How fast is HP-IL?

A discussion of the HP-IL performance, from specifications to real measurements.

PIL-Box optimization.
How fast is HP-IL: what marketing said.

HP “Marketing” often presented the HP-IL as able to reach a maximum speed of 20 kBytes/s, much faster than the standard RS232 link of the time (~1 kByte/s at 9600 bps).

This was based on the ~50us HP-IL frame duration (one byte transmission time), but has nothing to do with operation in real conditions.

This figure have been used more or less unchanged by several reviews on HP-IL:

- From “Interface Fundamentals in Microprocessor-Controlled Systems”, Chris Georgopoulos, 1985
The HP Journal on HP-IL (January 1983) provided a much better analysis:

Max theoretical performance with the 1LB3 HP-IL chip (software delays not included):
- 1 device: 7.1 kB/s
- 3 devices: 6.4 kB/s
- 5 devices: 5.5 kB/s

Real performances with actual controllers:
- HP-85: 3 kB/s
- HP-41C: 200 Bytes/s

(The HP-75C was not mentioned, and the HP-71B was not yet existing)

From the HP Journal Vol.34, N1, January 1983: article by Steve Harper.
How fast is HP-IL - specifications and benchmarks

Transfer rate (bytes/sec): 8K (copying to a loop, no devices on loop); 6.4K (copying in a file); 4.5K (OUTPUT statement, no formatting (USING)); 4K (ENTER statement, no formatting (USING)) and version 1B of the HP-IL module.

From the HP-71B specifications in the HP Catalog, 1987, p.61

- Using the HP-71B (best HP-IL controller) a realistic figure is 4 to 6 kB/s max.

- Using the HP Portable Plus, the performance is limited to the speed of the external devices to about 2-3 kB/s

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**DISC BENCHMARKS**

<table>
<thead>
<tr>
<th>Disc</th>
<th>Speed</th>
<th>Interleave</th>
</tr>
</thead>
<tbody>
<tr>
<td>9114 DS 3.5&quot;</td>
<td>3.5Kb/S</td>
<td>4</td>
</tr>
<tr>
<td>9121 SS 3.5&quot;</td>
<td>1.7Kb/S *</td>
<td>?</td>
</tr>
<tr>
<td>9122 DS 3.5&quot;</td>
<td>1.7Kb/S *</td>
<td>?</td>
</tr>
<tr>
<td>8290x 5.25&quot;</td>
<td>1.7Kb/S *</td>
<td>?</td>
</tr>
<tr>
<td>913x hard disc</td>
<td>1.7Kb/S *</td>
<td>NA</td>
</tr>
</tbody>
</table>

* 82169A HP-IL/HPIB Converter speed limit

From a HP Portable Plus (HP110 Plus) training.
http://www.jeffcalc.hp41.eu/hpplus/files/slides_mass_storage.pdf
How fast is HP-IL - measurements

Benchmark on HP-71B, using the sequence:
1 RESTORE IO @ SEND UNL MTA
2 T=TIME @ COPY HPILROM TO :LOOP @ T=TIME-T
3 DISP 16384/T;” bytes/s”

Results:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP-71B + HP-IL loopback test</td>
<td>8.5 kB/s</td>
</tr>
<tr>
<td>HP-71B + 1 device (HP9114A)</td>
<td>8.7 kB/s (yes, faster!)</td>
</tr>
<tr>
<td>HP-71B + 3 devices (HP9114A, HP82163B, HP82164A)</td>
<td>8.7 kB/s</td>
</tr>
<tr>
<td>HP-71B + 5 devices (. . . + HP3468A, HP5384A)</td>
<td>7.4 kB/s</td>
</tr>
<tr>
<td>HP-71B + HPIL/HPIB (HP82169A) mailbox mode</td>
<td>4.3 kB/s</td>
</tr>
<tr>
<td>HP-71B + HPIL/HPIB (HP82169A) translator mode</td>
<td>2.6 kB/s</td>
</tr>
<tr>
<td>HP-71B + PIL-IO board (v2.0)</td>
<td>3.5 kB/s (no USB)</td>
</tr>
<tr>
<td>HP-71B + PIL-Box (v2.1, ILPer stopped/bypass mode)</td>
<td>3.5 kB/s (no USB traffic, as PIL-IO)</td>
</tr>
<tr>
<td>HP-71B + PIL-Box (v2.1, 230 kbps, ILPer running)</td>
<td>1.8 kB/s (optimized config.)</td>
</tr>
</tbody>
</table>

These tests reflect only the performance of the transport layer of the HP-IL, there is no data processing in the HP-IL devices.
How fast is HP-IL – PIL-Box optimization

The bottleneck for the PIL-Box performance is the USB link.
USB is not efficient for the byte-per-byte communication of the HPIL.
To get the best result, some optimization is needed.

Use the benchmark sequence on HP-71B, to test the best configuration:
1. RESTORE IO @ SEND UNL MTA
2. T=TIME @ COPY HPILROM TO :LOOP @ T=TIME-T
3. DISP 16384/T;” bytes/s”

Use the latest PIL-Box firmware (currently v2.1),
try to use the 230 kbps com speed (jumper JP2 removed).
Try the different USB ports.
USB 3.0 ports may give better results.
Try to use an external USB hub.
Make sure the PC power option is using a ‘High Performance’ mode.

Even with the best settings, performance is depending on each particular PC.
Thanks for your attention!

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