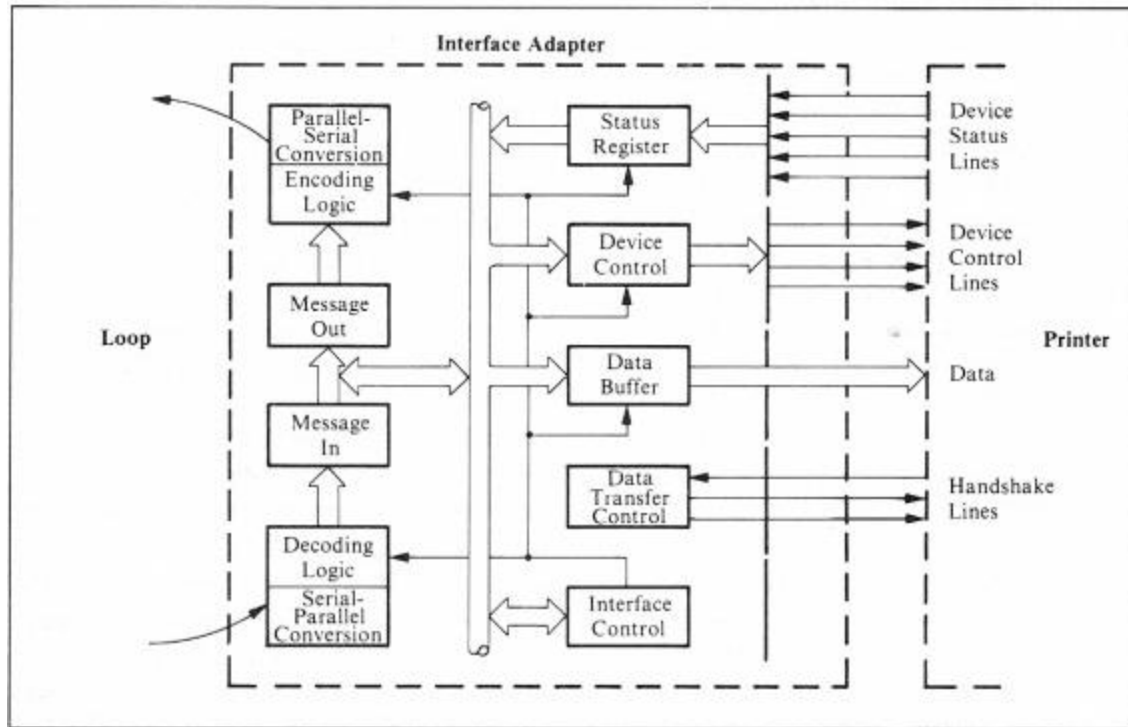


FIGURE 3-3. Detailed block diagram of an interface adapter for a printer

- If you can describe all possible data paths for above diagram, you're set
- But, if you can copy files in DOS, you're probably all set too...



# LIF Volumes

- Logical Interchange Format (LIF)
  - HP cross-platform media (disk, tape) image format
  - Can be used like a ZIP file (without compression)
- Supported across all HP machines 41 to 9000
- Filenames, but no “extensions” (it’s pre-DOS)
- File Type and Implementation Bytes Fields
- If you’re only going to read 1 article on LIF
  - <http://www.hpmuseum.org/cgi-sys/cgiwrap/hpmuseum/articles.cgi?read=24>



# LIF Volumes

- Programs easily exchanged
  - “Mount” volume w/PIL-Box s/w (it’s coming...)
  - Connect your controller
  - Copy program to the MassMem volume
  - Close PIL-Box s/w
  - Email, burn, etc. volume just as any other file
- Direct DOS <-> LIF file x-fer possible, but tricky
  - HPDIR (<http://hp9845.net/9845/projects/hpdir/>), Linux
  - File type and implem. bytes not supported in DOS



# PIL-Box

- USB interface for PC, primarily for PC / HP-IL file transfer
  - Provides virtual Mass Storage and Printer devices
  - Simple USB driver installation and easy to use client
- 
- Created by Jean Francois Garnier (J-F)
  - Widely used in Enthusiast Community
    - Introduced 2009
    - Over 150 in use
    - F/W Upgrade 5/2014



# PIL-Box “Assembly”



- Avail complete or kit
- ~1 week from France
- User supplies IL cable
  - Becoming more rare...
  - Cut 1 cable, atch ends
  - Trivial, takes < 5 mins
- Firmware upgradeable
  - Perf update in May ‘14
  - Possible Future SS/80



