AccessionIndex: TCD-SCSS-T.20150416.002
Accession Date: 16-Apr-2015
Accession By: Dr.Brian Coghlan
Object name: NS16032 MiniDSK16 File Processor with Shugart SA460 Floppy Disk Drive
Vintage: c.1983
Synopsis: Second NS16032 system built in the Dept.Computer Science, TCD, to develop firmware for the Virtualisation Testbed File Processor.

Description:
This system was the second NS16032 system built in the Dept.Computer Science, TCD, part of a general exploration by of virtualisation of various common functions such as file handling and graphics within a research project on a *Graphics Subsystem for Solid Modelling* to virtualise hidden-line and surface extraction, funded by a Provost's Development Grant to Dr.Brian Coghlan. However, the MiniDSK16 did not virtualise anything; it was built only to develop filesystem firmware.

The NS16032 (later renamed NS32016) was the first microprocessor to include demand-paged virtual memory. It was based on a very attractive 32-bit architecture and program model with 8 general-purpose registers, some special 24-bit registers like the PC, two stack, a frame and an interrupt base pointer, and a complex (CISC) instruction set, including coprocessor instructions, with 2-operand instructions, memory-to-memory operations, flexible addressing modes, and variable-length byte-aligned instruction encoding. Addressing modes could involve up to two displacements and two memory indirections per operand as well as scaled indexing. Perhaps because of this, there were fewer instructions than many RISC machines. The chipset included a CPU, FPU, MMU, ICU (for interrupts) and TCU (for timing), with a multiplexed 24-bit-address/16-bit-data bus. The principal chips were simply wired together on this bus. The FPU and MMU were essentially coprocessors, but additional coprocessors could be connected to the bus with minimal extra slave protocol logic. The CPU suffered from persistent bugs that greatly delayed full production, and was bypassed in the market.

The miniDSK16 file processor consisted of a NS16032-based processor board mounted above a Shugart SA460 floppy disk drive. For the time the hardware was particularly compact and capable, and unusually for the time, a custom proto-UNIX filesystem, called DSK16, was implemented as firmware.

The processor board included a very early NS16032SD-4 L250 Rev.F CPU, an NS16201N-6 TCU, a 40-pin socket for an unknown purpose, an NS32202D-6 ICU (replacement), 2 x firmware EPROMs (DSK EVEN: 3-Dec-1985, DSK ODD: 3-Dec-1985), 2 x Hitachi HM6116LP-15 2k x 8 SRAMs, an NCR5385 SCSI controller and WD1770PH-00 floppy disk controller, an NMC9306N E^{2}PROM, an ICL7660CPA voltage converter, and a Signetics SCN2681A dual serial line controller. The latter provided host and VDU interconnection.

The Shugart SA460 Floppy Disk Drive was a 5.25-inch full-height 96 tracks/inch double-sided floppy disk drive.

The homepage for this catalog is at: https://www.scss.tcd.ie/SCSSTreasuresCatalog/
Click *'Accession Index'* (1st column listed) for related folder, or *'About'* for further guidance.
Some of the items below may be more properly part of other categories of this catalog,
but are listed here for convenience.

Accession Index	Object with Identification
TCD-SCSS-T.20150416.002.01	NS16032 MiniDSK16 File Processor. Second NS16032 system built in the Dept.Computer Science, TCD, to develop firmware for the Virtualisation Testbed File Processor. C.1983.
TCD-SCSS-T.20150416.002.02	Shugart SA460 Floppy Disk Drive. S/N: A24998
TCD-SCSS-V.20220825.002	Shugart SA400 minifloppy Diskette Storage Drive. Shugart, manual for first 5.25-inch floppy disk drive. 1976.

