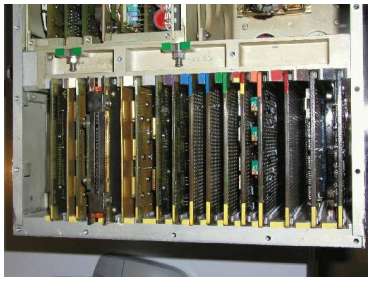
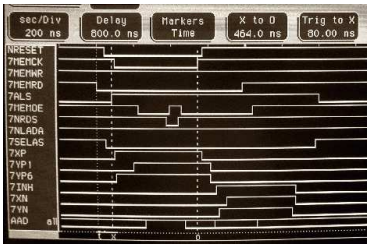
Programmer Electronic Control
- PCB photo collection, SerNr. 129 -

Reverse-Engineering and restoration Project

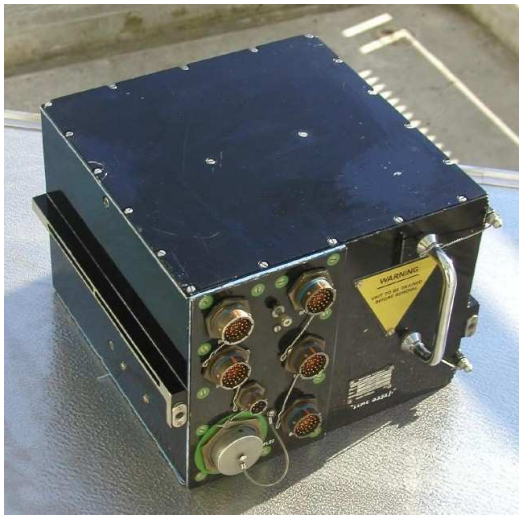
2005-2007 by Erik Baigar, erik@baigar.de

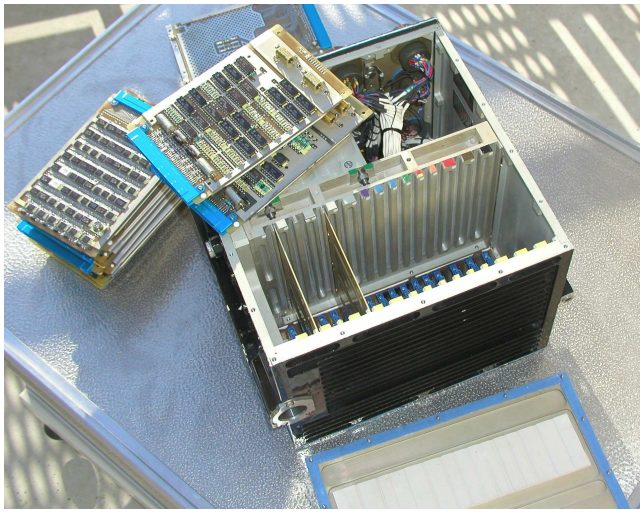
Revision 2008/05/03

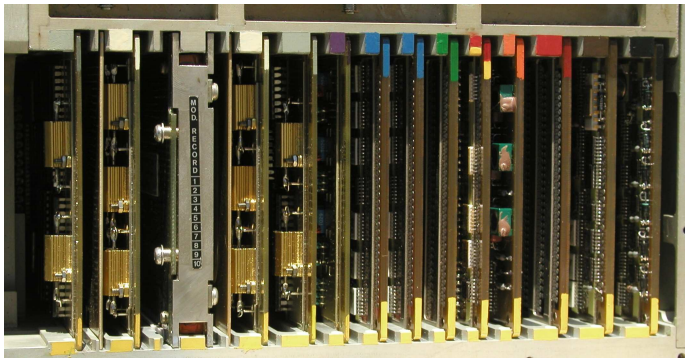


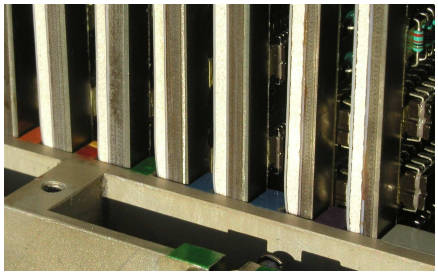


1 Overview - impressions from the unit...





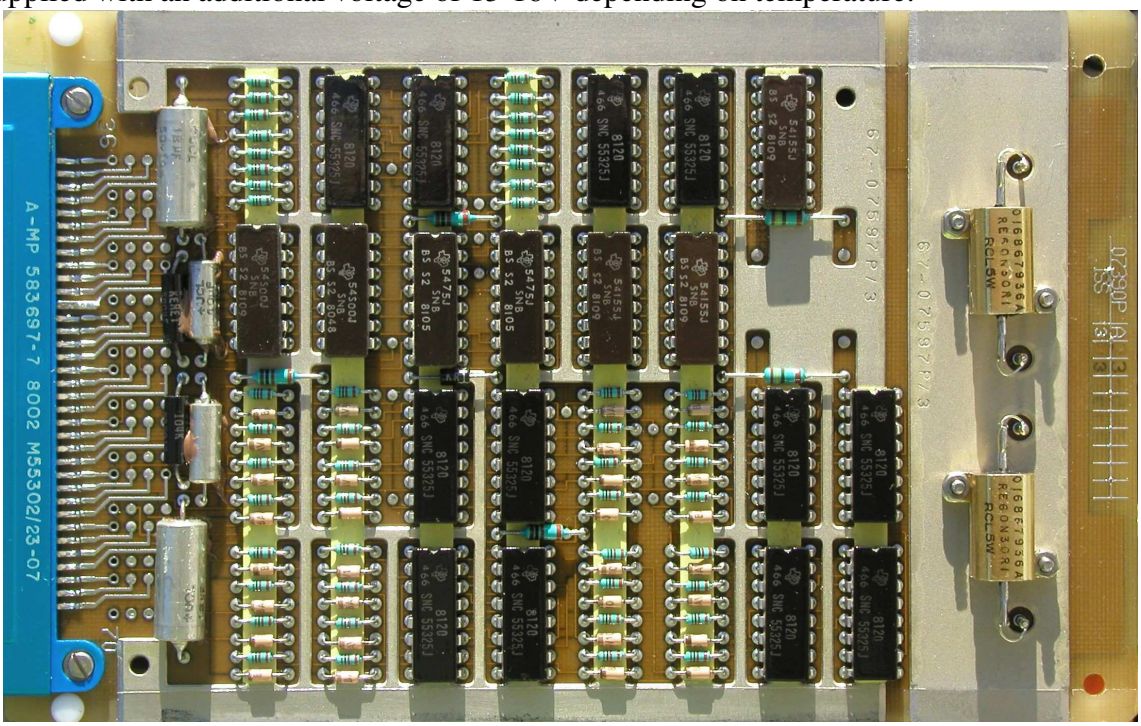




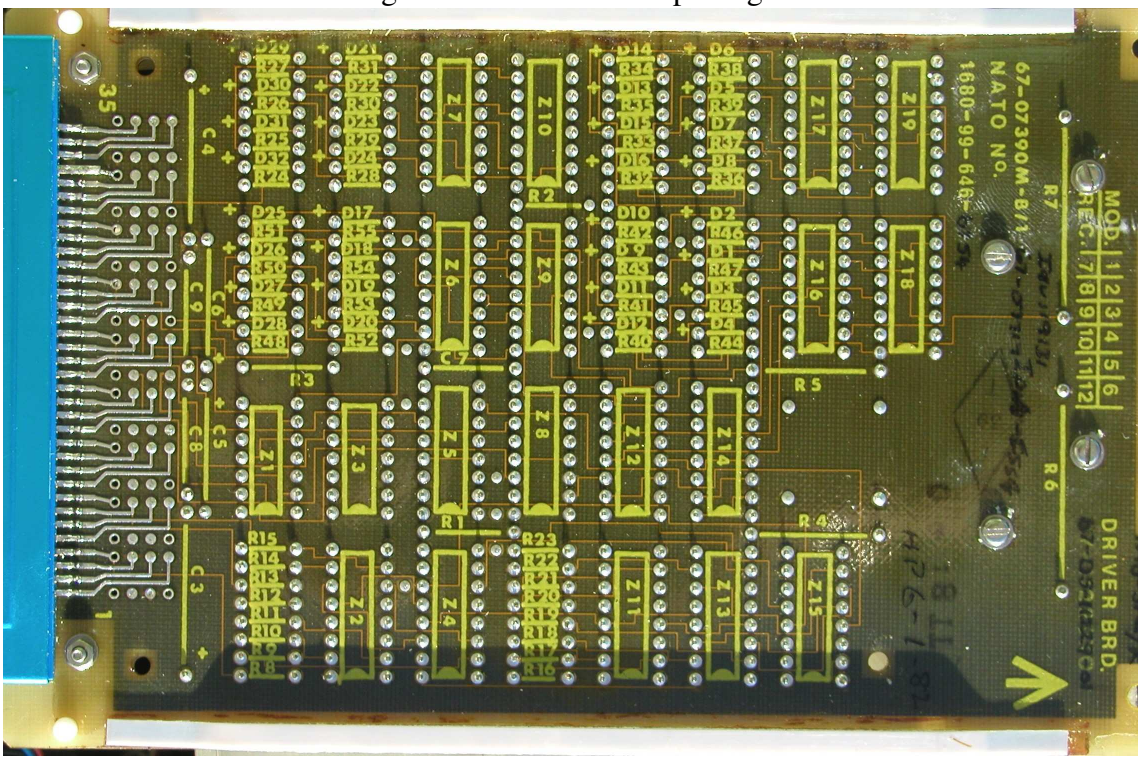
2 The memory subsystem (SK1-SK7)...