# PIL-Box Virtual Devices

- Mass Storage Device (DEVID\$="HDRIVE1")
  - Uses Filbert Protocol (SS/80 in future, 10MB+)
  - 616KB Max volume size, up to 640 file entries
  - Addressed as :TAPE(2), :MASSMEM(3), :HDRIVE1
  - “D:” drive from HP-110; holds DOS diskette img
- Printer Device (DEVID\$="DISPLAY" [old name])
  - “Printed” output displayed in scrollable window
  - Text only. No graphics, ESC sequence processing
  - Supports Win Clipboard – Copy/Paste to Win Apps

# IL-Peripheral Emulator



- Original client (VB) by J-F Garnier (PPC France, JPC-ROM, EMU71/D)
- Enhanced client (VC) by Christoph Giesselink (EMU48, EMU71/W)
- Open Source – “easily” extensible (genius-class folks take note)

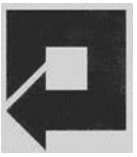


# ILPer Client

- “Printer” output window
  - Scrollable, large buffer
  - Captures “Printed” output
  - Log console activity
- HP-IL Scope window
  - Toggle on / off
  - Learn low-level HP-IL
  - Loop is slow when On
- Configuration controls
- Select Volume File







# ILPer Client – Same for Dif Controllers

## For HP-41

## For HP-110 Portable Plus

**ILPer**  
HP-IL Peripheral emulator

PIL-Box Link: COM3 [Start] [Stop]

Mass Storage LIF file: C:\DATA1\JF\ILPer\HDRIVE1.DAT

Printer: PRSTK

```

T= 5.0000
Z= 5.0000
Y= 5.0000
X= 5.0000
DIR
NAME  TYPE  REGS
PILBOX DA    10
NUM   DA    10
  
```

HP-IL Scope

Version 1.43 - J-F Gamier & C. Giesselink, 2009-2013

**ILPer**  
HP-IL Peripheral emulator

PIL-Box Link: COM3 [Start] [Stop]

Mass Storage LIF file: C:\DATA1\JF\portableplus\UTIL1.D

Printer: Volume in drive C has no label  
Directory of C:\

BURN	COM	1992	5-06-85	15h32
CLOCKPRG	COM	3193	10-07-85	11h30
EDISK	SYS	1808	5-06-85	16h22
FONIS	COM	570	11-01-80	23h20
HEEBIE	COM	4715	5-06-85	9h23
IMAGE	COM	5491	5-06-85	15h16
KERMIT	EXE	58368	21-01-89	2h32
PAM	MNU	86	21-11-91	21h31
SCOPE	BAS	896	1-01-86	12h37
TERM71	COM	628	1-01-86	12h14

HP-IL Scope

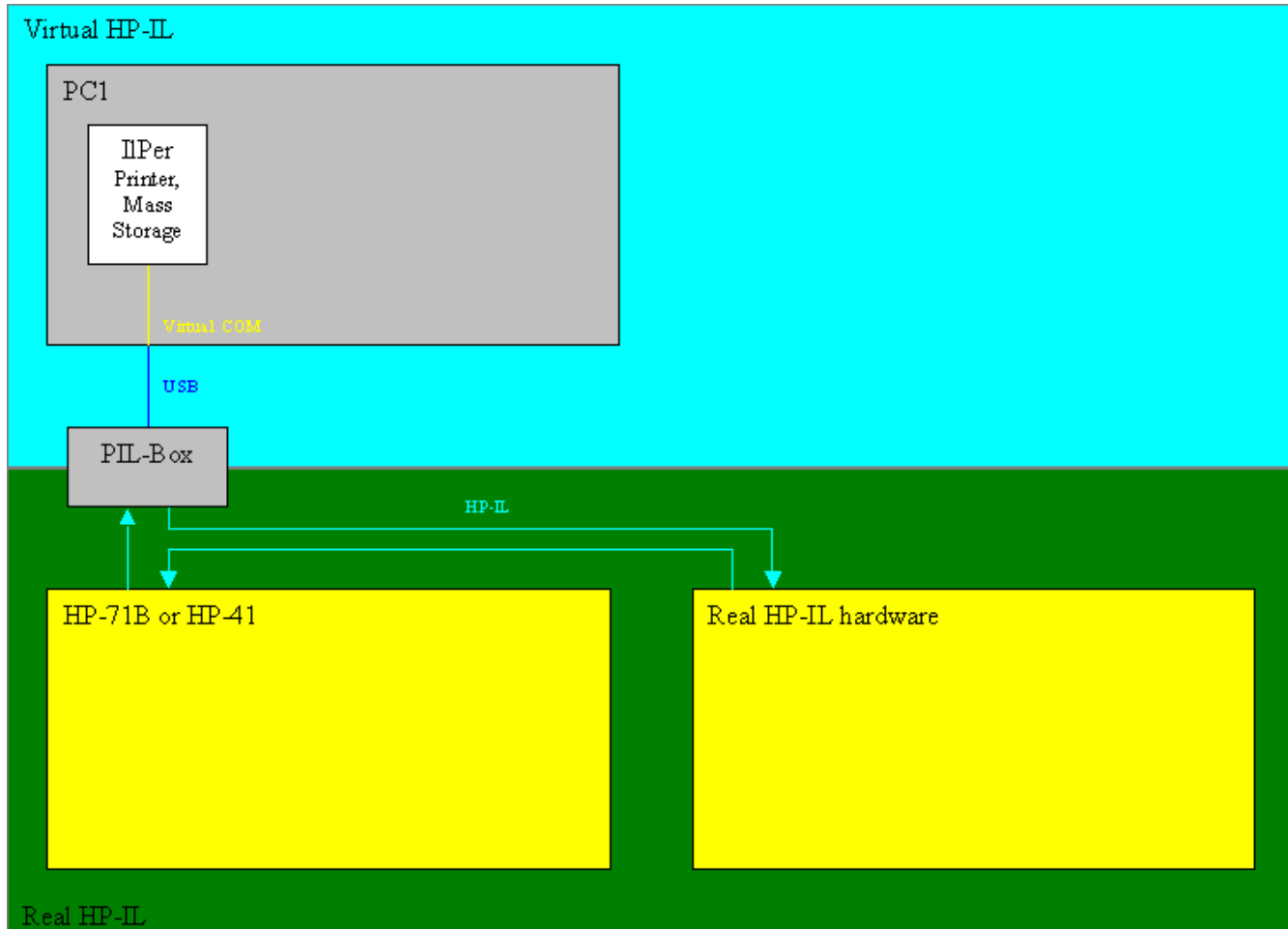
Version 1.43 - J-F Gamier & C. Giesselink, 2009-2013