References:

1. Wikipedia, *NS32000*, see:
    https://en.wikipedia.org/wiki/NS32000
    Last browsed to on 25-Aug-2022.

2. Wikipedia, *Seagate Technology*, see:
    https://en.wikipedia.org/wiki/Seagate_Technology
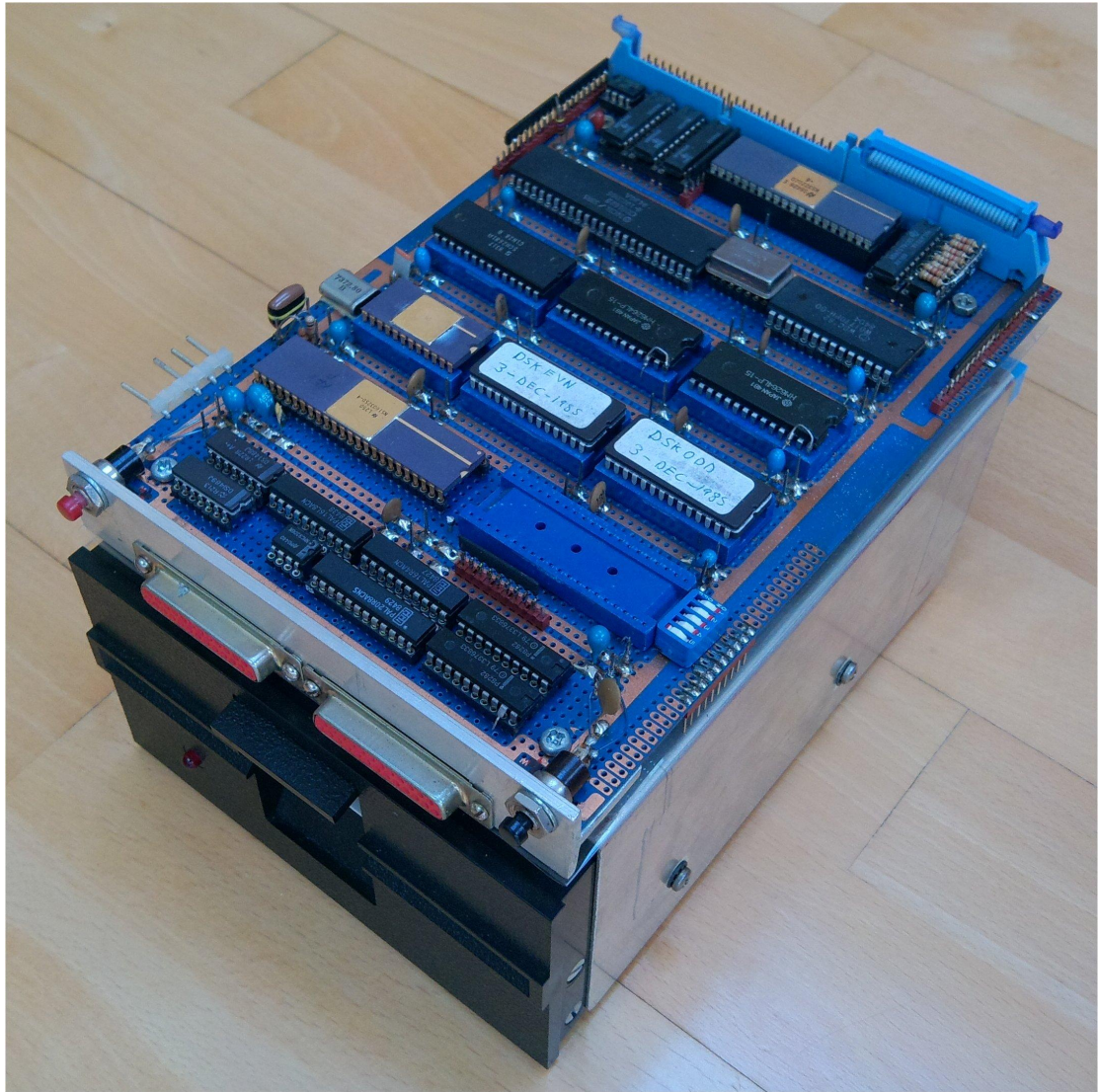   Last browsed to on 25-Aug-2022.

