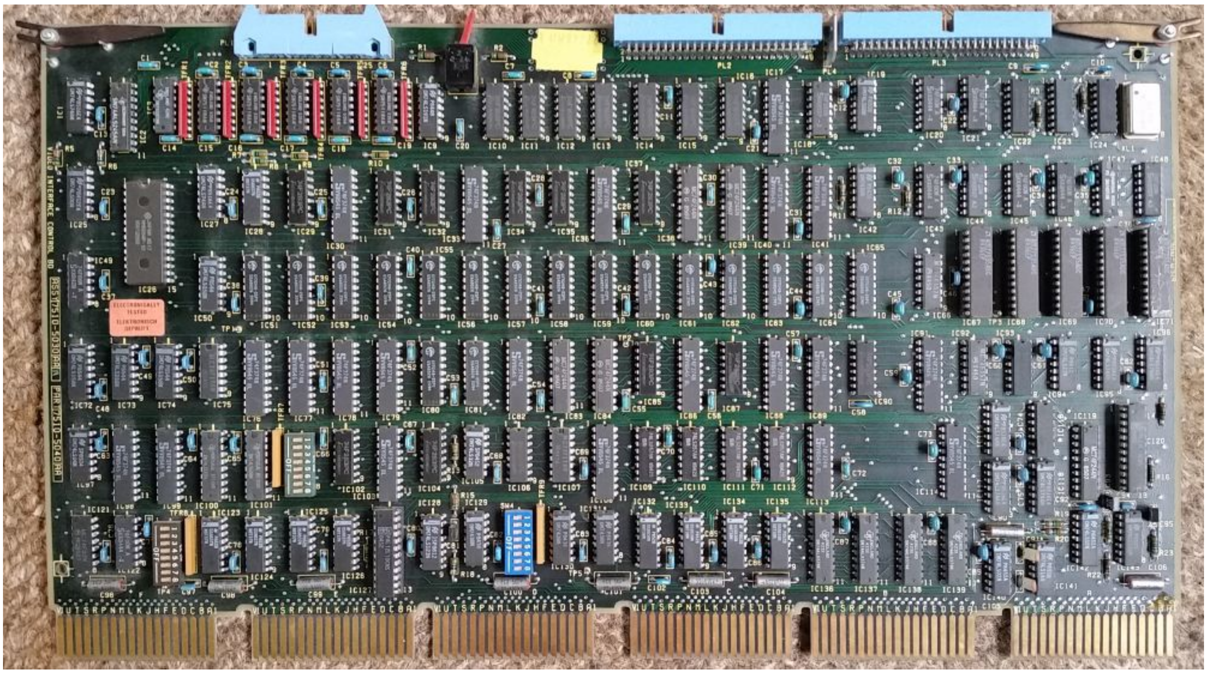
# The Lasergravure Impositioner

## The PCBs

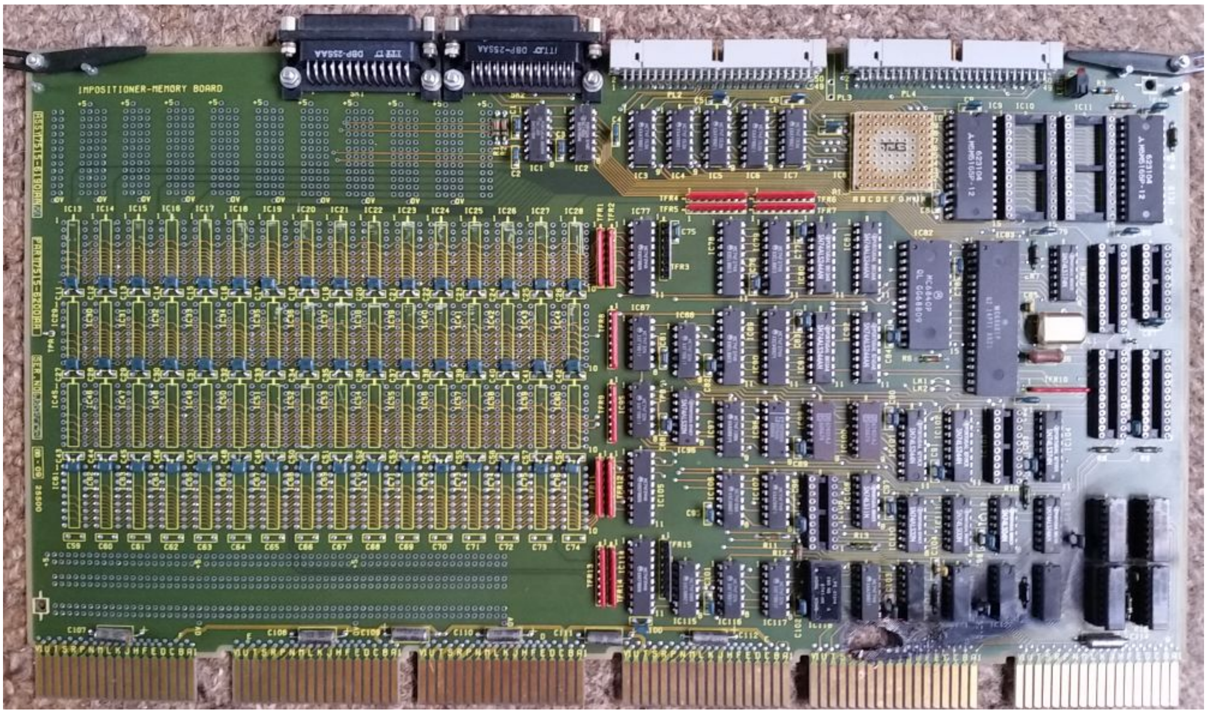
The Impositioner was the 1980s technology equivalent to the Caslon Inkjet FPE. It was two big cards in a PDP-11 backplane. Its job was to take in data from a set of images on a disk pack and to cut them up into a serial stream to feed to the engraver to produce imposed pages around the gravure cylinder, along the way adding registration marks, gutters and so on. The stream was then fed to the engraver electronics where the video output board did the detailed timing against the encoder and then digital-to-analogue conversion to drive the laser.

The Impositioner also included some of what is done by the re-order server on inkjet. It included 7M * 16-bit of DRAM and was able to take quite big chunks of images by DMA from the PDP backplane. It built the output stream using a versatile output DMA engine that followed a continually-extending linked list of control blocks, some of which referred to bits of input images and others to locally-generated data for marks and gaps. All this was controlled by an imposition plan that was downloaded at the start of engraving one cylinder.

The local processor that interpreted the plan and generated the control blocks was a 68000 which shared access to the DRAM with the DMA engine, on a devious scheme whereby the DMA got an access while the 68000 was getting its address ready, though this was very slow by modern standards with memory accessed at 1.5 MHz: 0.75 MHz for the CPU and 0.75 MHz for the DMA. The DMA engine ran a single chain of blocks for reading in image parts but up to 32 chains at once for output, in round-robin, to provide the data needed to engrave up to 8 heads simultaneously at arbitrary resolution to drive a Hell K202 mechanical engraver. The DMA engine was implemented in 74-series logic around a microcoded sequencer and a fast SRAM holding all of the counts and pointers. I think the DMA microcode ran at 9 MHz (3 states per DRAM cycle); the board has a 36 MHz crystal.



Impositioner control board (7510-5030)  (this one is actually called a video interface and it was scrapped as the factory built it on the wrong issue PCB).




Impositioner memory board (7515-6190) (this one was set on fire by a faulty tantalum capacitor and had its memory chips recovered).

## Other details

When working with Lasergravure, the Impositioner sent out data at the Crosfield native resolution of 12 pixels/mm and the screen was superimposed by the video output board. The Klischographs had to work at the mechanical pecking resolution which was unrelated to the contone image and different depending on the screen pattern chosen. To handle this the digital data were passed from the Impositioner into axial and circumferential resolution converter boards which performed cubic interpolation in both axes. This required, for the axial direction, data from four lines, which is why there were 32 output chains, 4 for each of the 8 heads. The calculation of the circumferential conversion depended on knowing or guessing how the Klisch calculated its clock dividers; we found a reliable algorithm that depended on reducing to prime factors.

DRAM cycle was 333 ns, CPU bus cycle 666 ns ("6 MHz" chip), complete cycle of input DMA - CPU - output DMA - CPU = 1333 ns and this takes at least 9 microcode steps, so won't work unless microcode is <148 ns, so probably was 111 ns.

## Related

There was also an in-line hardware USM board. The data path through resolution conversion, unsharp masking and output was designed with a common interface so boards could be used or bypassed easily.

The serial comms bus to remote units (laser power supply, modulator chassis, lathe control) was a very simple custom design with a single-chip micro on each. The bus was a single serial pair and power. The remote units were programmed in Forth.

There was also a whole rack of boards making a K202 simulator, which was to allow the factory to test Gravure Plus without having a K202. It provided all the signals to convince the Gravure Plus to run and collected the streamed data for analysis. The interface to the K202 was a huge 100-way T-bar screw connector which we broke into, taking the K202 scanner's data and adding our digital data so that it was possible to merge our digital images with scanned images on the same engraving run; we emulated the digital interface to the "AK Daten" board within the Klisch (Abtastkopf Daten - read head data).

Everything was got to work but was never used in earnest. Lasergravure died because the plastic would never last on the press. Gravure Plus died because Hell would not tolerate it.

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