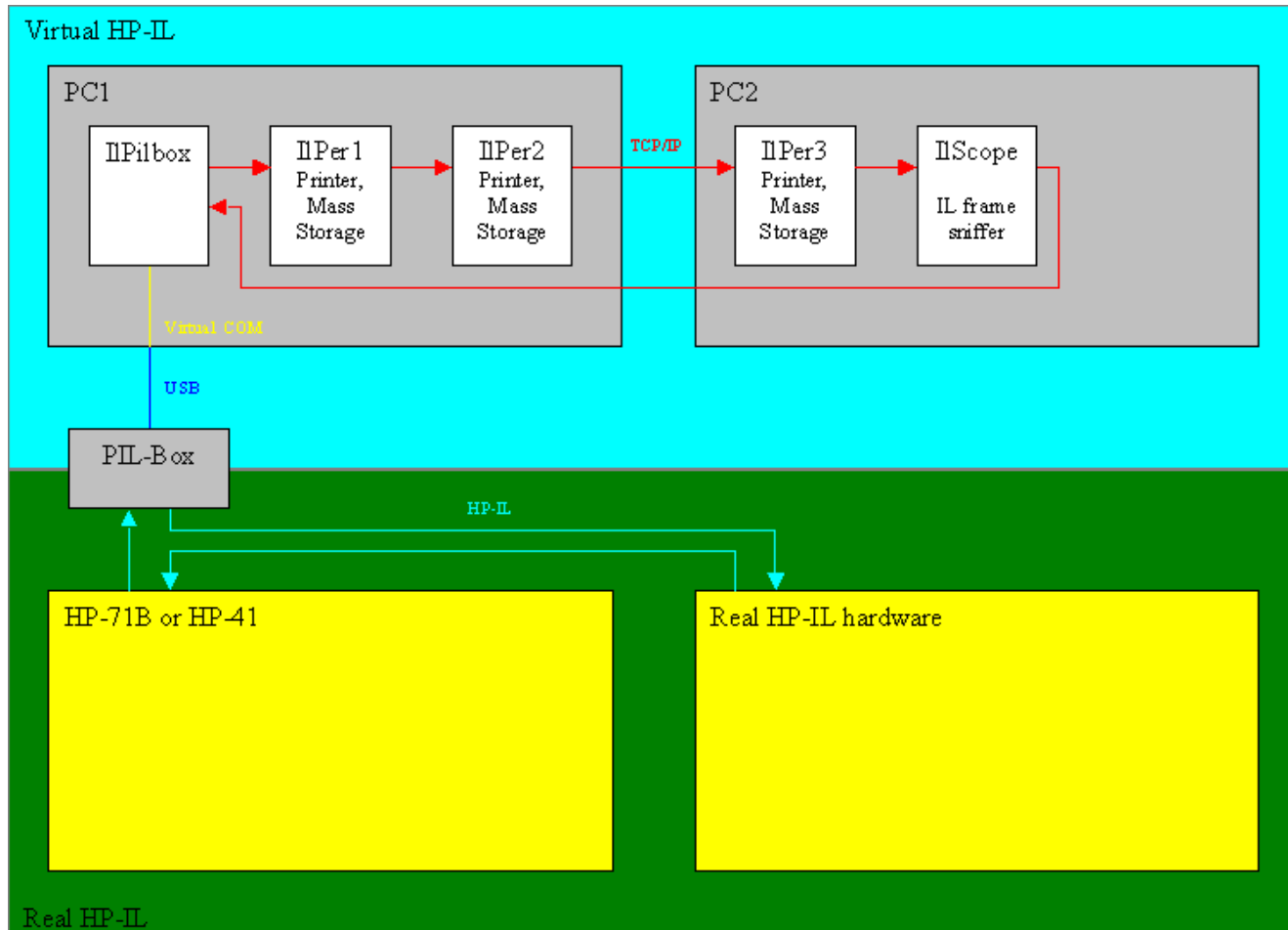
# When Virtual is not enough

- Virtual Monitors (82163A and 92198) by C.G.
  - For true video out (e.g. DISPLAY IS... on 71B)
- HP-IL frame code debugger by C.G.
  - Trace and analyze IL Frames
- ILPer provides 1 Mass Mem and 1 Ptr Device
- What if I want 2+ virtual mass mem devices?
  - Copying files from one “disk” to another
  - Reading from one disk, Writing to another

# Simple ILPer Flow



# ILPer Enhanced by TCP/IP



# ILPIL-Box “Gateway”

The screenshot displays the ILPer (HP-IL Peripheral emulator) software interface. It consists of two main windows and two smaller configuration windows.

**ILPer (HP-IL Peripheral emulator) - Top Left Window:**

- Mass Storage LIF file:** hdrive1.dat
- PIL-Box Link:** TCP/IP, Start, Stop buttons. Radio buttons for 9600 bps and 115 kbps (selected).
- Printer:** ENTER^
- HP-IL Scope:**

IFC	AAU	AAD	01		
TAD	01	SAI	DAB	2E	
UNL	LAD	01	UNL		
AAU	AAD	01	TAD	01	
SAI	DAB	2E	LAD	01	
UNL	AAU	AAD	01		
TAD	01	SAI	DAB	2E	
LAD	01	DAB	45	DAB	4E
DAB	54	DAB	45	DAB	52
DAB	5E	DAB	0D	DAB	0A
UNL					
- Version:** 1.36.2 - J-F Garnier & C. Giesselink, 2009-2010
- Scope:**  Scope

**ILPer (HP-IL Peripheral emulator) - Top Right Window:**

- Mass Storage LIF file:** hdrive2.dat
- PIL-Box Link:** TCP/IP, Start, Stop buttons. Radio buttons for 9600 bps and 115 kbps (selected).
- Printer:** (Empty)
- HP-IL Scope:**

IFC	AAU	AAD	03		
TAD	01	DAB	2E	ETO	
UNL	LAD	01	UNL		
AAU	AAD	03	TAD	01	
DAB	2E	ETO	LAD	01	
UNL	AAU	AAD	03		
TAD	01	DAB	2E	ETO	
LAD	01	DAB	45	DAB	4E
DAB	54	DAB	45	DAB	52
DAB	5E	DAB	0D	DAB	0A
UNL					
- Version:** 1.36.2 - J-F Garnier & C. Giesselink, 2009-2010
- Scope:**  Scope

**HP-IL Interface - PIL-Box Bridge (Bottom Left Window):**

- HP-IL Link:** Out TCP/IP Address: localhost, Out Port (49152 - 65535): 60001, In Port (49152 - 65535): 60000
- PIL-Box Link:** COM5, Start, Stop, Cancel buttons. Radio buttons for 9600 bps and 115 kbps (selected).

**HP-IL Interface Scope (Bottom Right Window):**

- HP-IL Link:** Out TCP/IP Address: localhost, Out Port (49152 - 65535): 60000, In Port (49152 - 65535): 60003, Start, Stop, Cancel buttons.
- HP-IL Scope:**

IFC	AAU	AAD	05	TAD	01	DAB	2E	ETO			
UNL	LAD	01	UNL	AAU	AAD	05	TAD	01			
DAB	2E	ETO	LAD	01	UNL	AAU	AAD	05			
TAD	01	DAB	2E	ETO	LAD	01	DAB	45	DAB	4E	
DAB	54	DAB	45	DAB	52	DAB	5E	DAB	0D	DAB	0A
UNL											



# TCP/IP Config Surprisingly Easy



The image displays four screenshots of the ILPer (HP-IL Peripheral emulator) software interface, illustrating the configuration process for TCP/IP. The main window, titled "ILPer", includes a "PIL-Box Link" dropdown menu set to "TCP/IP", a "Start" button, and a "Stop" button. A "Mass Storage LIF file" field and a "Printer" section with a license notice are also visible.

The first two screenshots show the "HP-IL Interface Setup" dialog box. In the first, the "Out TCP/IP Address" is "localhost", "Out Port (49152 - 65535)" is "60002", and "In Port (49152 - 65535)" is "60001". In the second, the "Out Port" is "60003" and the "In Port" is "60002".

The third screenshot shows the "HP-IL Interface - PIL-Box Bridge" dialog box. The "Out TCP/IP Address" is "localhost", "Out Port (49152 - 65535)" is "60001", and "In Port (49152 - 65535)" is "60000". The "PIL-Box Link" dropdown is set to "COM5", and the "115 kbps" option is selected.

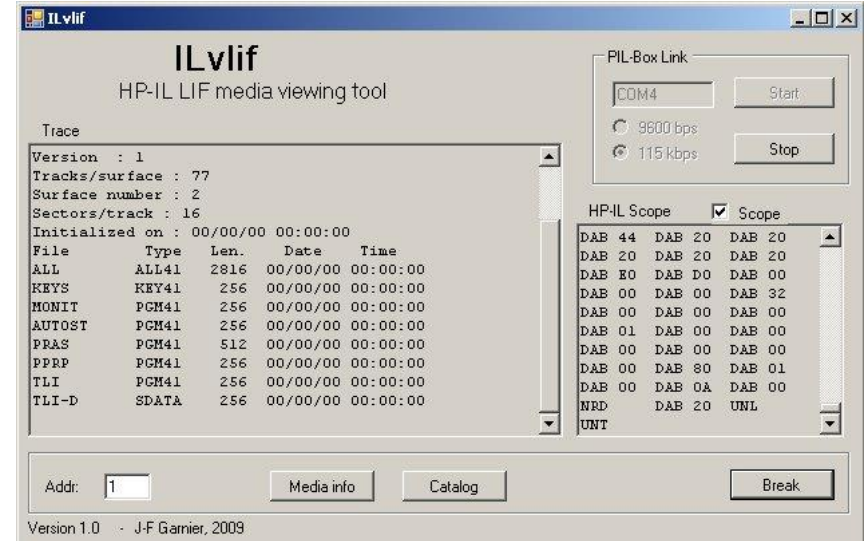
The fourth screenshot shows the "HP-IL Interface Scope" dialog box. The "Out TCP/IP Address" is "localhost", "Out Port (49152 - 65535)" is "60000", and "In Port (49152 - 65535)" is "60003". The "Start" button is highlighted.



# Tools to do Virtually Everything ...or Everything Virtually



- IL View LIF File
- Connect 9914B or 82161A via PIL-Box
- Use ILVlif as virtual controller
- Examine/ Print physical media catalogs
- No need to find and connect handheld

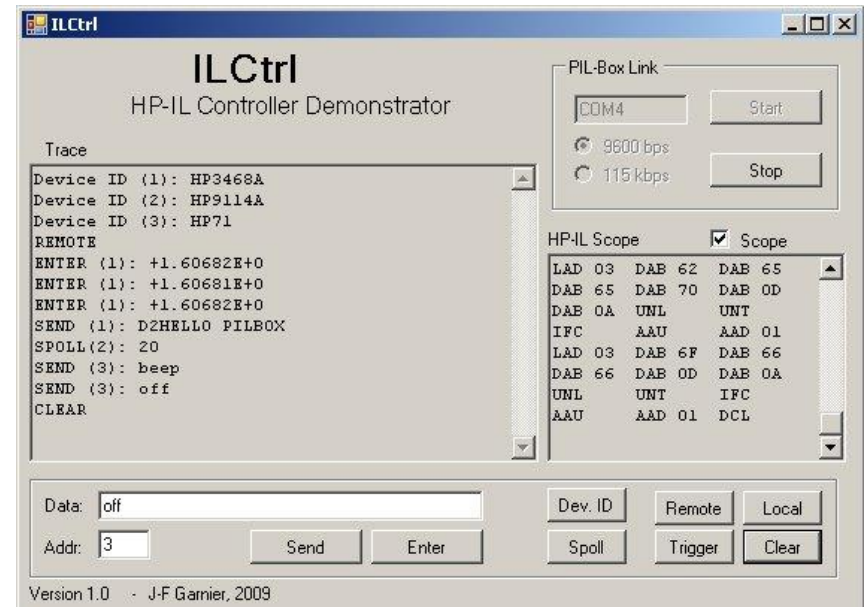




# Tools to do Virtually Everything ...or Everything Virtually



- ILCtrl – Controller
- Send HP-IL Commands without device
- Requires moderate+ knowledge of HP-IL
- Easy to create log of commands & replies
- Useful to see typically hidden replies/errors
- Enhanced vers. by C.G.







# What can I do with these tools?



- Mass Memory Example
  - Copy files from LIF volume to device
- Printer Example
  - How to copy a ROM using a printer
- Larger Projects...



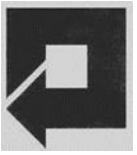
# Copy Files from LIF Volume

- Hypothetical Scenario – Arrive at a conference and find your machine says “Memory Lost”
  - Connect PIL-Box to USB port and HP-71B
  - Start ILPer – select RPP.LIF – click “Start”
  - “Restore IO” on HP-71B to ID/config devices
  - “COPY ROMCOPY:TAPE TO :PORT(1)”
  - “ROMCOPY JPCROM:TAPE TO :PORT(3)”
  - “COPY LexFile:TAPE TO :PORT(1)”
  - “COPY MYPROG:TAPE” (to :MAIN)



# How to copy a ROM using a printer

- I want to use my '71 MATH ROM, in EMU71
  - Use simple program to “Print” ROM contents
  - Copy/paste output to text file mathrom.dmp
  - Convert: “DMP2ROM mathrom.dmp mathrom.bin”
    - Existing utils from C.G. using Derek Nickel's Voyager fmt
  - Verify ROM CRC: “TITANCHK mathrom.bin”
    - TITANCHK Util included with EMU71
  - Load mathrom.bin into EMU71
- You can't do that with a physical printer!



# How to copy a ROM using a printer

```
10 DIM A$(64)
20 A=IP(HTD(ADDR$(“EDTEXT"))/256)*256 ! Start address of ROM to dump
30 FOR I=0 TO 16*32-1 ! Length of ROM (here for 16KB)
40  A$=PEEK$(DTH$(A+I*64),64)
50  OUTPUT :3 ;A$ ! PIL-Box is address 3 & 4 on my loop, 3 is printer
60 NEXT I
```

- 20 Get address of 1<sup>st</sup> file in the ROM (in this example, Text Editor)
- 30-60 Loop on all bytes in the ROM
- 40 Get the next 64 nibs (32 bytes)
- 50 “Print” them to the virtual Printer



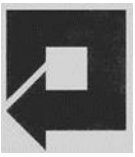
# Key HP-IL Resources

- J-F Garnier's HP-IL Website
  - <http://www.jeffcalc.hp41.eu/hpil/index.html>
- Christoph Giesselink's HP-IL Website
  - <http://hp.giesselink.com/hpil.htm>
- Museum of HP Calculators Forum
  - <http://www.hpmuseum.org/forum/index.php>
- eBay – All items discussed still available



# Credits

- Huge Thanks to Creators of these Tools!!
  - J-F Garnier
  - Christoph Giesselink
- Both Enormously Generous & Accomplished Politicians
  - “Bob, replies to this question would benefit all” (use Forum!)
- Thanks for inspiration and tireless patience (with me)
  - Joe Horn
  - Dave Frederickson, Sylvain Cote
  - eBay hudendai, jones.sebago.lake, vintagecalculatorsinc



## In Closing...

- Contributions from audience
  - Other uses?
  - War stories?
- Questions?
- Demos on Sunday?
- What Else Can One Build...