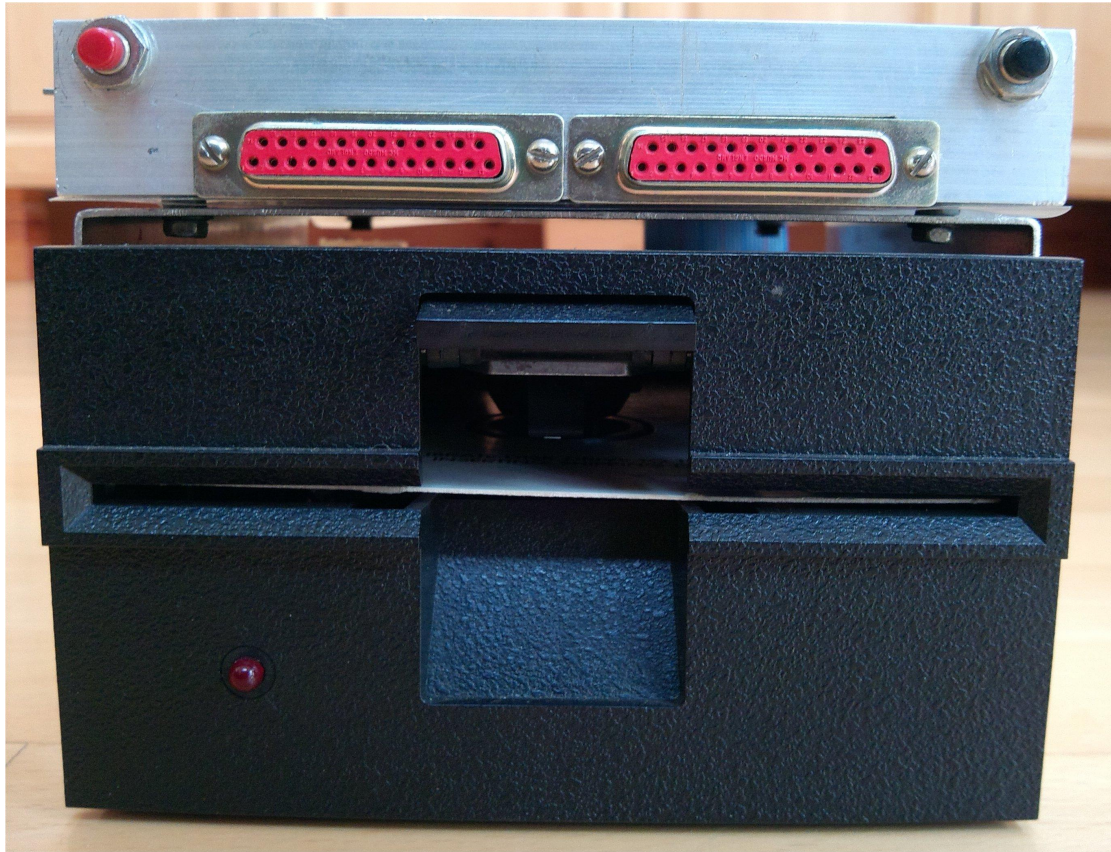*Figure 1: NS16032 MiniDSK16 File Processor three-quarter view*

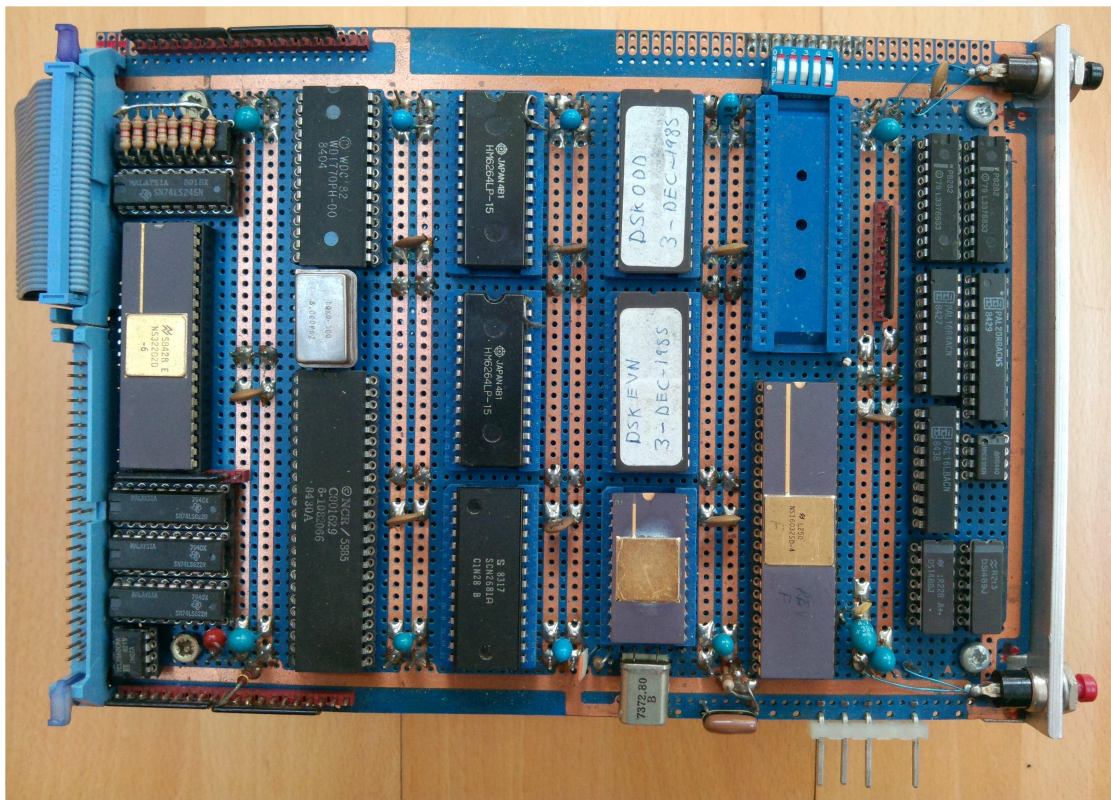*Figure 2: NS16032 MiniDSK16 File Processor front view*

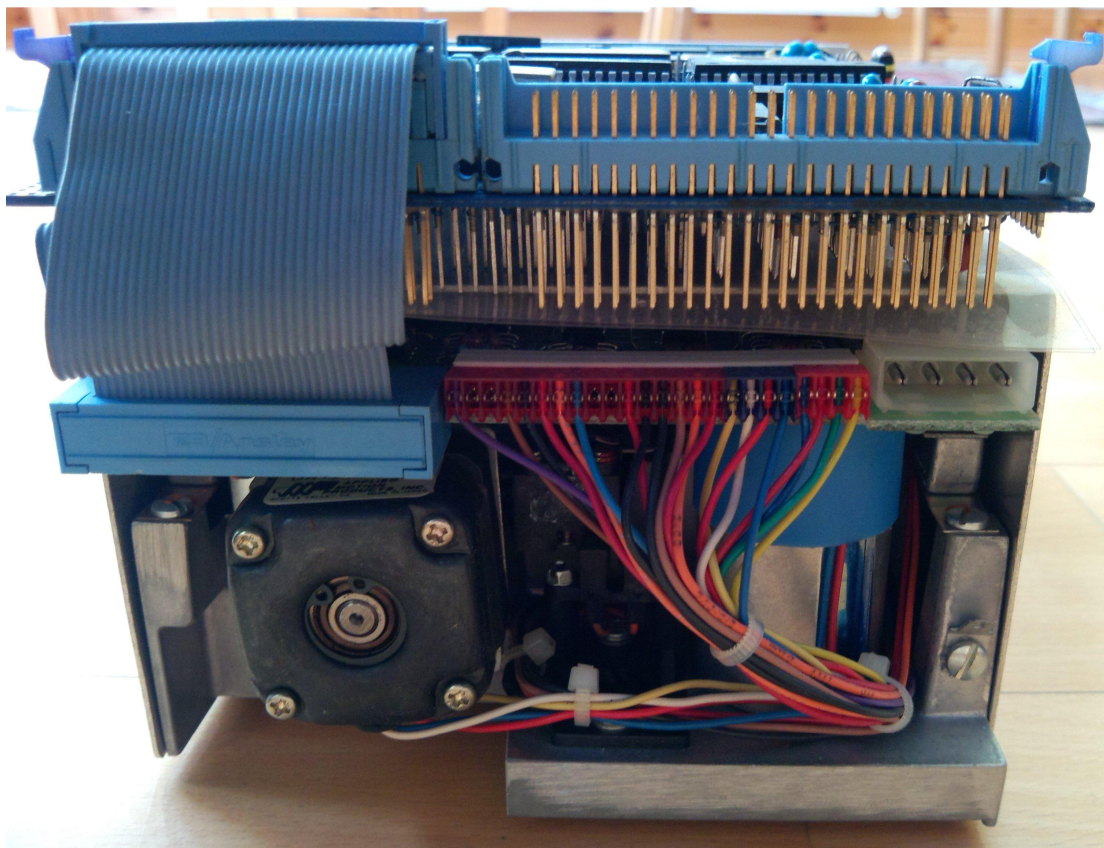*Figure 3: NS16032 MiniDSK16 File Processor top view*
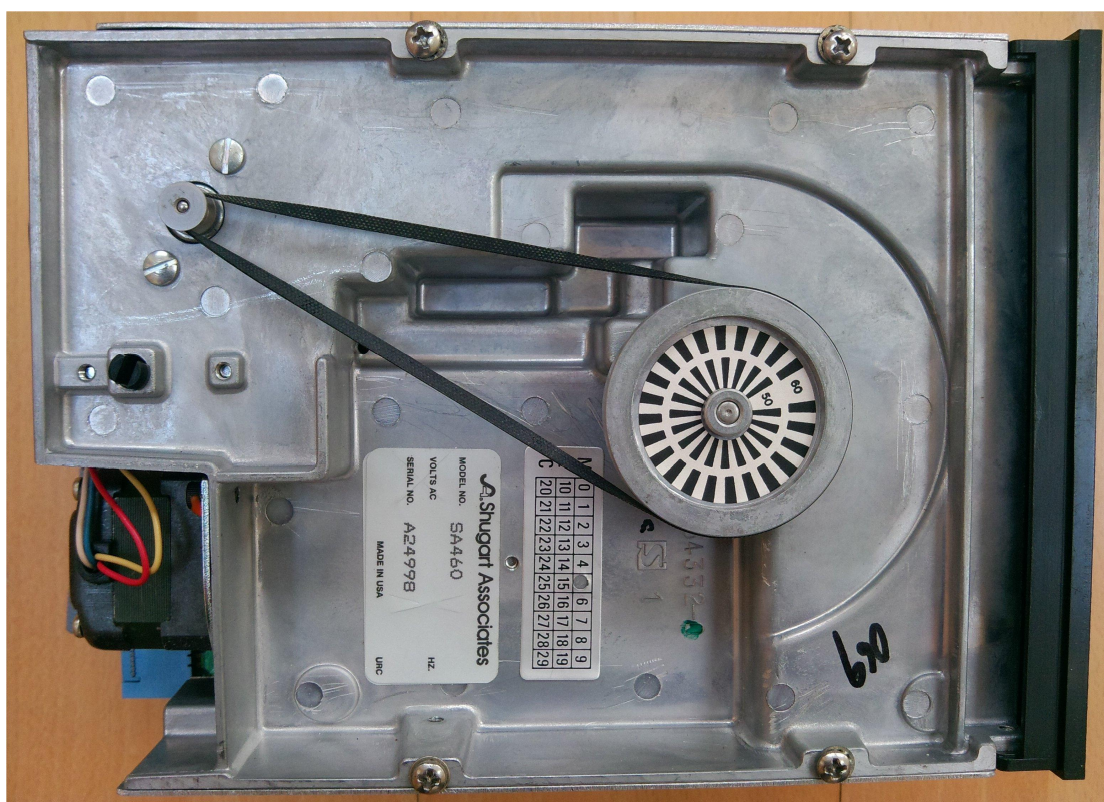
Figure 4: NS16032 MiniDSK16 File Processor rear view

Figure 5: NS16032 MiniDSK16 File Processor bottom view