2.1 X- and Y-Linedriver PCBs (SK1, SK6)

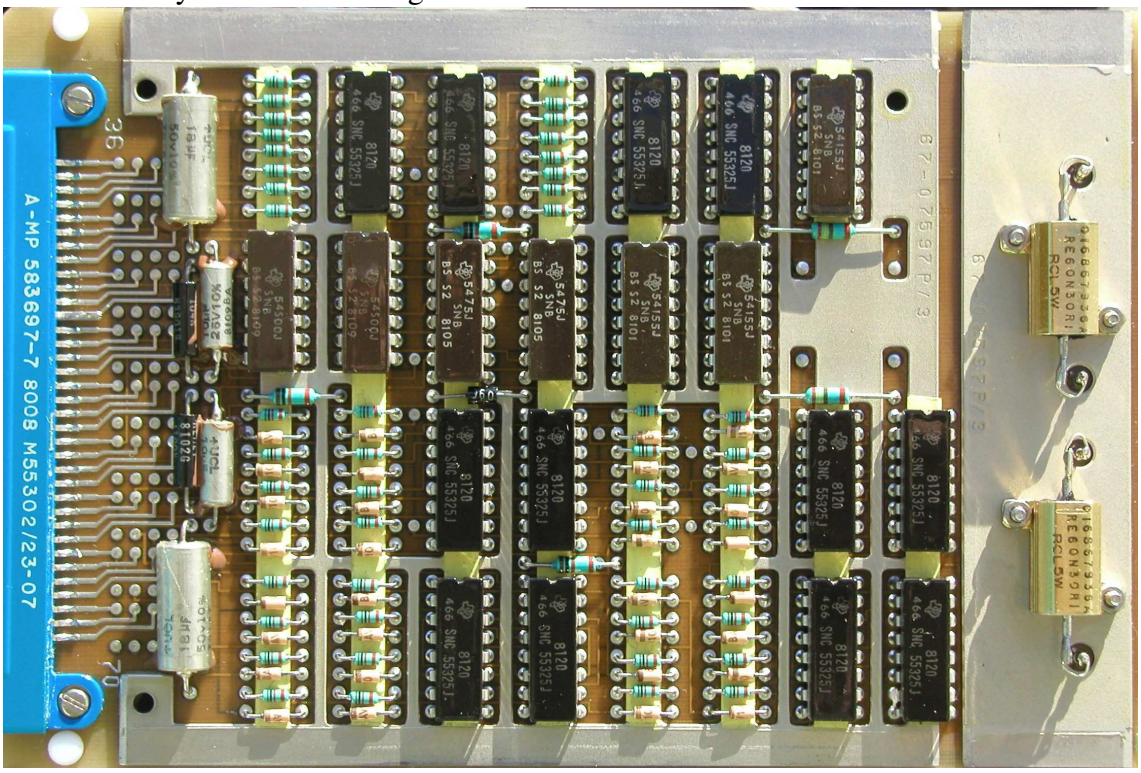
SK1, NSN1680-99-646-6754 is the first of two X- and Y-line driver PCBs for the core memory. It is supplied with an additional voltage of 13-16V depending on temperature:



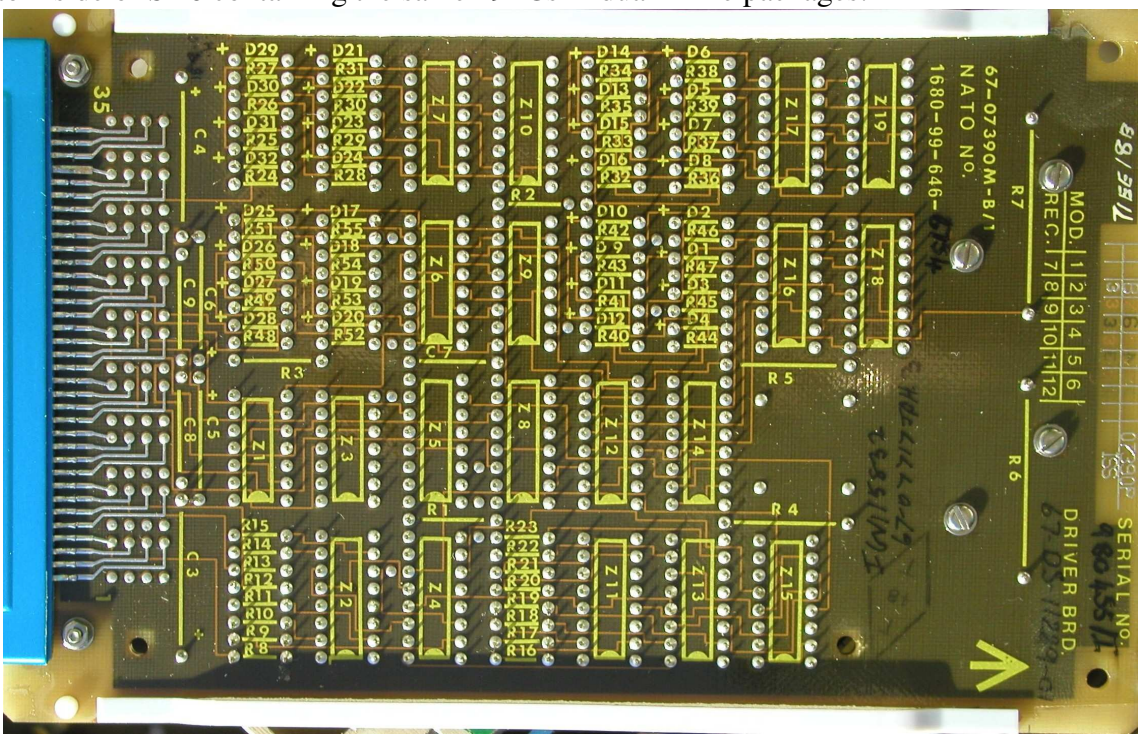
Bottom side of the PCB containing 19 ICs in dual inline packages:



Second X- and Y-line driver PCB for the core memory, sitting at position SK6. It is identical to the SK1 PCB and they can be interchanged:

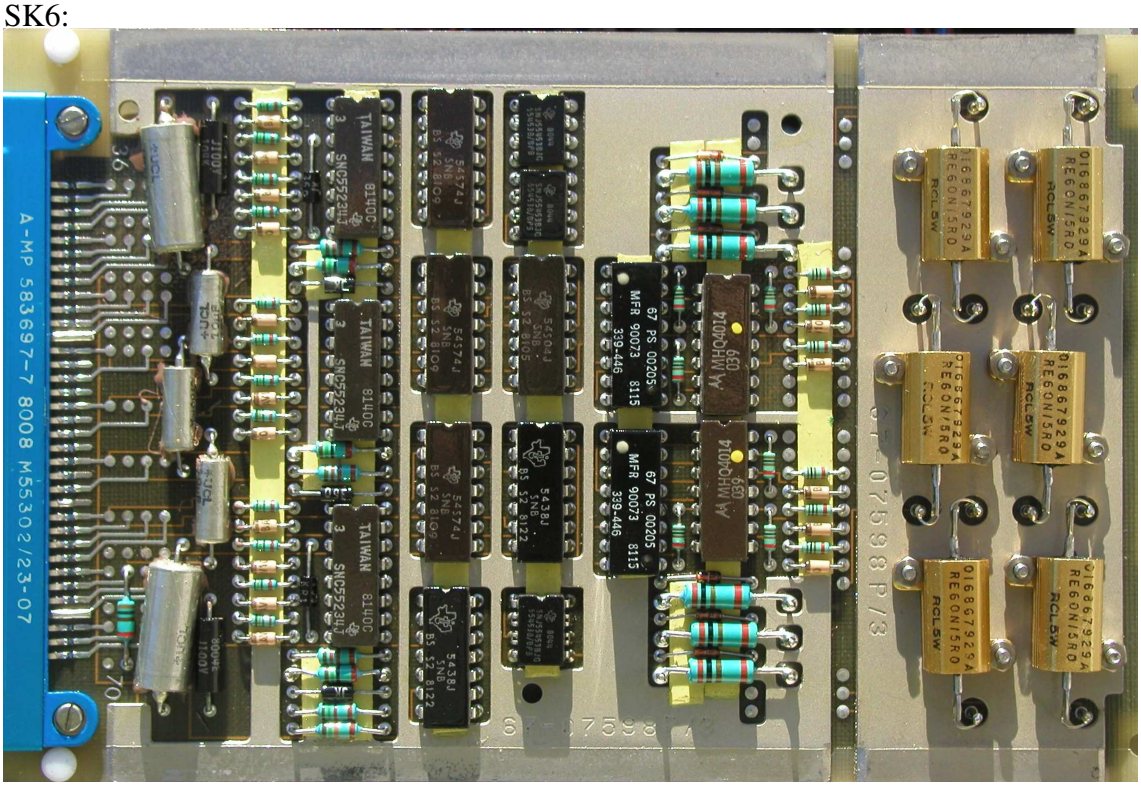


Bottom side of SK6 containing the same 19 ICs in dual inline packages:

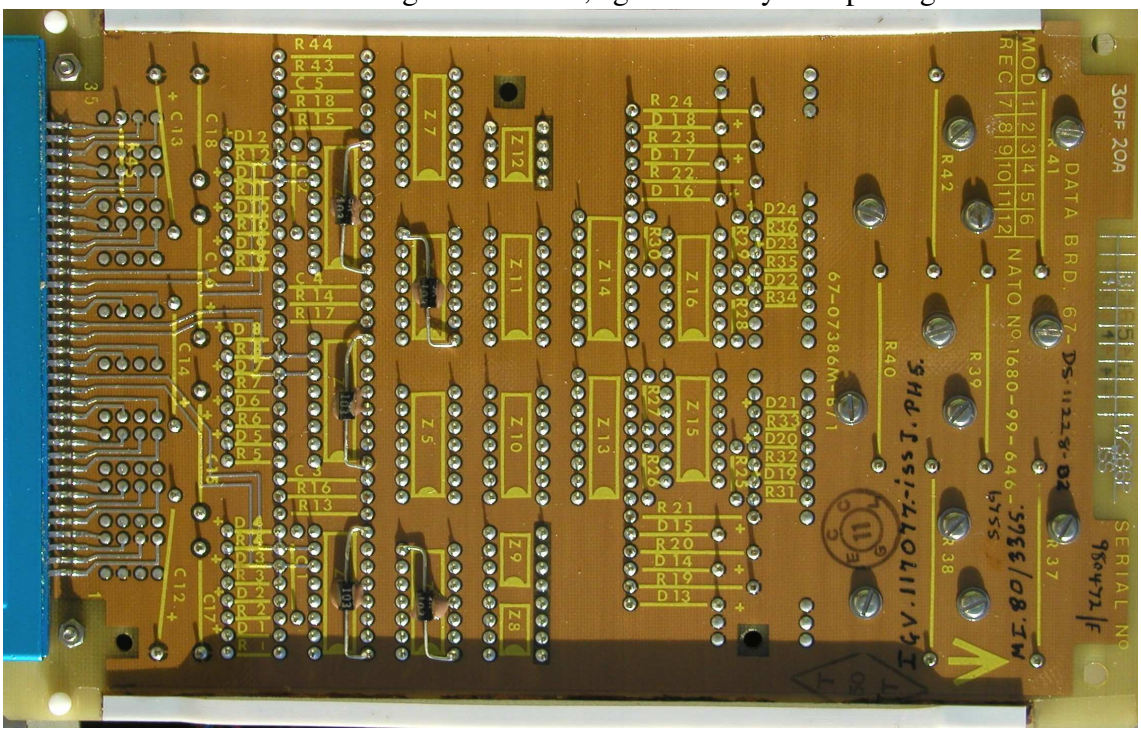


2.2 Sense-Amps and Inhibit-Driver PCBs (SK2, SK5)

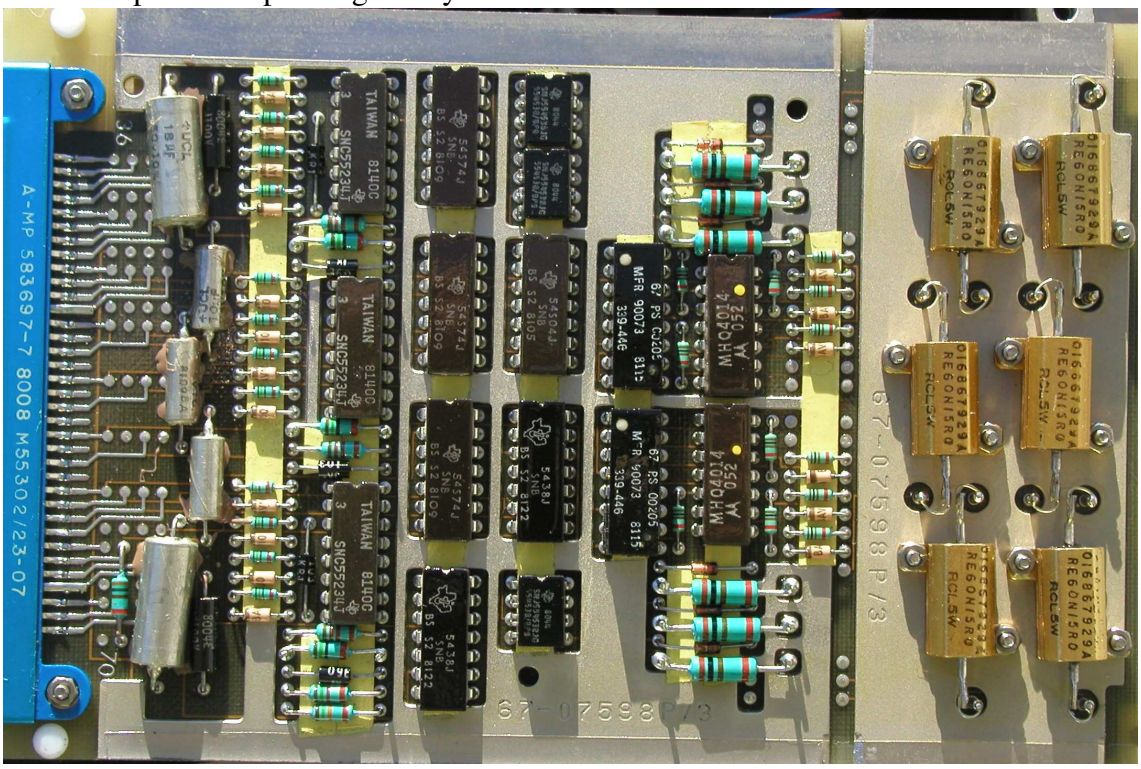
The SK2 and SK5 each contain 6bits of the sense amplifiers, the data latches and the inhibit drivers. NSN is 1680-99-646-6755 and it is supplied with the same core voltage as the line driver PCBs SK1 and SK6:



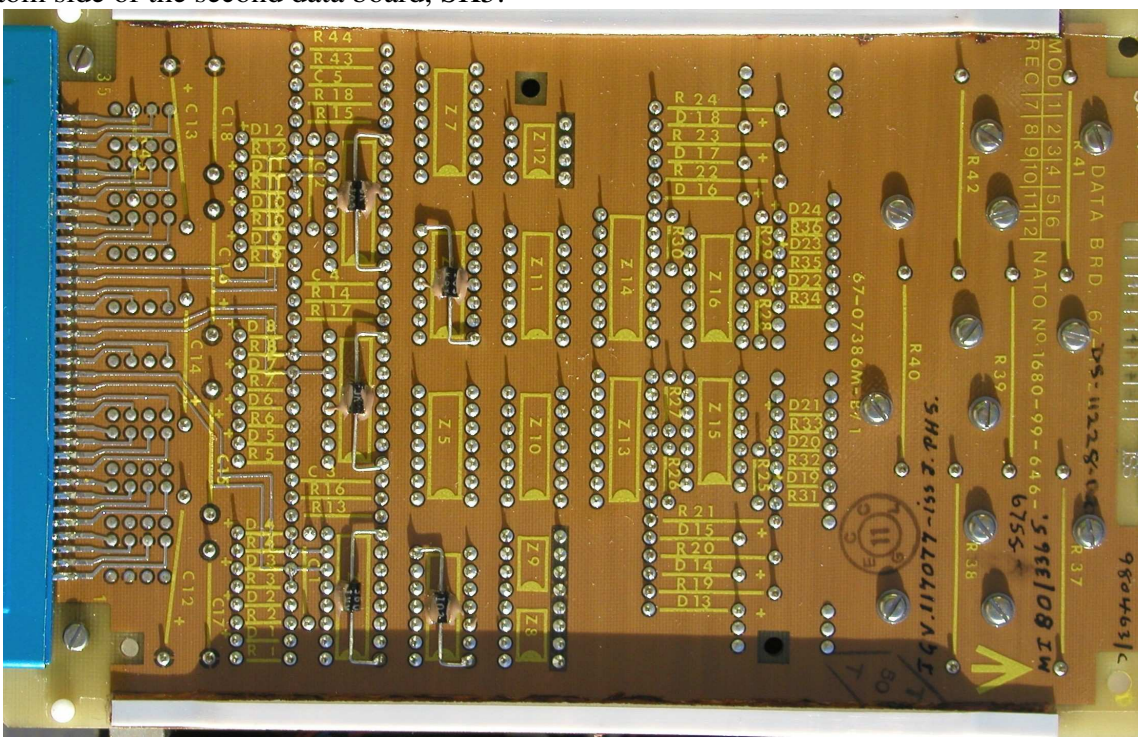
Bottom side of SK2 with its 16 integrated circuits, again military DIL packages:



The second of the data boards, SK5: Observe the cooling planes used to transfer the heat from the chips and especially the current limiting resistors to the chassis. The memory subsystem consumes about 30W of power if operating at a cycle time of 1.2us:

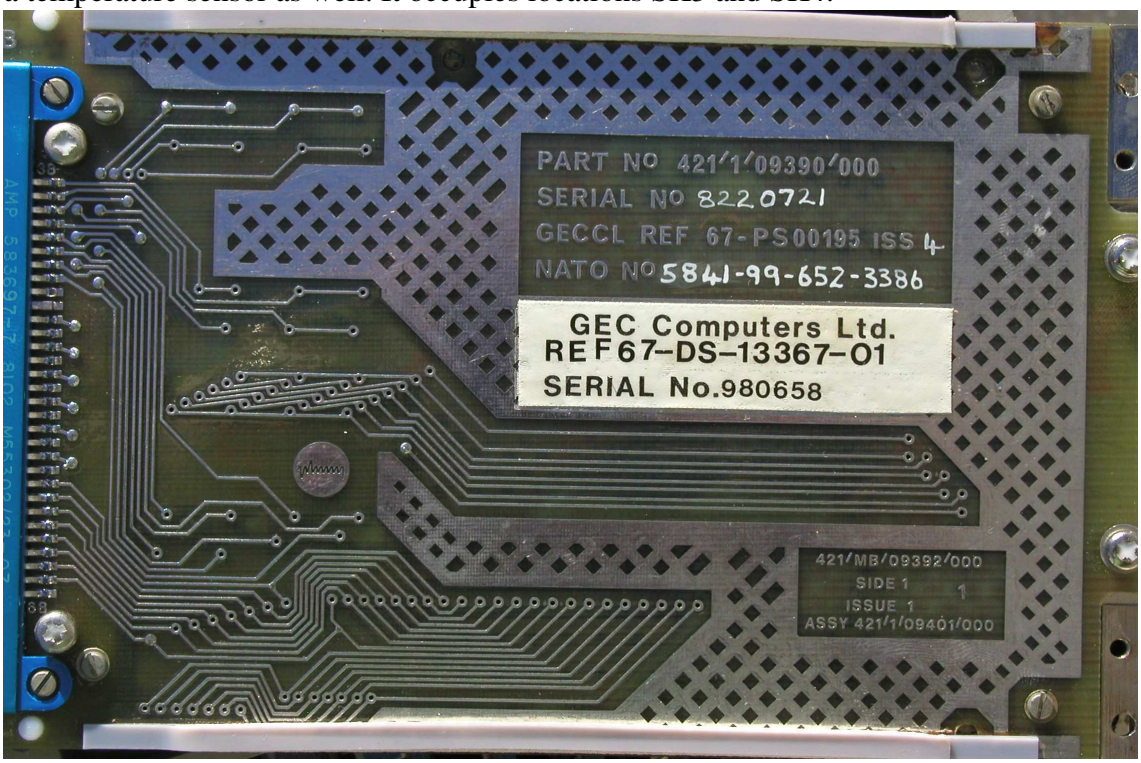


Bottom side of the second data board, SK5:

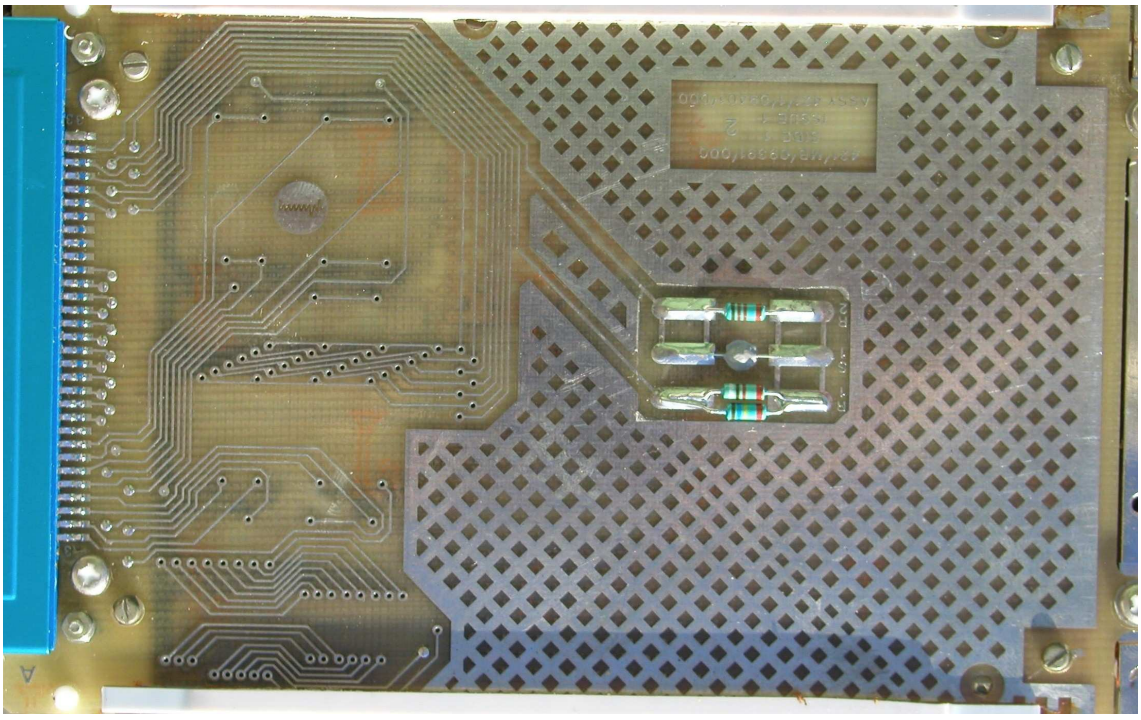


2.3 Core Sandwich (SK3 and SK4)

The core memory itself, 8192 words of 12 bit memory or a total of about 96000 individual cores can not be seen directly. It is embedded and protected between two PCBs which contain the diodes and a temperature sensor as well. It occupies locations SK3 and SK4:

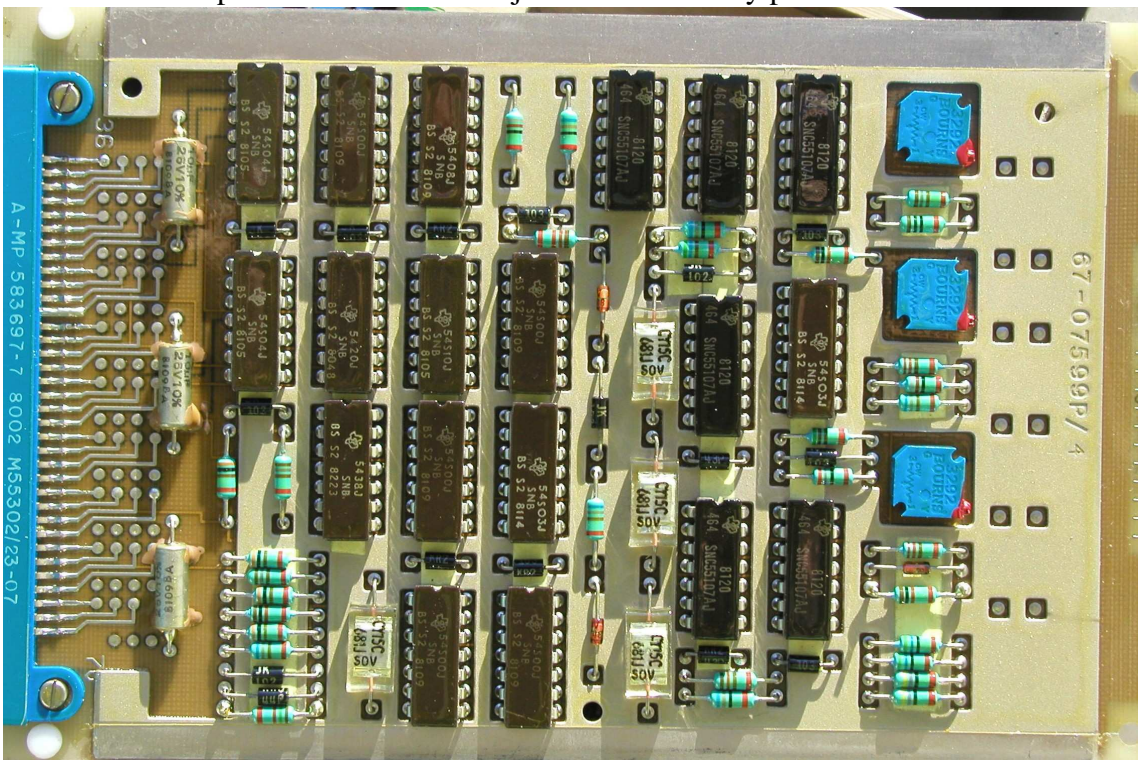


NSN5841-99-652-3386, other side of the core stack with the temperatore sensors in the central region:

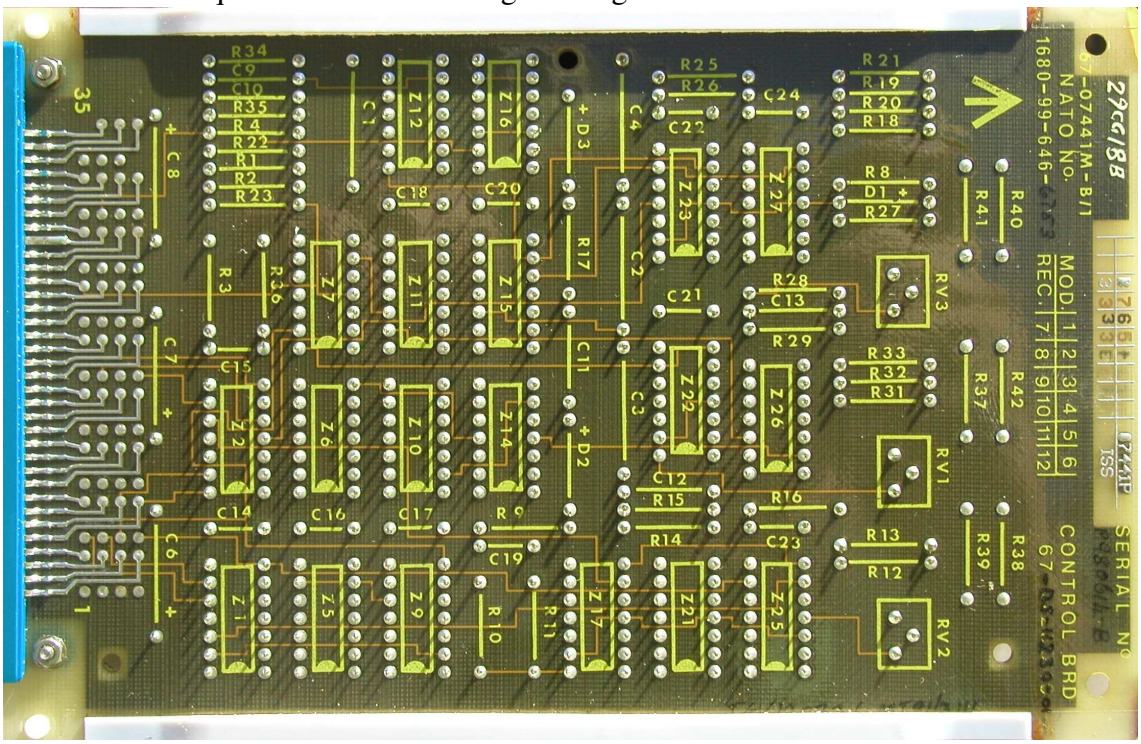


2.4 Memory-Controller (Sequencer, SK7)

This PCB on position SK7 with NSN1680-99-646-6753 generates the timing for memory operation and especially the memory operation finishedßignal for the processor. Timing is generated by using line receivers as comparators and manual adjustment is done by potentiometers:

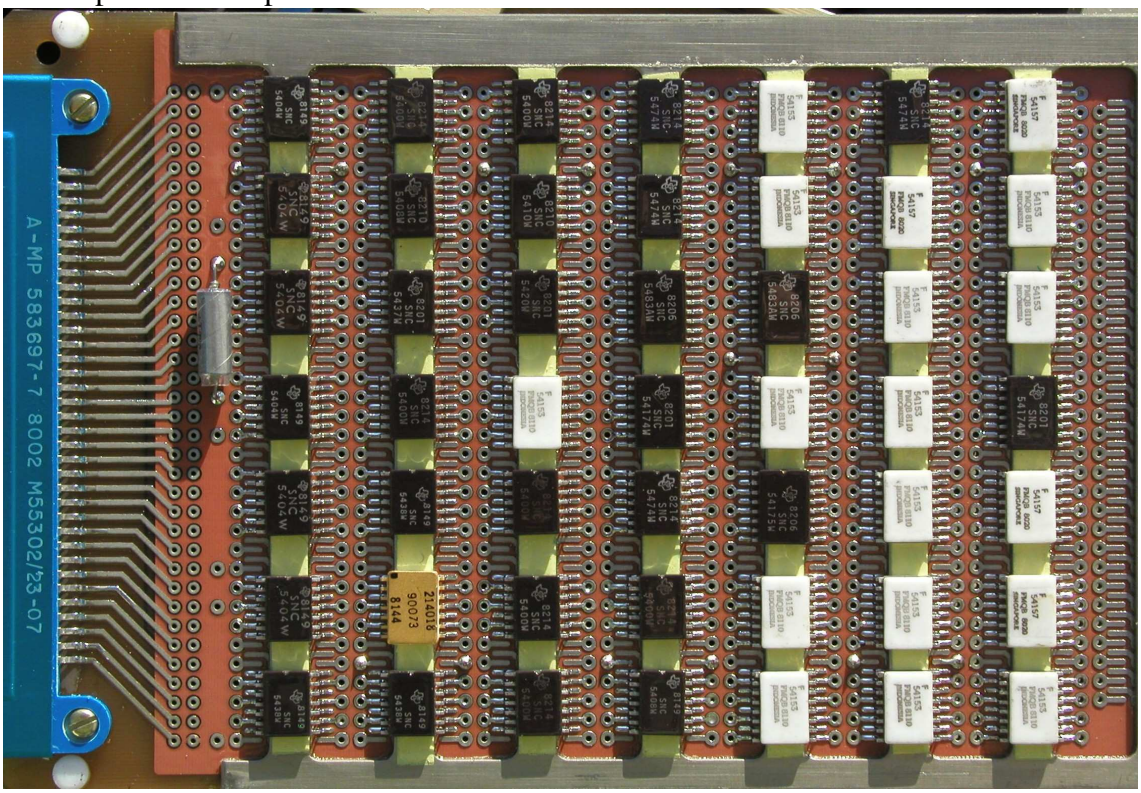


Solder side of the sequencer SK7 containing 27 integrated circuits:

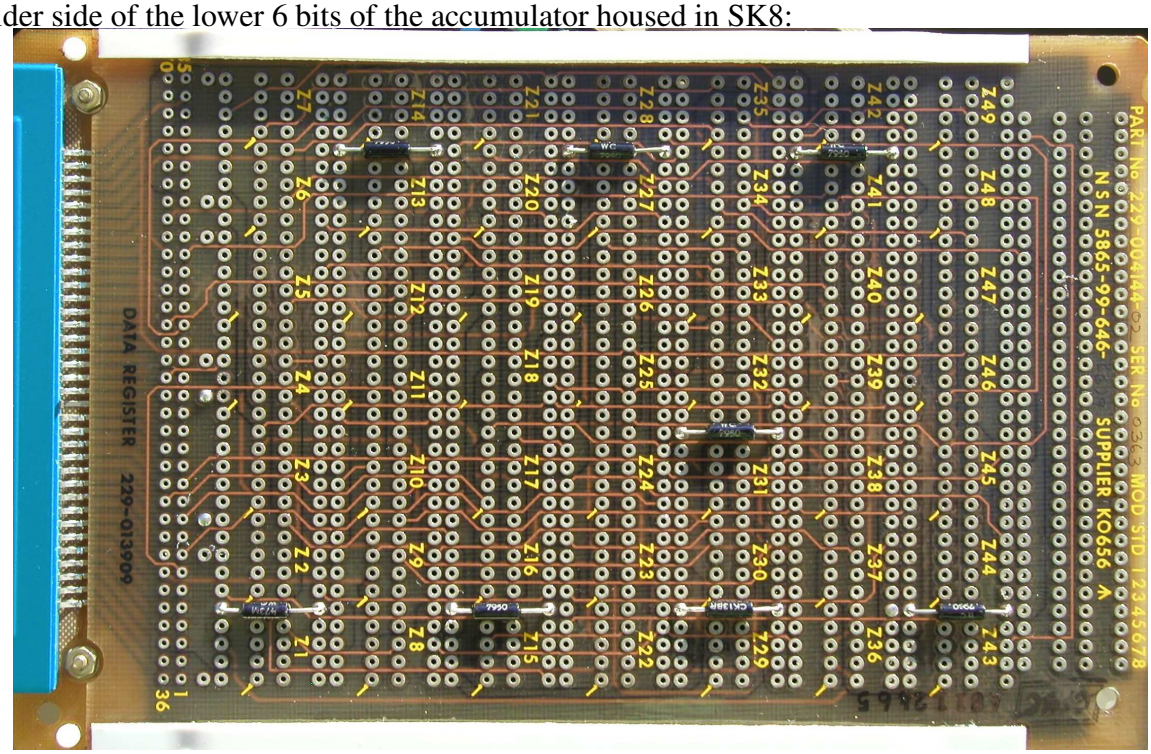


3 The processor (SK8-SK12)...

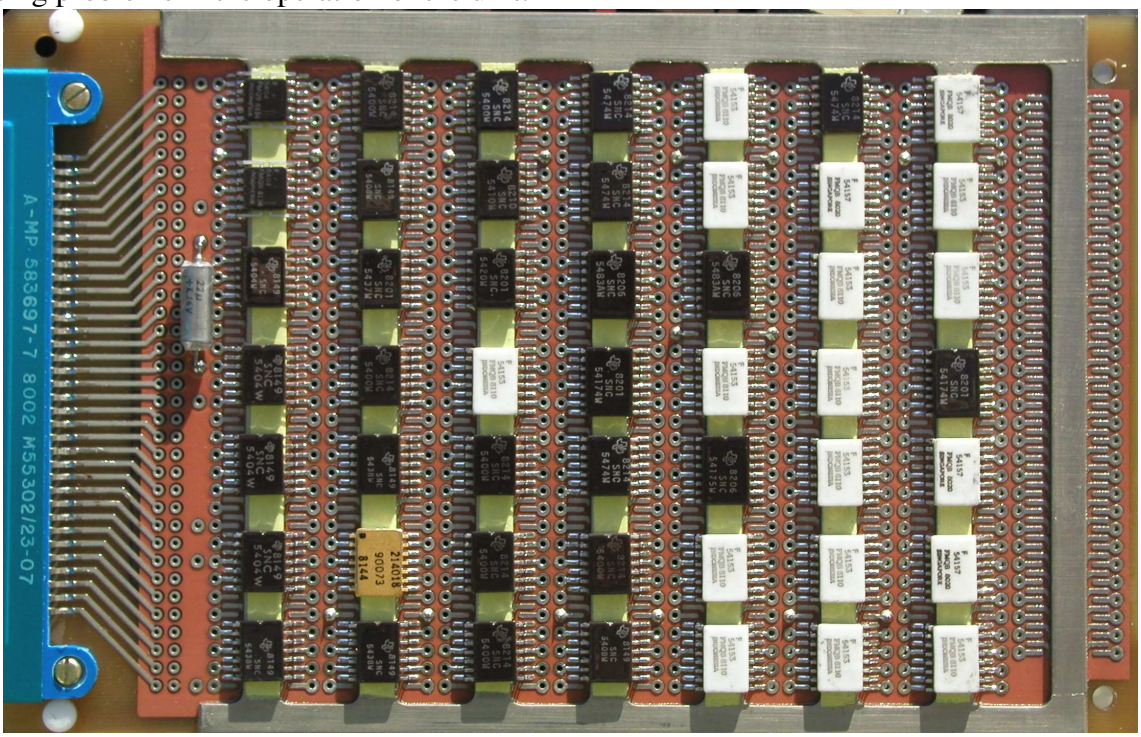
The central register of the unit, the accumulator is spread over two different PCBs, SK8 and SK9, where each PCB holds 6 bits of the 12-bit accumulator. The PCBs with NSN5865-99-646-6679 use 49 TTL chips each to implement the accu and some of the arithmetic functions:



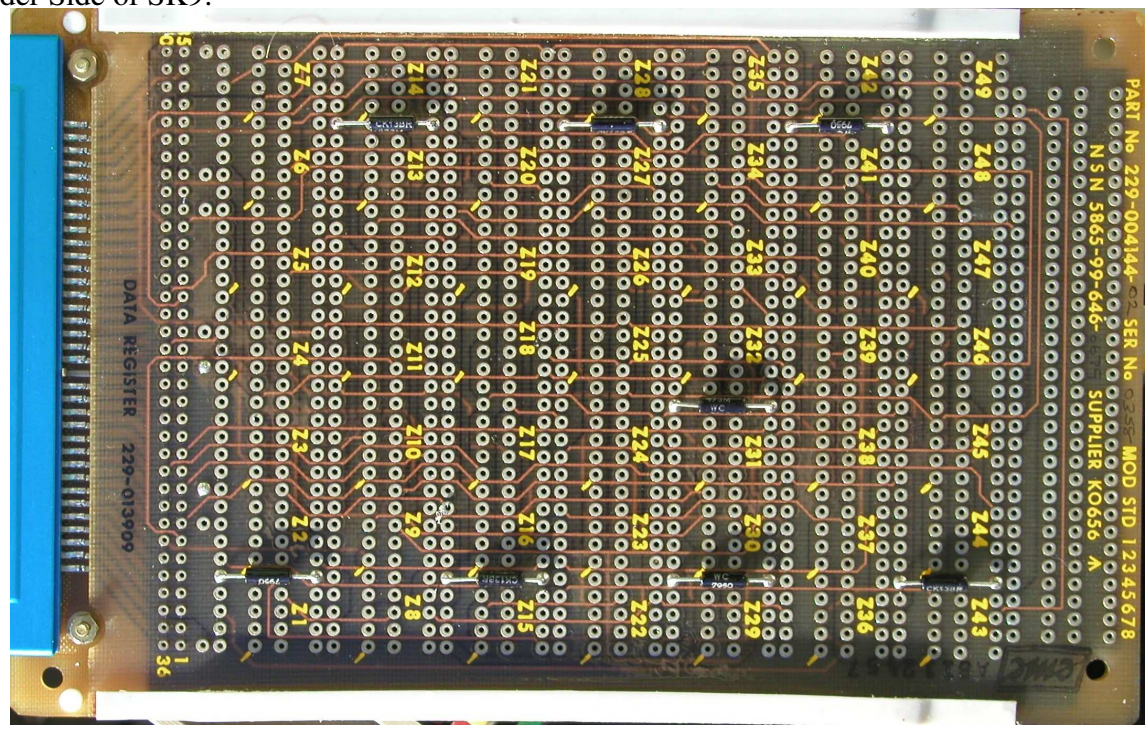
Solder side of the lower 6 bits of the accumulator housed in SK8:



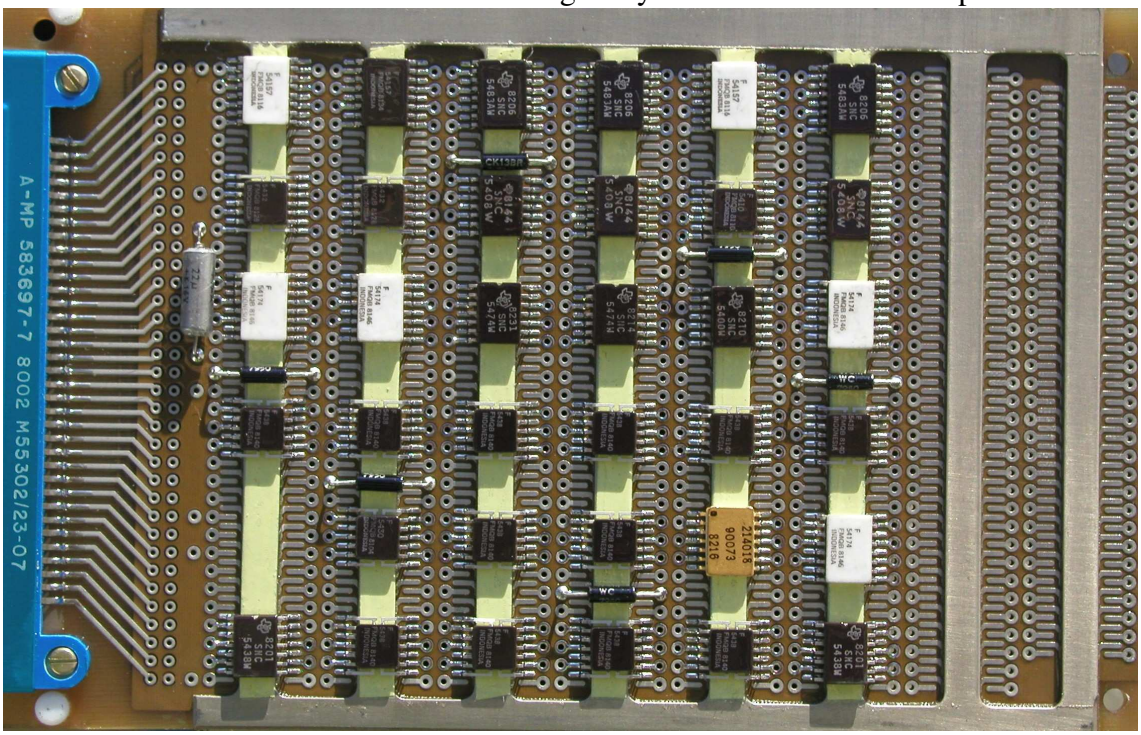
The upper 6 bits on the second NSN5865-99-646-6679. Both PCBs can be interchanged without causing problems in the operation of the unit:



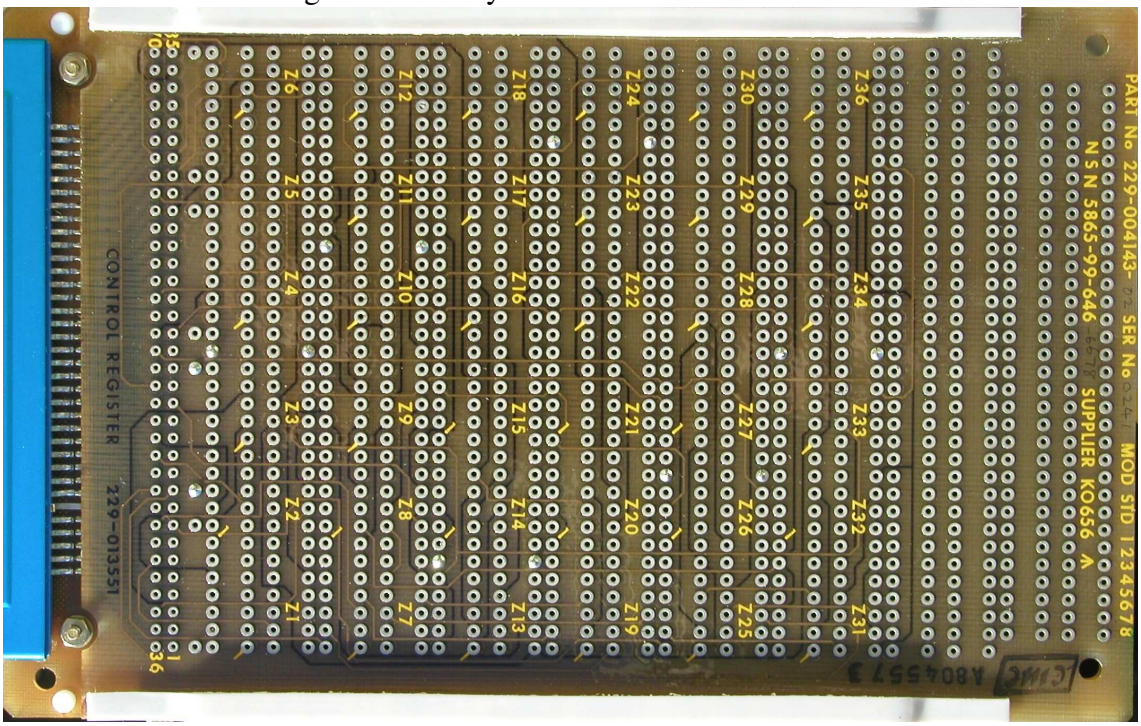
Solder Side of SK9:



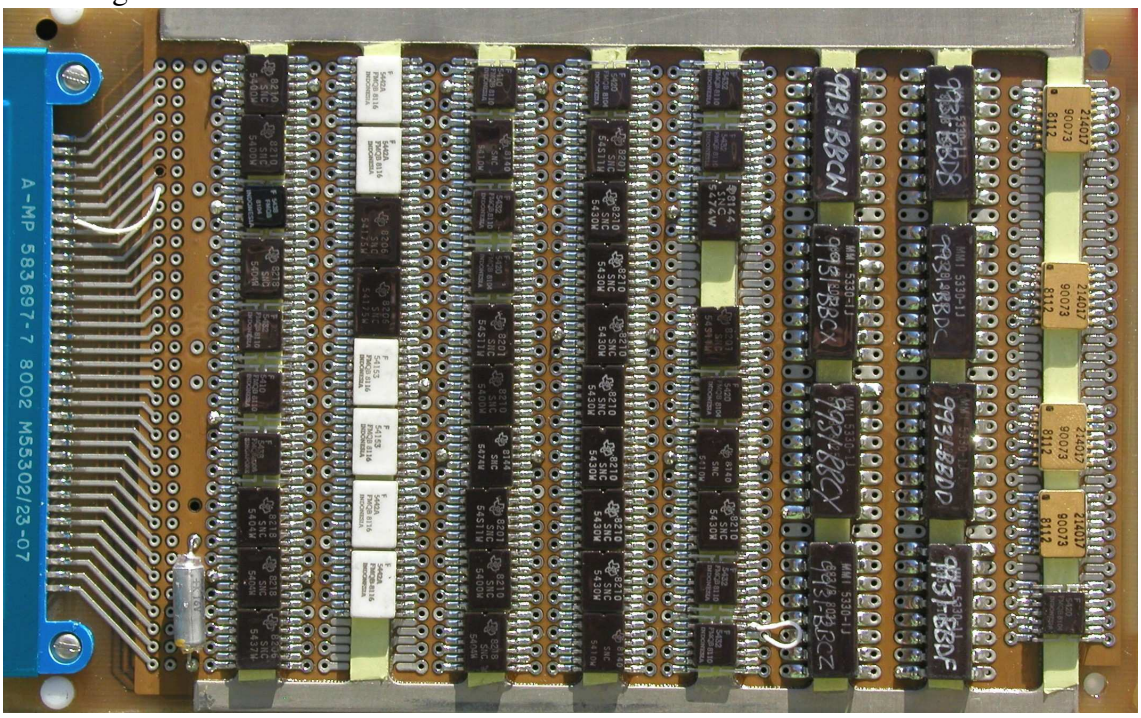
The control register PCB at SK10 contains the program counter and the adder unit. Shift operations are done here by MUXers and the adder of the ALU is used for calculation of relative jums, too. This PCB with NSN 5865-99-646-6678 contaings only 36 surface mounted chips:



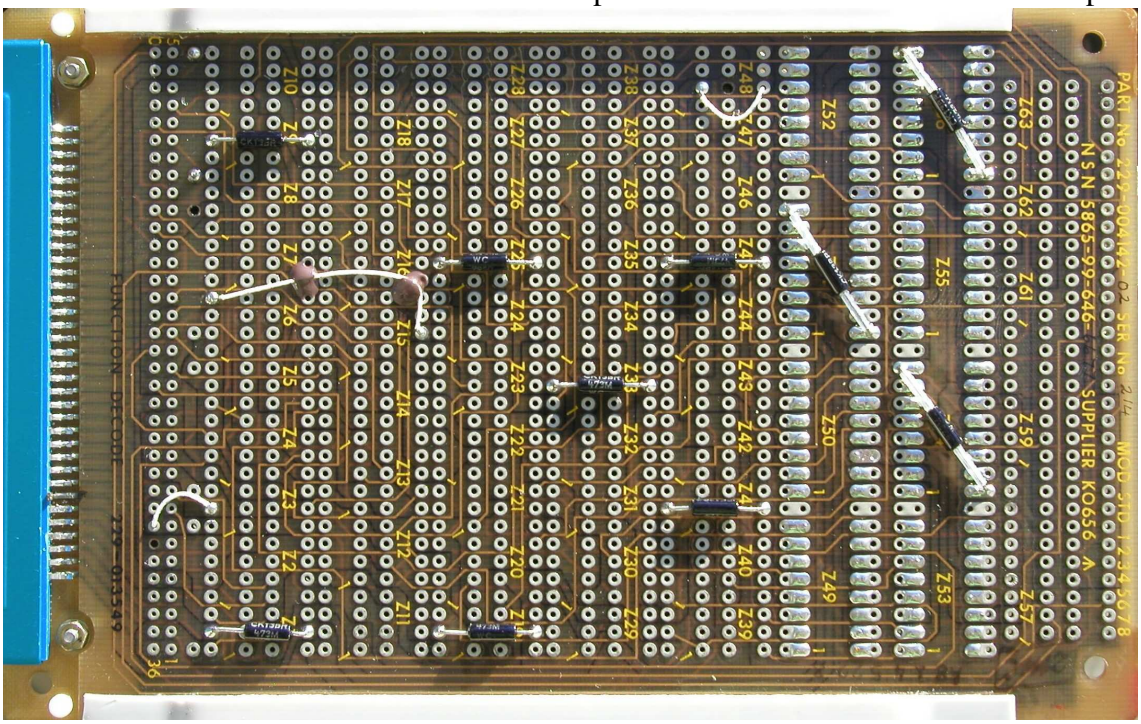
Solder side of the control register assembly:



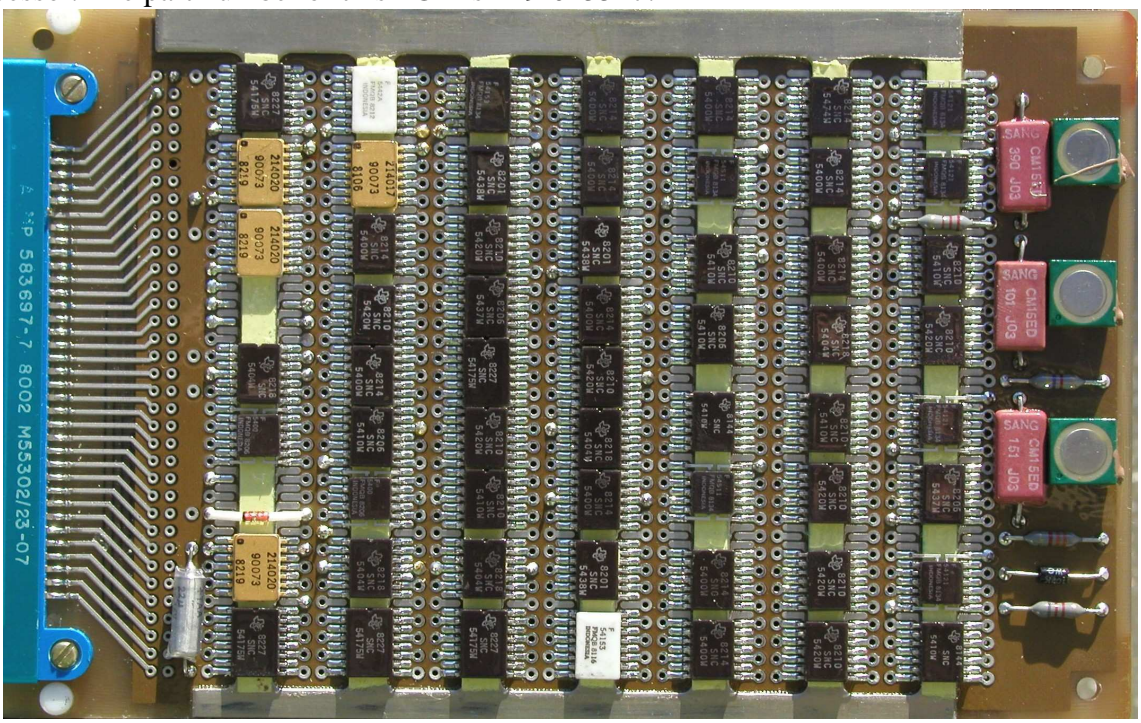
The most know how of the unit is residing here on SK11, the function decode PCB with NSN5865-99-646-6677: This contains 63 chips and among them 8 PROMs with 32*4 bit of memory each. They contain the 'microcode' and the PCB is used to decode the functions and coordinate the operations throughout the whole unit:



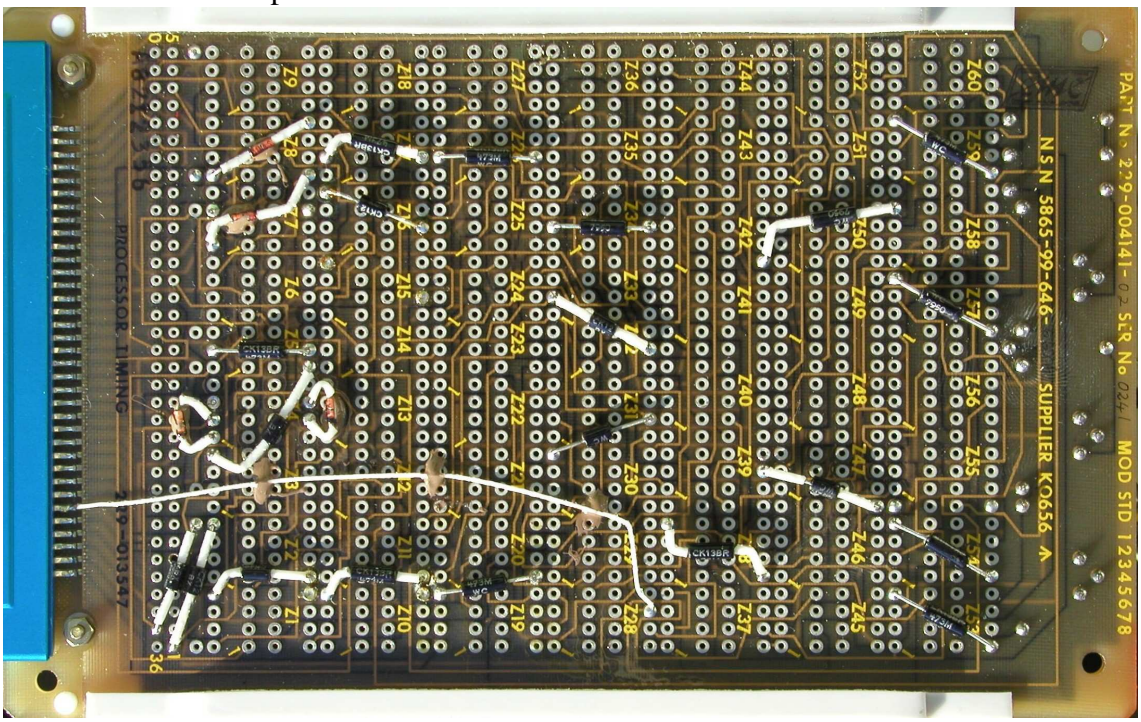
Back side of the function decode PCB with mixed parts: surface mounted and dual inline packages:



SK12 with it's 60 chips and three potentiometers generates the internal timing and scedule for the processor. The part number of this PCB is 229-013547:

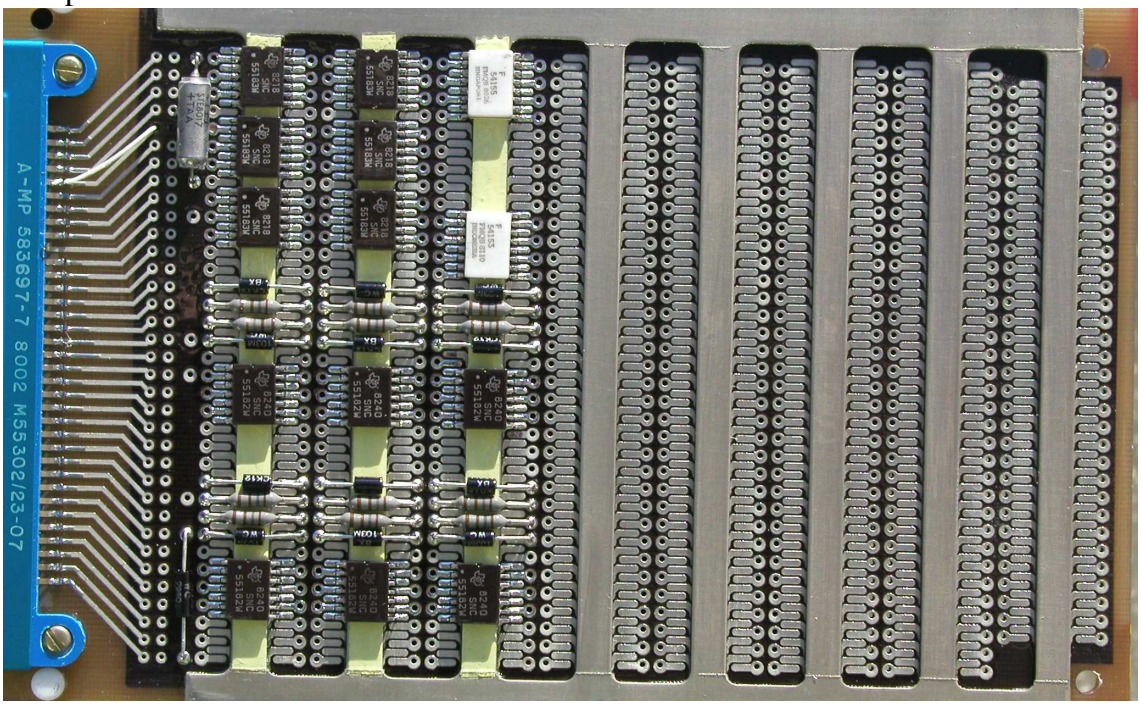


Solder side of this 60-chip PCB:

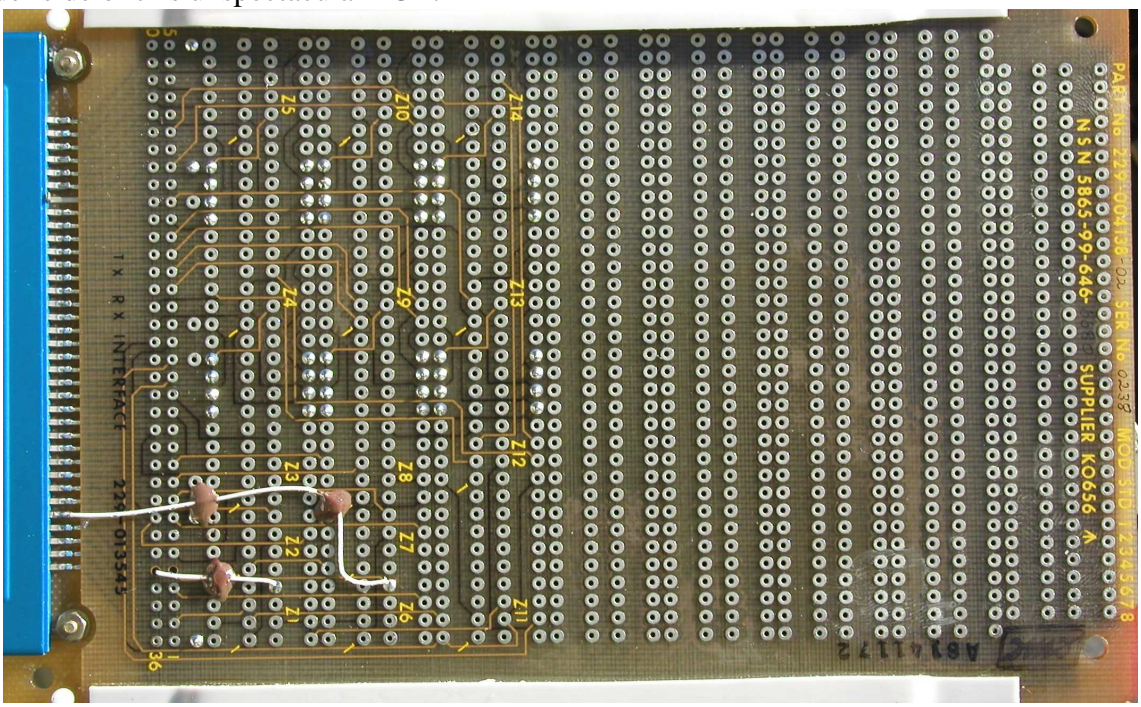


4 IO and interrupt (SK13-SK15)...

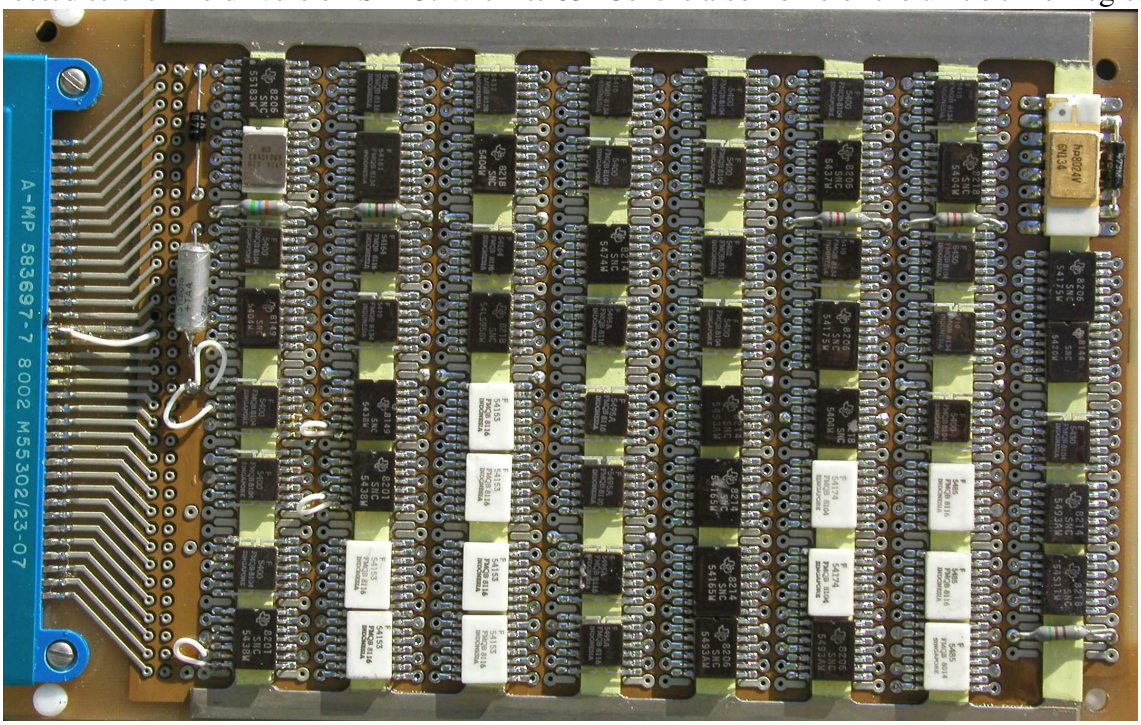
This PCB with only 14 ICs and NSN5865-99-646-6680 contains the differential line drivers and receivers connected to the external 2MBit high speed connectors DPL01-DPL04. The connections are multiplexed to the serial receiver:



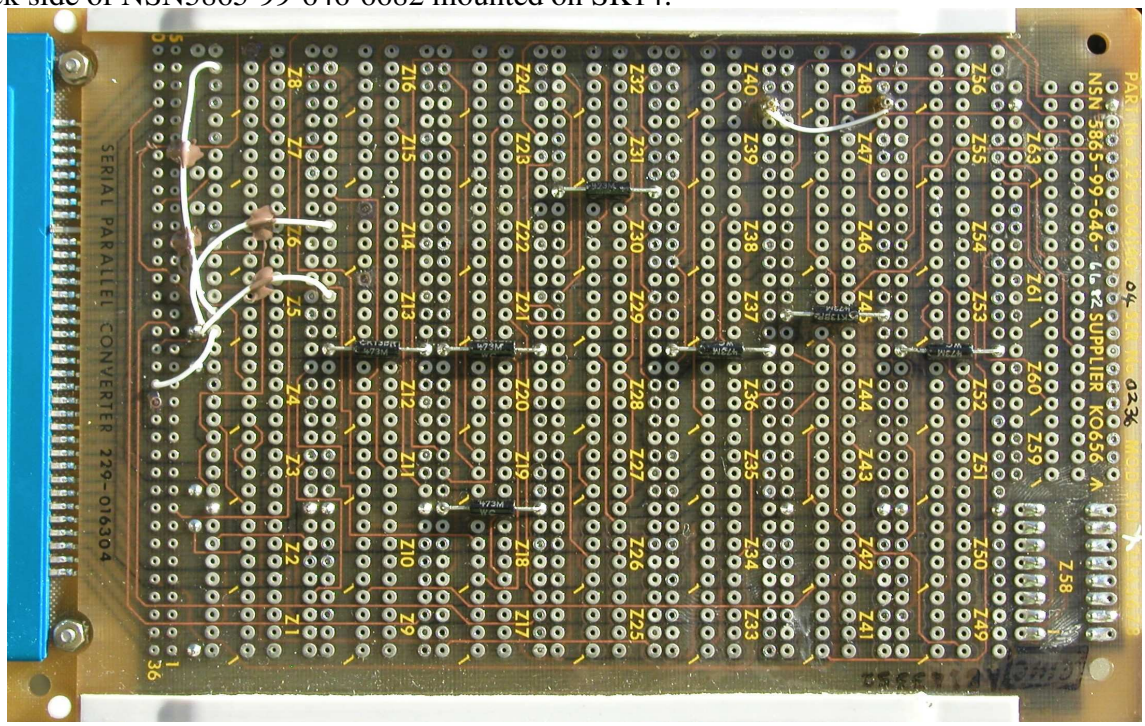
Solder side of this unspectacular PCB:



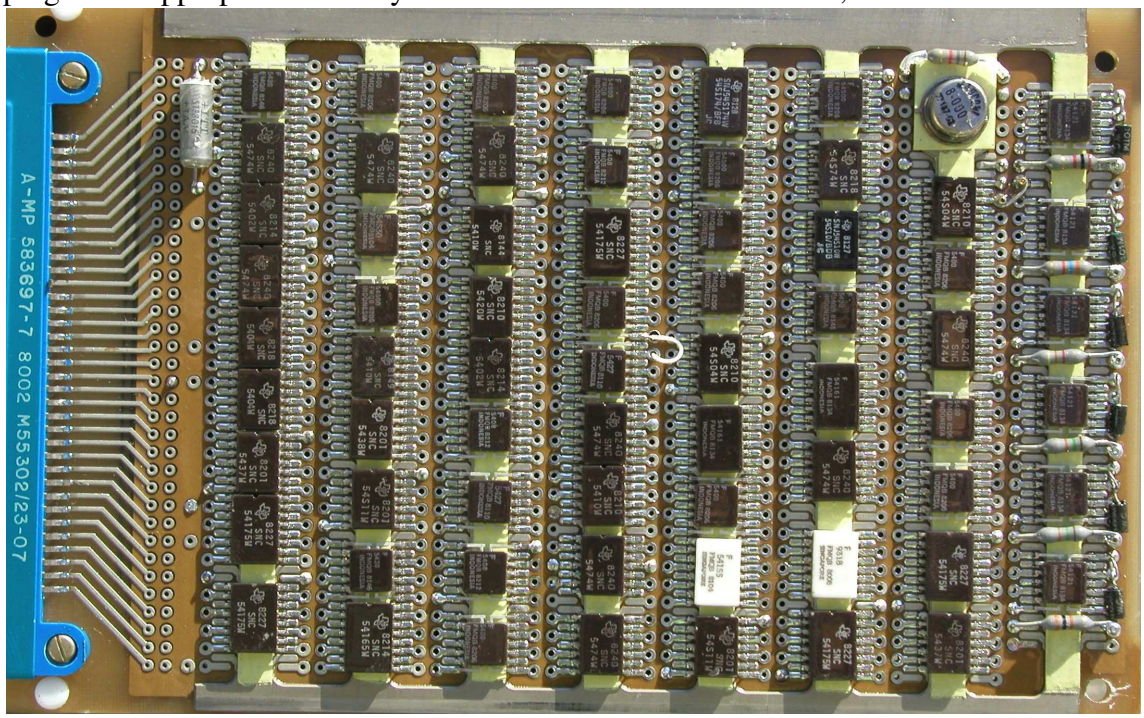
NSN5865-99-646-6682 mounted on SK14 contains the serial shift registers and associated logic connected to the line drivers on SK13. With its 63 ICs it is also home of the unit's timer register:



Back side of NSN5865-99-646-6682 mounted on SK14:



Last but not least, interrupts are taken care of by the PCB on SK15, NSN5865-99-646-6681. Here the interrupt lines of DPL01-DPL04, timer and other sources are combined. Maybe the logic of jumping to the appropriate memory location is contained on this PCB, too:



Interrupt PCB seen fomr it's solder side: