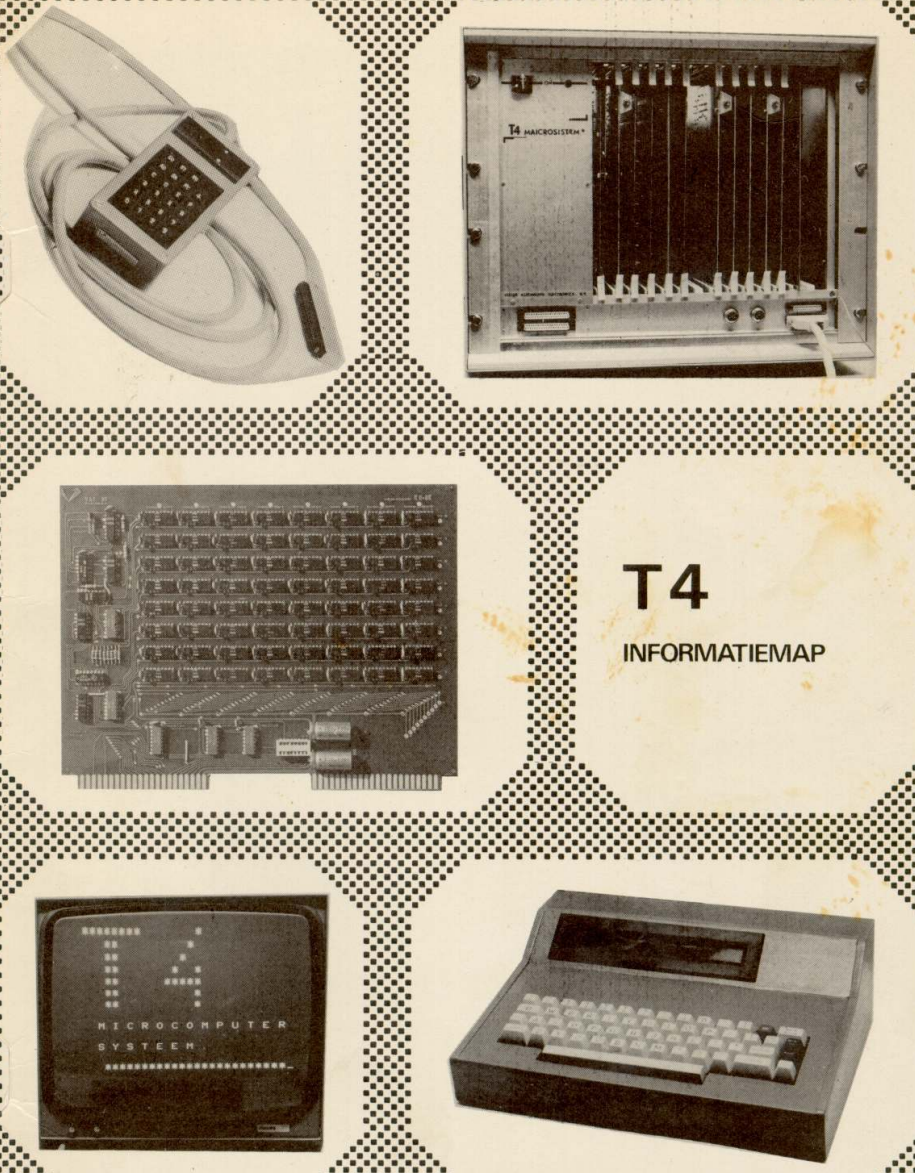


T4 KIM-1 expansion system

Visser Assembling Electronics/Forbo KIM-1 T4 Expansion system



T4
INFORMATIEMAP

VISSER ASSEMBLING ELECTRONICS BV
TOUSSAINTSTRAAT 7 - 1814 EG - ALKMAAR - TELEFOON 072-126652

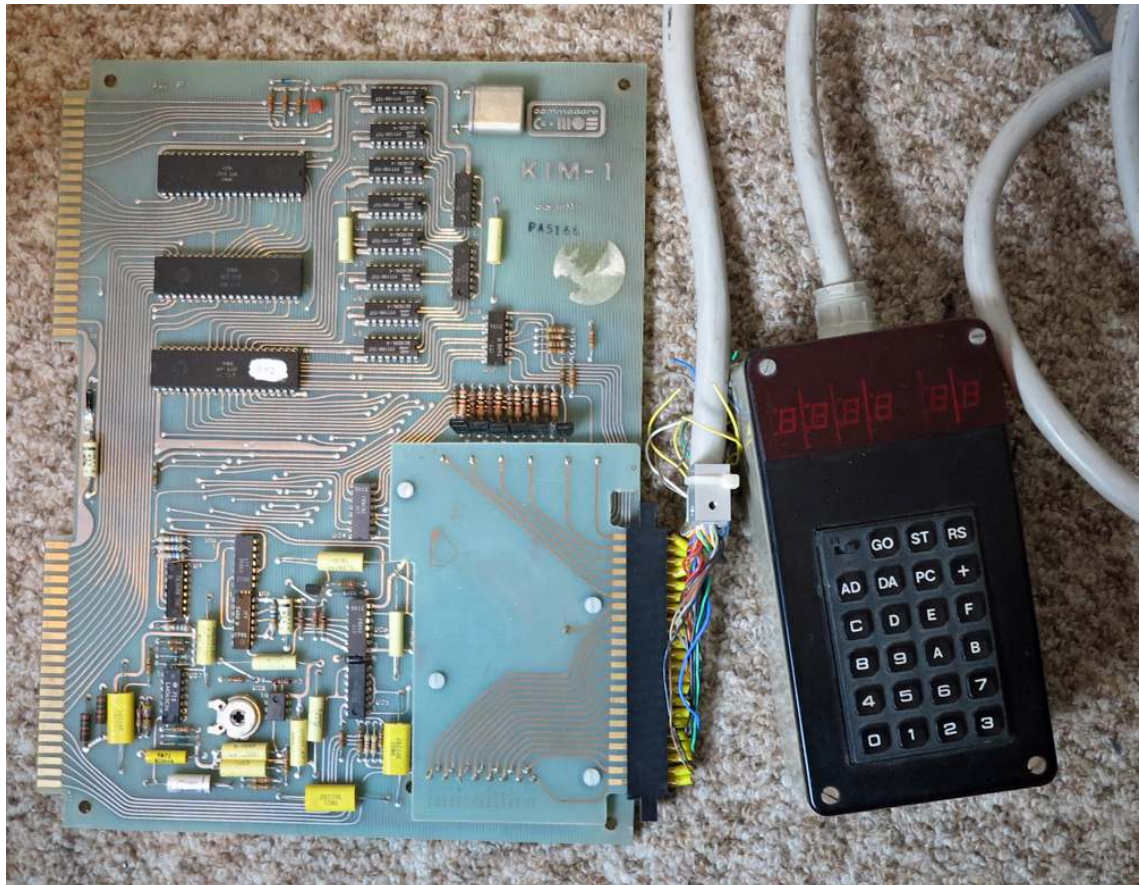
T4 KIM-1 expansion system

T4 system

- System based on cards same size as the KIM-1
- KIM-1 adapted to fit in a board cage, keyboard/LEDs via adapter board and cable outside of the cage
- Input/output digital and analog
- Video card
- Memory cards, RAM, EPROM

Contents

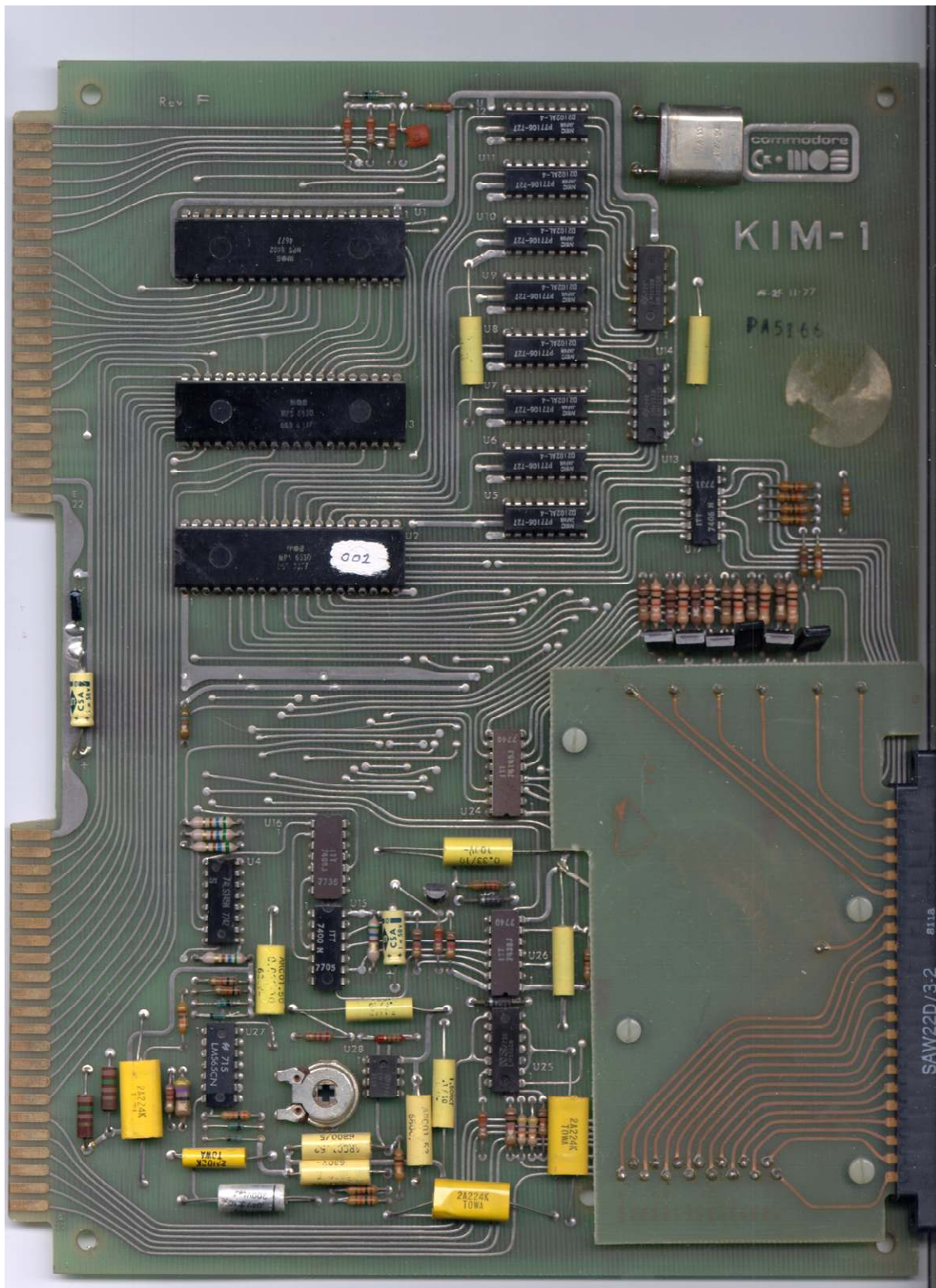
1. Adapted KIM-1 for board cage
2. Photos of cards.
3. T4 folder and descriptions.
4. Circuit diagrams and connector descriptions.



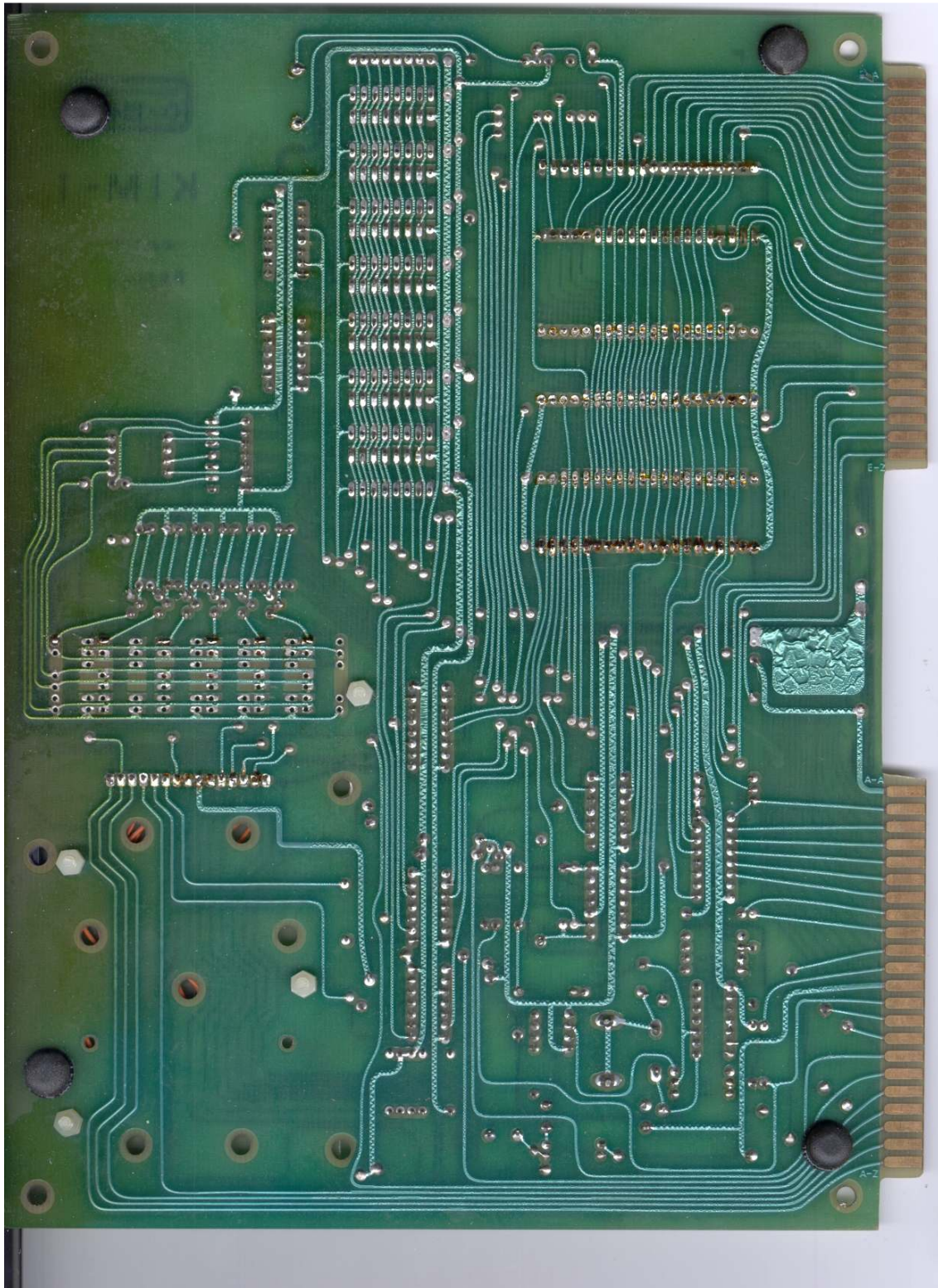
T4 KIM-1 expansion system



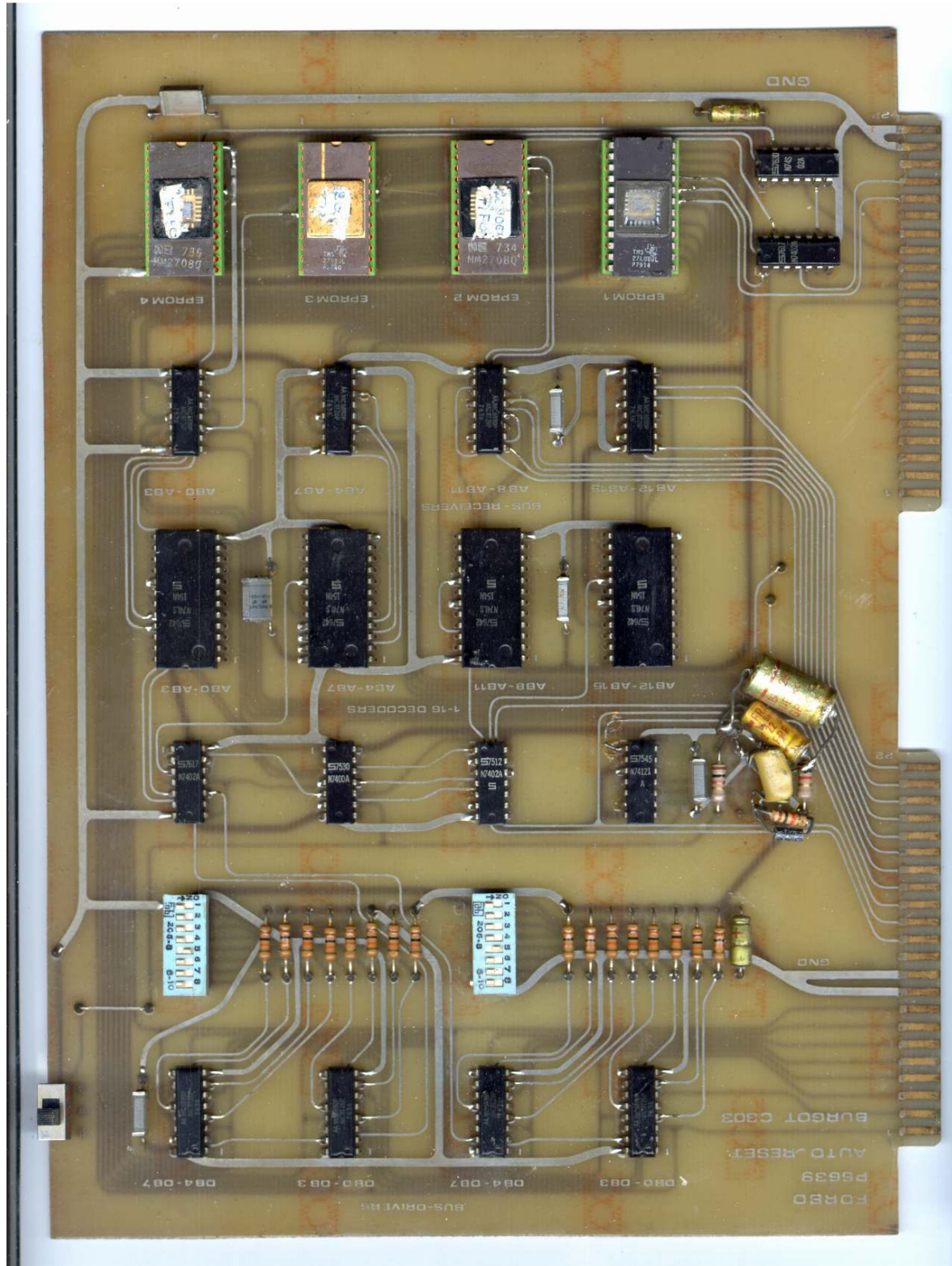
T4 KIM-1 expansion system



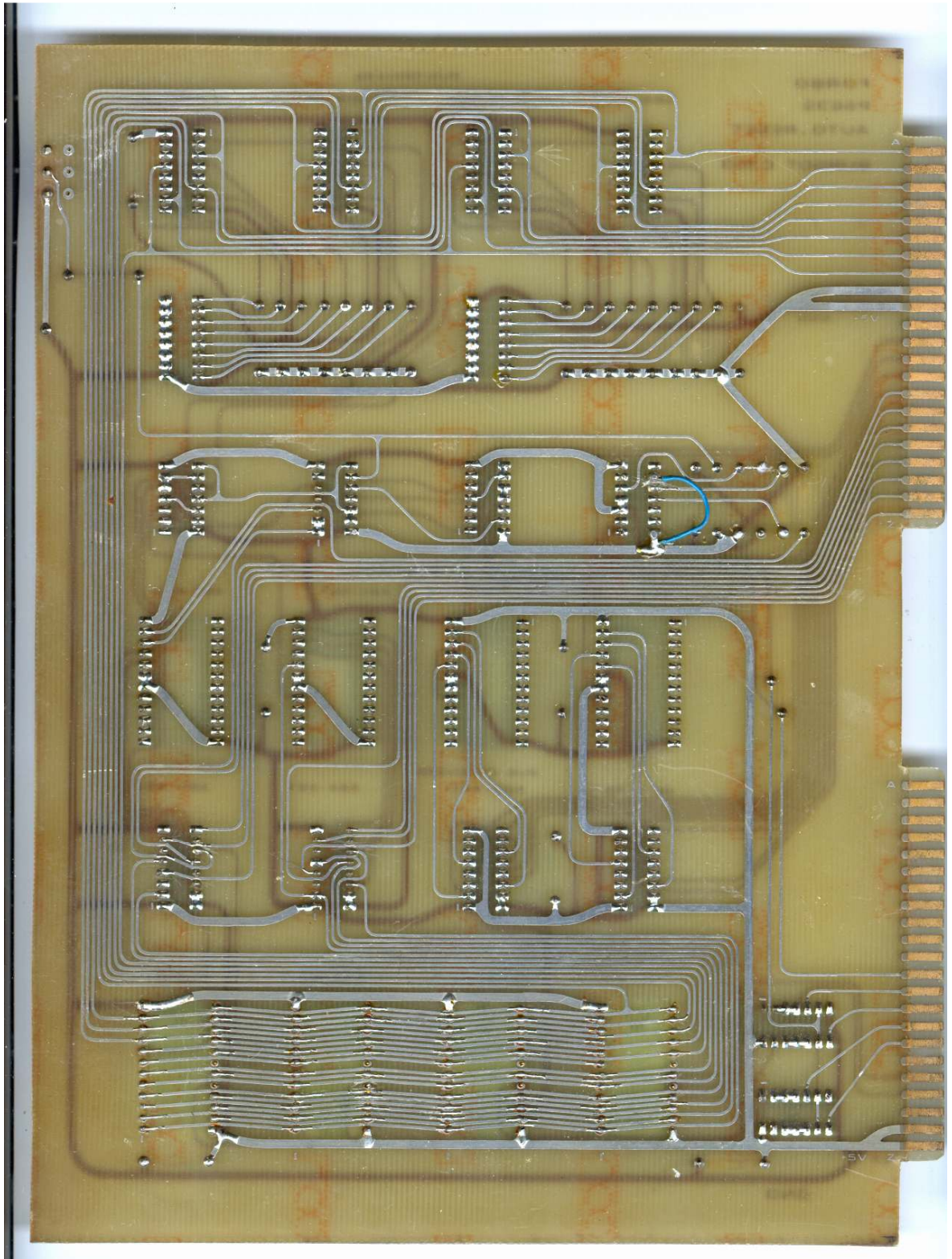
T4 KIM-1 expansion system



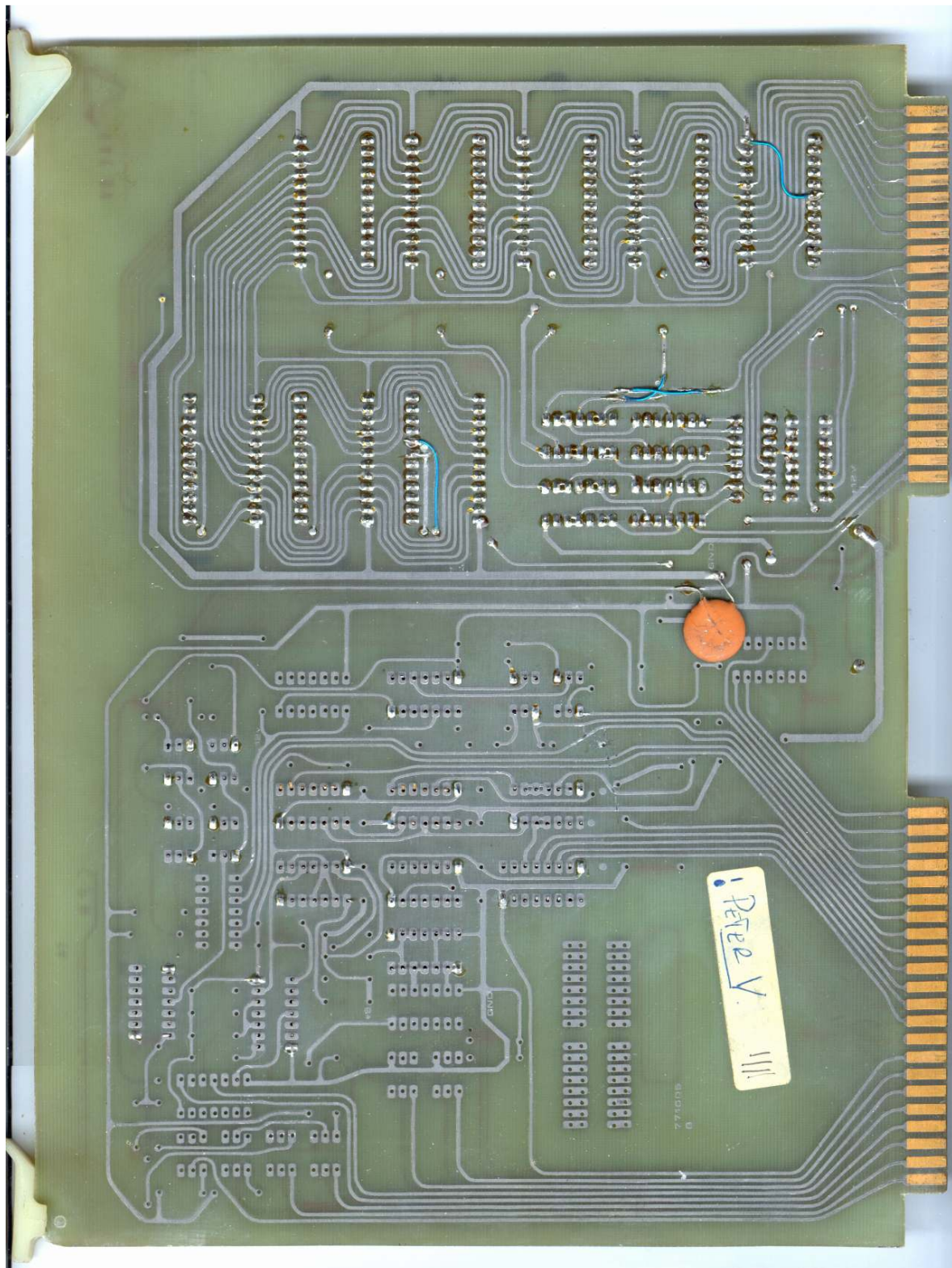
T4 KIM-1 expansion system



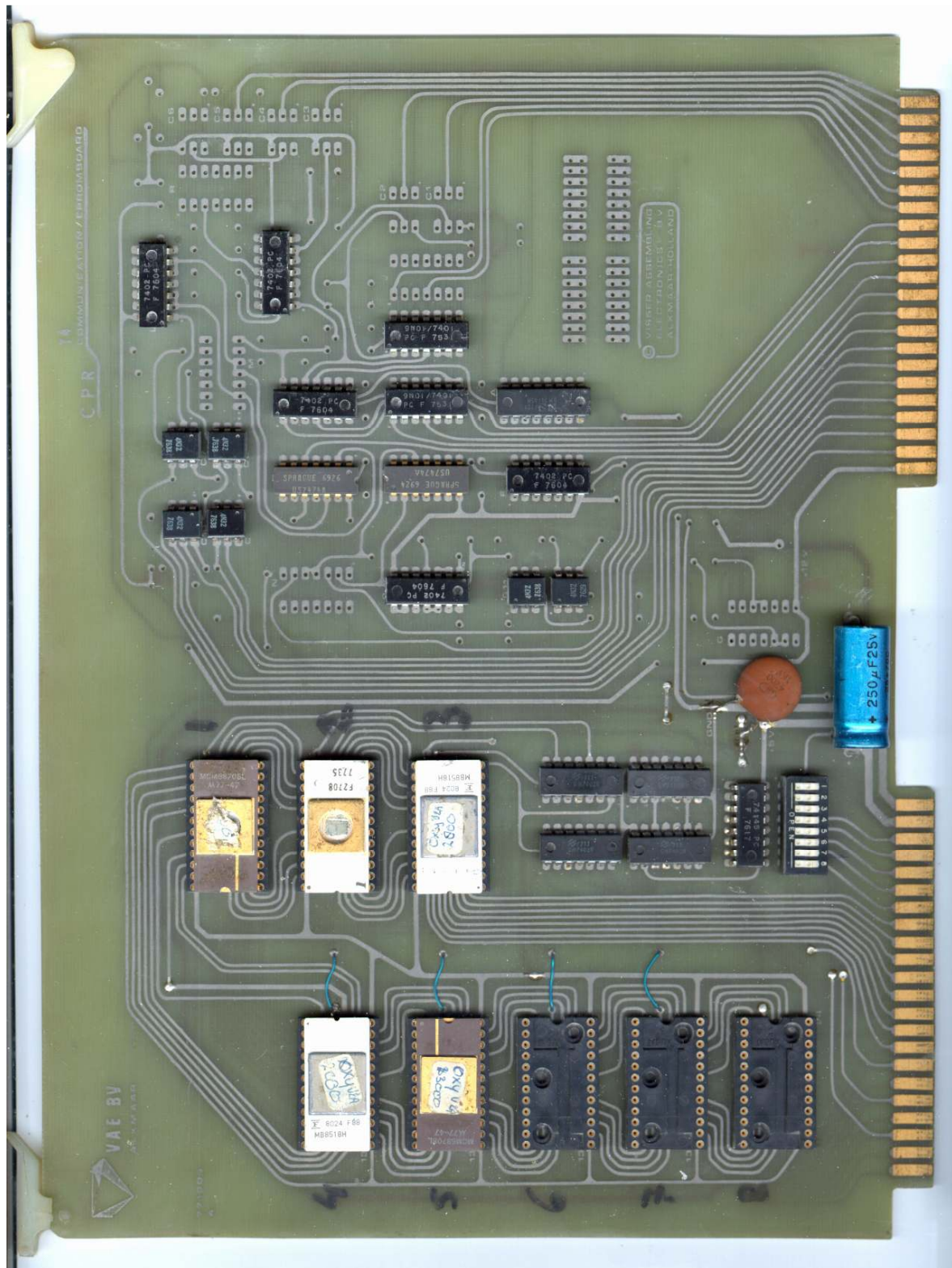
T4 KIM-1 expansion system



T4 KIM-1 expansion system



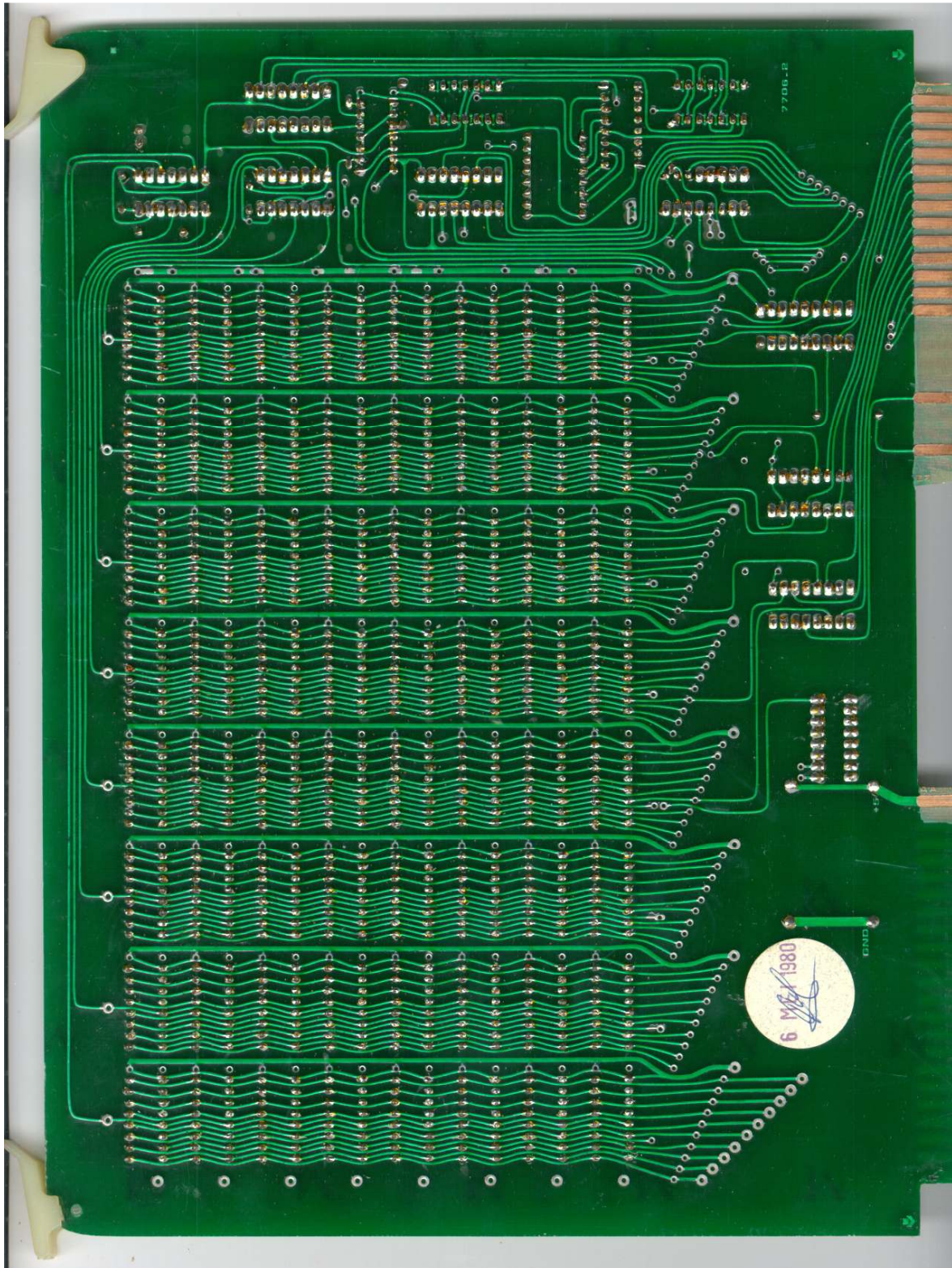
T4 KIM-1 expansion system



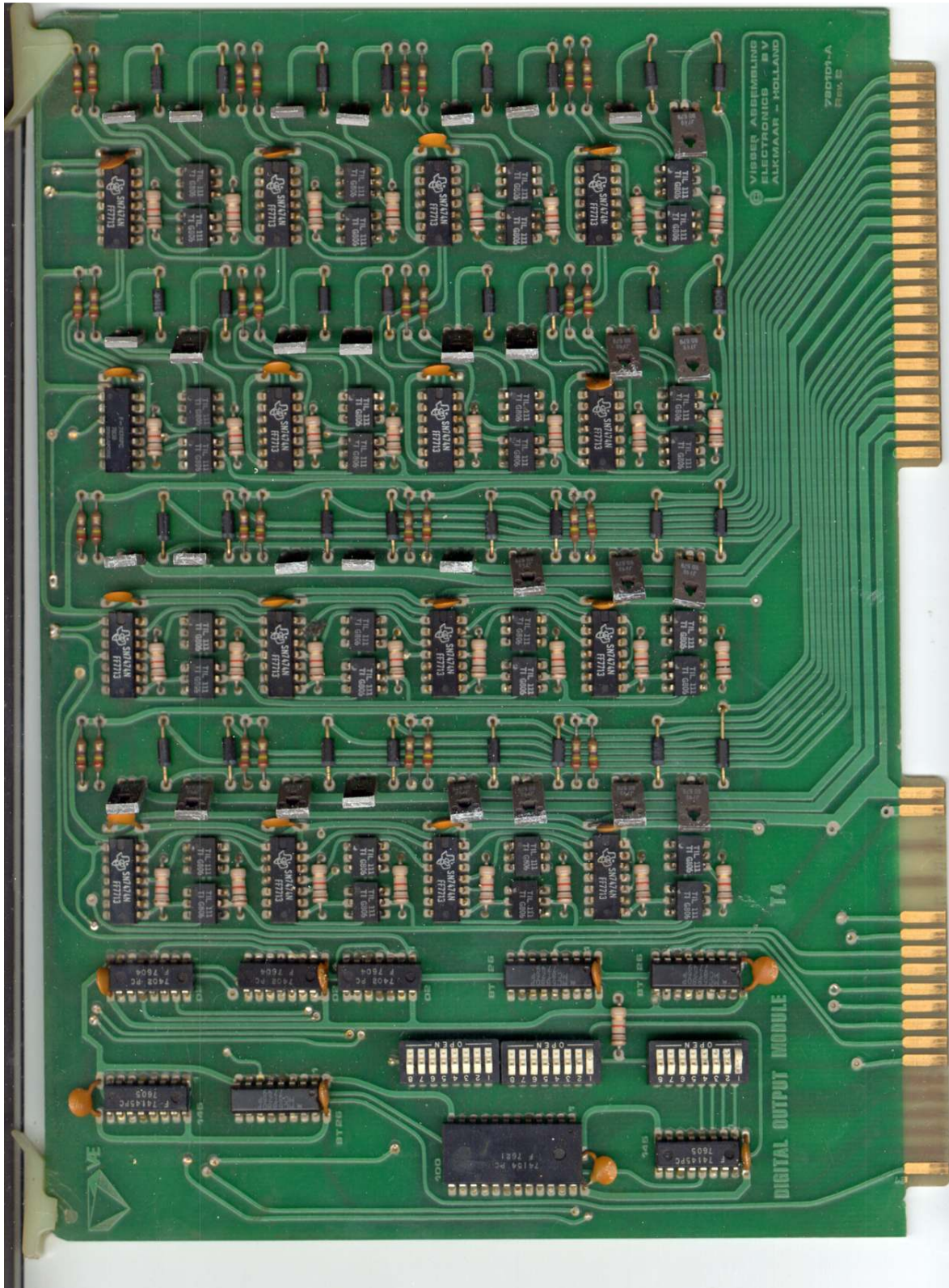
T4 KIM-1 expansion system



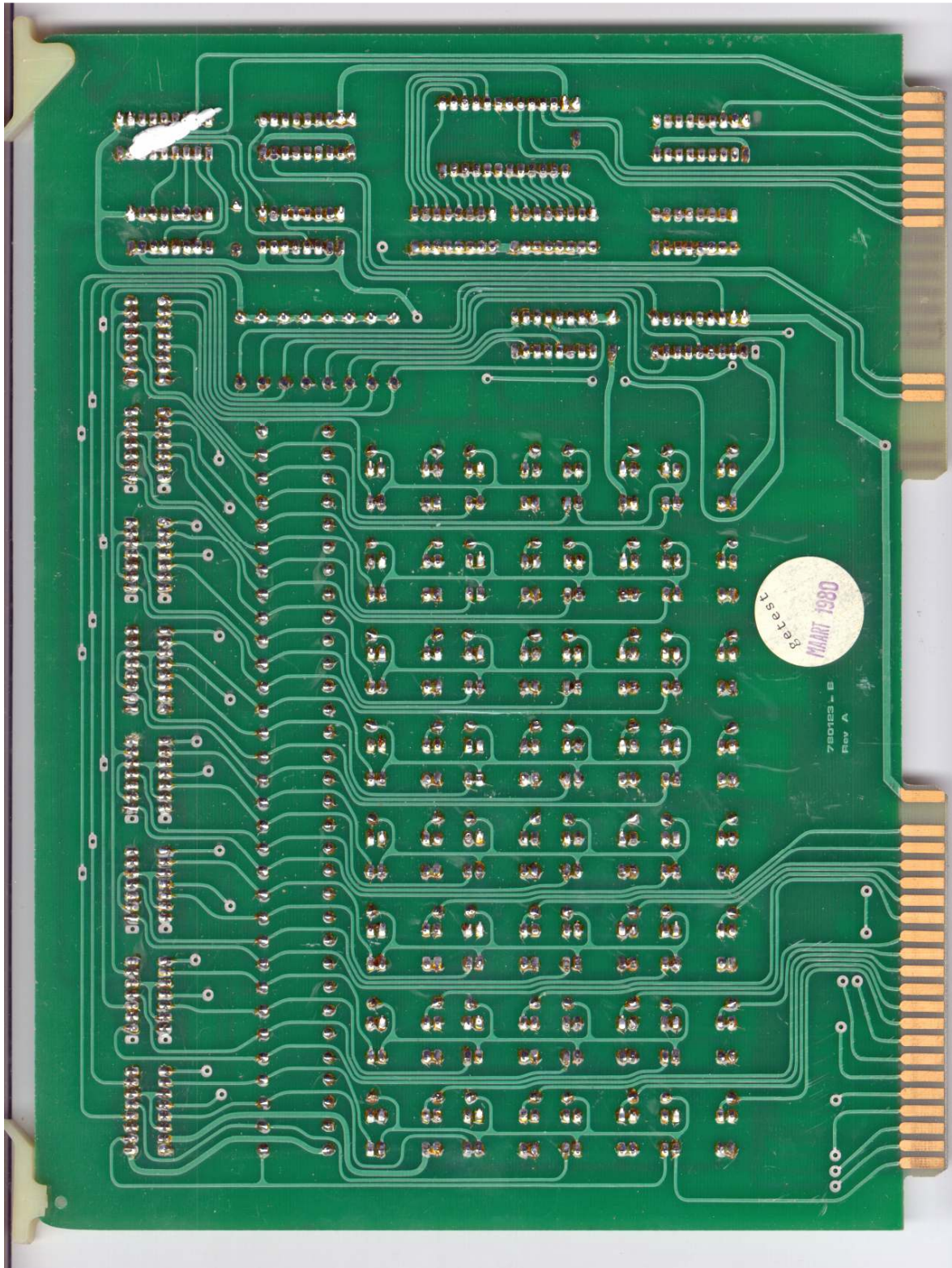
T4 KIM-1 expansion system



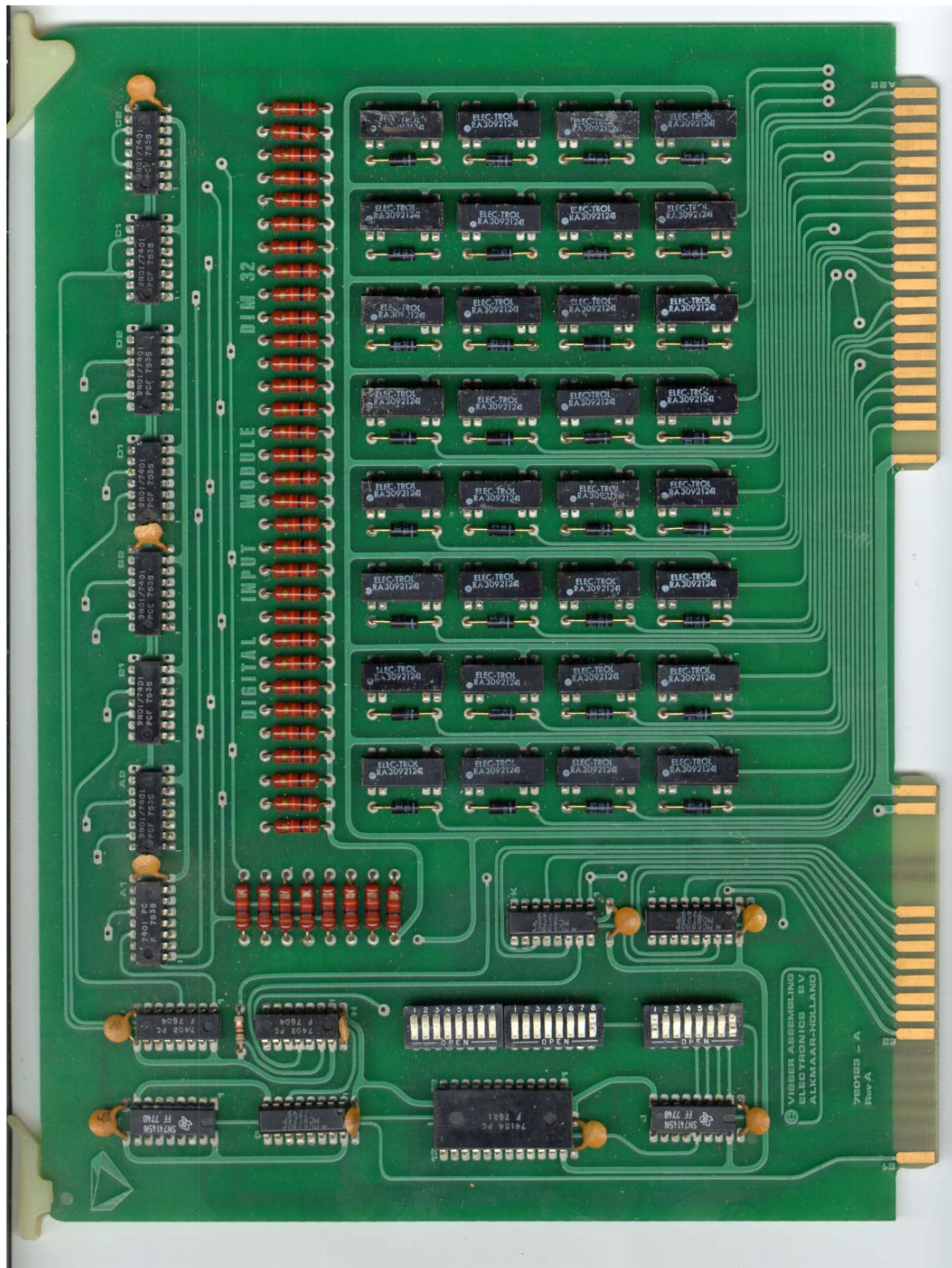
T4 KIM-1 expansion system



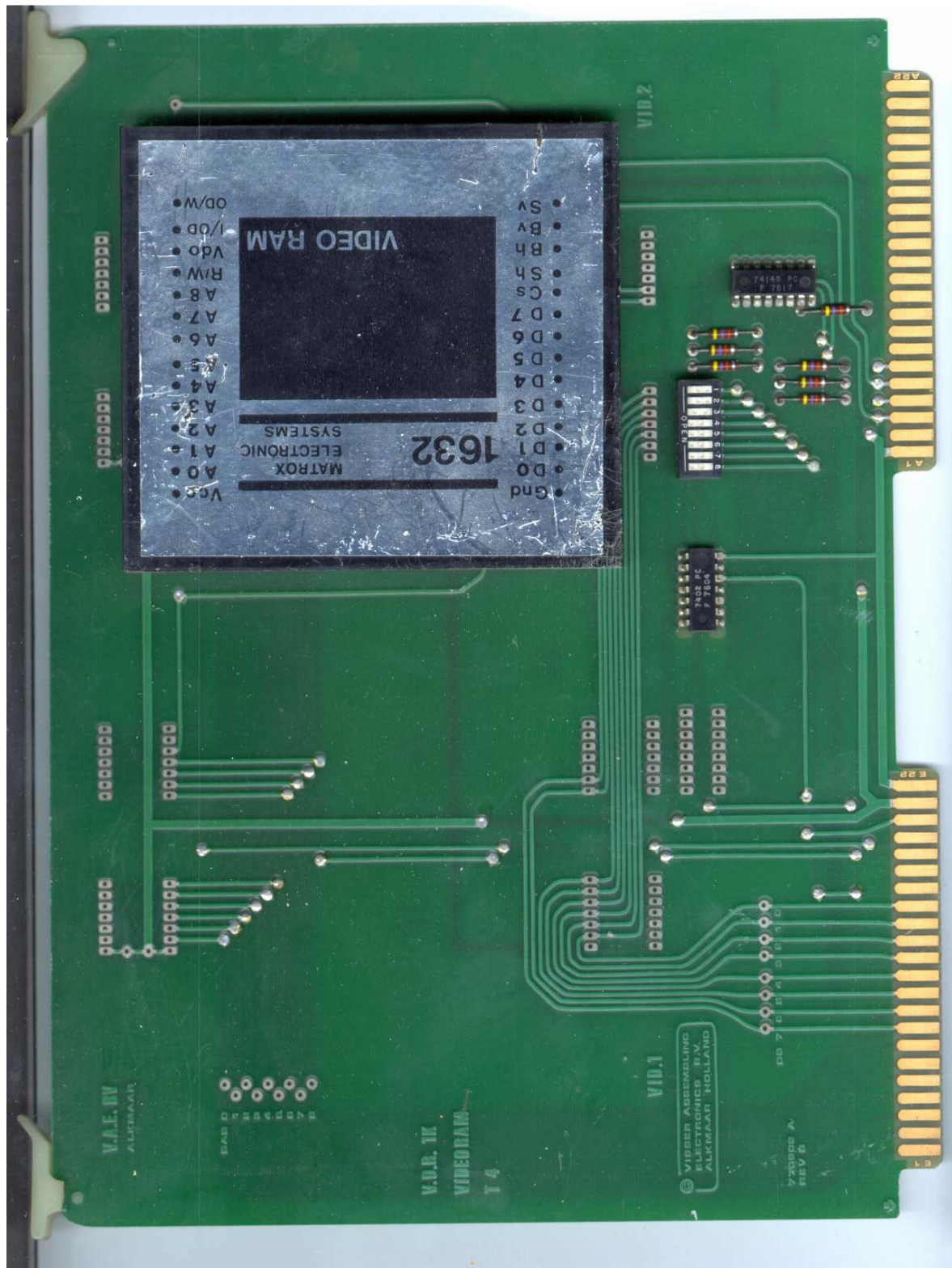
T4 KIM-1 expansion system



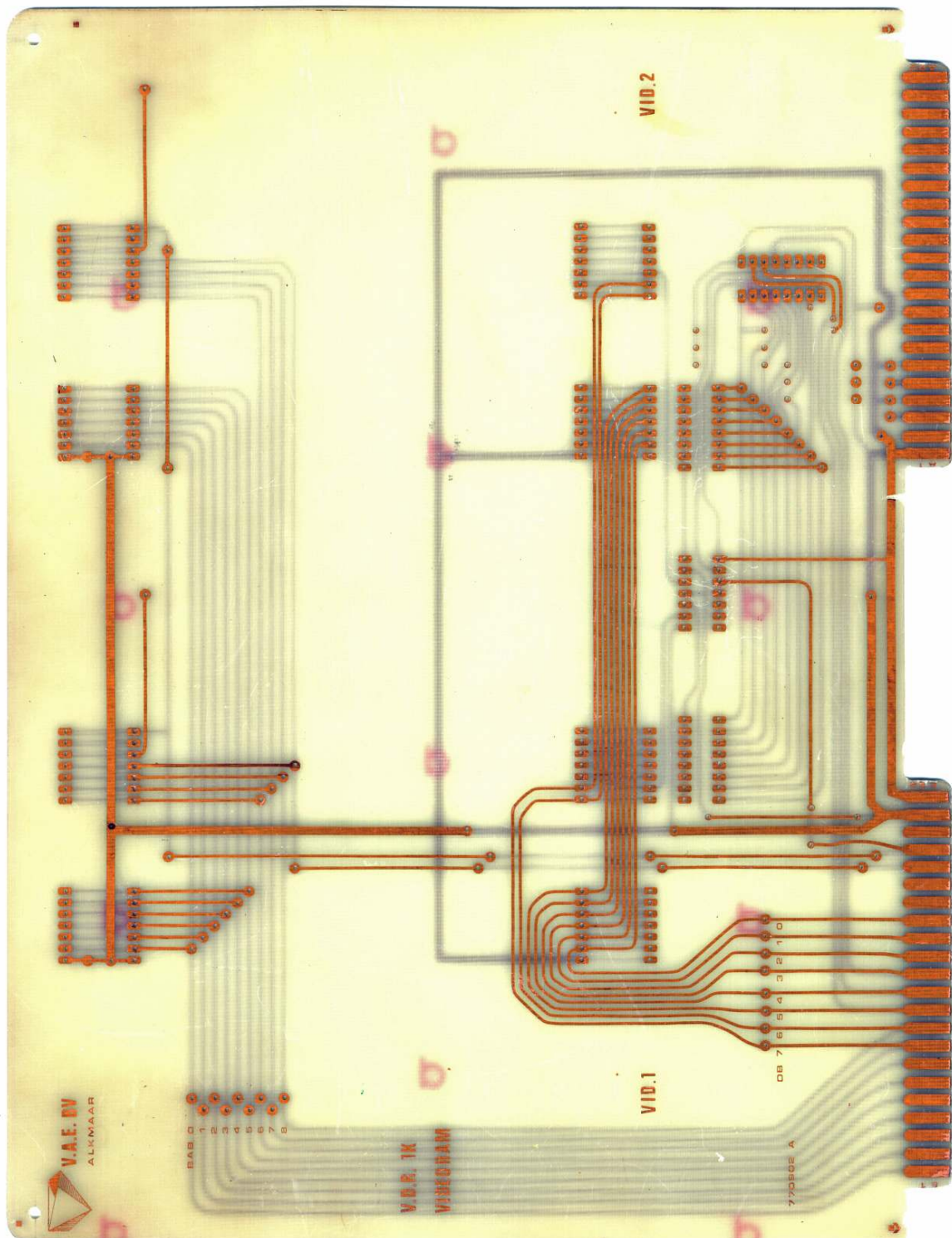
T4 KIM-1 expansion system



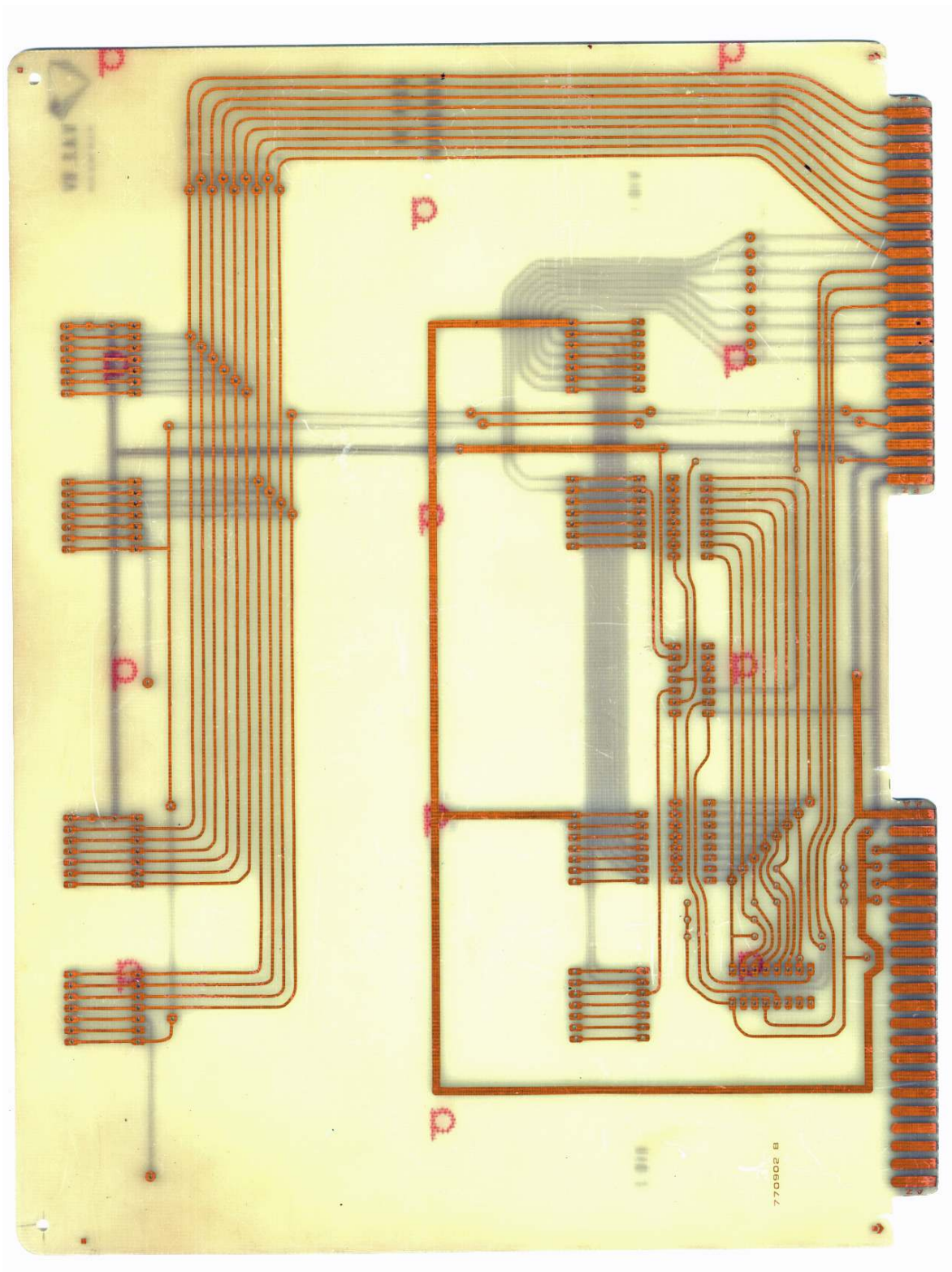
T4 KIM-1 expansion system



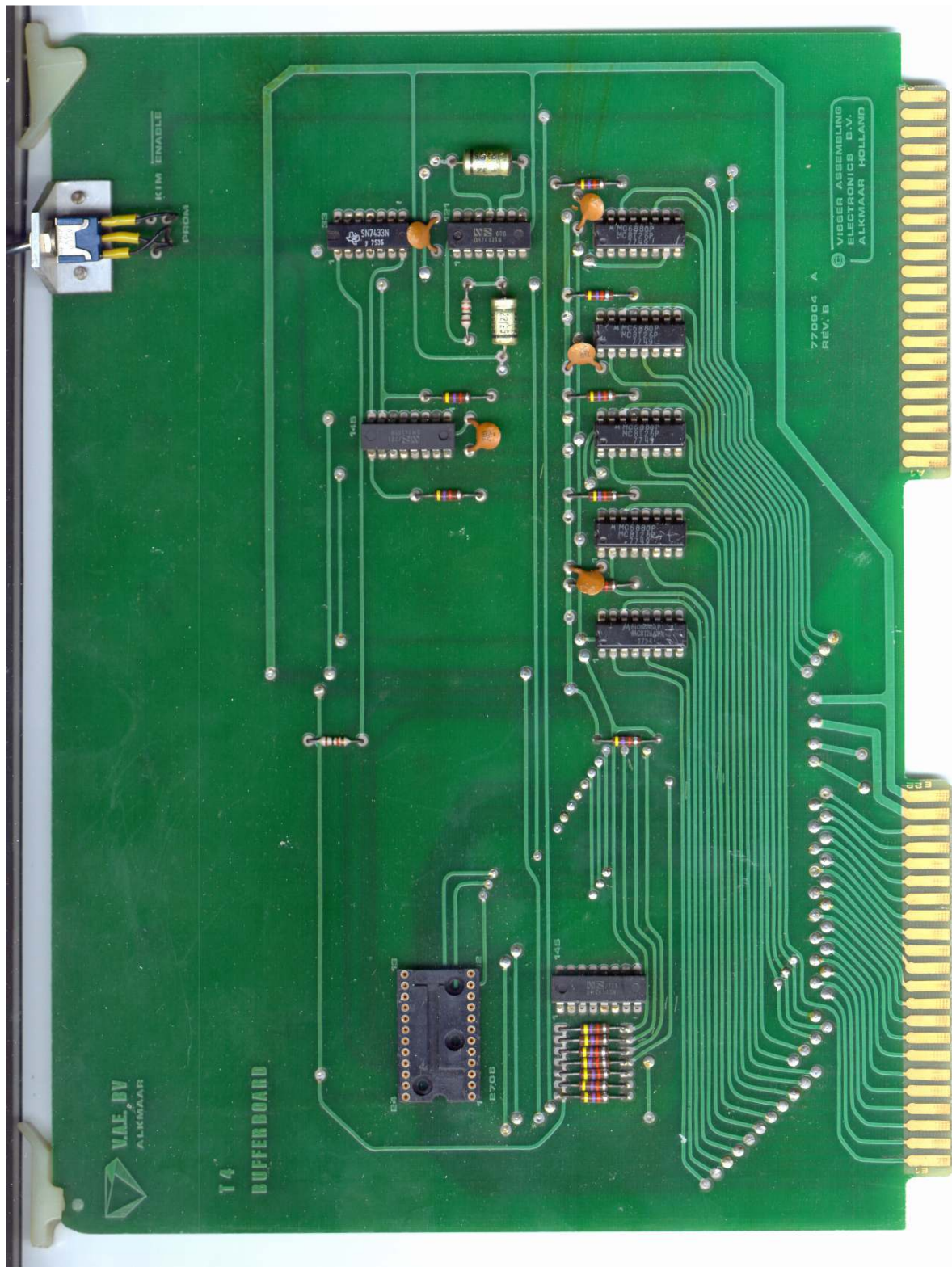
T4 KIM-1 expansion system



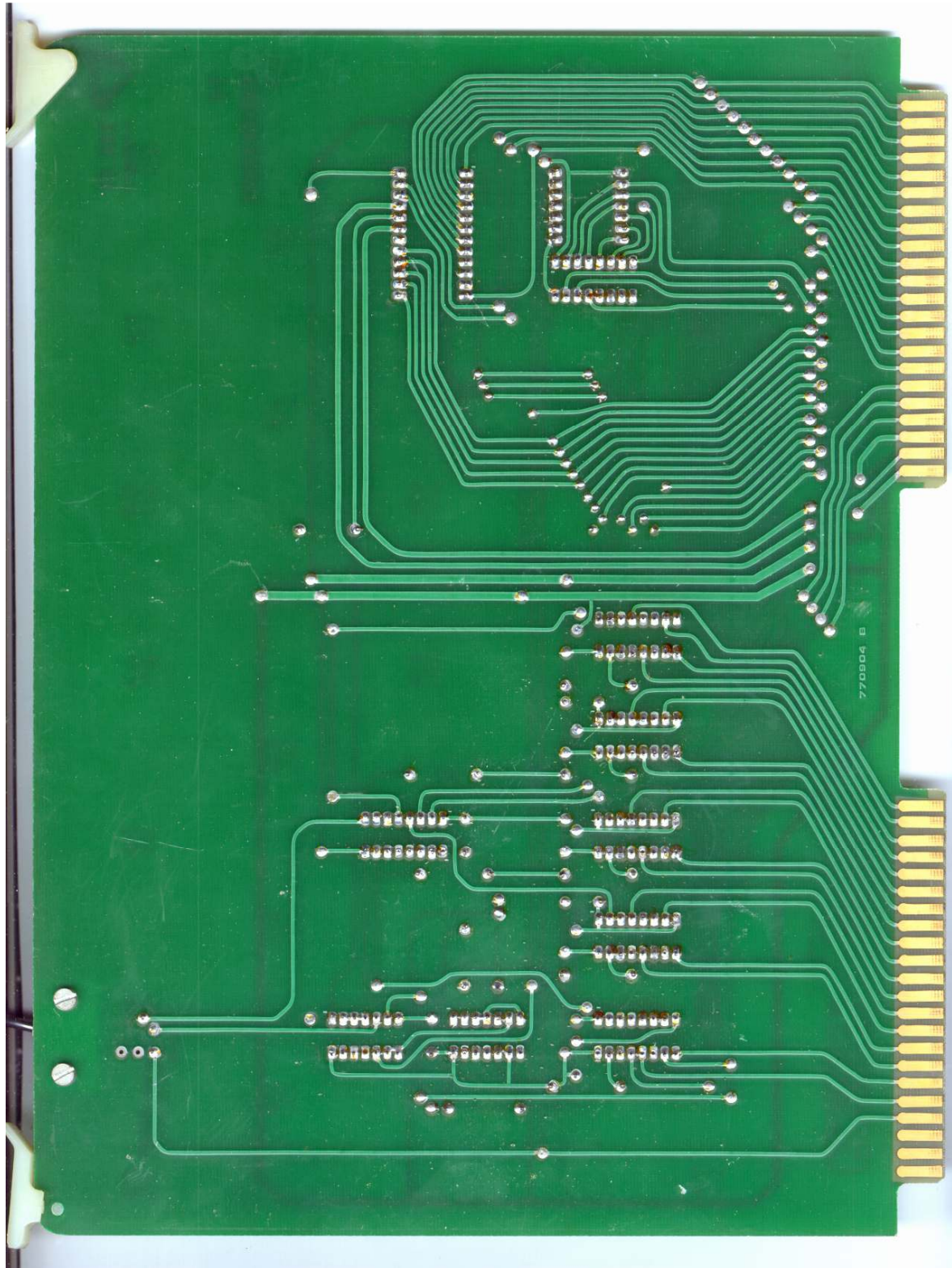
T4 KIM-1 expansion system



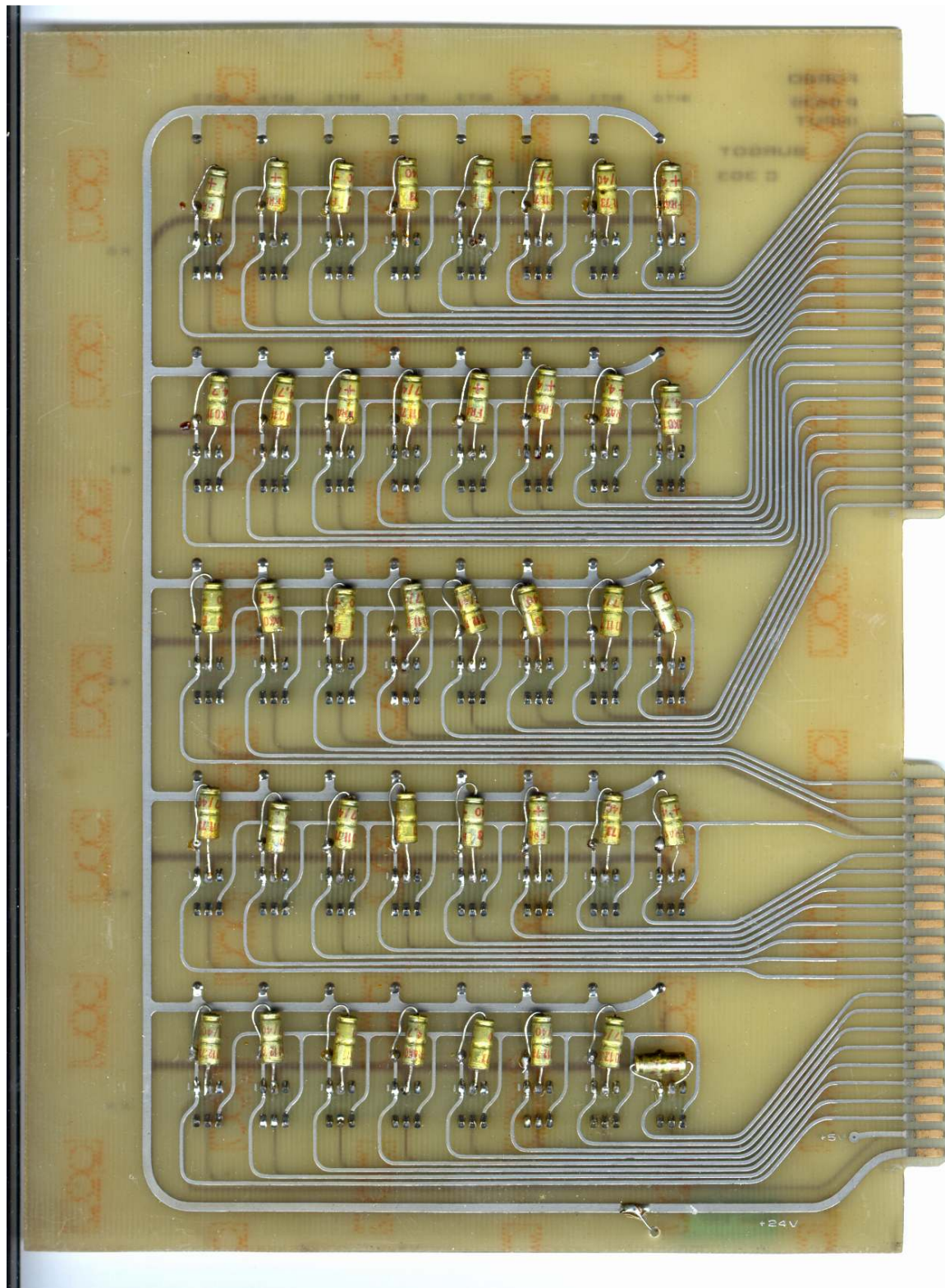
T4 KIM-1 expansion system



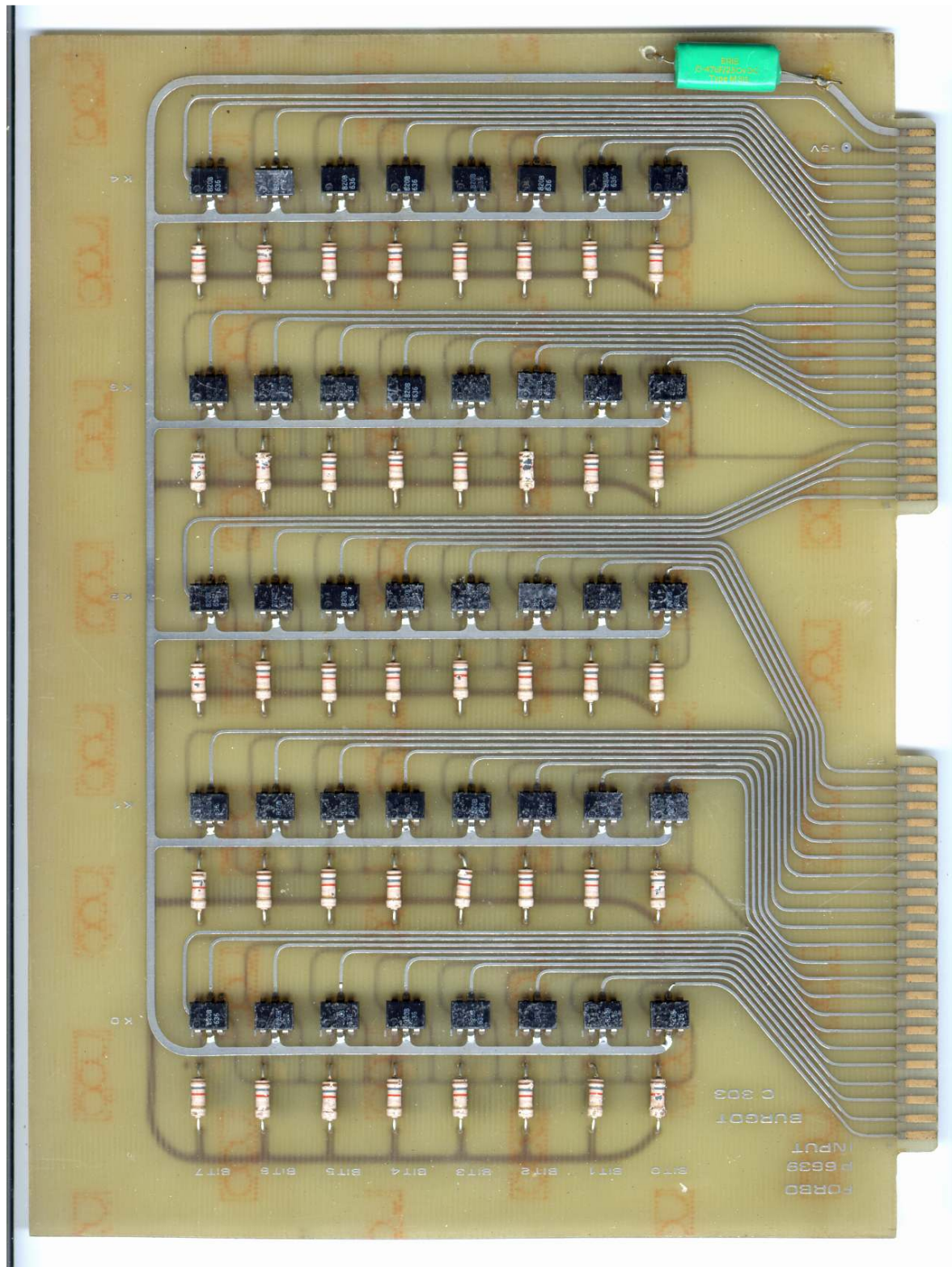
T4 KIM-1 expansion system



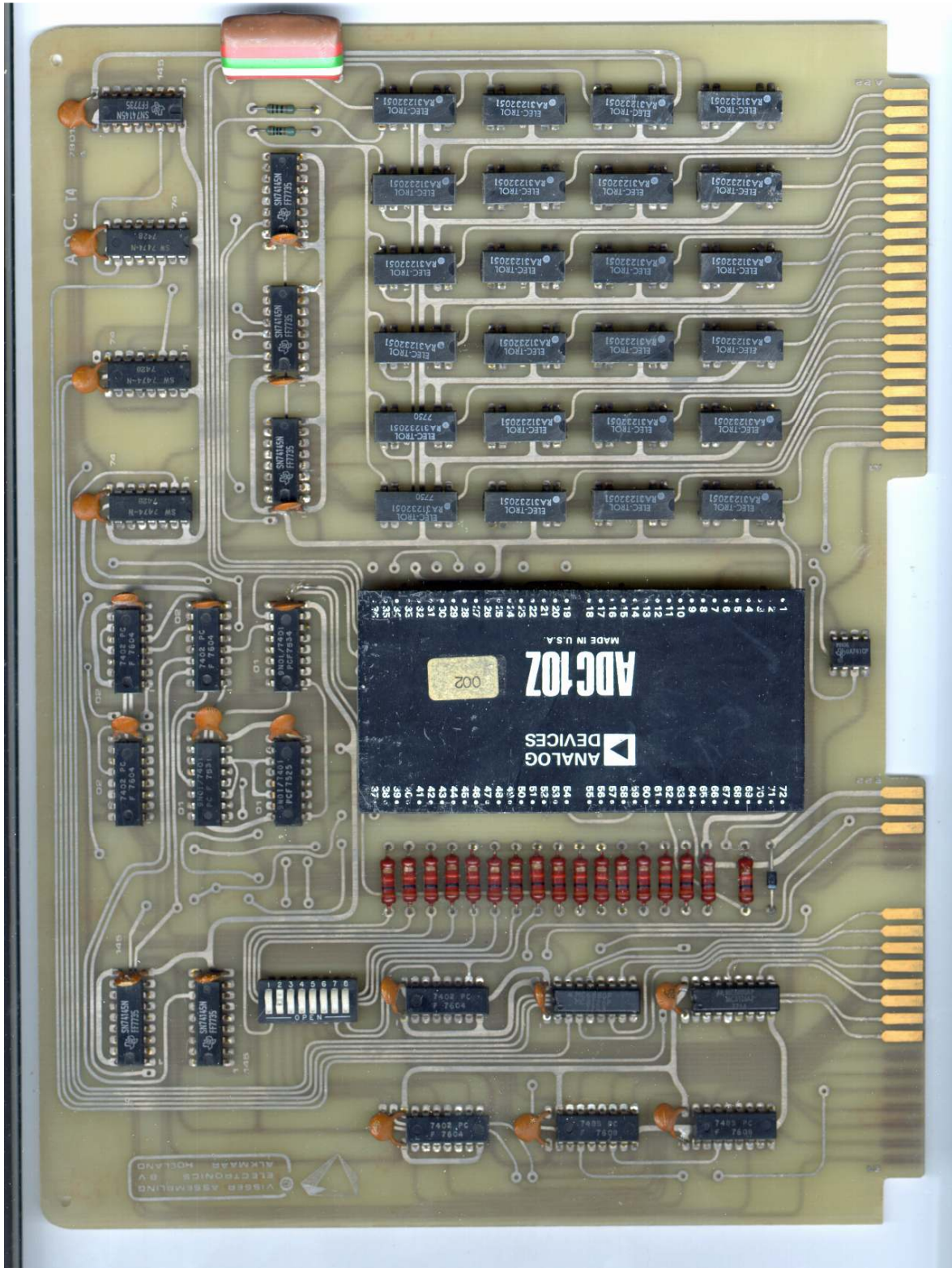
T4 KIM-1 expansion system



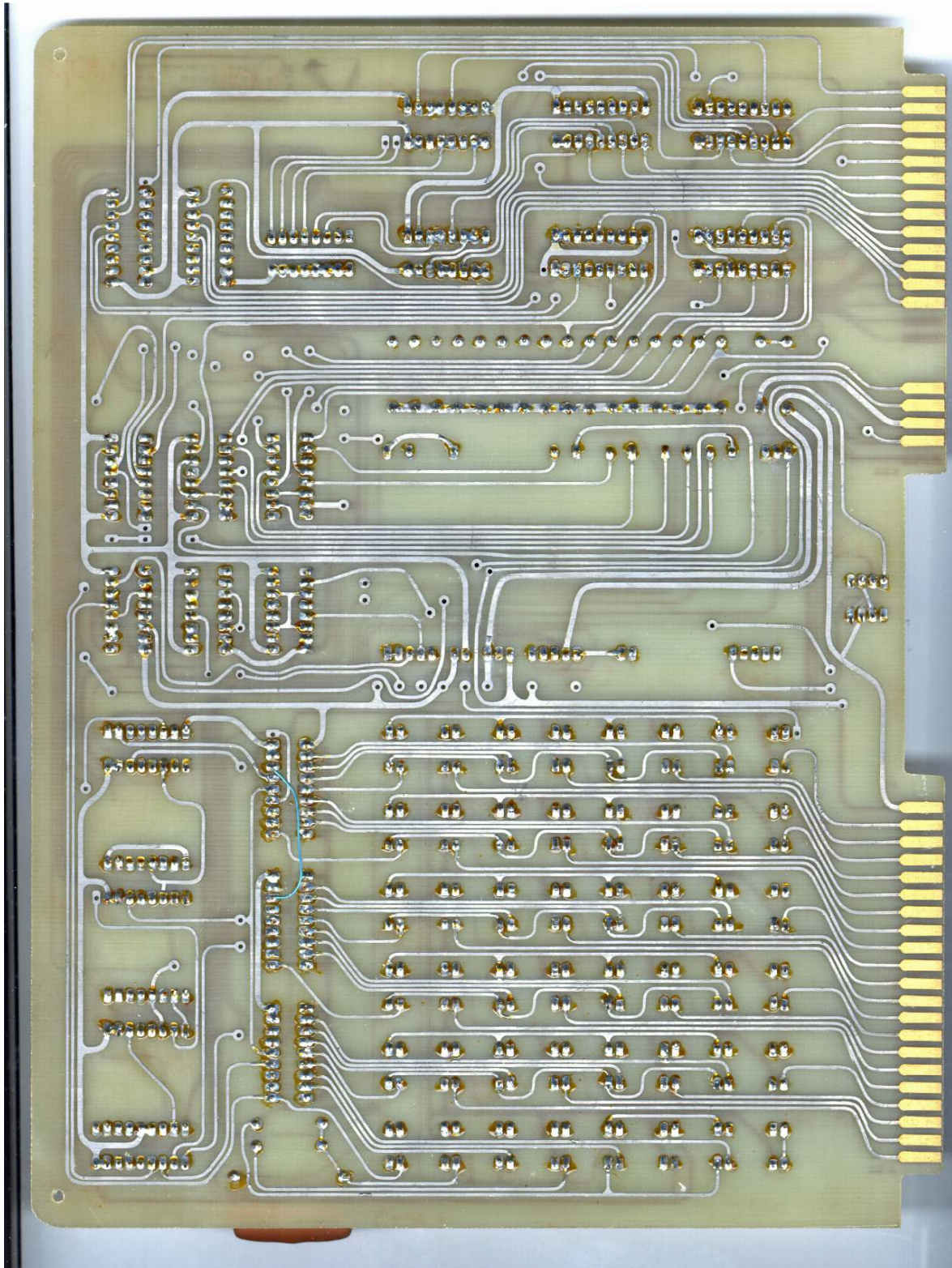
T4 KIM-1 expansion system



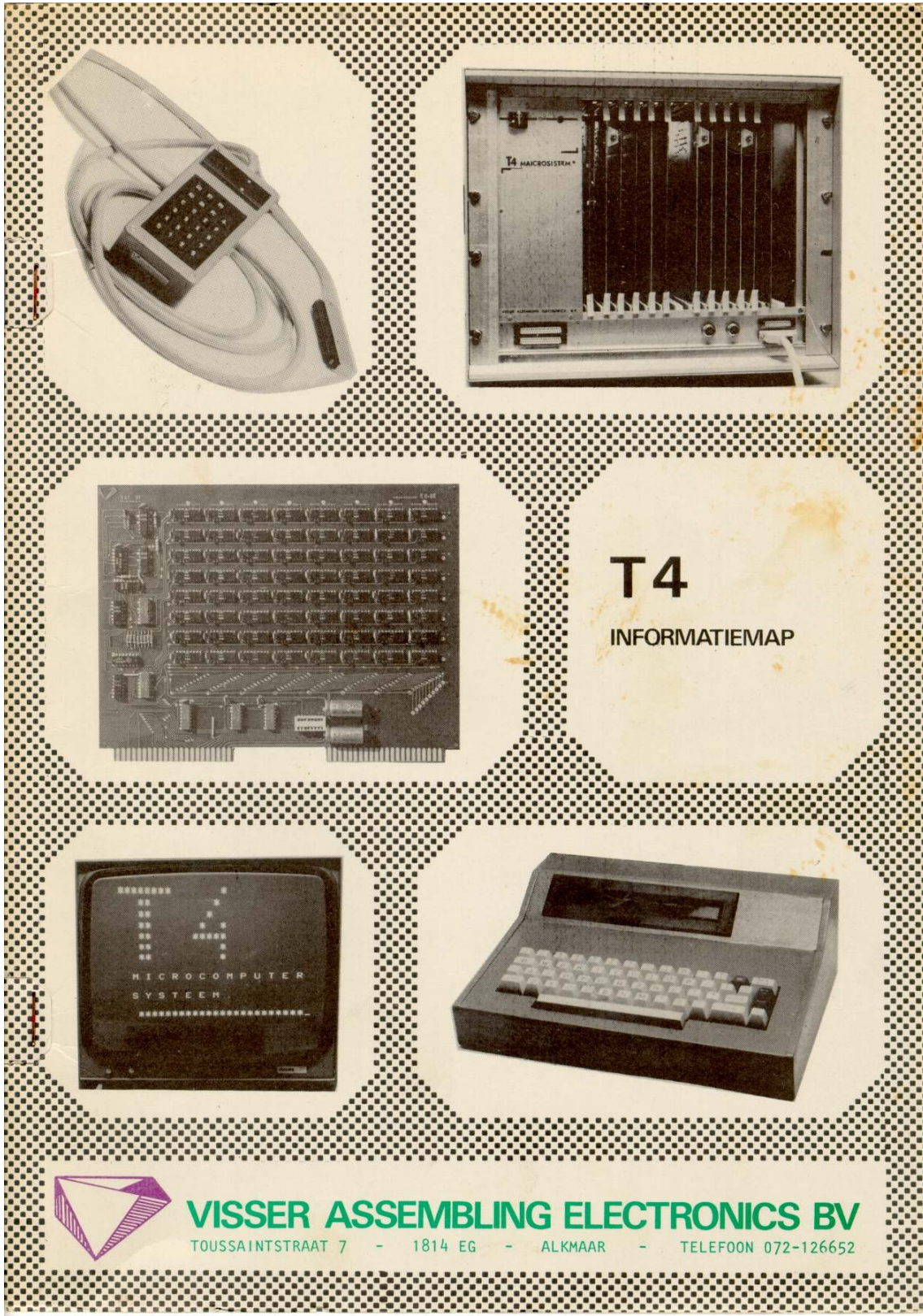
T4 KIM-1 expansion system



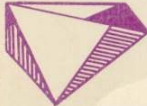
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4
INFORMATIEMAP

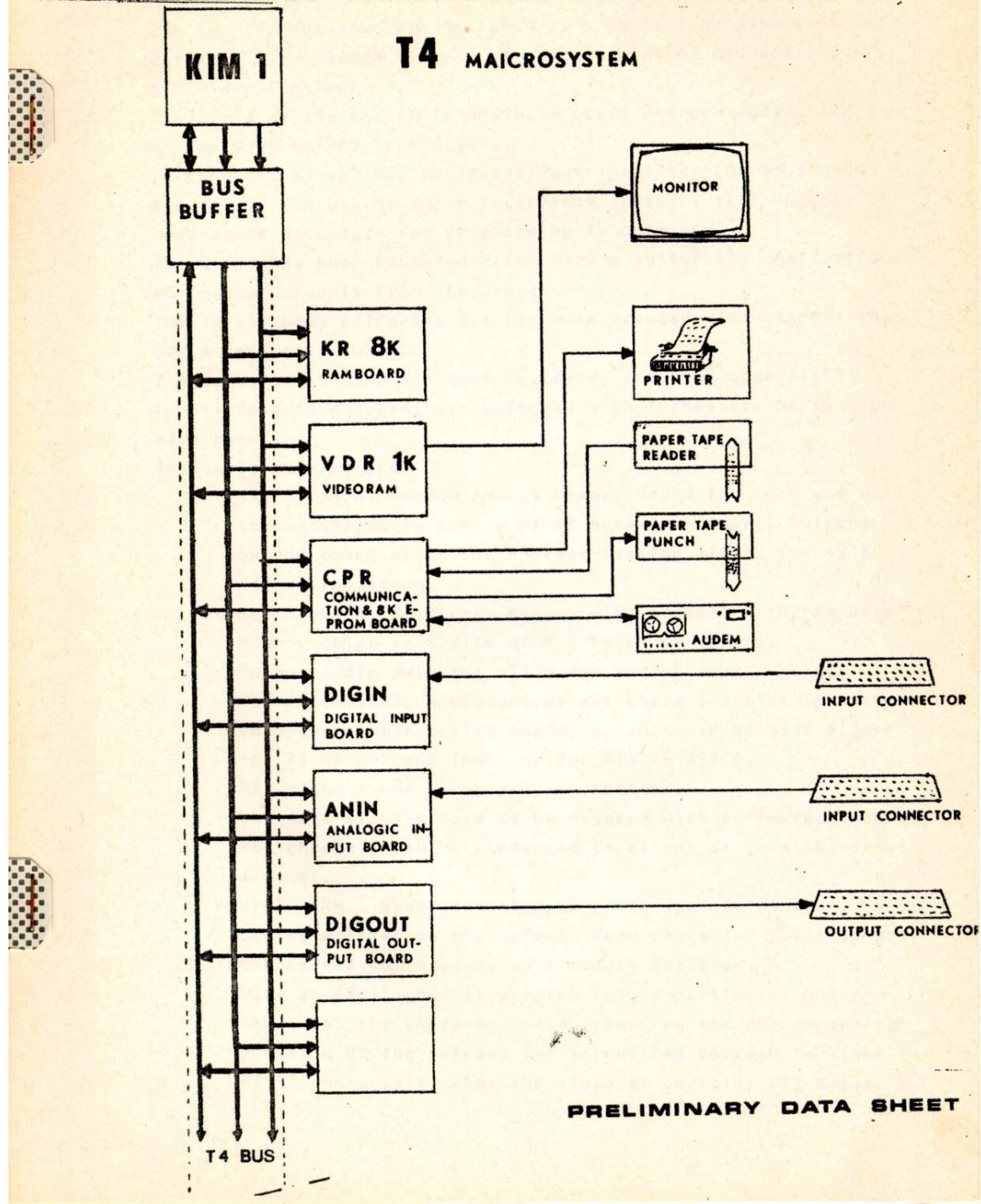
 **VISSER ASSEMBLING ELECTRONICS BV**
TOUSSAINTSTRAAT 7 - 1814 EG - ALKMAAR - TELEFOON 072-126652

T4 KIM-1 expansion system



VISSER ASSEMBLING ELECTRONICS b v

PO BOX 426 - 1800 AK - ALKMAAR - THE NETHERLANDS - TEL: 072 - 12 66 52



T4 KIM-1 expansion system

T 4 SYSTEM DESCRIPTION

Introduction.

The T4 - System has been designed as a general purpose computer suitable for a large variety of process control and small scale E D P applications.

The basis of the system is a single board microcomputer, KIM 1 as produced by MOS TECHNOLOGY .

T4 consists of various peripheral and interface boards around the KIM 1. The use of these interfaces is such, that an easy to understand procedure for programming is obtained.

The KIM 1 has been expanded first with a BUSBUFFER, that buffers all output signals from the processor.

Thus a slightly different bus has been created with signals that can stand heavy loads.

The datasignals have not been buffered, thus the data lines to all interface boards are buffered with threestate buffers on each board.

\ Available modules are:

- RAM - board. Random Access Memory board for read and write operations in a size of 8K bytes per board. Switches on the board allow for address-setting within the 65 K addressing space.
- ROM - board. Read Only Memory with erasable programmable memory chips in a size of 8 K bytes per board.
On board dip switches allow for variable addressing.
- COMMUNICATIONS. A communications board contains two asynchronous communication channels, that can be used either for 20 mA current loop, or for EIA RS 232 C.
All signals are under program control.
The data signals have to be created with software. Each of the channels can be connected to either as terminal or as dataset.
- VIDEO RAM . When connected to a standard TV monitor, text can be written on the screen. Each character position of the screen corresponds to a memory location.
When an ASCII code is written into a particular memory location, the character will appear on the corresponding position on the screen. The screen can contain 16 lines of 32 characters, thus the videoram contains 512 bytes.

T4 KIM-1 expansion system

- DIGITAL INPUTS. The digital input board can accept 32 signals from the field. Input is fully isolated. The 32 signals can be read from 4 consecutive addresses.
Input boards are either using opto isolators or reed relays for isolation.
- DIGITAL OUTPUTS. A digital output board houses 32 output signals, that are ending in either opto isolator driven darlington transistors or in reed relays. The signals are organized in groups of 8 bits, thus occupying 4 different addresses.
- ANALOG INPUT; An analog inputboard is a complete subsystem that is capable of reading 22 different analog signals with a range of either -5 through +5 Volts or 0 - 10 Volt.
A flying capacitor is used for full isolation. Each board contains a separate zero and full scale calibration channel.
All multiplexer timing is software driven. The multiplexer is using reed relays.

The T 4 BUS occupies all 44 pins of the EXPANSION CONNECTOR. All expansionconnectors starting at the BUSBUFFER can be wired through.

ADDRESSING SCHEME OF T 4 .

The full 65 K addressingspace of the 6502 processor is being used within the T4 system configuration.
Fixed addresses have been assigned for the various peripheral boards.

Address 0000 - 1FFF is occupied by the KIM 1 including 1K RAM on location 0000 - 03FF and the KIM MONITOR in the 6530 ROM'S at location 1800 - 1FFF. The leftover space from 0400 - 17FF is partially used by the timers and may be used for an additional 4K RAM or EPROM.(Not standard T4)

Address 2000 - DFFF is assigned for any type of memory,that is organized in 8K amounts. Each 8 K starts 2000 higher than the preceding one.

The total capacity of T 4 for RAM and EPROM is thus $6 \times 8 = 48K$
This means for example 16 K EPROM and 32 K of RAM. Any mix of 8K boards can be used.

T4 KIM-1 expansion system

3

Address E000 - EFFF is for VIDEORAM applications. The total capacity is 8 VIDEORAM's, thus 8 different TV monitors.

Address F000 - F1FF is used for analog inputs. Since one board occupies 2 addresses for addressing 22 channels, this gives a total capacity of $512 \times 22 = 11264$ different channels.

Address F200 - F7FF is not assigned. It is reserved for future expansion.

Address F800 - FBFF is for digital in- and output. Each address contains 8 input bits (when a read-type instruction is executed) and 8 output bits (with any write-type instruction) This gives a system capability of 8192 input signals and 8192 output signals.

Address FC00 - FFFF is assigned for the 1K EPROM that is on the BUSBUFFER board.

0000-1FFF	KIM 1 Microcomputer module. (Can have RAM/PROM in location 0400-13FF).
2000-3FFF	Memory. RAM/PROM/GRAPHICS
4000-5FFF	" " " "
6000-7FFF	" " " "
8000-9FFF	" " " "
A000-BFFF	" " " "
C000-DFFF	" " " "
E000-EFFF	VIDEO RAM MODULES
F000-F1FF	ANALOG INTERFACE (Input/output)
F200-F7FF	Not assigned
F800-FBFF	DIGITAL INPUT/OUTPUT MODULES
FC00-FFFF	1K PROM on busbuffer which can contain vectors of KIM 1 (switch selectable)

T4 KIM-1 expansion system

BUSBUFFER BOARD.

The bufferboard of T4 acts as interface between the KIM 1 processorboard and the T4 BUS.

All output signals from the bufferboard are buffered through an 8T26 (+ 100 TTL loads)

KIM 1 signals that are buffered are:

- AB 0 - AB 15 Address lines. On the T4 BUS these signals are named BAB 0 - BAB 15
- $\Phi 2$ and $\overline{\Phi 2}$ second phase of microprocessor clock. All data for write type instructions is available at the rising edge of $\Phi 2$, while data for read type instructions must be available at the falling edge of $\Phi 2$. Addresses and RW are stable throughout $\Phi 2$.

These signals are named B $\Phi 2$ and $\overline{B\Phi 2}$ on the T4 BUS.

- RW and \overline{RW} . Read-write control. The RW-signal is high during a processor read and low during a processor-write.

These signals are named BRW and \overline{BRW} on the T4 BUS.

- During powerup, the bufferboard generates the \overline{RST} , that is required for processorstart and various peripherals. When active the signal is low. It is available on the T4 BUS and fed back into the processorboard.

- A decoding circuit on the bufferboard supplies the signals $\overline{KIM\ ENABLE}$, $\overline{8K1}$, $\overline{8K2}$, $\overline{8K3}$, $\overline{8K4}$, $\overline{8K5}$, $\overline{8K6}$ and $\overline{8K7}$.

The signals $\overline{8K1}$ - $\overline{8K7}$ indicate, that the current memory address falls into a particular multiple of 2000(hex). For example when address 31A6 is on the bus, the signal $\overline{8K1}$ will be low. $\overline{8K1}$ - $\overline{8K7}$ are T4-bus signals. These signals are open collector driven and can stand 10 TTL-loads.

- $\overline{KIM\ ENABLE}$ is fed back to the processor and enables the first 8K of the addressingspace. It is generated either when address 0000 - 1FFF is on the addressbus, or when the switch on the bufferboard is in the position "KIM" and address FC00 - FFFF is on the addressbus. The signal $\overline{I/O\ SELECT}$ is a T4-bus signal, generated when address F000 - FBFF is on the addressbus. It is used for digital and analog I/O selection.

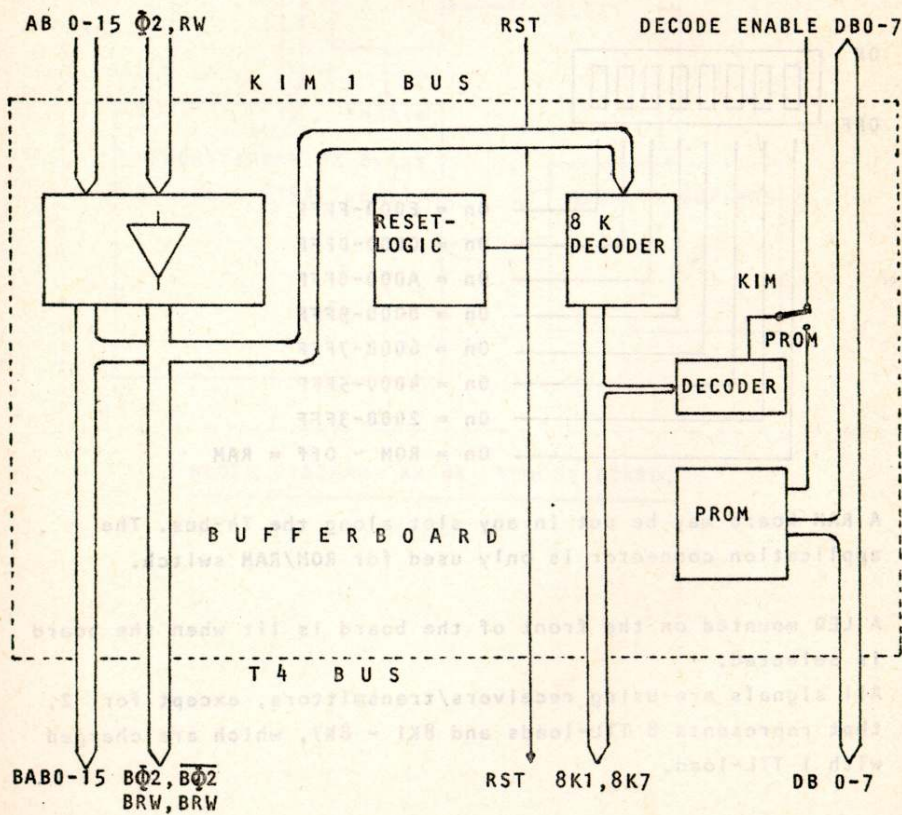
T4 KIM-1 expansion system

On the bufferboard is an EPROM-socket available that can receive a 2708 1K byte EPROM. This EPROM occupies the uppermost 1K in the addressingspace. When addresses FC00 - FFFF appear on the address-bus, this either triggers the EPROM or the KIM locations 1C00 - 1FFF. This can be selected with the PROM/KIM switch on the buffer-board.

If the T4-system resets due to power up, this EPROM has to contain the vectors when the switch is in the PROM-position.

If no PROM available, the switch must be in the KIM-position. Various monitor PROMS can be supplied, that contain KIM-monitor-like programs, suitable to a particular configuration.

The bufferboard must have its own fixed place in the mounting, since both application- and expansion-connector are in use.



BLOCK DIAGRAM BUSBUFFER MODULE.

T4 KIM-1 expansion system

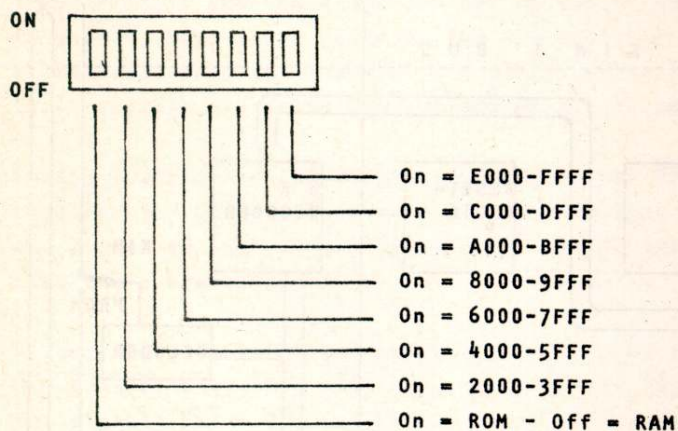
RAM - BOARD.

A RAM-board contains an array of 64 x 2102 1K bits chips, that is organized as 8K bytes.

The RAM can be used to read and write data.

An onboard switch allows for read-only operation. If a program has to be tested, that finally must reside in PROM, a suitable procedure will be to load the program in RAM and then set the RAM to read-only to simulate the features of a ROM. This switch can also be connected external on the applicationsconnector of the RAM-board.

The first address of an 8K RAM board can be set to any Integer multiple of 2000(hex), except for 0000. A jumper has to be soldered on the board to make address E000 - FFFF available. Switch settings:

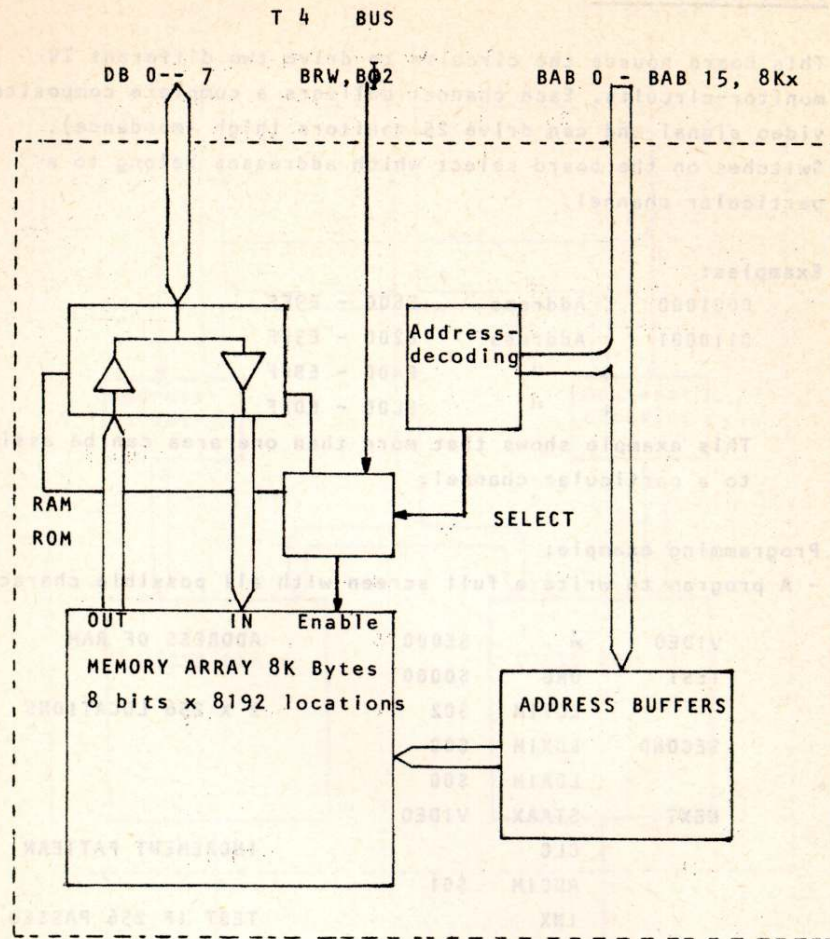


A RAM board may be put in any slot along the T4-bus. The application connector is only used for ROM/RAM switch.

A LED mounted on the front of the board is lit when the board is selected.

All signals are using receivers/transmitters, except for 2, that represents 8 TTL-loads and 8K1 - 8K7, which are charged with 1 TTL-load.

T4 KIM-1 expansion system



BLOCK DIAGRAM KR 8K MEMORY BOARD.

T4 KIM-1 expansion system

VIDEO RAM - BOARD.

This board houses the circuits to drive two different TV-monitor-circuits. Each channel delivers a complete composite video signal and can drive 25 monitors (high impedance). Switches on the board select which addresses belong to a particular channel.

Examples:

0001000	Address	E800 - E9FF
0110001	Address	E200 - E3FF
+	"	EA00 - EBFF
+	"	EC00 - EDFF

This example shows that more than one area can be assigned to a particular channel.

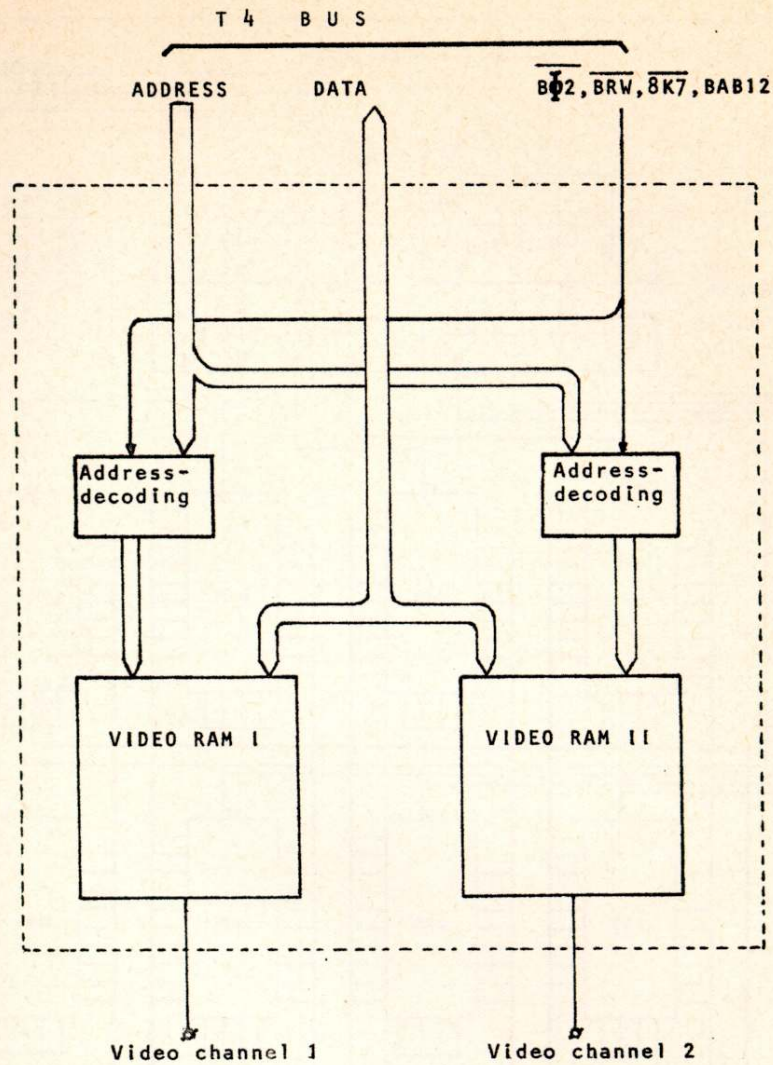
Programming example:

- A program to write a full screen with all possible characters:

VIDEO		\$E000	ADDRESS OF RAM
TEST	ORG	\$0000	
	LDYIM	\$02	2 X 256 LOCATIONS
SECOND	LDXIM	\$00	
	LDAIM	\$00	
NEXT	STAAX	VIDEO	
	CLC		INCREMENT PATTERN
	ADCIM	\$01	
	INX		TEST IF 256 PASSED
	BNE	NEXT	
	DEY		TEST IF ALL DONE
	BNE	SECOND	

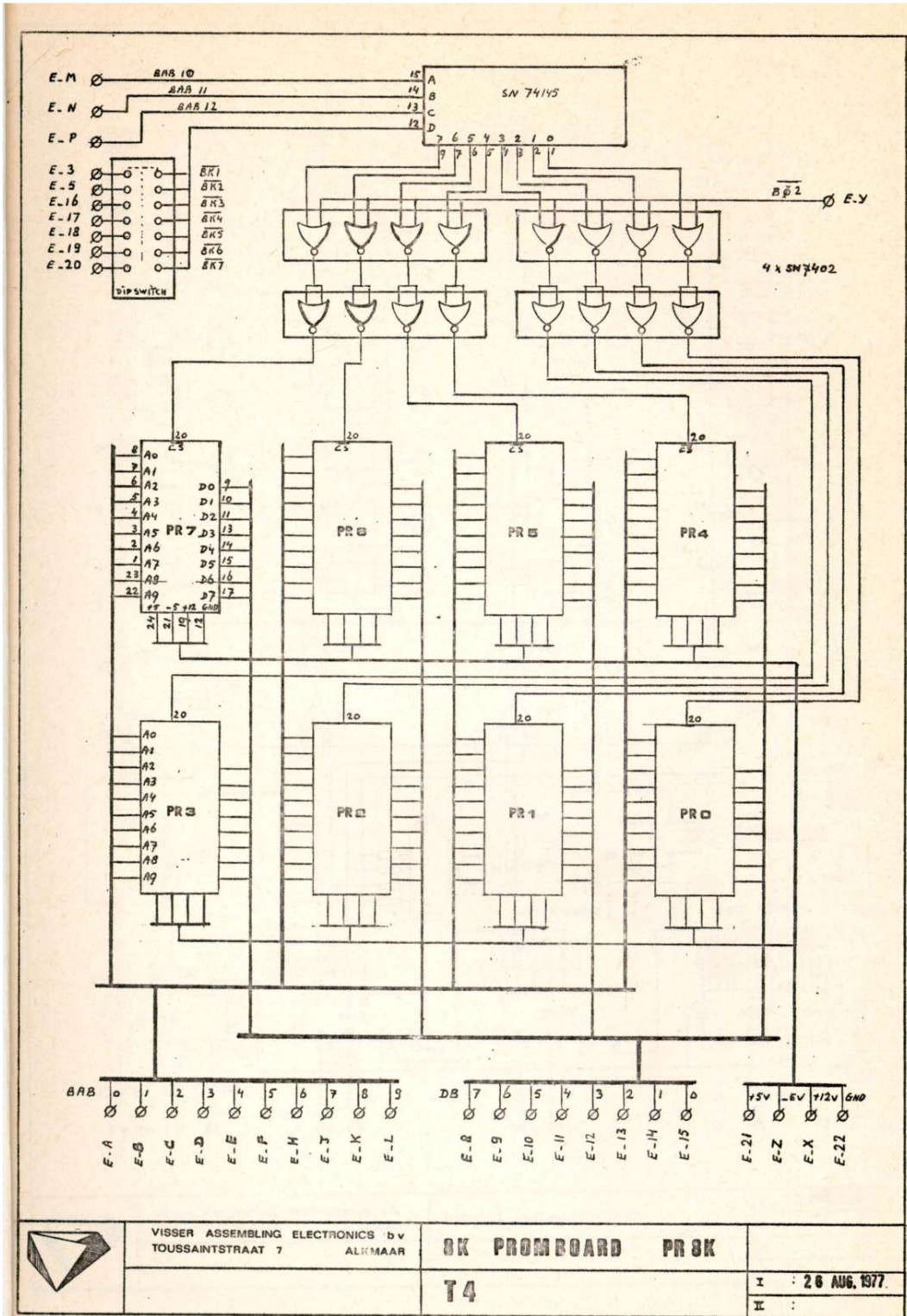
The video RAM board has its own fixed place in the mounting, since videosignals are taken from the application connector.

T4 KIM-1 expansion system

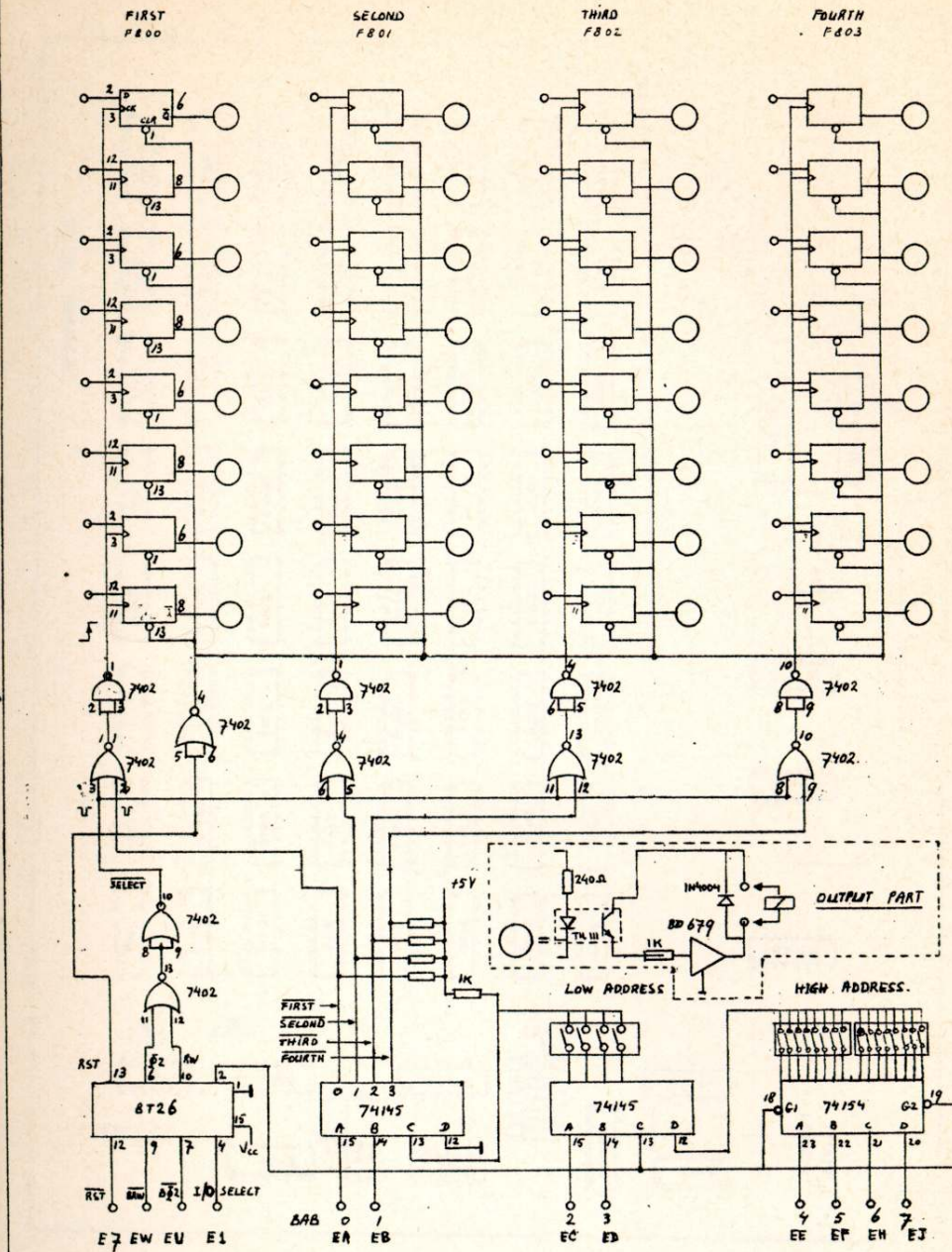


BLOCK DIAGRAM VIDEO RAM MODULE.

T4 KIM-1 expansion system



T4 KIM-1 expansion system



VISSER ASSEMBLING ELECTRONICS b.v.
TOUSSAINTSTRAAT 7 ALKMAAR

DIGITAL OUTPUT BOARD

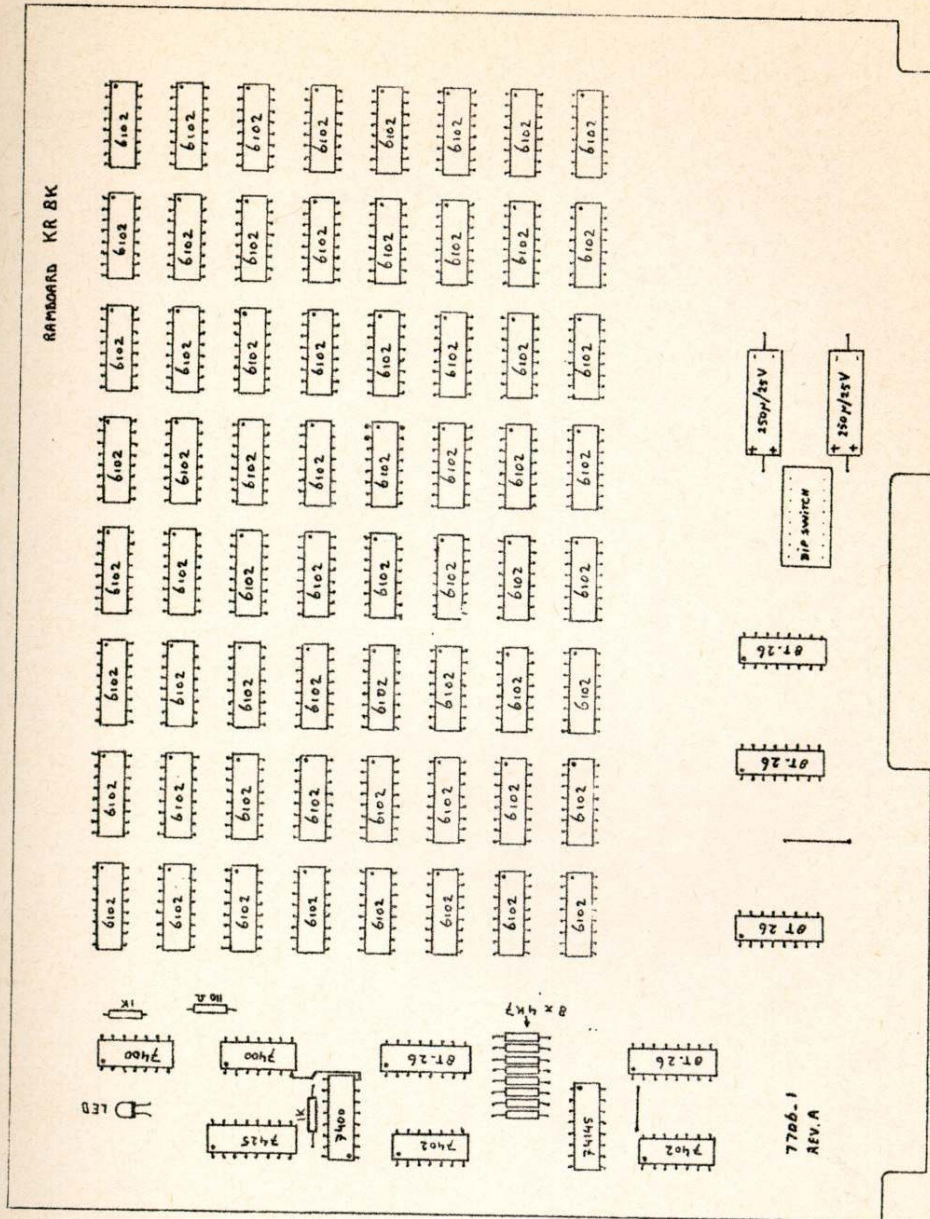
28 MAART 1978

三

2

1

T4 KIM-1 expansion system



VISSER ASSEMBLING ELECTRONICS b.v.
TOUSSAINTSTRAAT 7 ALKMAAR

RAMBOARD KR 8K

21 juli 1977

2908 -19

1632

632

632

632

632

VISSER ASSEMBLING ELECTRONICS BV
TOUSSAINTSTRAAT 7 ALKMAAR
TELEFOON : 072 - 12 66 52

* PRINT LAYOUT EN REALISERING
* MICROPROCESSOR SYSTEEM T 4
* 8K MEMORY BOARDS
* SPECIALE BUFFERPRINT VOOR T4
* VIDEORAM BOARD
* EXPERIMENTEERPRINT OP KIM I
FORMAAT
* AUDEM 240 S DATAOPSLAGEENHEID
MET AUDIOCASSETTEINTERFACE.

T4 KIM-1 expansion system

KIM

GEbruikers CLUB NEDERLAND

HARDWARE LIBRARY

VIDEO RAM AAN KIM

16 LIJNEN

32 CHARACTERS PER LIJN

Nummer:

Blad: 1 VAN 1

Om met de kim-1 op een eenvoudige manier een display aan te sturen, is een schakeling opgebouwd rond de Matrox 1632.

Het zal duidelijk zijn dat de schakeling uitermate geschikt is voor de kim-1, als u in ogenschouw neemt dat:

- De kim nog een stuk gedecodeerd geheugenruimte bezit waar niets mee wordt gedaan n.l. de adressen \$ 1400 tot \$ 1700
- De Matrox 1632 alleen 5 V \pm 0,5 A nodig heeft die bij de kim voorhanden is.

EXPANSION CONNECTOR VAN KIM

- 21 \circ
- 22 \circ
- 15 \circ
- 14 \circ
- 13 \circ
- 12 \circ
- 11 \circ
- 10 \circ
- 9 \circ
- 8 \circ

EXPANSION CONNECTOR VAN KIM

- Vcc \circ
- A0 \circ
- A1 \circ
- A2 \circ
- A3 \circ
- A4 \circ
- A5 \circ
- A6 \circ
- A7 \circ
- A8 \circ
- R/W \circ
- V400 \circ
- INS0 \circ
- F \circ
- VIDEO OUT \circ
- L \circ
- y \circ

APPLICATION CONNECTOR VAN KIM

- H \circ

T4 KIM-1 expansion system

KIM

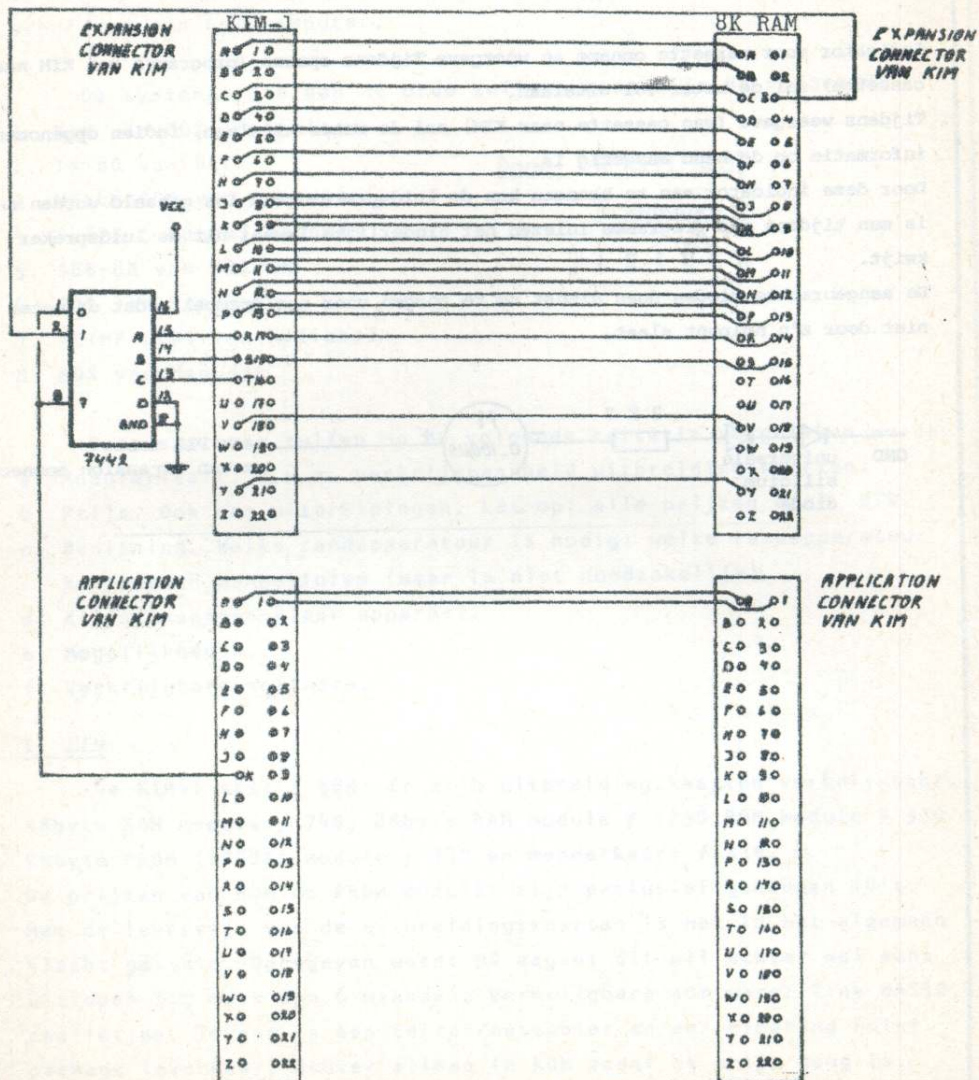
GEbruikers CLUB NEDERLAND
HARDWARE LIBRARY

8K RAM BOARD AAN KIM-1

Number:

Blad: 1 VAN 1

8K RAM board aan standaard KIM-1. Zoals uit het schema blijkt is dit gerealiseerd met een minimum aan komponenten t.w. een IC type 7442. Het 8K RAM board is volgens deze schakeling gestationeerd op de adressen \$2000 tot \$4000. In principe kan het 8K board ook geplaatst worden op \$4000 tot \$6000 etc. behalve \$E000 t/m FFFF deze 8K is doorverbonden met de eerste 8K i.v.m. restartvectoren.



Datum ingang:

5 DEC 1977

Vervangt:

NIEUW

d.d.:

-

Ref.:

WILLEM V. GELDEREN

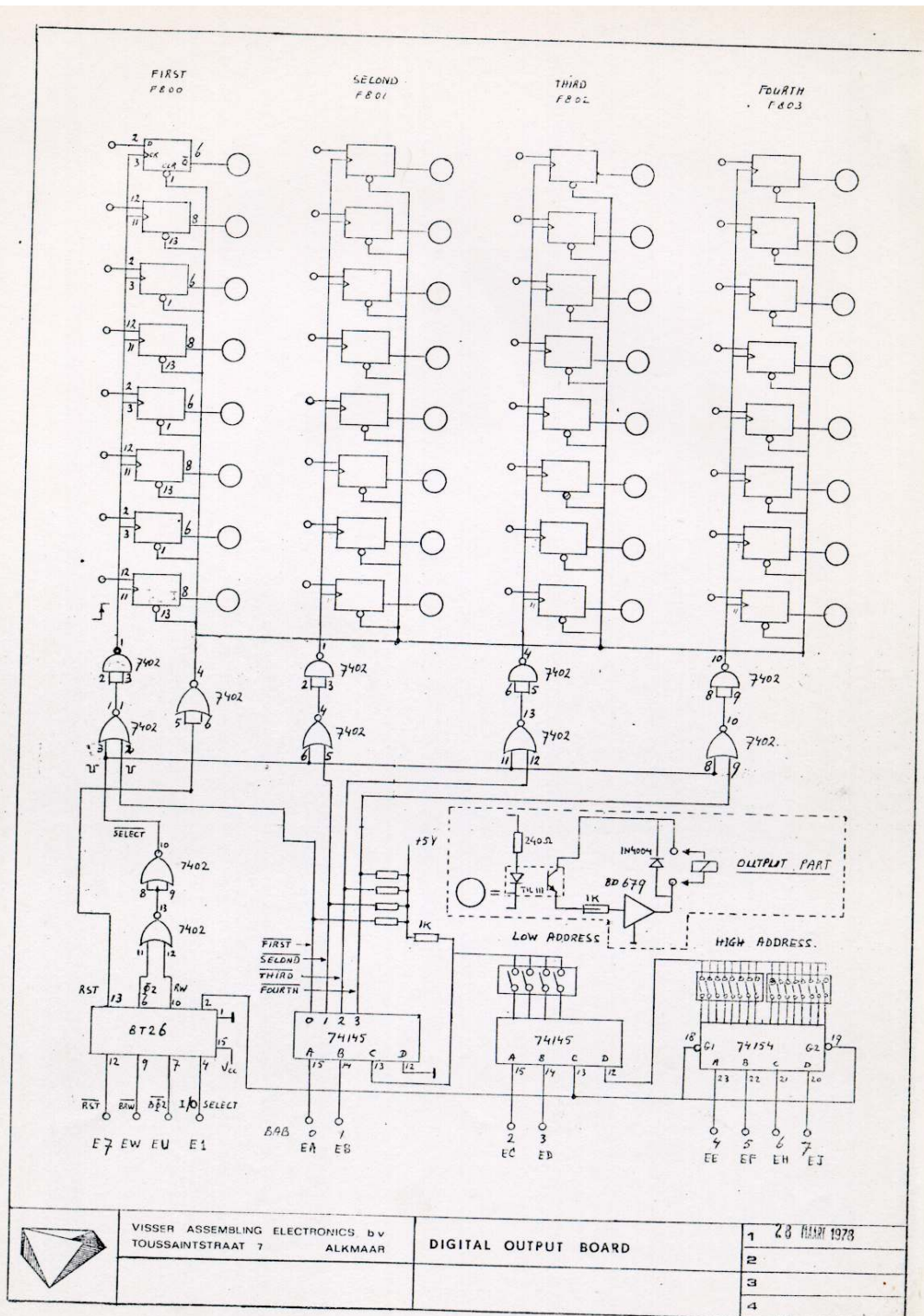
T4 KIM-1 expansion system



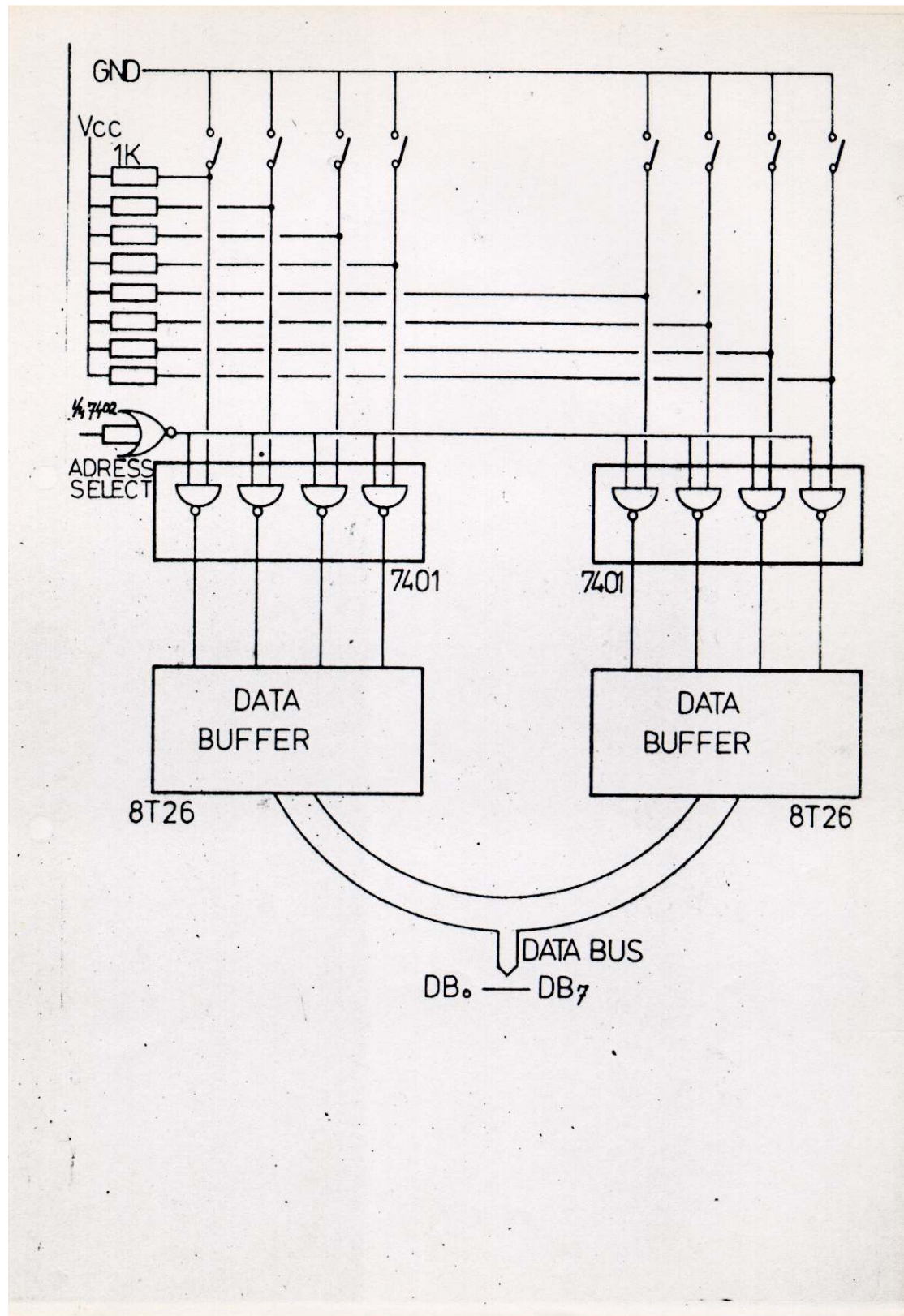
Adres 0-15 Ekim A - Busbuffer
Phi 2 2^e ph. clock A
RST
Decode enable
Databus 0-7

E 7 | 15

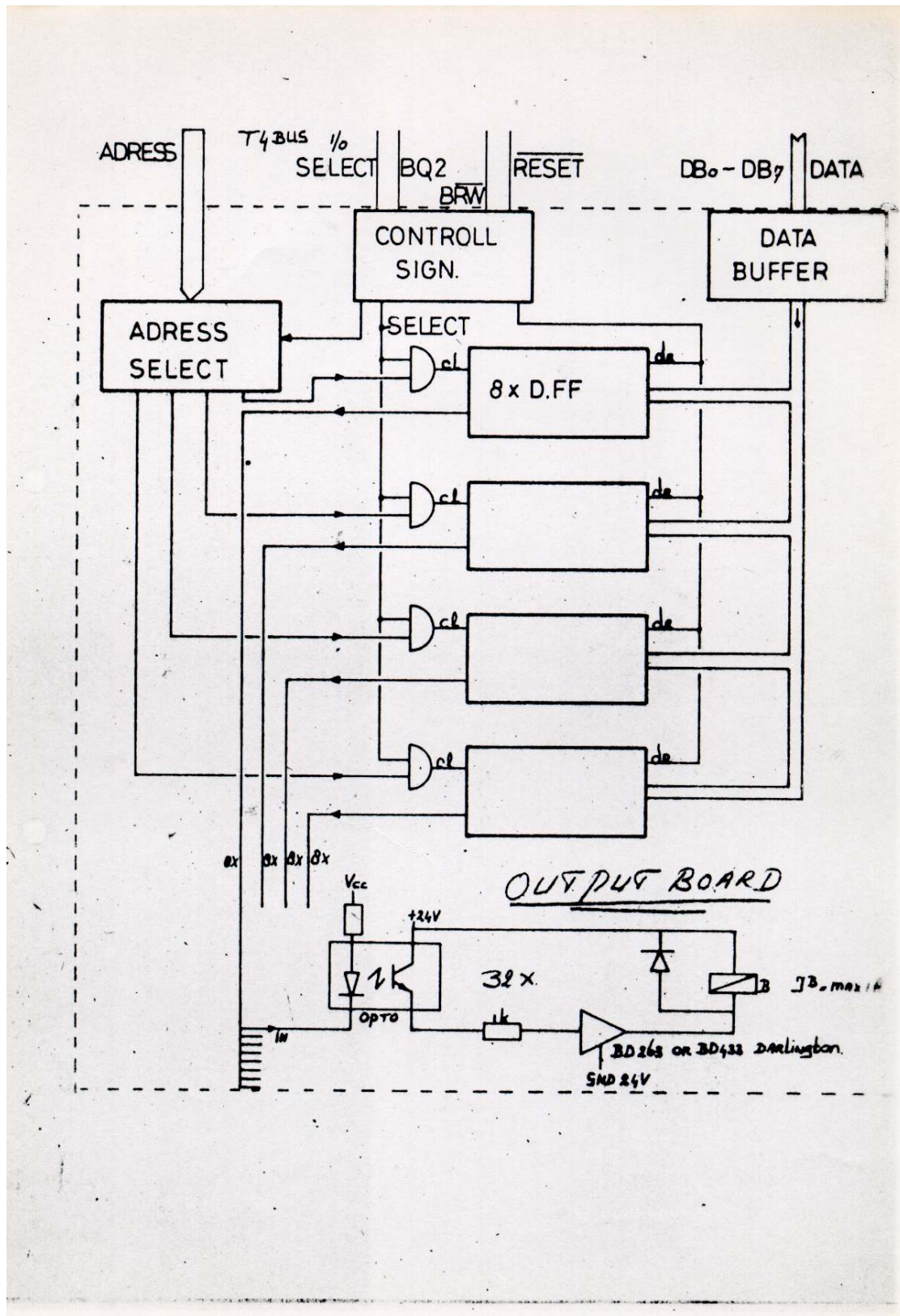
T4 KIM-1 expansion system



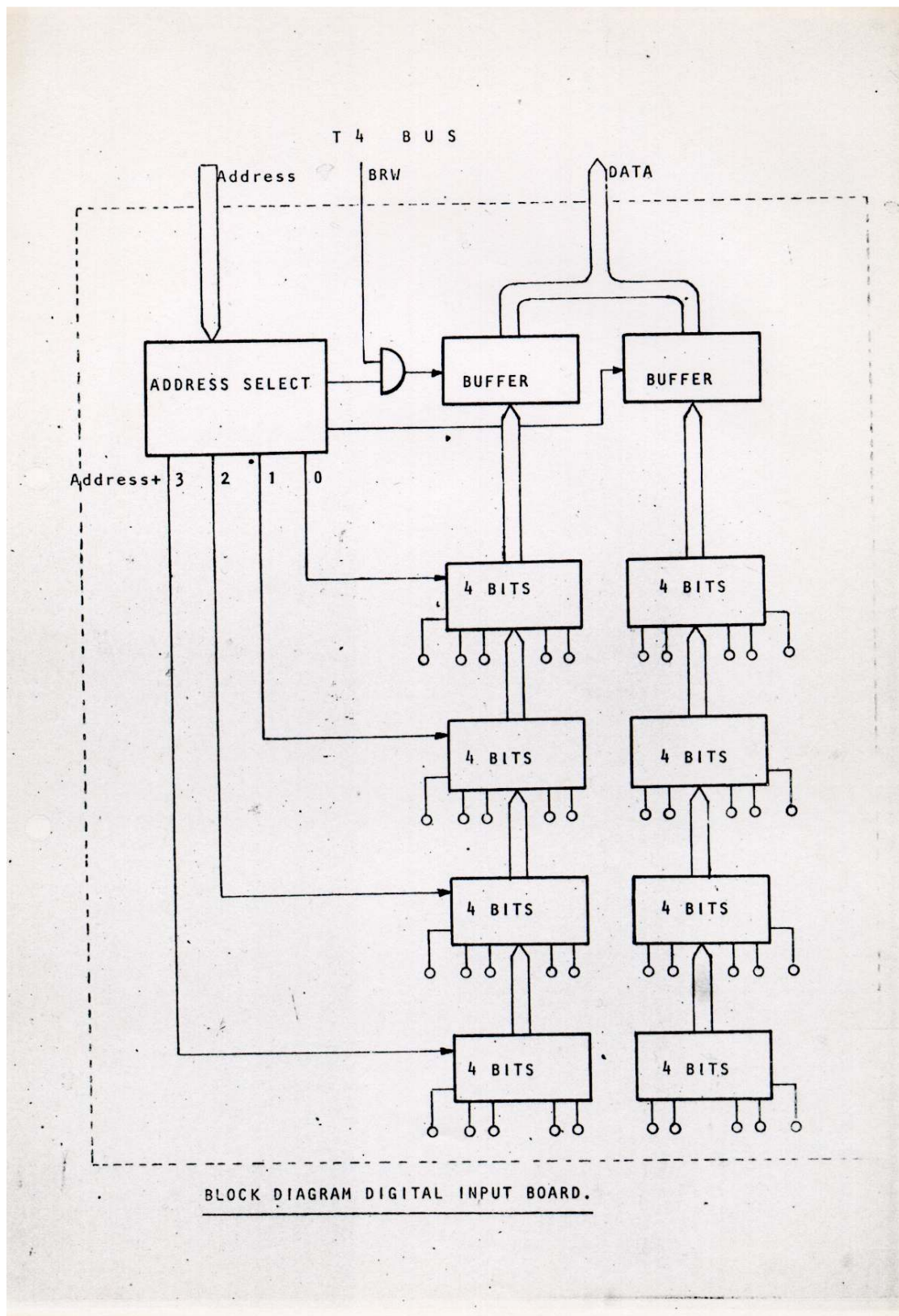
T4 KIM-1 expansion system



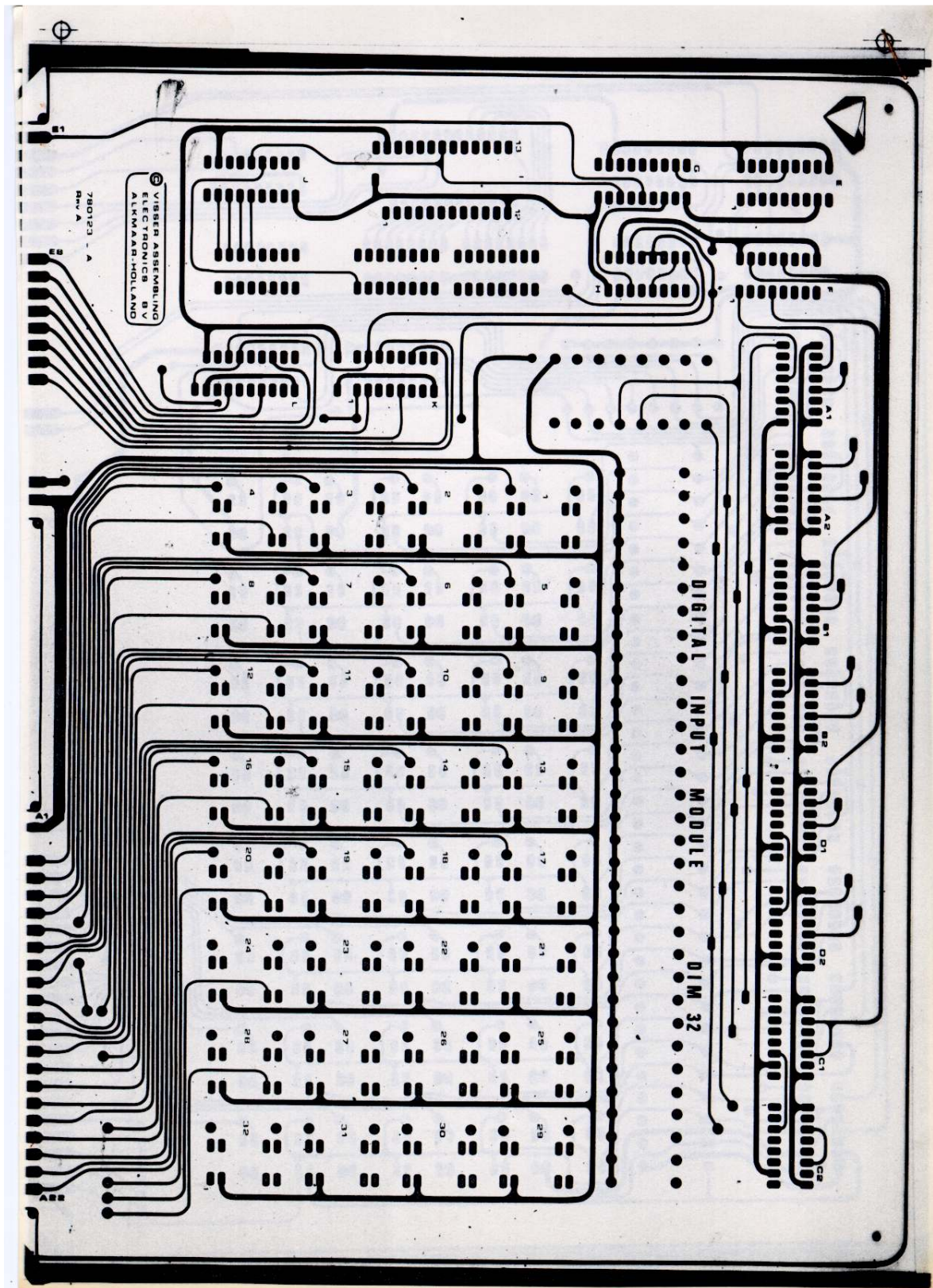
T4 KIM-1 expansion system



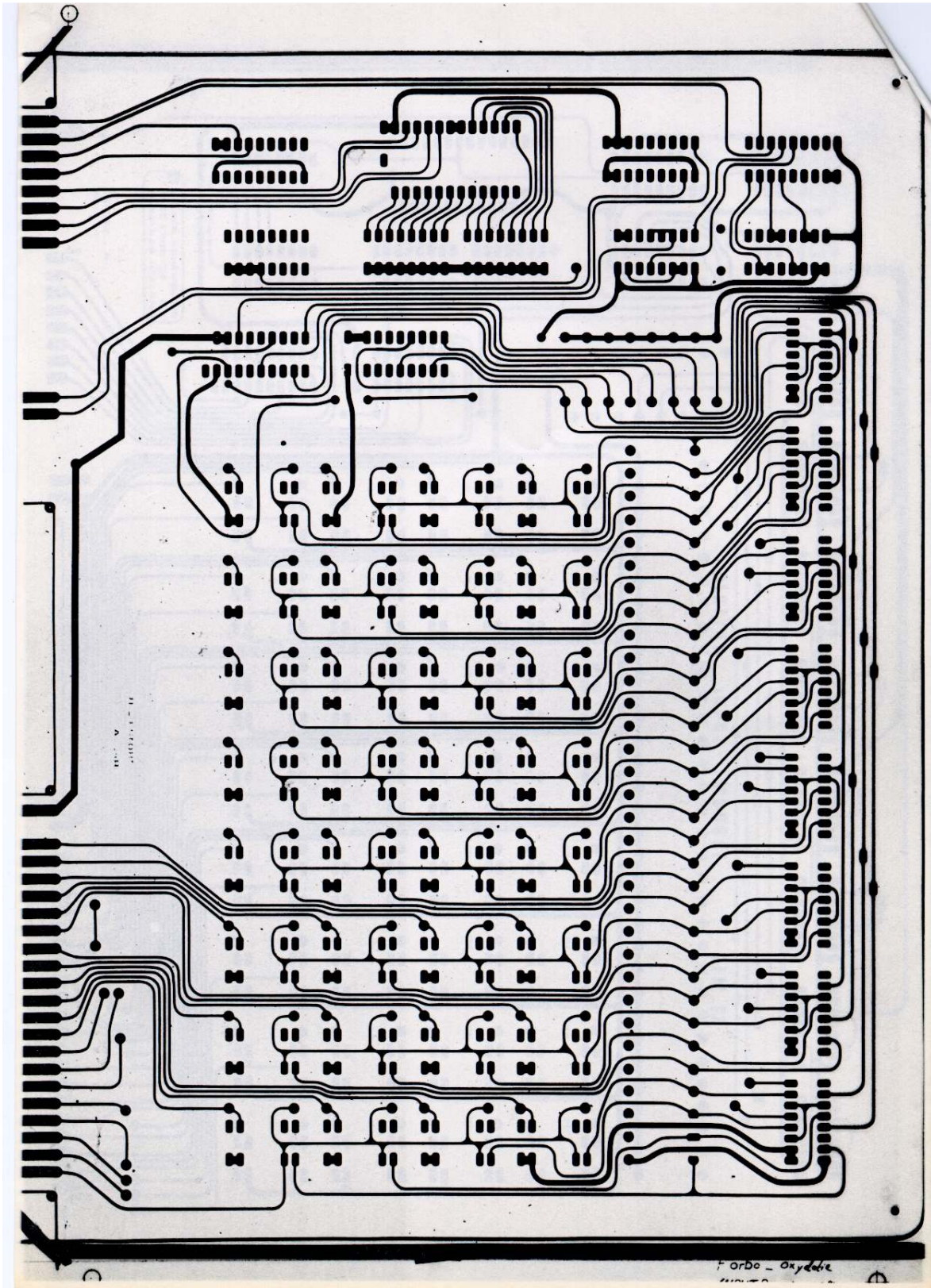
T4 KIM-1 expansion system



T4 KIM-1 expansion system

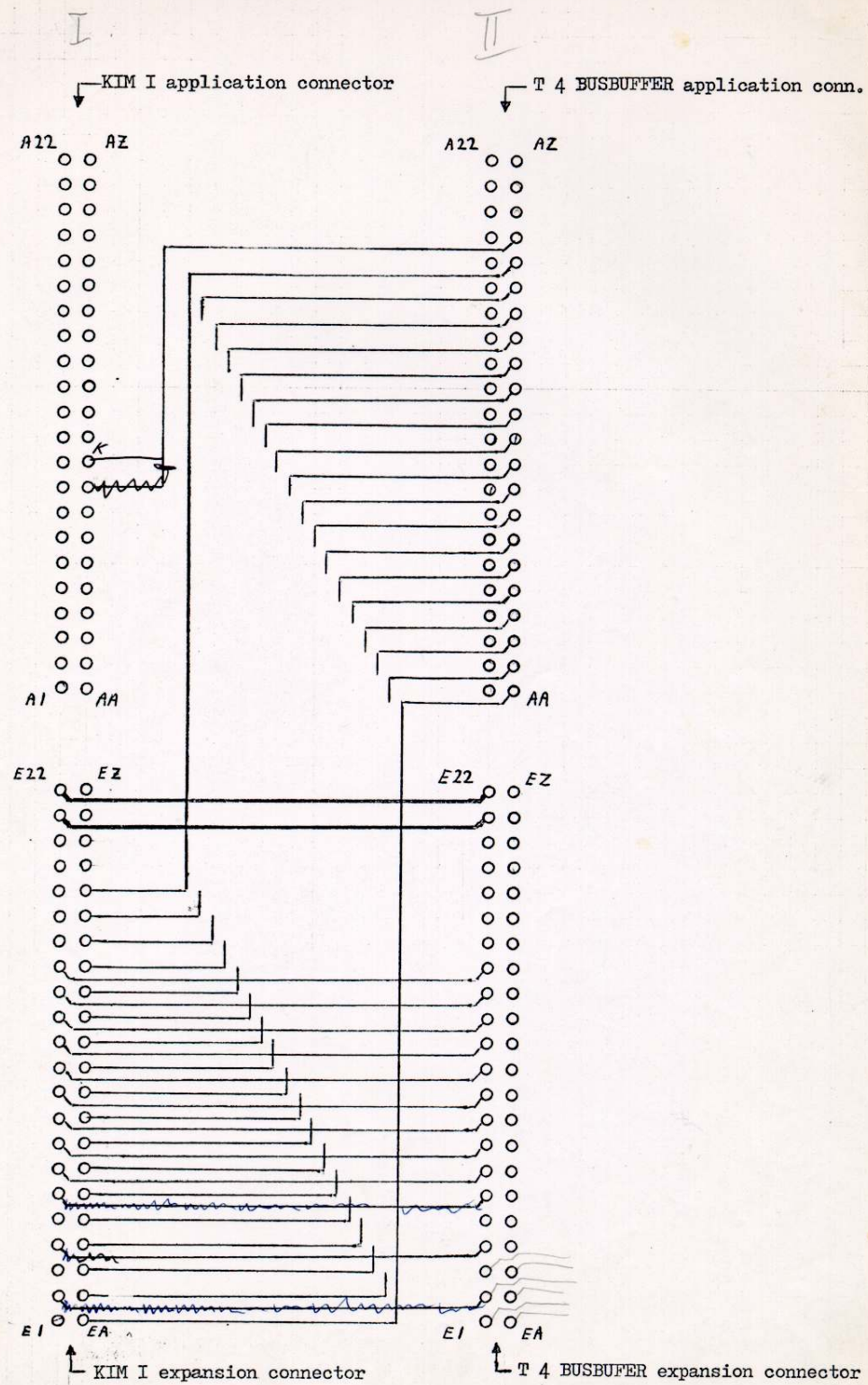


T4 KIM-1 expansion system

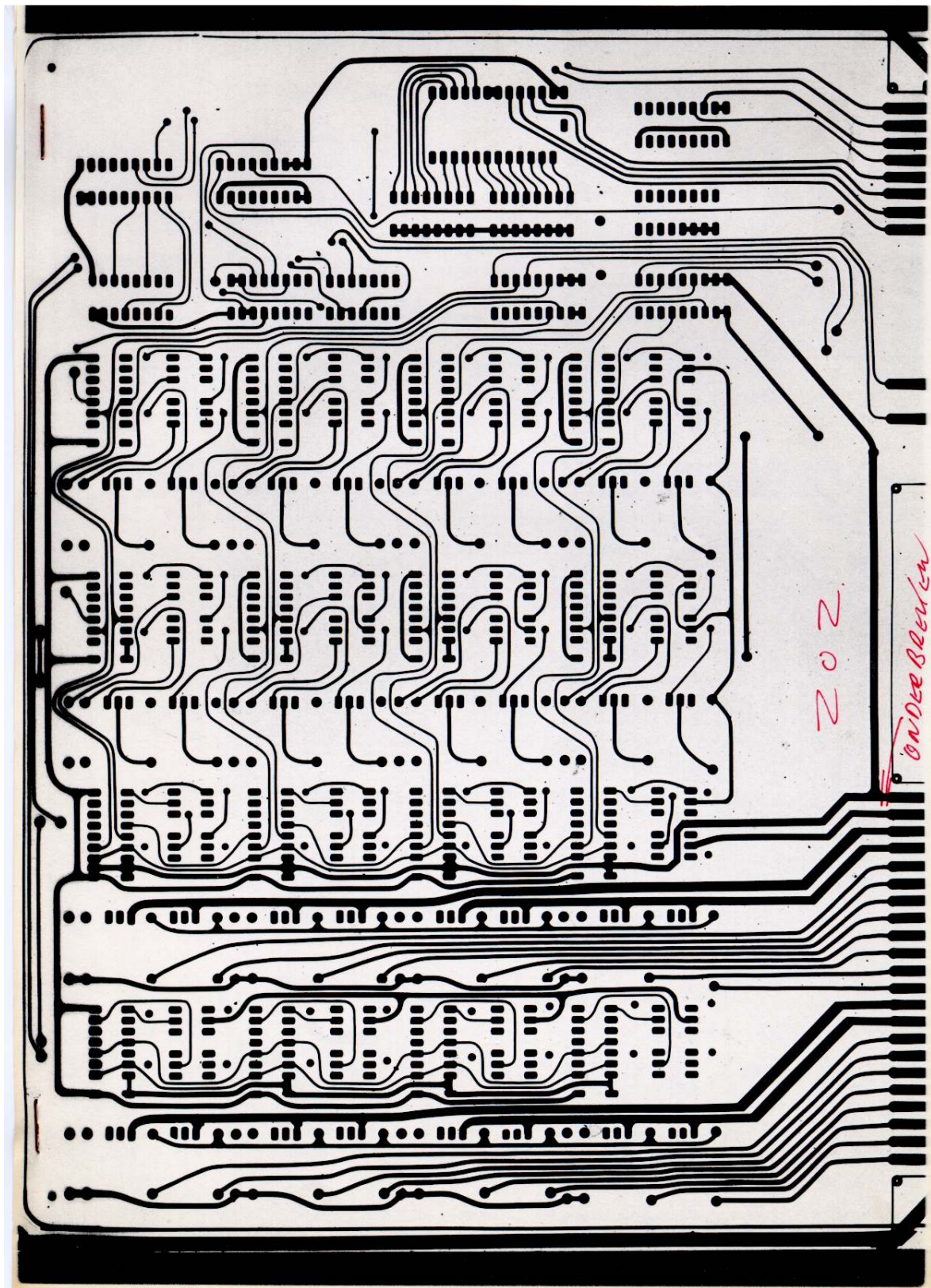


T4 KIM-1 expansion system

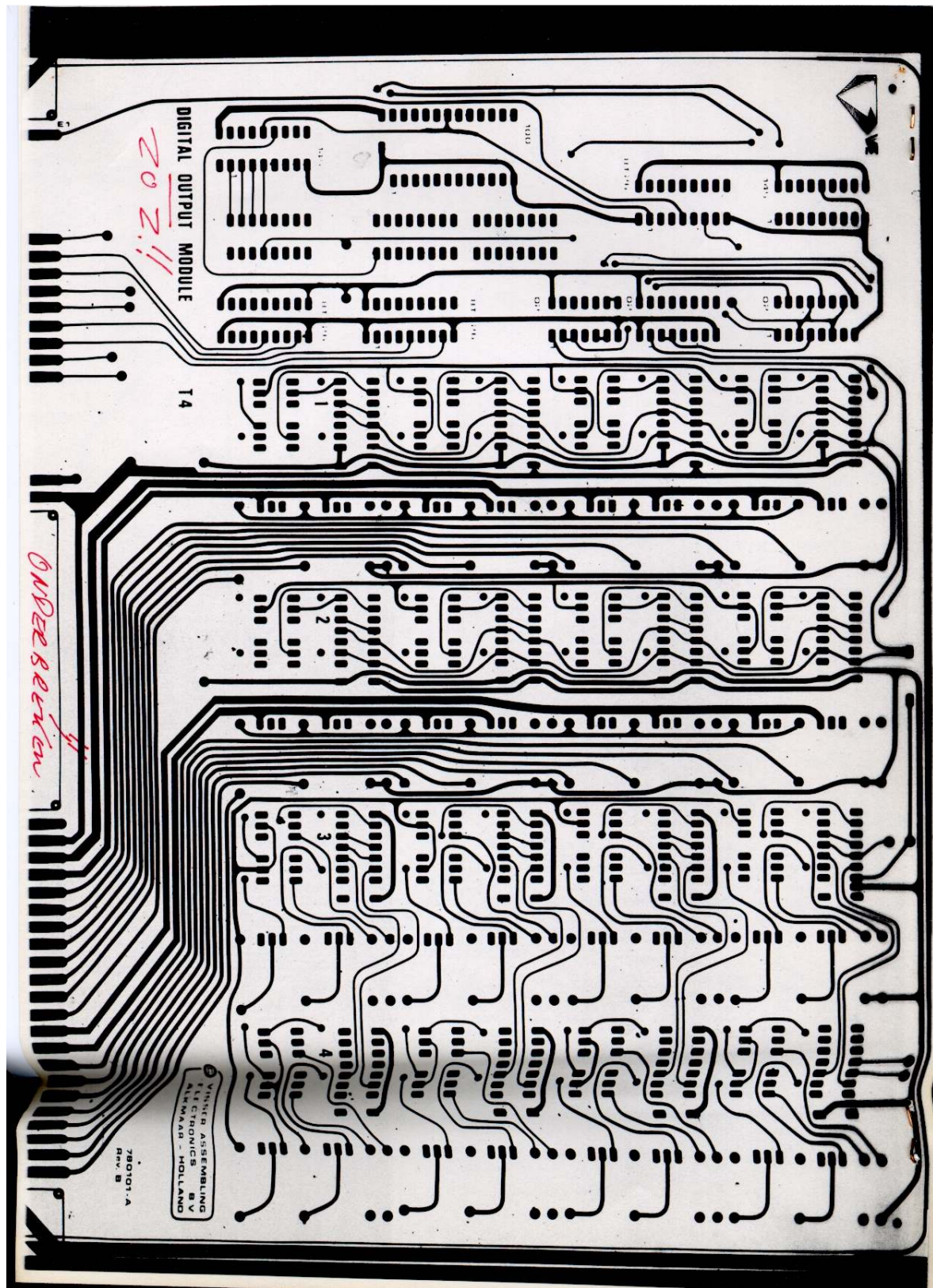
Aansluitingen van KIM I en T 4 Bufferprint in het T 4 Systeem.



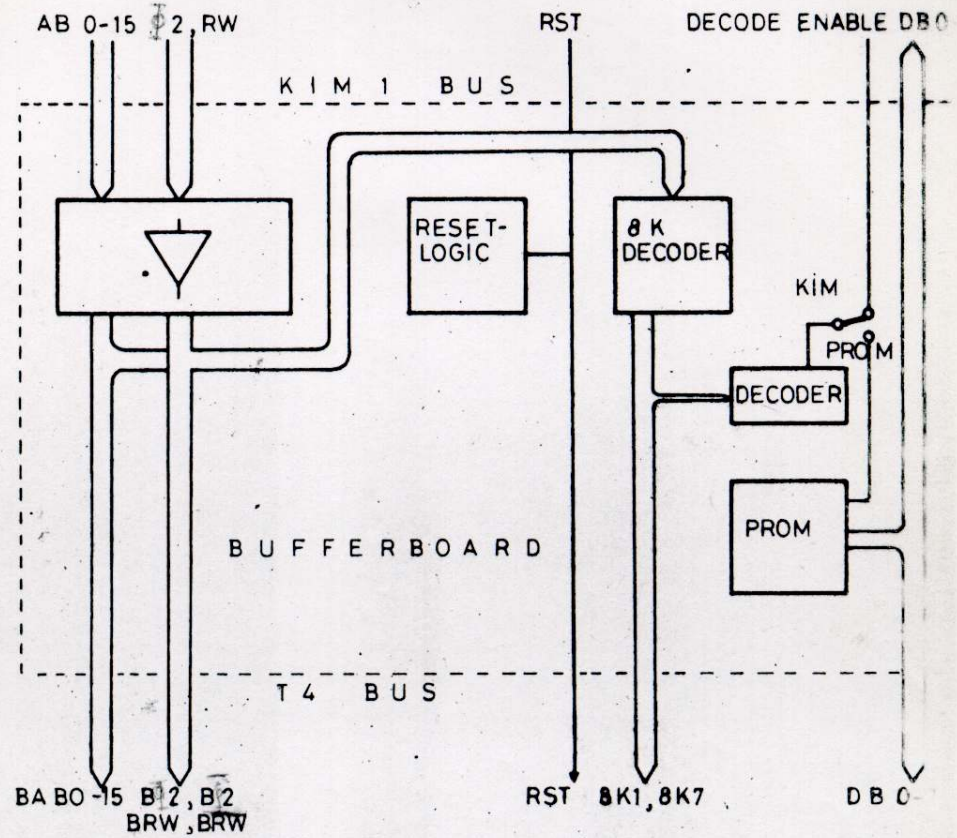
T4 KIM-1 expansion system



T4 KIM-1 expansion system



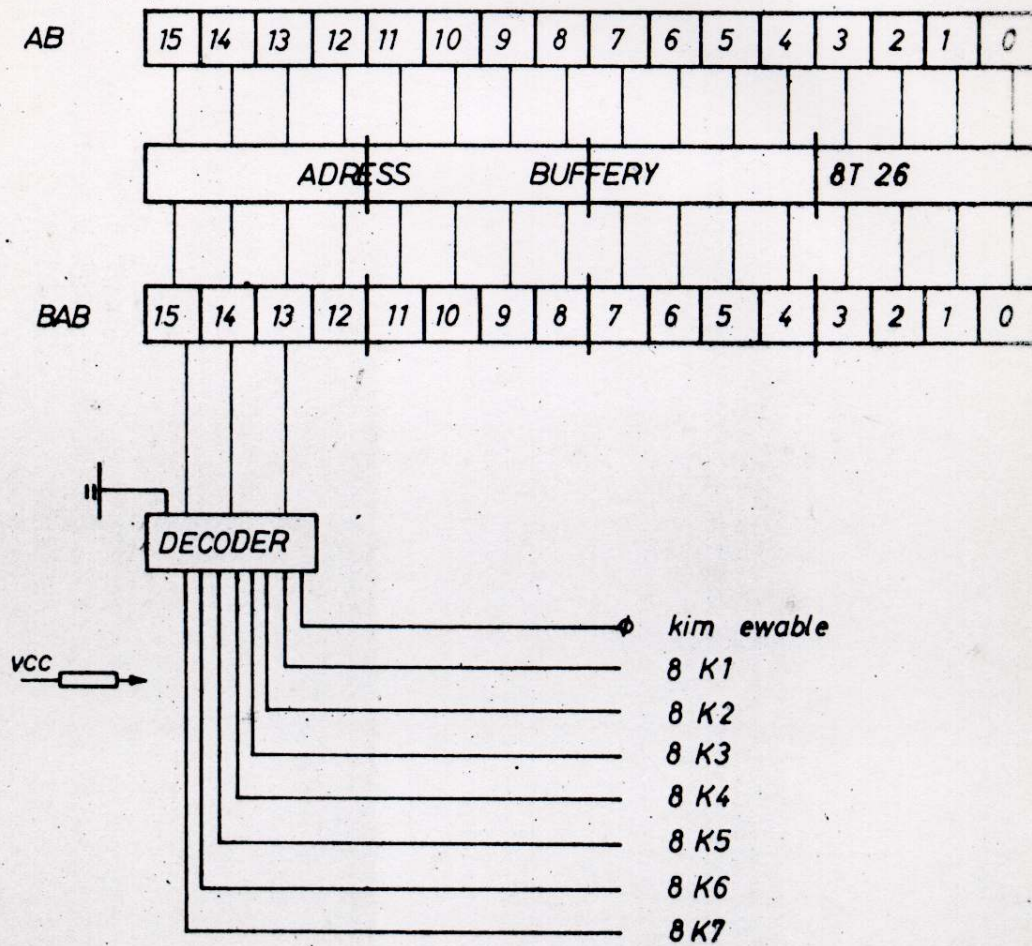
T4 KIM-1 expansion system



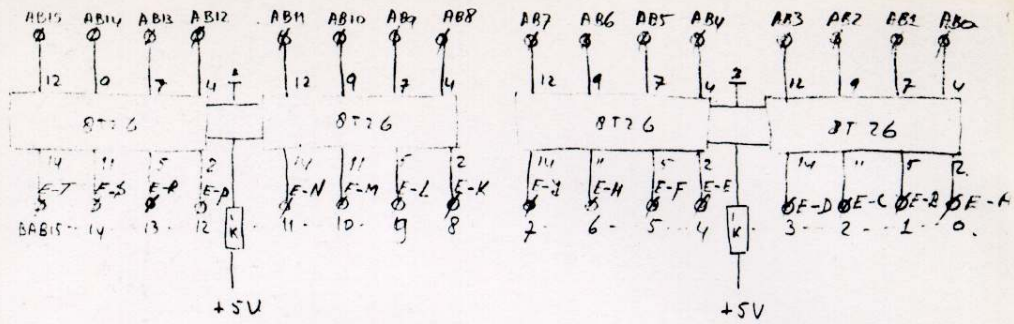
BLOCK DIAGRAM BUSBUFFER MODULE

T4 KIM-1 expansion system

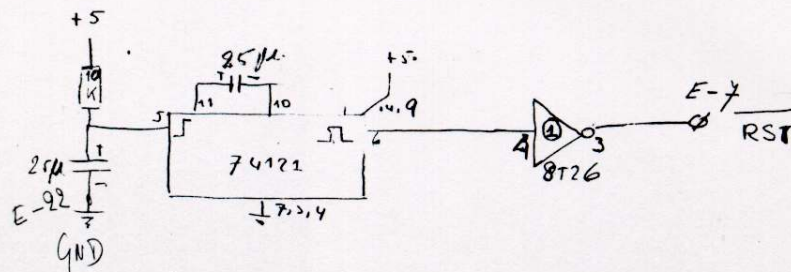
BUFFER AND 8K DECODING



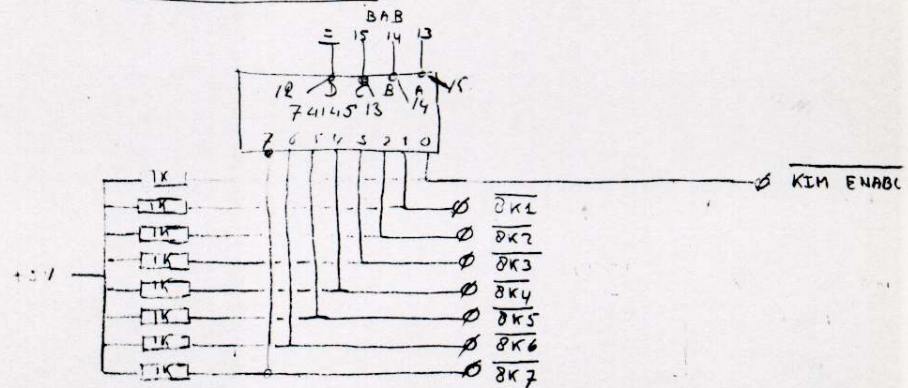
T4 KIM-1 expansion system



Address buffers.



Reset generator

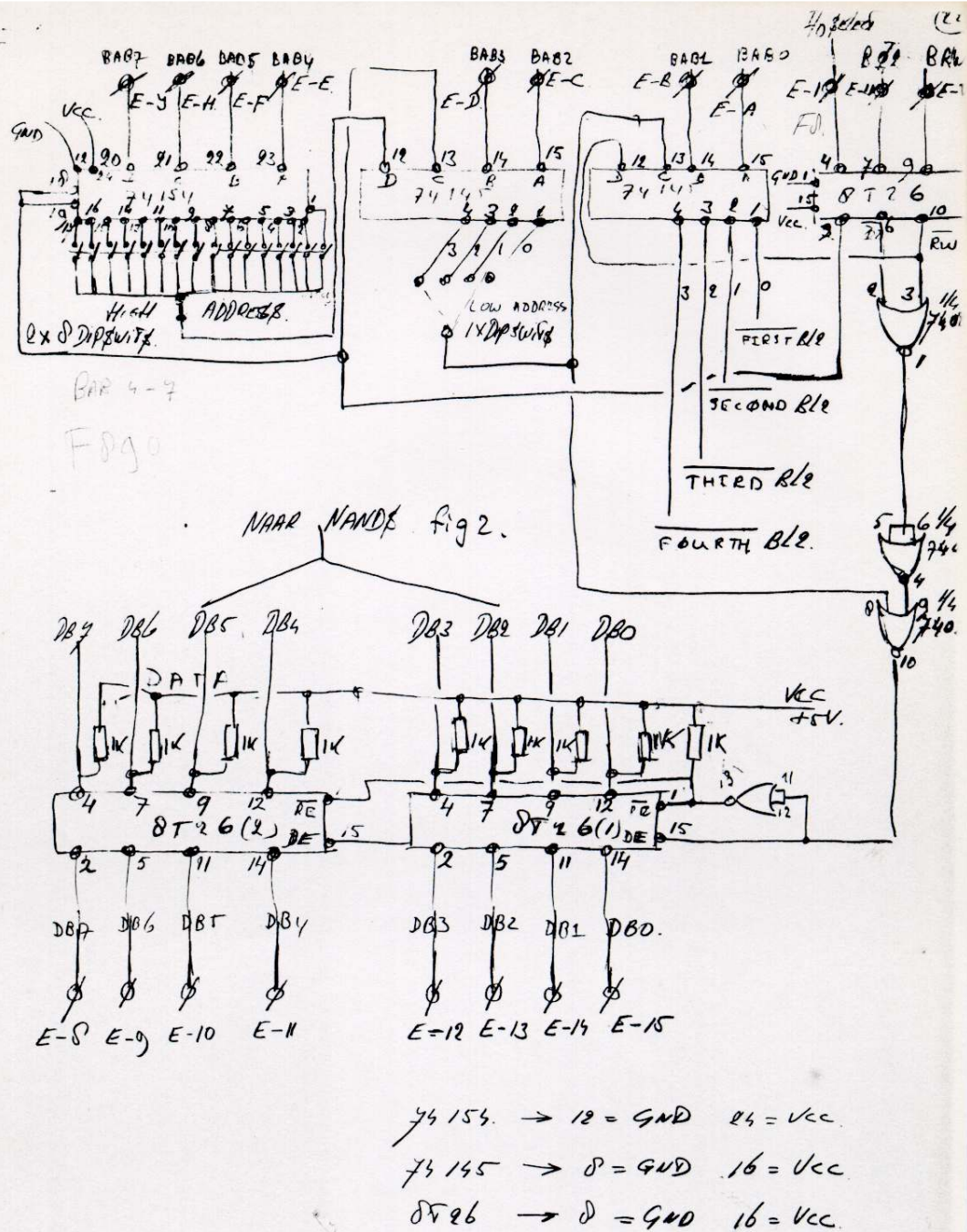


8K DECØDER

KIMBUS BUFFER

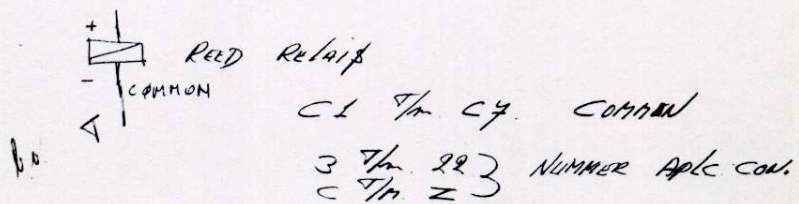
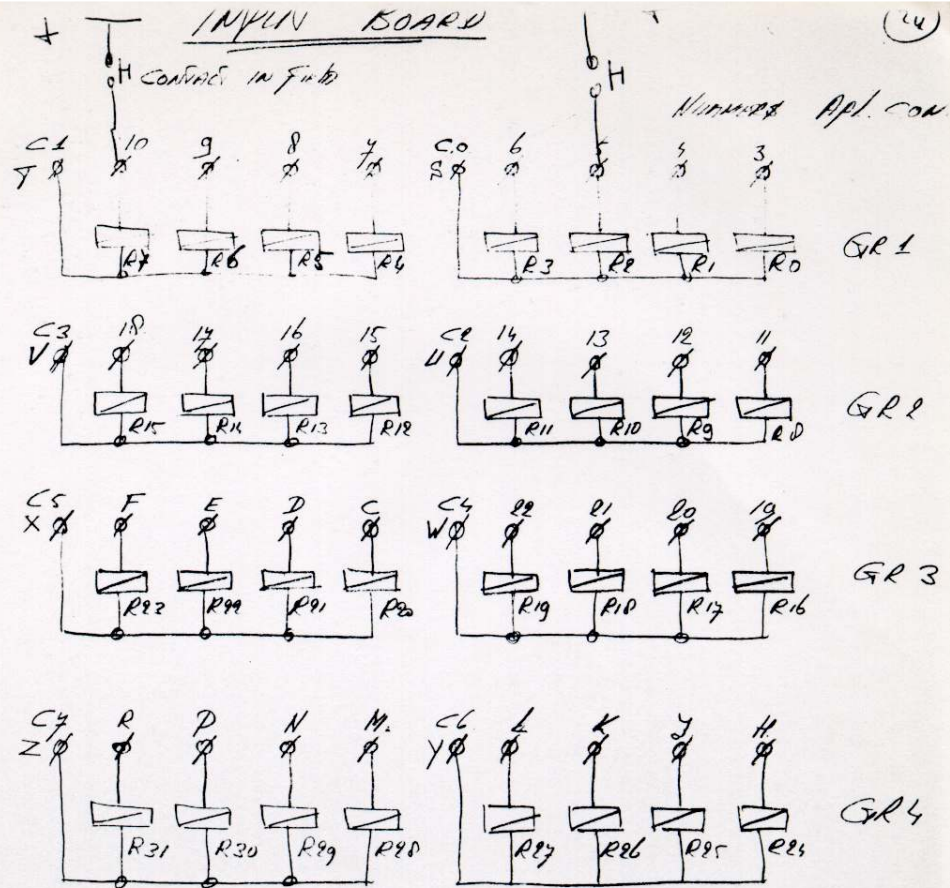
fig 1 of 2 T4 system

T4 KIM-1 expansion system



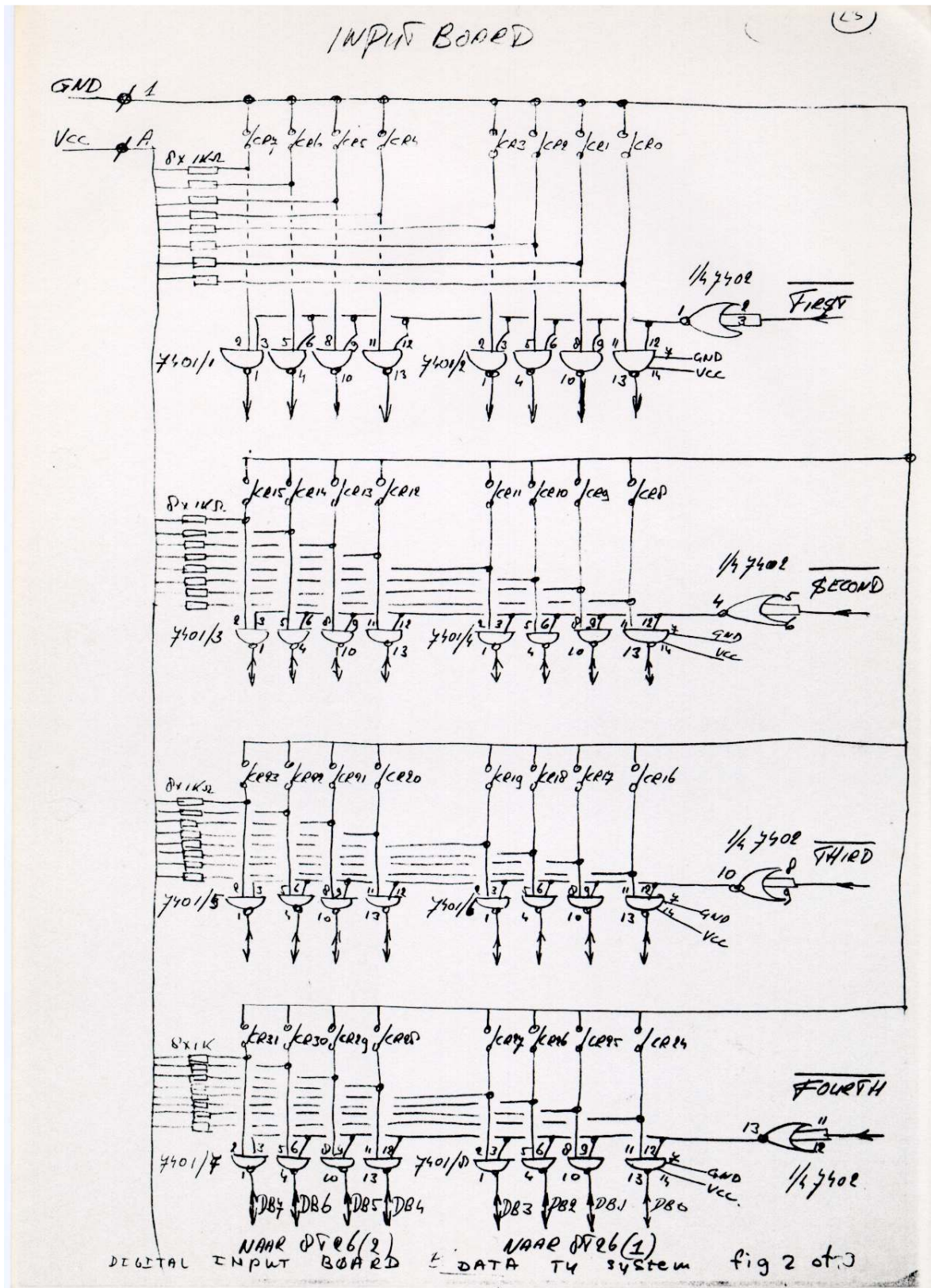
DIGITAL INPUT BOARD CONTROL Th system fig 20

T4 KIM-1 expansion system

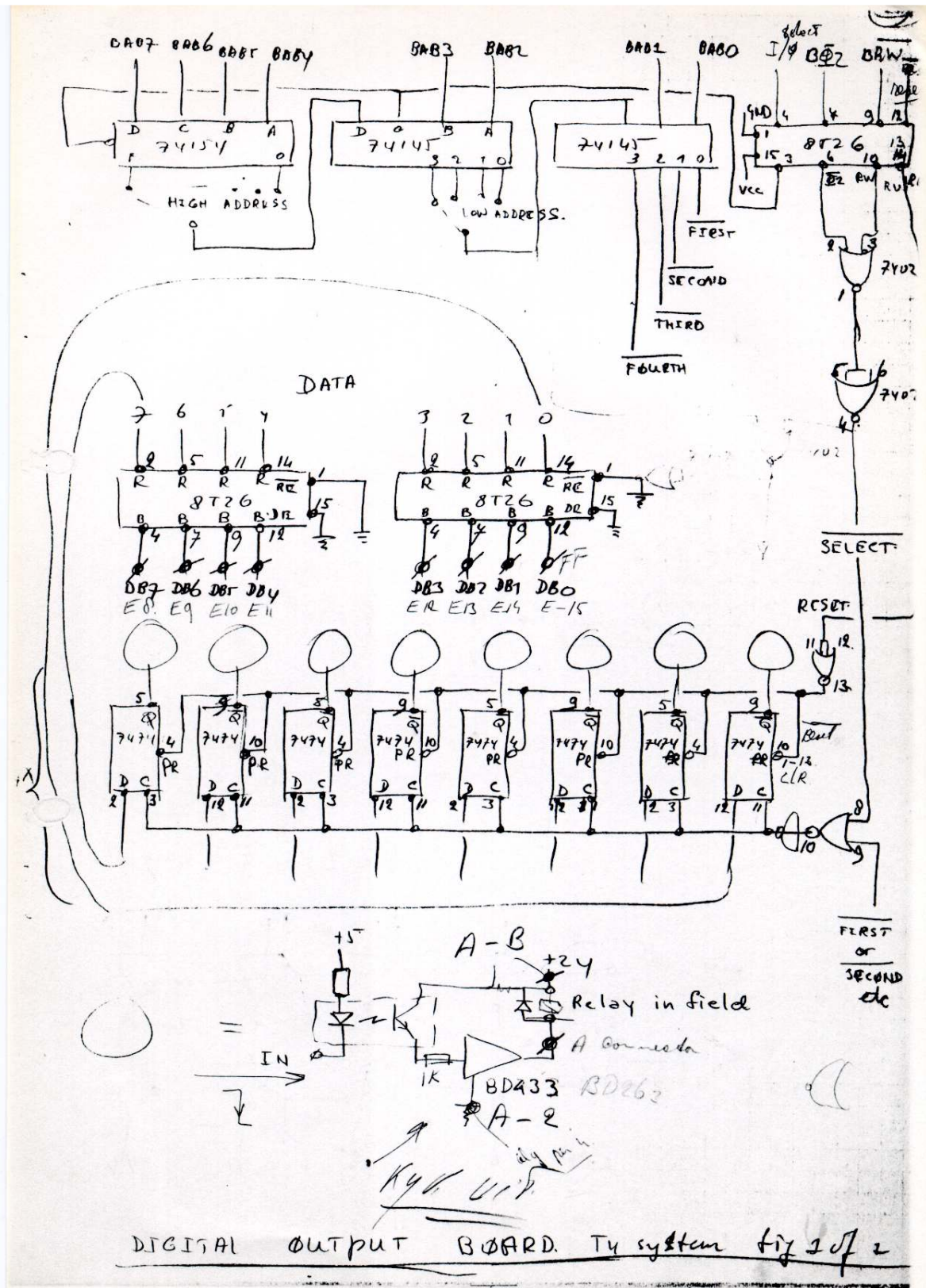


Digital input board T4 system Fig 3 of 3

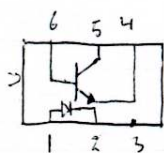
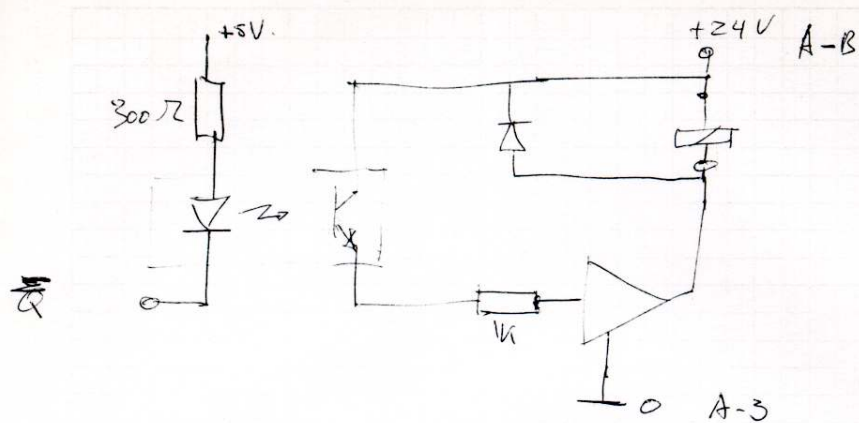
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system

OUTPUT AANSluitINGEN.

onderste con nr	output	Appl. connector
1	output 0	A - 5
2	1	A - 6
3	2	A - 7
4	3	A - 8
5	4	A - 9
6	5	A - 10
7	6	A - 11
8	7	A - 12
9	1.0	A - 15
10	1.1	A - 16
11	1.2	A - 17
12	1.3	A - 18
13	1.4	A - 19
14	1.5	A - 20
15	1.6	A - 21
16	1.7	A - 22
17	2.0	A - E
18	2.1	A - F
19	2.2	A - H
20	2.3	A - I
21	2.4	A - K
22	2.5	A - L
23	2.6	A - M
24	2.7	A - N
25	3.0	A - S
26	3.1	A - T
27	3.2	A - U
28	3.3	A - V
29	3.4	A - W
30	3.5	A - X
31	3.6	A - Y
32	3.7	A - Z
33	gemeenschappelijke output	A - B + 24V
34		
35		
36		
37		

Alg outp

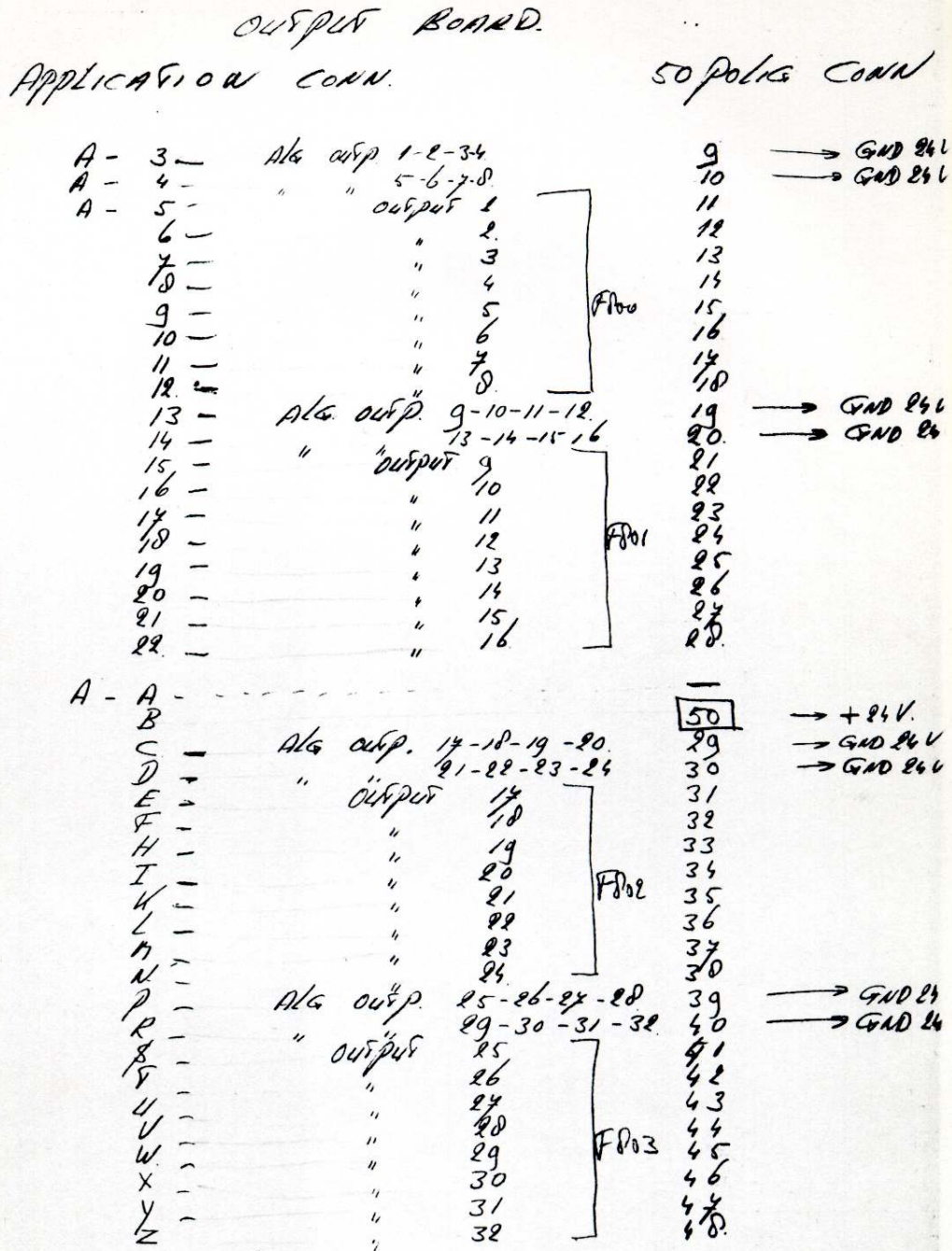
"
"
"
"
"
"
"

1 - 2 - 3 - 4
5 - 6 - 7 - 8
9 - 10 - 11 - 12
13 - 14 - 15 - 16
17 - 18 - 19 - 20
21 - 22 - 23 - 24
25 - 26 - 27 - 28
29 - 30 - 31 - 32

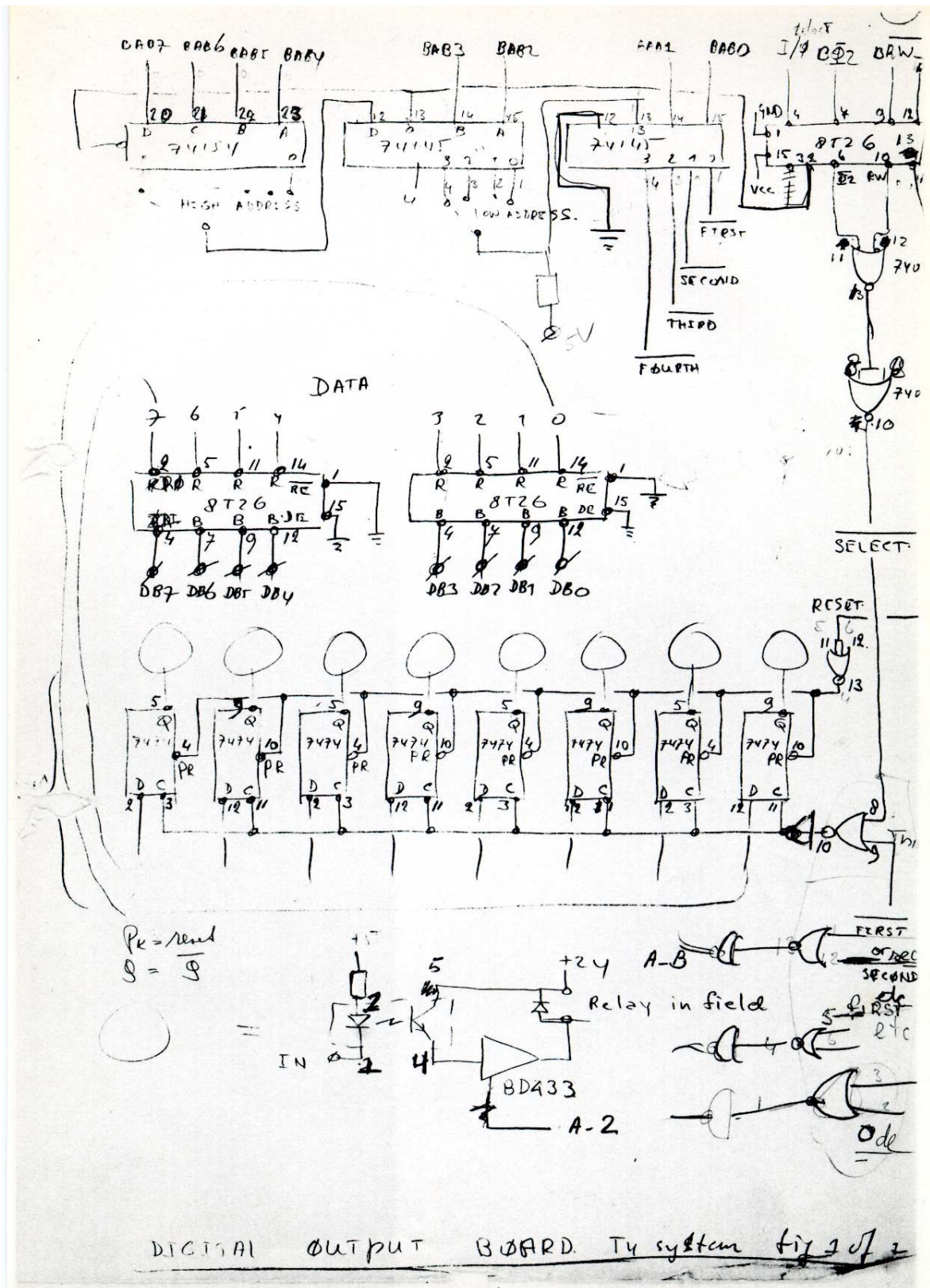
A - 3
A - 4
A - 13
A - 14
A - C
A - D
A - P
A - R

-24V

T4 KIM-1 expansion system



T4 KIM-1 expansion system



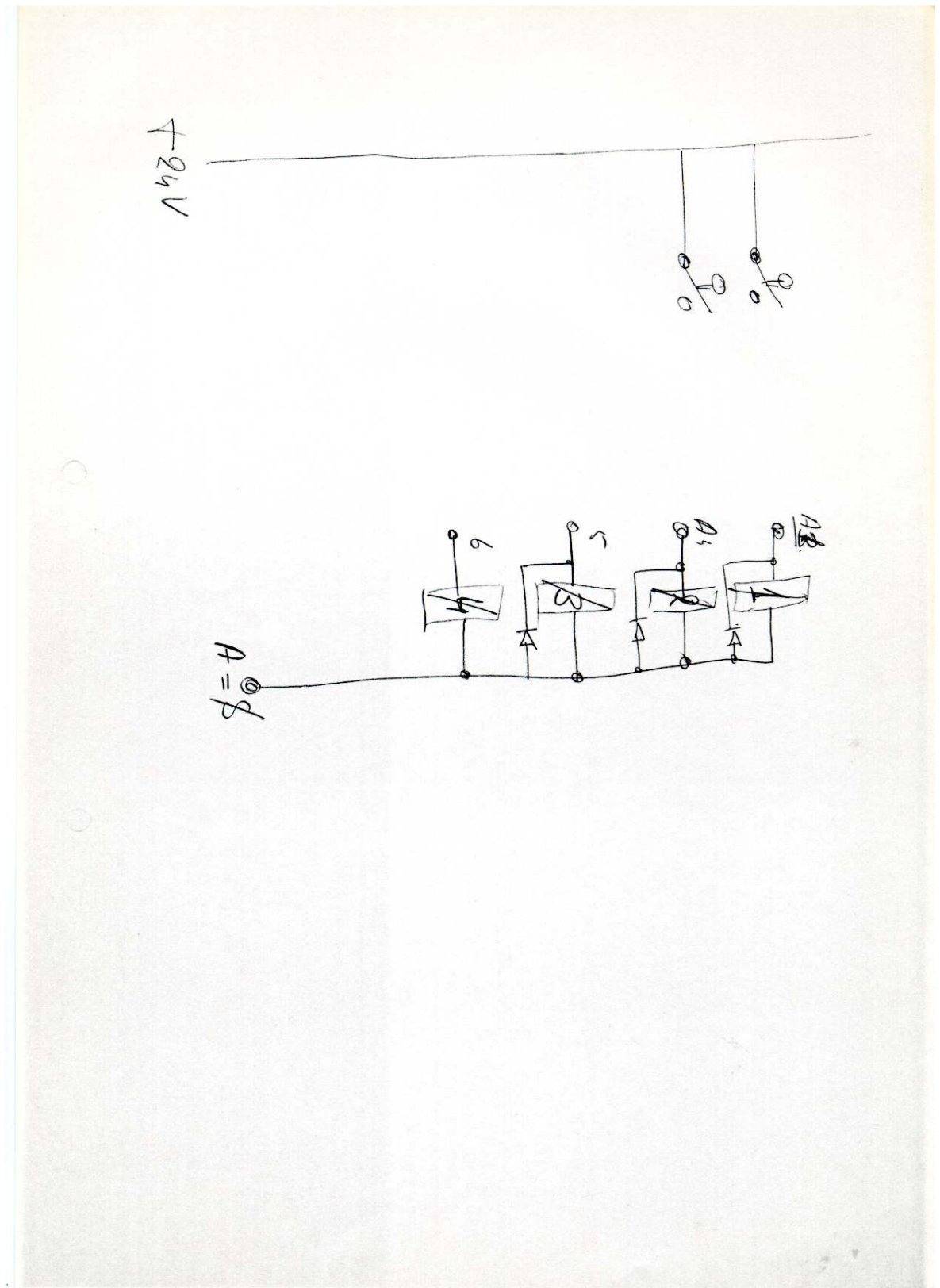
T4 KIM-1 expansion system

PIN	SIGNAL NAME	DESCRIPTION
1	I/O SELECT	HIGH IF ADDRESS = F800 - FBFF
2	RDY	KIM - SIGNAL (PROCESSOR)
3	8K1	LOW IF ADDRESS = 2000 - 3FFF
4	8K0	KIM - SIGNAL (CALLED IPB)
5	8K2	LOW IF ADDRESS = 4000 - 5FFF
6	NMI	KIM - SIGNAL (CALLED NMI)
7	RST	RESET PROCESSOR AND PERIPHERALS IF LOW
8	DB7	DATA - BUS BITS
9	DB6	
10	DB5	
11	DB4	
12	DB3	
13	DB2	
14	DB1	
15	DB0	
16	8K3	LOW IF ADDRESS = 6000 - 7FFF
17	8K4	" " " " 8000 - 9FFF
18	8K5	" " " " A000 - BFFF
19	8K6	" " " " C000 - DFFF
20	8K7	" " " " E000 - FFFF
21	+5V	SUPPLY POWER
22	GROUND	
A	BAB0	BUFFERED ADDRESS BIT 0
B	BAB1	" " " 1
C	BAB2	" " " 2
D	BAB3	" " " 3
E	BAB4	" " " 4
F	BAB5	" " " 5
H	BAB6	" " " 6
J	BAB7	" " " 7
K	BAB8	" " " 8
L	BAB9	" " " 9
M	BAB10	" " " 10
N	BAB11	" " " 11
P	BAB12	" " " 12
R	BAB13	" " " 13
S	BAB14	" " " 14
T	BAB15	" " " 15
U	BE2	PHASE 2 PROCESSOR CLOCK
V	BRW	HIGH IF READ
W	BRW	HIGH IF WRITE
X	+12V	SUPPLY POWER
Y	BE2	INVERTED PHASE 2 PROCESSOR CLOCK
Z	-5V	SUPPLY POWER

EXPANSION . CONN

BUFFERED KIMBUS SIGNALS. T4 system

T4 KIM-1 expansion system

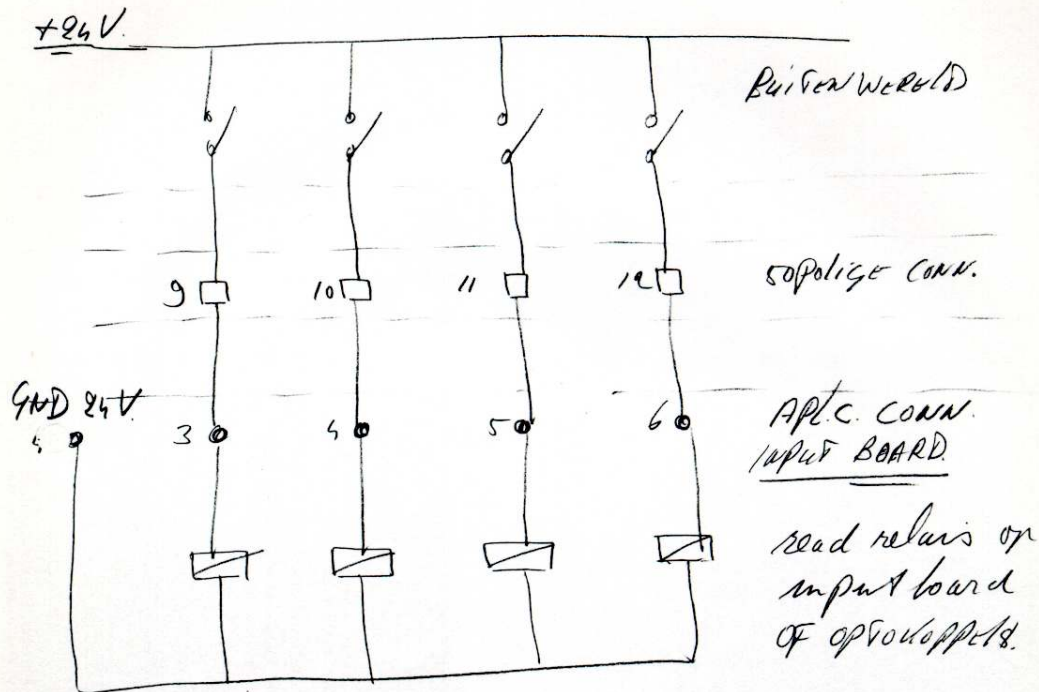


T4 KIM-1 expansion system

INPUT BOARD

VOORBEELD

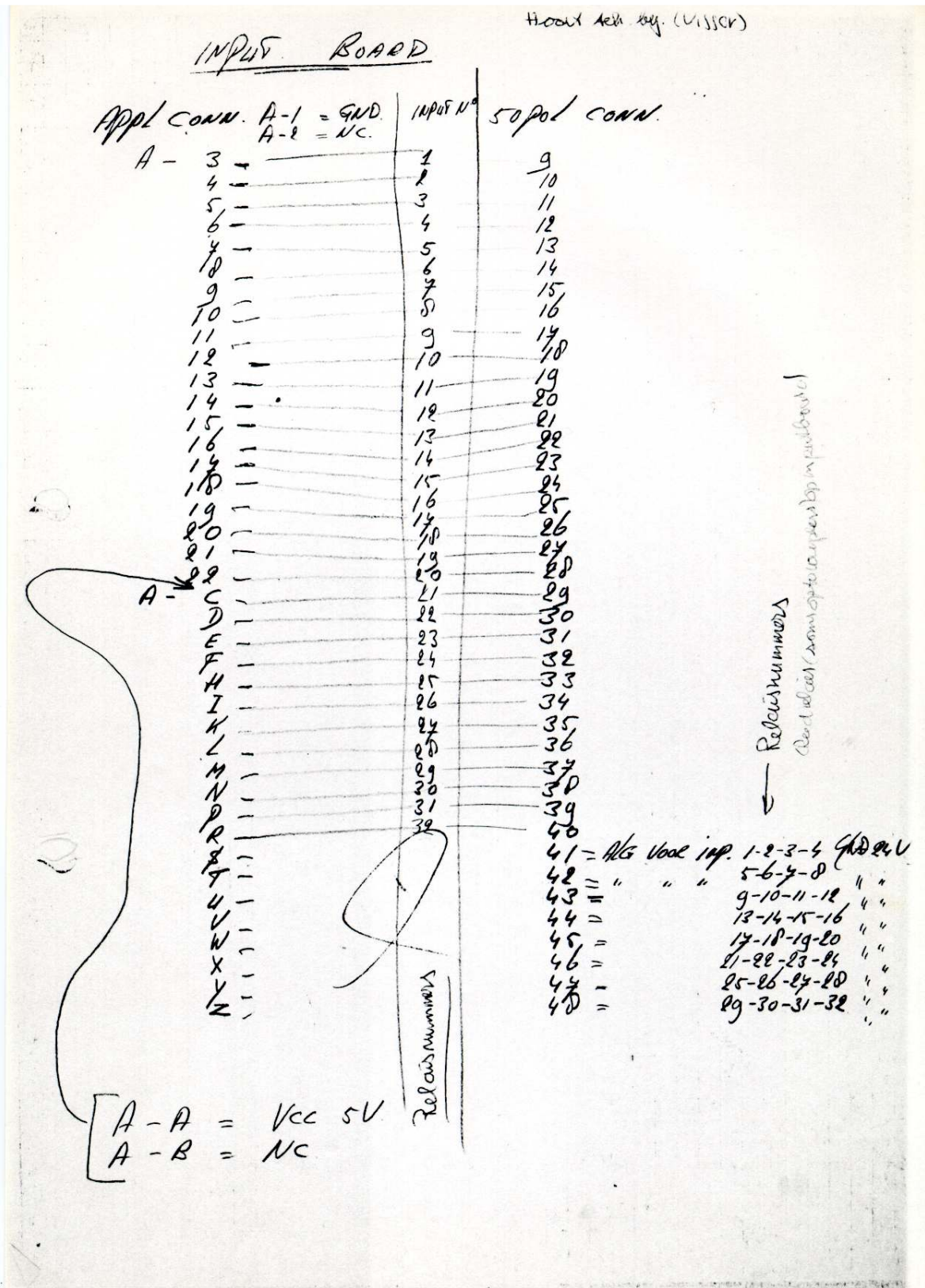
WERKING



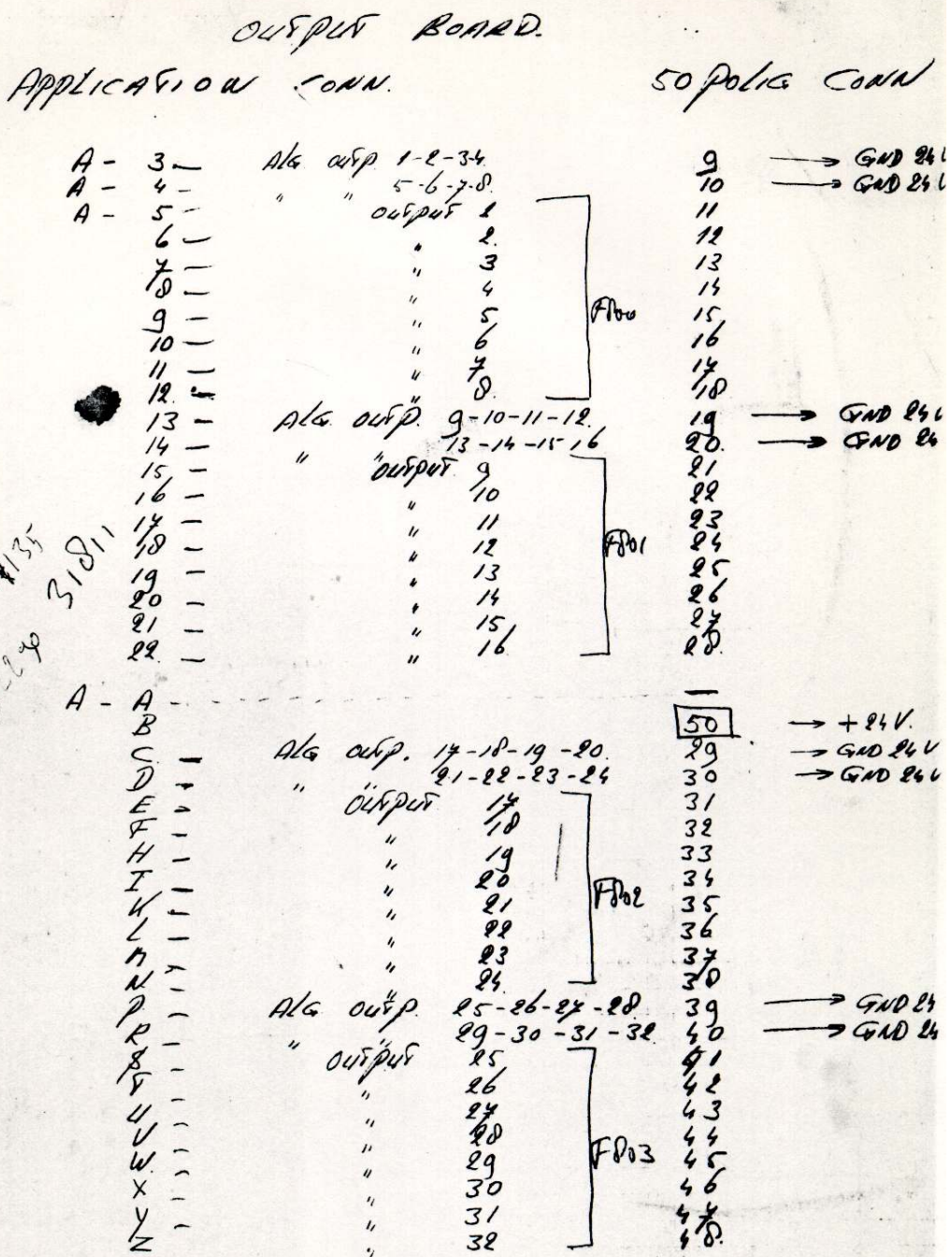
T4 KIM-1 expansion system

		INPUT CONN. 50 PINS	APPLICATION CONN. INPUT BOARD
INPUT	1	1	A-3
"	2	2	-4
"	3	3	-5
"	4	4	-6
"	5	5	-7
"	6	6	-8
"	7	7	-9
"	8	8	-10
"	9	9	-11
"	10	10	-12
"	11	11	-13
"	12	12	-14
"	13	13	-15
"	14	14	-16
"	15	15	-17
"	16	16	-18
"	17	17	-19
"	18	18	-20
"	19	19	-21
"	20	20	-22
"	21	21	-C
"	22	22	-D
"	23	23	-E
"	24	24	-F
"	25	25	-H
"	26	26	-J
"	27	27	-K
"	28	28	-L
"	29	29	-M
"	30	30	-N
"	31	31	-P
"	32	32	-R
		33	
		34	
		35	
		36	
		37	
		38	
		39	
		40	-S
		41	-T
		42	-U
		43	-V
		44	-W
		45	-X
		46	-Y
		47	-Z
		48	
		49	
		50	
ALG. V 1-2-3-4 —		40	
" V 5-6-7-8 —		41	
" V 9-10-11-12 —		42	
" V 13-14-15-16 —		43	
" V 17-18-19-20 —		44	
" V 21-22-23-24 —		45	
" V 25-26-27-28 —		46	
" V 29-30-31-32 —		47	
		48	
		49	
		50	
ATTN AAN GND 24 VOLT			
			Application CONN
			A-A = VCC 5V
			A-B = N.C.

T4 KIM-1 expansion system



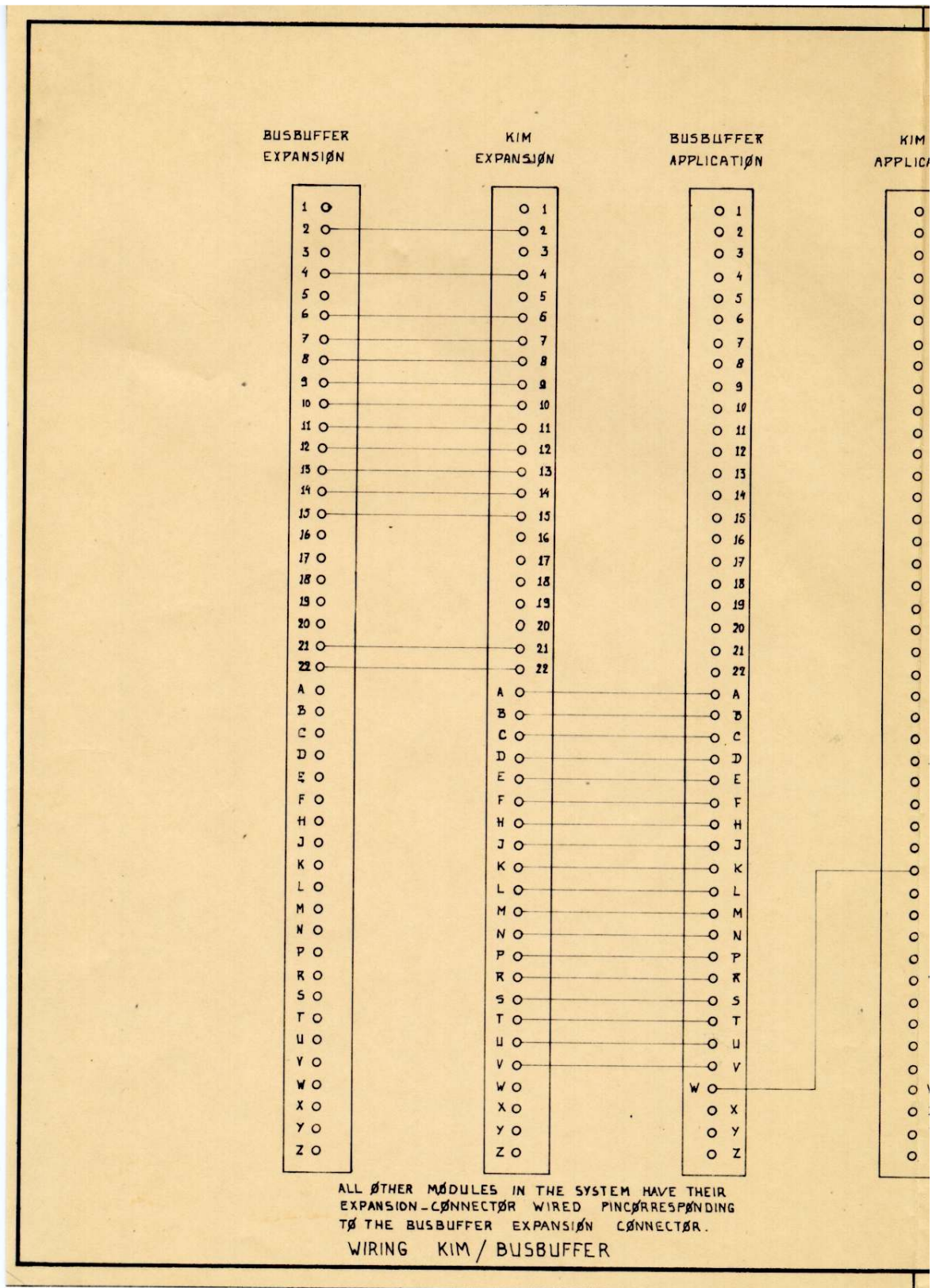
T4 KIM-1 expansion system



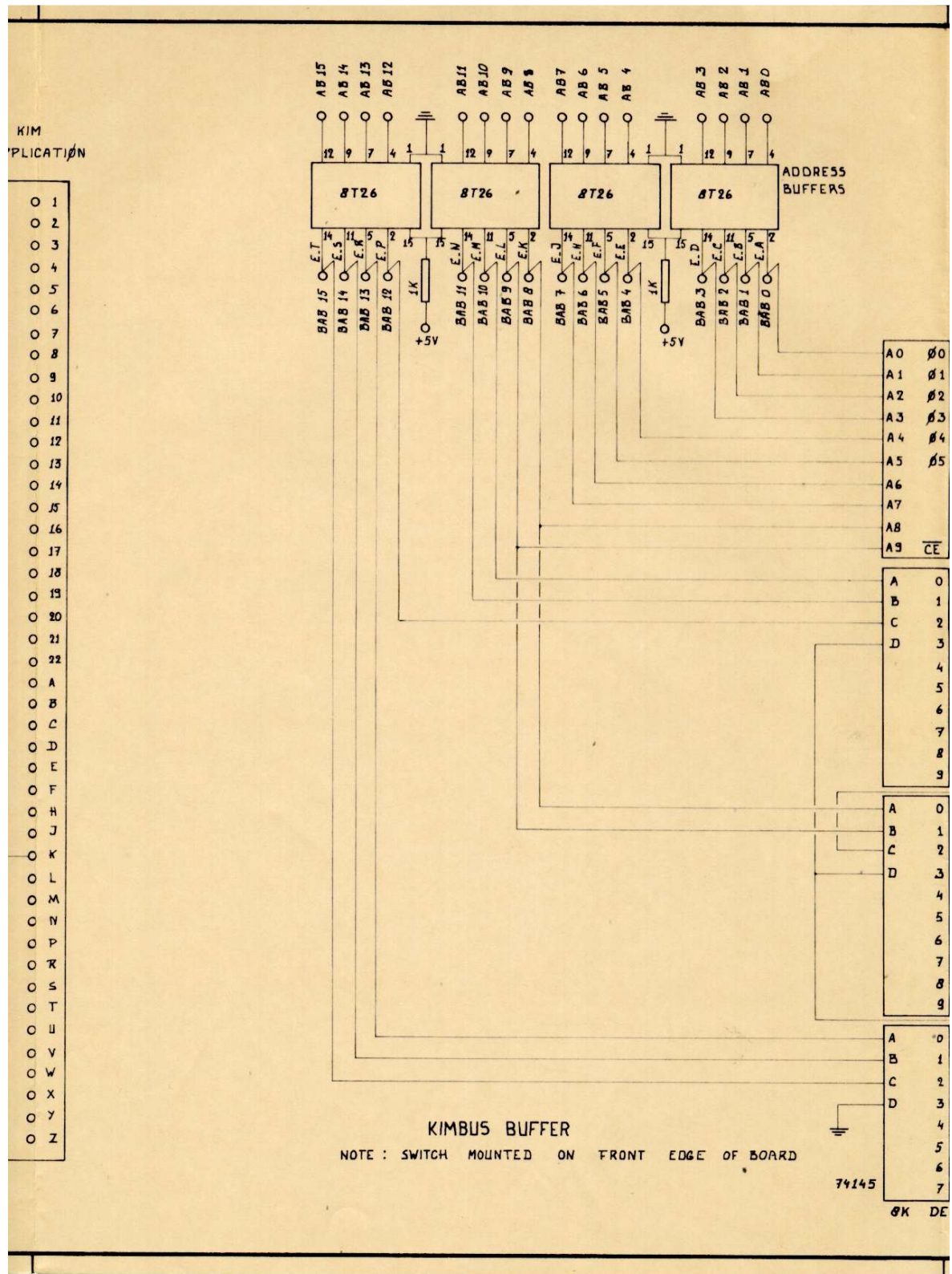
T4 KIM-1 expansion system

POST No.	AAN- TAL	OMSCHRIJVING	AFMETING	MATERIAAL	OPMERKING
SCHAAL		GET. J.M.A. POPMA	DATUM 26 - 3 - '77	BEH. BIJ	
BENAMING					
FORBO KROMMENIE B.V. TE KROMMENIE <small>AUTEURSRECHT VOORBEHOUDEN VOLGENS DE WET</small>				<small>FORM.</small> 2A3	<small>TEKENING No.</small>
				VERVANGT	

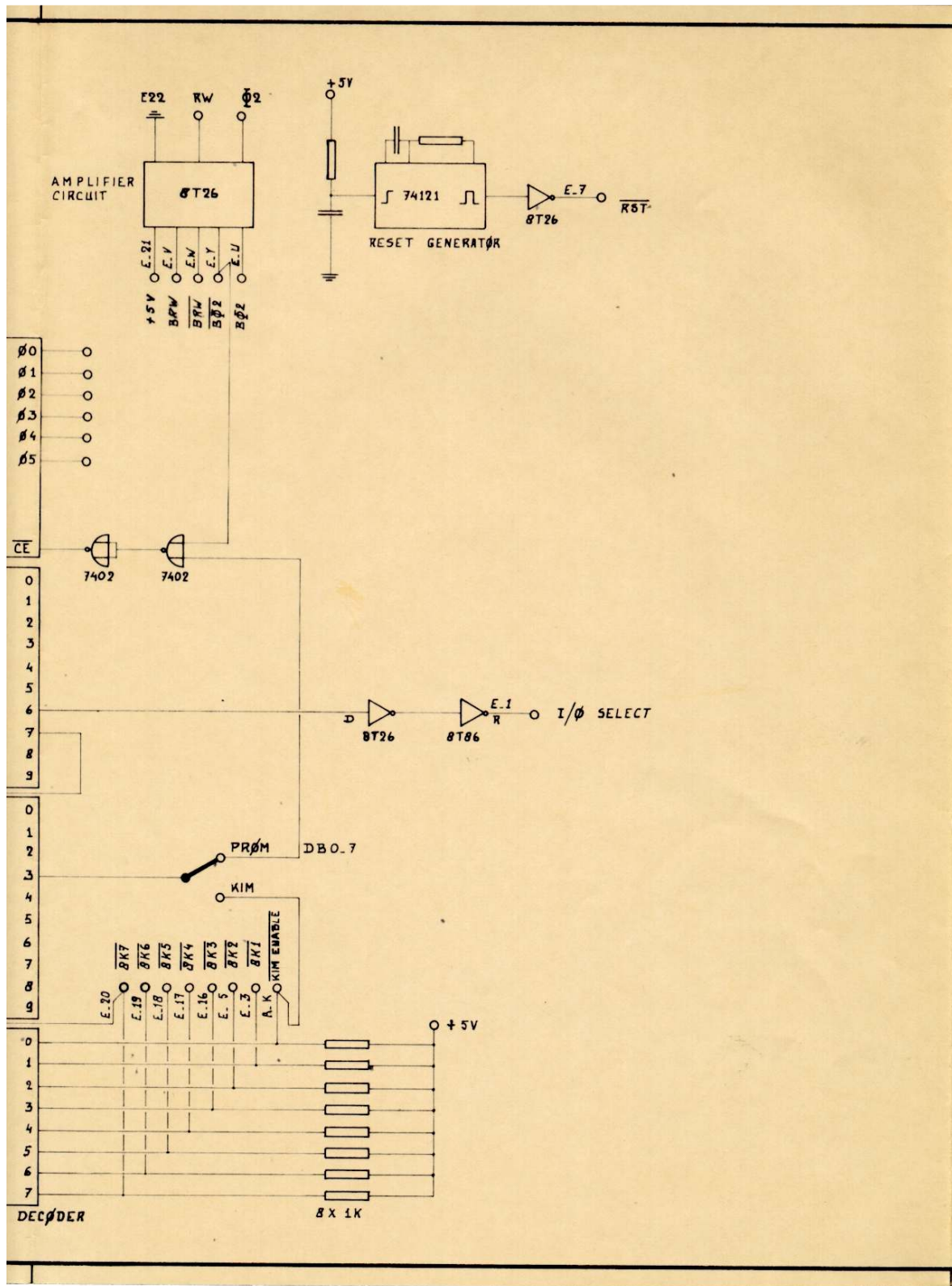
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system

KIM

GEBRUIKERS CLUB NEDERLAND

HARDWARE LIBRARY

VIDEO RAM AAN KIM

Nummer:

16 LIJNEN

32 CHARACTERS PER LIJN

Blad: 1 VAN 1

Om met de kim-1 op een eenvoudige manier een display aan te sturen, is een schakeling opgebouwd rond de Matrox 1632.

Het zal duidelijk zijn dat de schakeling uitermate geschikt is voor de kim-1, als u in ogenschouw neemt dat: a. De kim nog een stuk gedekodeerd geheugenruimte bezit waar niets mee wordt gedaan n.l. de adressen \$ 1400 tot \$ 1700

b. De Matrox 1632 alleen 5 V \pm 0,5 A nodig heeft die bij de kim voorhanden is.

EXPANSION
CONNECTOR
VAN KIM

21
22
15
14
13
12
11
10
9
8

GND
D0
D1
D2
D3
D4
D5
D6
D7
CS
Sh
Bh
BV
SV

1632

MATROX
ELECTRONIC
SYSTEMS

VIDEO RAM

Vcc
A0
A1
A2
A3
A4
A5
A6
A7
A8
R/W
Vd0
INS
F

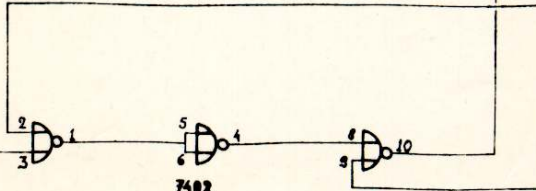
EXPANSION
CONNECTOR
VAN KIM

A
B
C
D
E
F
H
J
K
V
O
W
L
Y

VIDEO OUT

APPLICATION
CONNECTOR
VAN KIM

H



Vcc = 14
GND = 7

Volgens schema is de video ram op de adressen S 1400 tot S 1600 aangesloten.

De schakeling is reeds enige maanden naar volle tevredenheid in gebruik.

Kosten van video ram f 765,-- Tamatra Breda.

Datum ingang:

5 DEC 1977

Vervangt:

NIEUW

d.d.:

-

Ref.:

CO FILMER

T4 KIM-1 expansion system

KIM

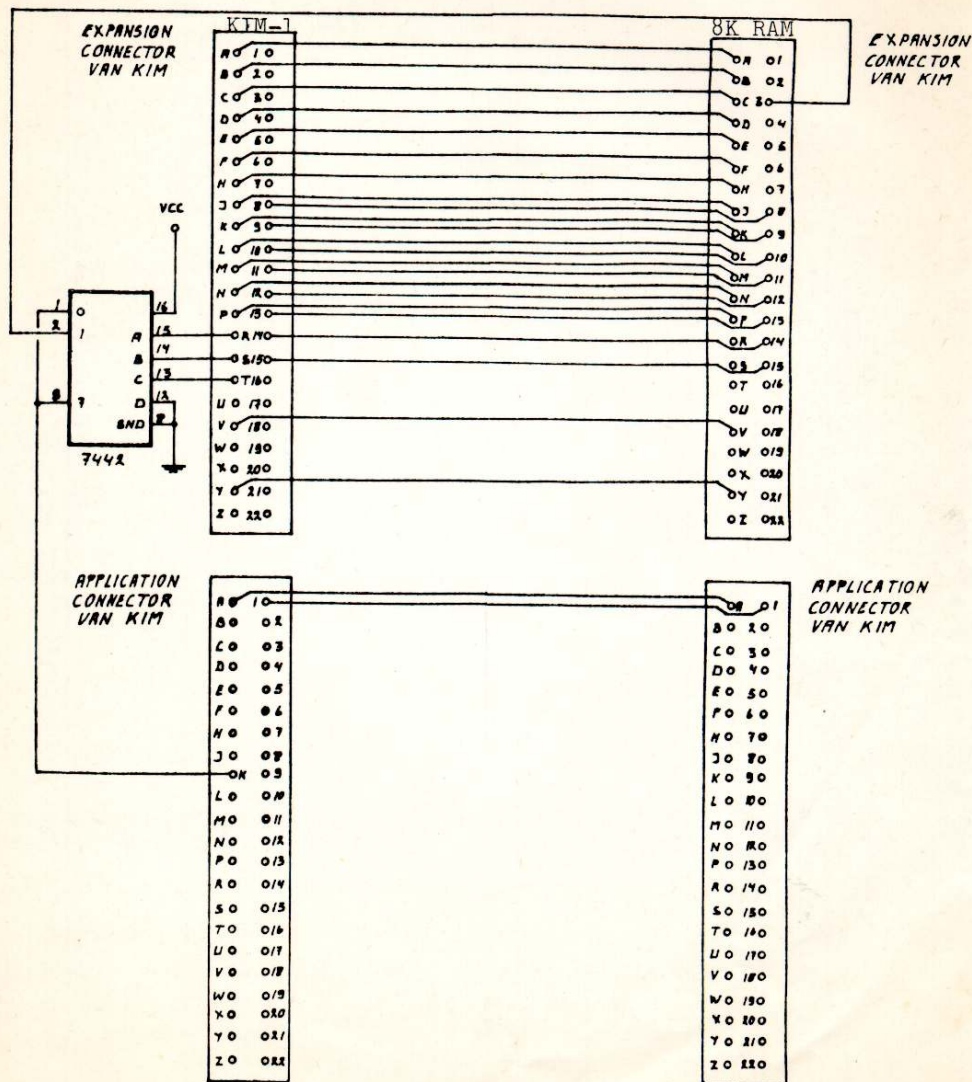
GEbruikers CLUB NEDERLAND
HARDWARE LIBRARY

8K RAM BOARD AAN KIM-1

Nummer:

Blad: 1 VAN 1

8K RAM board aan standaard KIM-1. Zoals uit het schema blijkt is dit gerealiseerd met een minimum aan componenten t.w. een IC type 7442. Het 8K RAM board is volgens deze schakeling gestationeerd op de adressen \$2000 tot \$4000. In principe kan het 8K board ook geplaatst worden op \$4000 tot \$6000 etc. behalve \$E000 t/m FFFF deze 8K is doorverbonden met de eerste 8K i.v.m. restartvectoren.



Datum ingang:

5 DEC 1977

Vervangt:

NIEUW

d.d.:

-

Ref.:

WILLEM V. GELDEREN

T4 KIM-1 expansion system

2. Het T4 systeem.

Het T4 systeem bestaat uit een aantal printen die in een rek kunnen worden geschoven. Voor elke print bevinden zich twee connectors boven elkaar in het rek. De printen in het T4 systeem worden via de bovenste connector met elkaar verbonden. (data-, adres-, en controllijnen). De onderste connector wordt gebruikt voor verbindingen buiten het T4 systeem. (inputs, outputs). De microprocessor bevindt zich op een printkaart, die in de handel is gebracht onder de naam Kim. Op deze kaart bevindt zich de microprocessor 6502 met een aantal ic benodigd voor de besturing. Via een toetsenbord met display is de Kimkaart te bedienen. Op het display wordt het adres en de data hexadecimaal weergegeven. Op het toetsenbord bevinden zich toetsen voor de hexadecimale getallen 0 t/m F en enkele besturingstoetsen. De volgende signalen worden door de Kimkaart op de bovenste connector gezet:

- 1 Data D0 tot en met D7
- 2 Adressen A0 tot en met A15
- 3 Control signalen zoals ϕ 2 (klokpuls), read/write, I/O select.

Voor het T4 systeem zijn onder anderen nog de volgende printkaarten ontwikkelt:

- 1 inputkaarten
- 2 Outputkaarten
- 3 8K ramkaarten

- ad1 Een input kaart ziet 0V als een logische "0" en 24V als een logische "1".
- ad2 Een outputkaart geeft bij een logische "0" 0V af en bij een logische "1" 24V.
- ad3 Op een 8K ramkaart kan men 8000 woorden van 8 bits wegschrijven

Deze kaarten worden in de volgende hoofdstukken uitvoeriger behandeld.

T4 KIM-1 expansion system

-4-

Met de I/O select geven we een 4line to 16line decoder vrij. Zie functietabel 3.2. Van dit ic (74154) zijn de 16 uitgangen normaal "1". Als de decoder vrij is gegeven wordt afhankelijk van de ingangsvariablen een uitgang "0" gemaakt. Als ingangsvariablen zijn adreslijnen A4,A5,A6,A7 gebruikt. Deze adreslijnen hebben betrekking op het derde hexadecimale cijfer van het adres.

Voorbeeld 1: We selecteren het adres \$F823

De I/O select zal "0" zijn (F800 tot en met F8FF)

A4="0"

A5="1"

A6="0"

A7="0"

Volgens functietabel 3.2 zal uitgang 2 "0" worden.

Normaal gesproken is van de 16 schakelaartjes slechts een contact gemaakt. Ingang 0 van het volgende ic zal slechts "0" worden als de schakelaar op uitgang 2 gemaakt is.

logic

FUNCTION TABLE												
NO.	INPUTS				OUTPUTS							
	D	C	B	A	0	1	2	3	4	5	6	7
0	L	L	L	L	L	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H
3	L	L	H	H	H	H	L	H	H	H	H	H
4	L	H	L	L	H	H	H	L	H	H	H	H
5	L	H	L	H	H	H	H	L	H	H	H	H
6	L	H	H	L	H	H	H	H	L	H	H	H
7	L	H	H	H	H	H	H	H	L	H	H	H
8	H	L	L	L	H	H	H	H	H	L	H	H
9	H	L	L	H	H	H	H	H	H	L	H	H
INVALID	H	L	H	L	H	H	H	H	H	H	H	H
	H	L	H	H	H	H	H	H	H	H	H	H
	H	H	L	L	H	H	H	H	H	H	H	H
	H	H	L	H	H	H	H	H	H	H	H	H
	H	H	H	L	H	H	H	H	H	H	H	H

H = high level (off), L = low level (on)

Functietabel 3.2 74154 4 line to 16 line decoder.

logic

FUNCTION TABLE															
G1 G2		INPUTS				OUTPUTS									
		D	C	B	A	0	1	2	3	4	5	6	7	8	9
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	L	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	L	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	L	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	L	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	L	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	L	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H

H = high level, L = low level, X = irrelevant

Functietabel 3.3 74145 4 line to 10 line decoder.

Opmerking: H = "1"
L = "0"

Het functiediagram van het volgende ic (74145) is gegeven in functie-tabel 3.3. We zien uit de tabel dat een van de gebruikte uitgangen ook "0" kan worden als zowel de ingang C als D "0" is. Dit is het geval als het adres overeenkomt met die in de voorgaande trap is ingesteld. Met de schakelaars op de uitgang van dit ic kunnen weer een gedeelte van het adres instellen.

Voorbeeld 2. We willen hetzelfde adres selecteren als in voorbeeld 1. Dit adres was \$F823.

Stel dat het voorgaande trap zodanig ingesteld is dat D "0" wordt.

Uit het adres volgt dat: A2="0"

A3="0"

Uit de functietabel volgt nu dat uitgang 0 "0" wordt.

Als de schakelaar op uitgang 0 gemaakt is zal de ingangen C en D van het er opvolgende ic "0" zijn.

Voor het laatste ic geldt hetzelfde verhaal als voor het voorgaande ic. Nu worden de uitgangen echter gebruikt om een van de 4 woorden aan te sturen. Afhankelijk van A0 en A1 zal het 1e, 2e, 3e of 4e woord aangestuurd worden.

3.2 Inputkaart

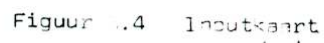
Aan een inputkaart kan men 32 inputs aanbieden. Hierbij is een spanning van 0V een "0" en een spanning van 24V een "1". De 32 inputs worden in 4 woorden van 8 bits gescheiden. Hieronder zal ik de verwerking van een woord behandelen. De overige 3 woorden lopen hier min of meer parallel aan. De schakeling is getekend in figuur 3.4. Met de inputs wordt een relai aangestuurd. Het schakelcontact van het relai is aangesloten op een spanning van 0V en 5V. Als het schakelcontact gemaakt wordt trekt deze de ingang van de nand naar 0 volt ("0"). Bij open contact is dit 5 volt ("1"). Op de andere ingang van de nand is de selectie van het woord aangesloten. Bijvoorbeeld FIRST. Als de gewenste adres op de adresbus staat zal deze "0" gemaakt zijn (zie adressering). Dit signaal wordt geïnverteerd op de ingang van de nands aangeboden. Hiermee wordt de nand als invertor vrij gegeven. Met het relai was echter ook al een inversie toegepast, zodat op de uitgang van de nands de niet geïnverteerde inputs verschijnen.

De uitgangen van de nands gaan naar een buffer 8T26. Op de ingang van dit ic is met behulp van weerstanden en and functie gekreëerd. Hierdoor kan men de uitgangen van de nands van de andere woorden aan elkaar knopen. De uitgangen van de niet aangestuurde woorden zijn "1". Het aangestuurde woord zal zodoende aan de ingang van het buffer worden aangeboden.

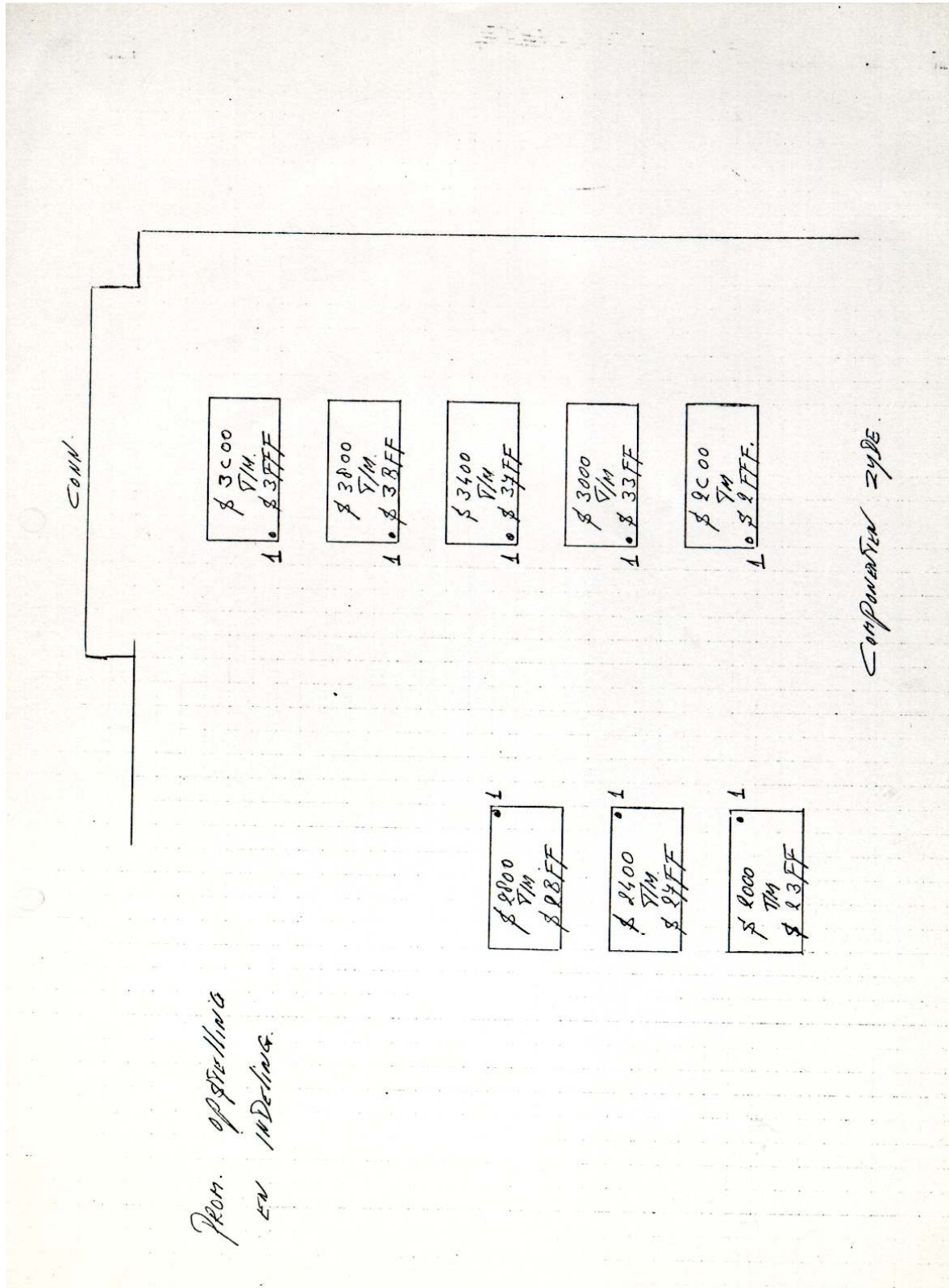
De uitgang van het buffer heeft 2 standen: 1 De standen aan de ingang.
2 De stand waarin hij niks beïnvloed.

-6-

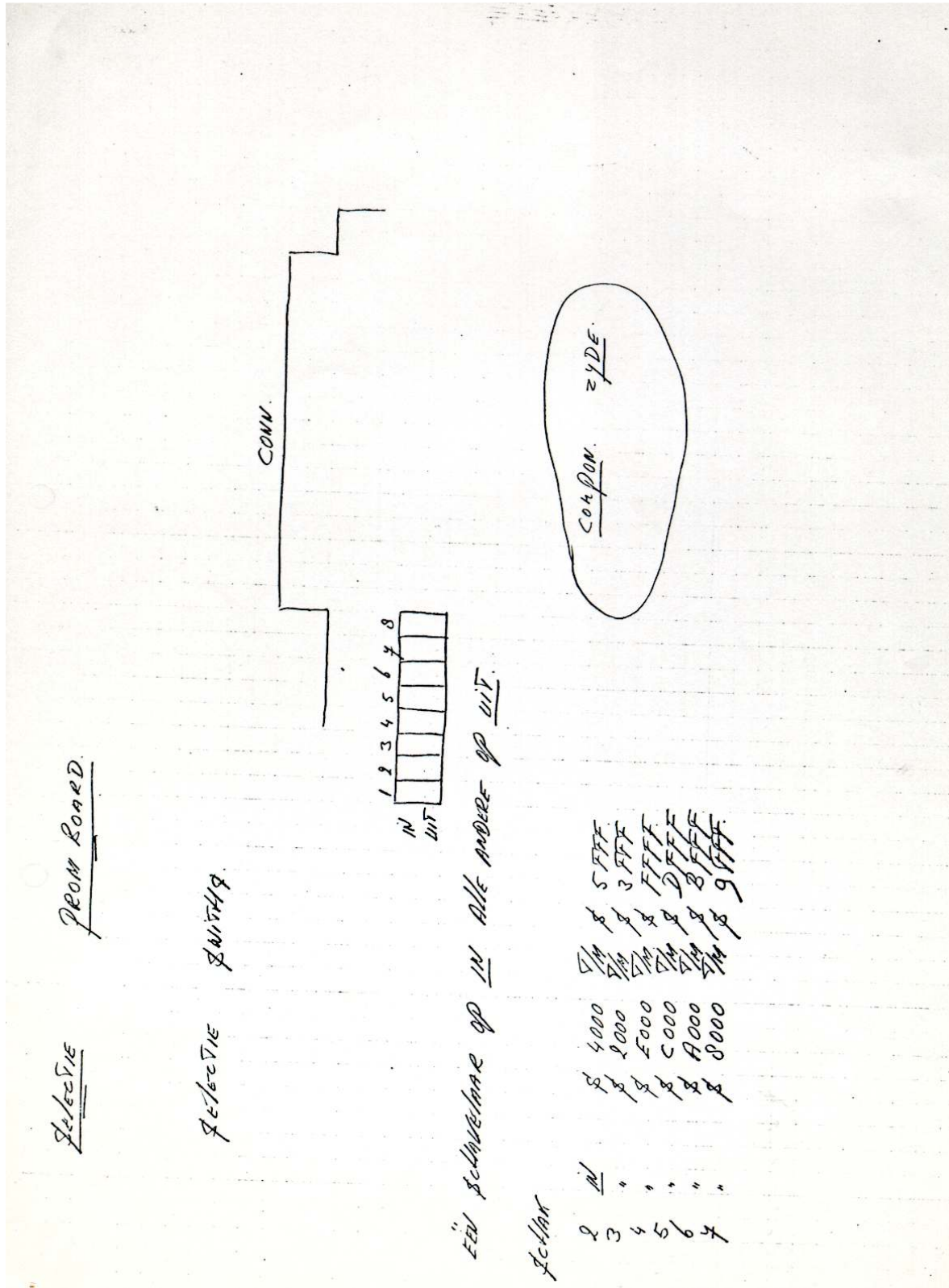
Het buffer zal vrij worden gegeven als: $\bar{R}/W = "0"$
 $\phi = \text{nnn}$ (normaal gesproken altijd)
 KS = "0" (zie figuur 3.1)



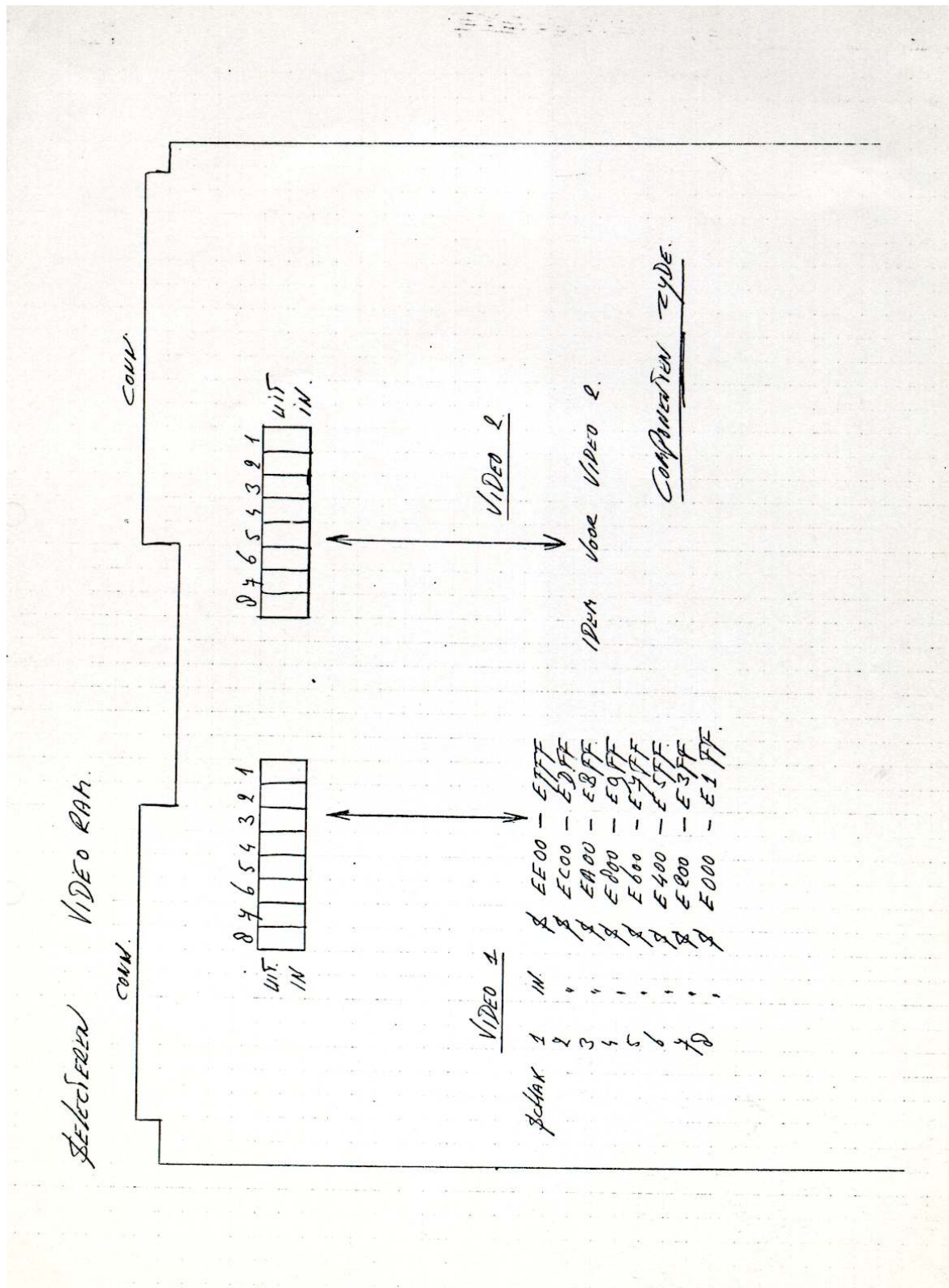
T4 KIM-1 expansion system



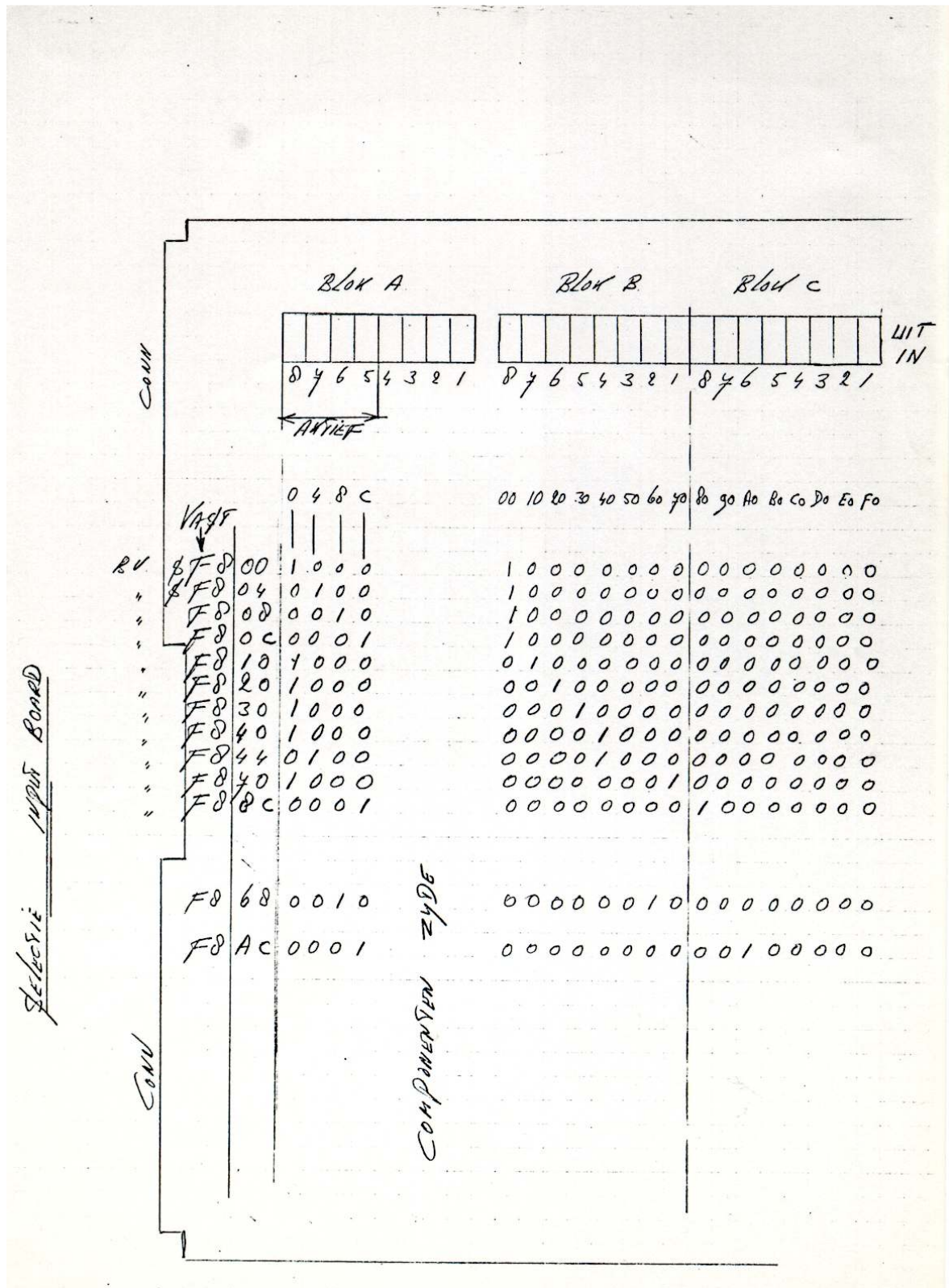
T4 KIM-1 expansion system



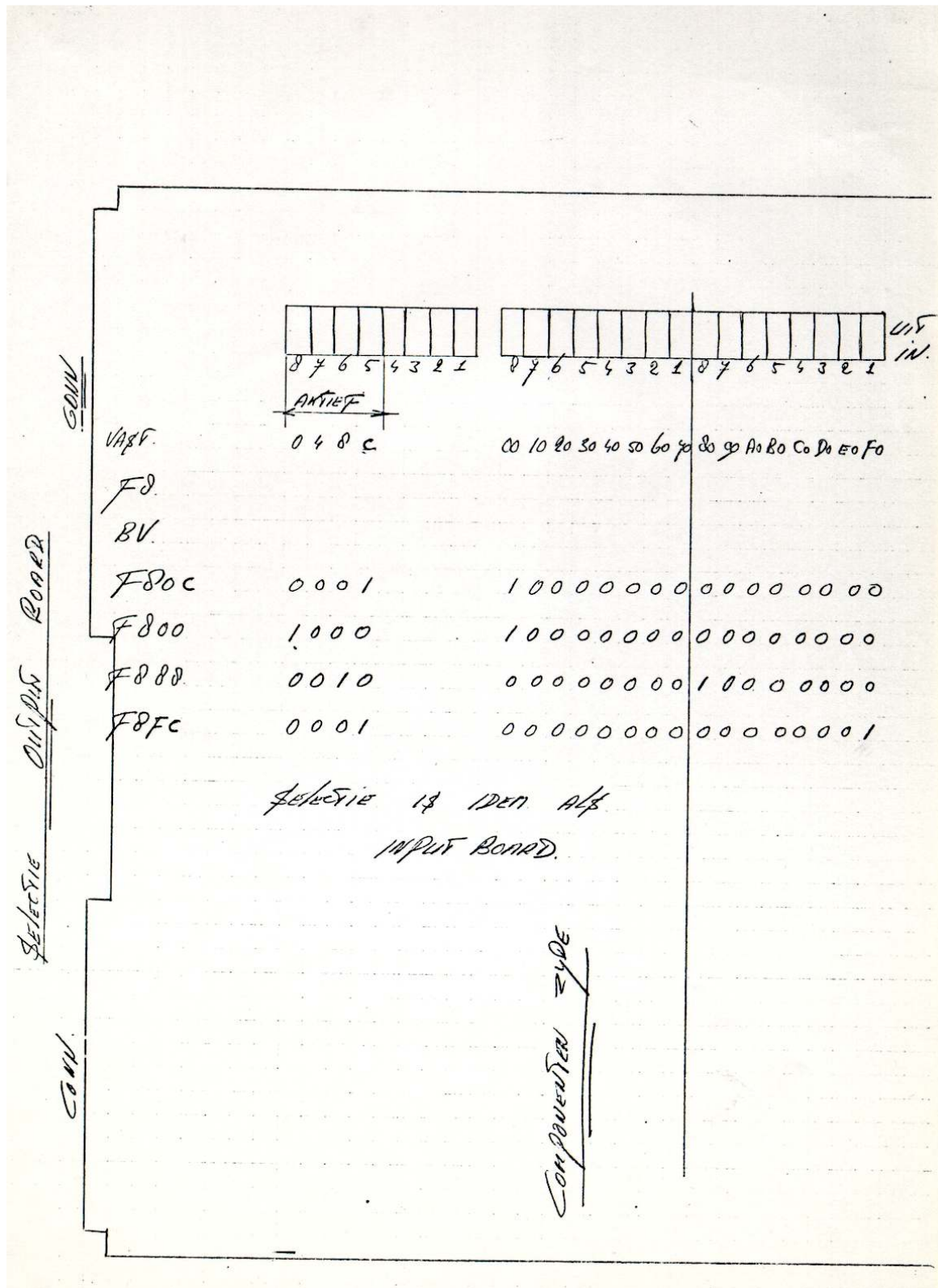
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system

OUTPUT AANSLUITINGEN

output	output	APPL. CONNECTOR
1 - output 0		A - 5
2 - " 1		A - 6
3 - " 2		A - 7
4 - " 3		A - 8
5 - " 4		A - 9
6 - " 5		A - 10
7 - " 6		A - 11
8 - " 7		A - 12
9 - " 1.0		A - 15
10 - " 1.1		A - 16
11 - " 1.2		A - 17
12 - " 1.3		A - 18
13 - " 1.4		A - 19
14 - " 1.5		A - 20
15 - " 1.6		A - 21
16 - " 1.7		A - 22
17 - " 2.0		A - E
18 - " 2.1		A - F
19 - " 2.2		A - H
20 - " 2.3		A - I
21 - " 2.4		A - K
22 - " 2.5		A - L
23 - " 2.6		A - M
24 - " 2.7		A - N
25 - " 3.0		A - S
26 - " 3.1		A - T
27 - " 3.2		A - U
28 - " 3.3		A - V
29 - " 3.4		A - W
30 - " 3.5		A - X
31 - " 3.6		A - Y
32 - " 3.7		A - Z
33 - " gemeenschappelijke output		A - B + 24V
34 - "		
35 - "		
36 - "		
37 - "		

Alg output		
1 - 2 - 3 - 4		A - 3
5 - 6 - 7 - 8		A - 4
9 - 10 - 11 - 12		A - 13
13 - 14 - 15 - 16		A - 14
17 - 18 - 19 - 20		A - C
21 - 22 - 23 - 24		A - D
25 - 26 - 27 - 28		A - P
29 - 30 - 31 - 32		A - R

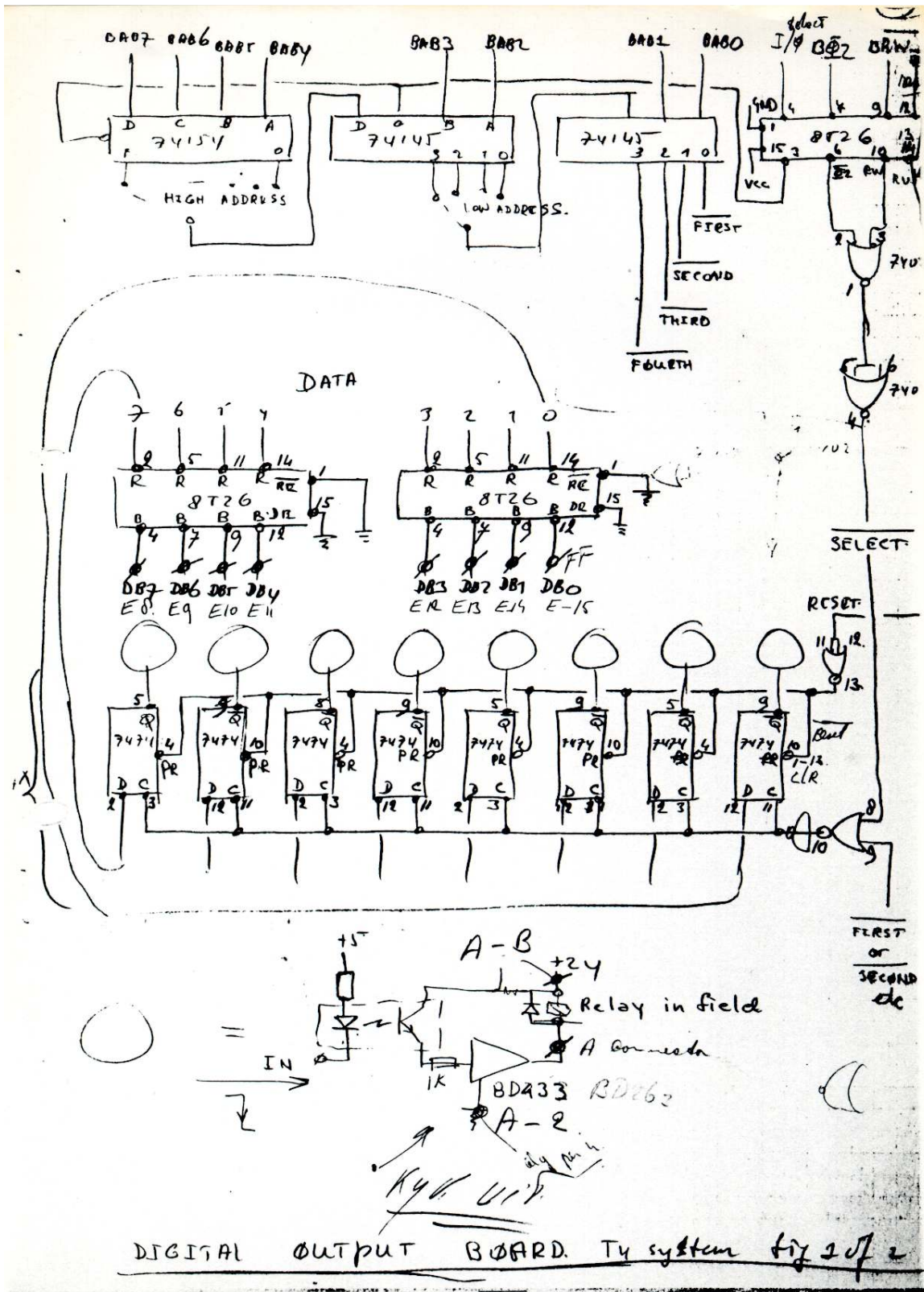
T4 KIM-1 expansion system

OUTPUT BOARD. APPLICATION CONN. 50 pin CONN

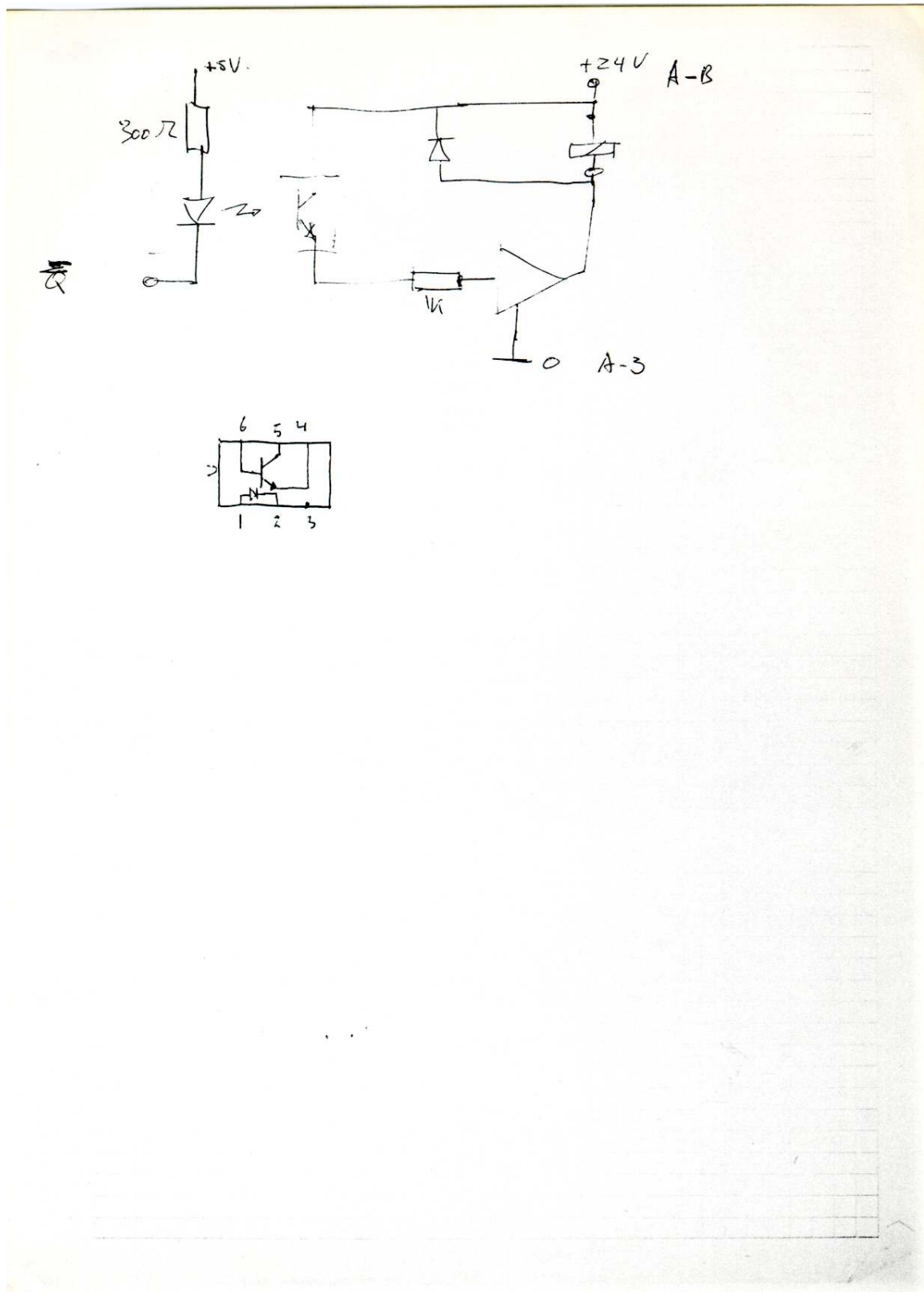
A - 3 -	Alg outp	1-2-3-4	9	→ GND 24V
A - 4 -	"	5-6-7-8	10	→ GND 24V
A - 5 -	"	output 1	11	
6 -	"	2	12	
7 -	"	3	13	
8 -	"	4	14	
9 -	"	5	15	
10 -	"	6	16	
11 -	"	7	17	
12 -	"	8	18	
13 -	Alg outp	9-10-11-12	19	→ GND 24V
14 -	"	13-14-15-16	20	→ GND 24V
15 -	"	output 9	21	
16 -	"	10	22	
17 -	"	11	23	
18 -	"	12	24	
19 -	"	13	25	
20 -	"	14	26	
21 -	"	15	27	
22 -	"	16	28	
A - A -			50	→ +24V
B -	Alg outp	17-18-19-20	29	→ GND 24V
C -	"	21-22-23-24	30	→ GND 24V
D -	"	output 17	31	
E -	"	18	32	
F -	"	19	33	
H -	"	20	34	
I -	"	21	35	
J -	"	22	36	
K -	"	23	37	
N -	"	24	38	
P -	Alg outp	25-26-27-28	39	→ GND 24V
R -	"	29-30-31-32	40	→ GND 24V
S -	"	output 25	41	
T -	"	26	42	
U -	"	27	43	
V -	"	28	44	
W -	"	29	45	
X -	"	30	46	
Y -	"	31	47	
Z -	"	32	48	

X

T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system

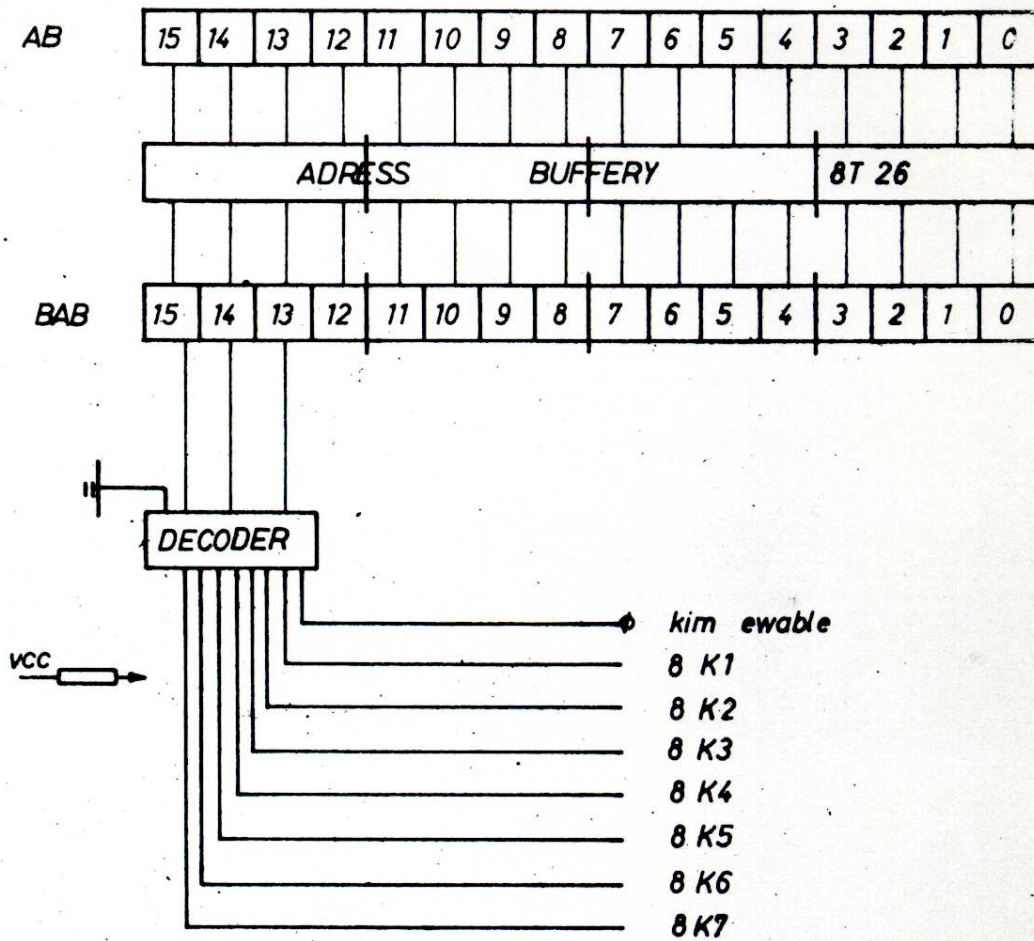
PIN	SIGNAL NAME	DESCRIPTION
1	I/O SELECT	HIGH IF ADDRESS = F800 - FBFF
2	RDY	KIM - SIGNAL (PROCESSOR)
3	8K1	LOW IF ADDRESS = 2000 - 3FFF
4	8K0	KIM - SIGNAL (CALLED IRQ)
5	8K2	LOW IF ADDRESS = 4000 - 5FFF
6	NMI	KIM - SIGNAL (CALLED NMI)
7	RST	RESET PROCESSOR AND PERIPHERALS IF LOW
8	DB7	DATA - BUS BITS
9	DB6	
10	DB5	
11	DB4	
12	DB3	
13	DB2	
14	DB1	
15	DB0	
16	8K3	LOW IF ADDRESS = 6000 - 7FFF
17	8K4	" " " " 8000 - 9FFF
18	8K5	" " " " A000 - BFFF
19	8K6	" " " " C000 - DFFF
20	8K7	" " " " E000 - FFFF
21	+5V	SUPPLY POWER
22	GROUND	
A	BAB0	BUFFERED ADDRESS BIT 0
B	BAB1	" " " 1
C	BAB2	" " " 2
D	BAB3	" " " 3
E	BAB4	" " " 4
F	BAB5	" " " 5
H	BAB6	" " " 6
J	BAB7	" " " 7
K	BAB8	" " " 8
L	BAB9	" " " 9
M	BAB10	" " " 10
N	BAB11	" " " 11
P	BAB12	" " " 12
R	BAB13	" " " 13
S	BAB14	" " " 14
T	BAB15	" " " 15
U	BF2	PHASE 2 PROCESSOR CLOCK
V	BRW	HIGH IF READ
W	BRW	HIGH IF WRITE
X	+12V	SUPPLY POWER
Y	BF2	INVERTED PHASE 2 PROCESSOR CLOCK
Z	-5V	SUPPLY POWER

EXPANSION . CONN

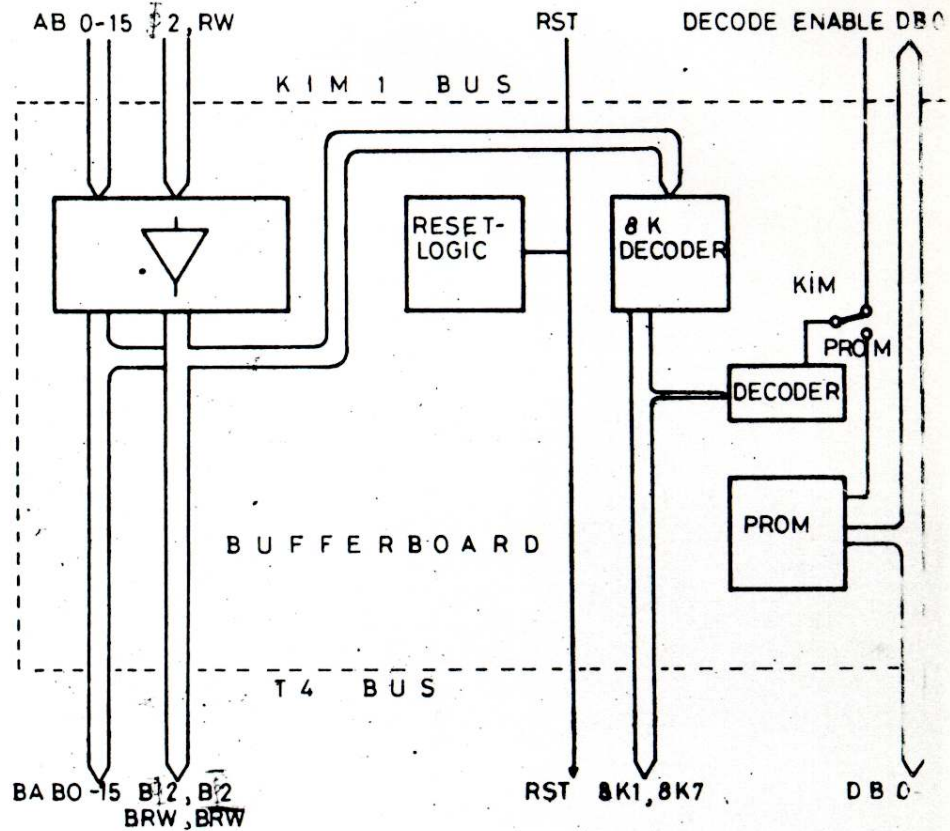
BUFFERED KIMBUS SIGNALS. T4 system

T4 KIM-1 expansion system

BUFFER AND 8K DECODING



T4 KIM-1 expansion system

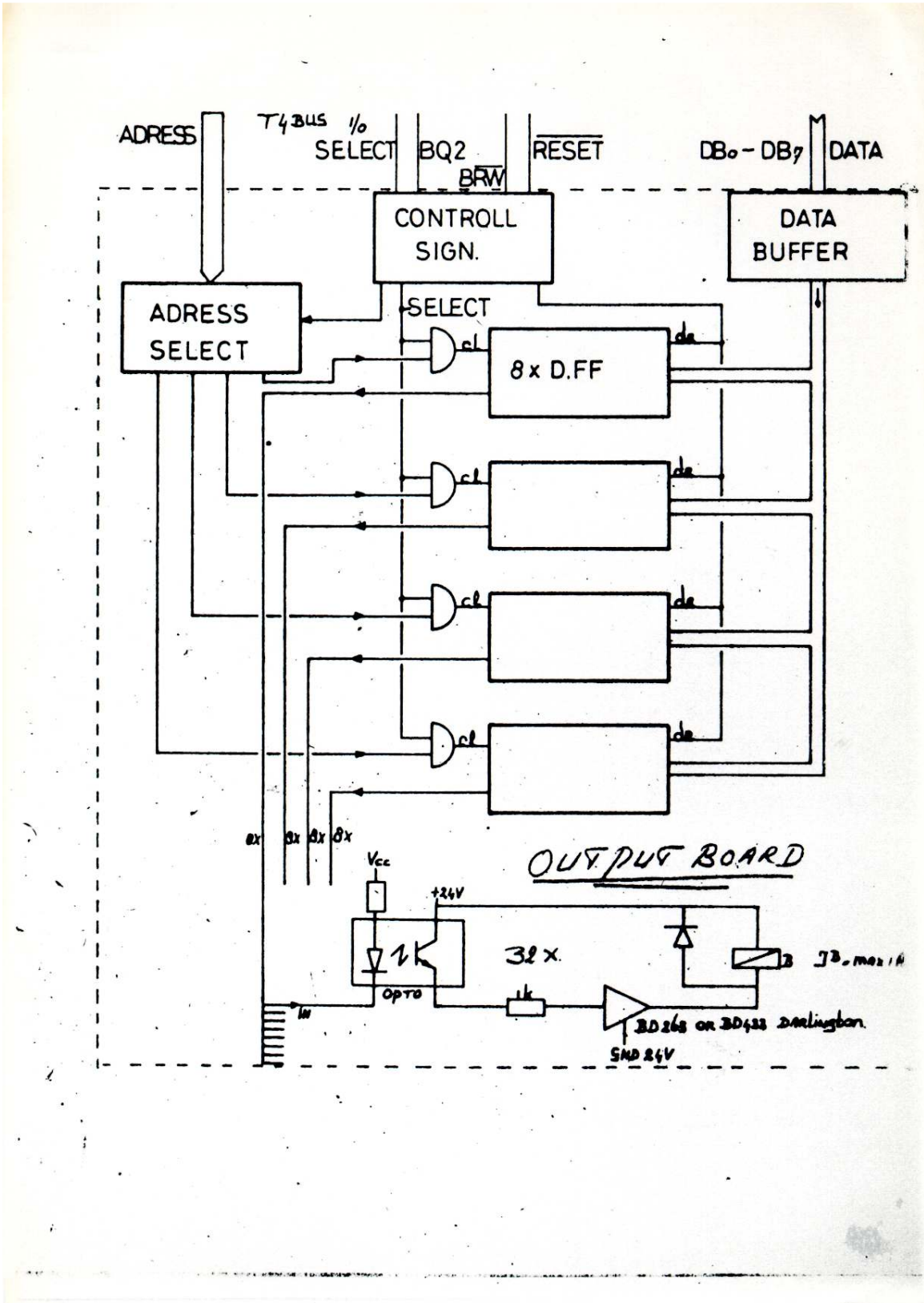


BLOCK DIAGRAM BUSBUFFER MODULE

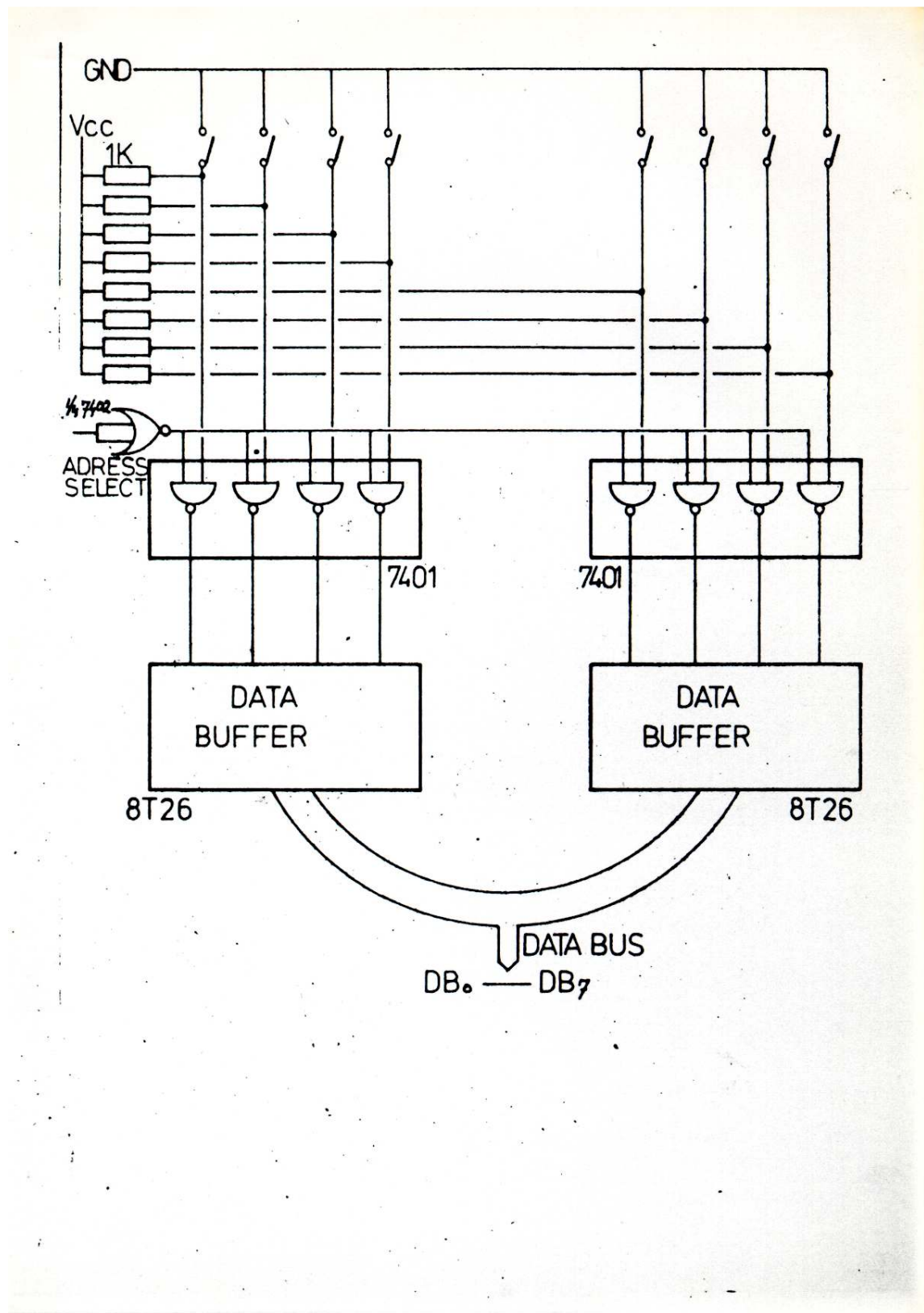
T4 KIM-1 expansion system



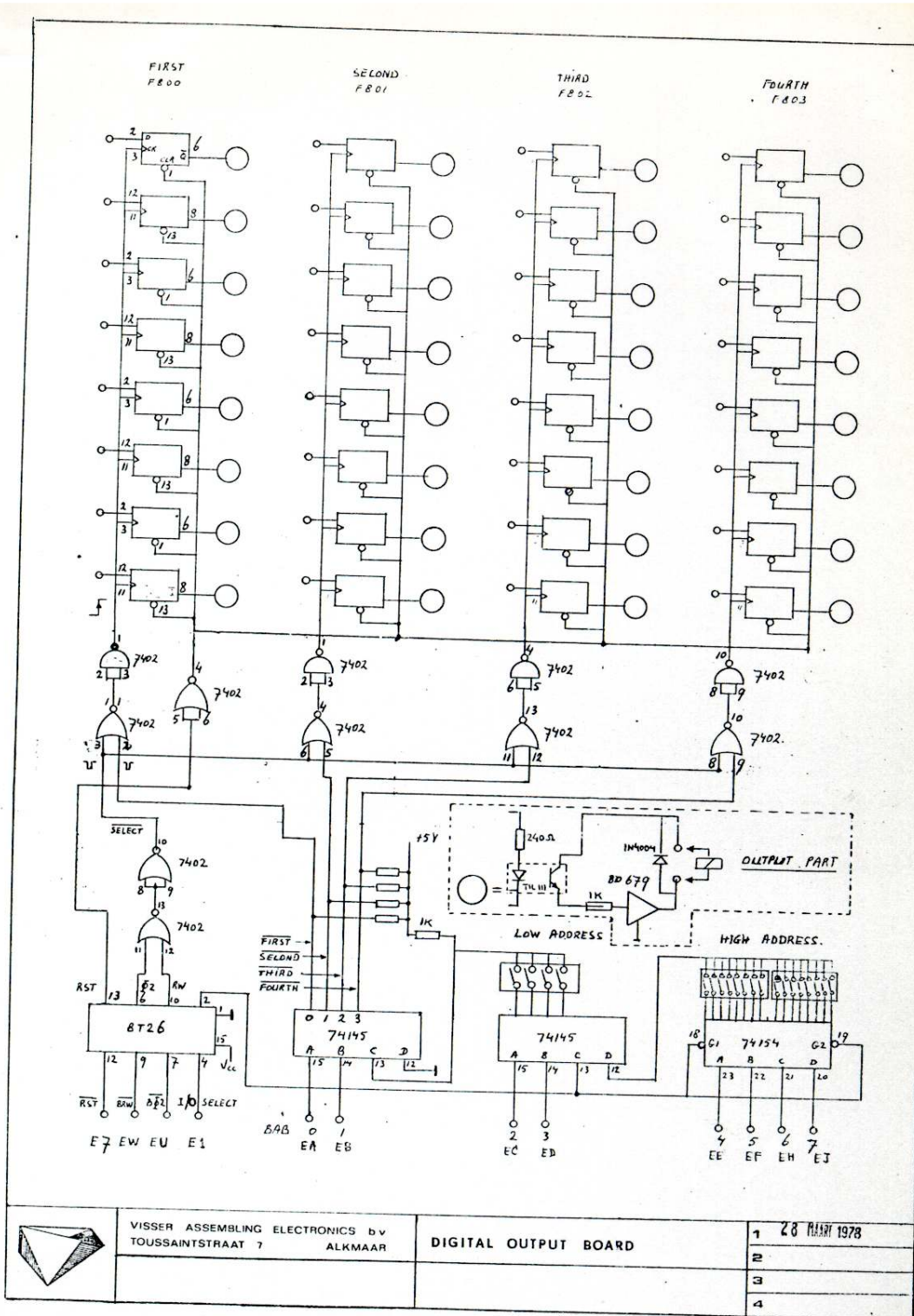
T4 KIM-1 expansion system



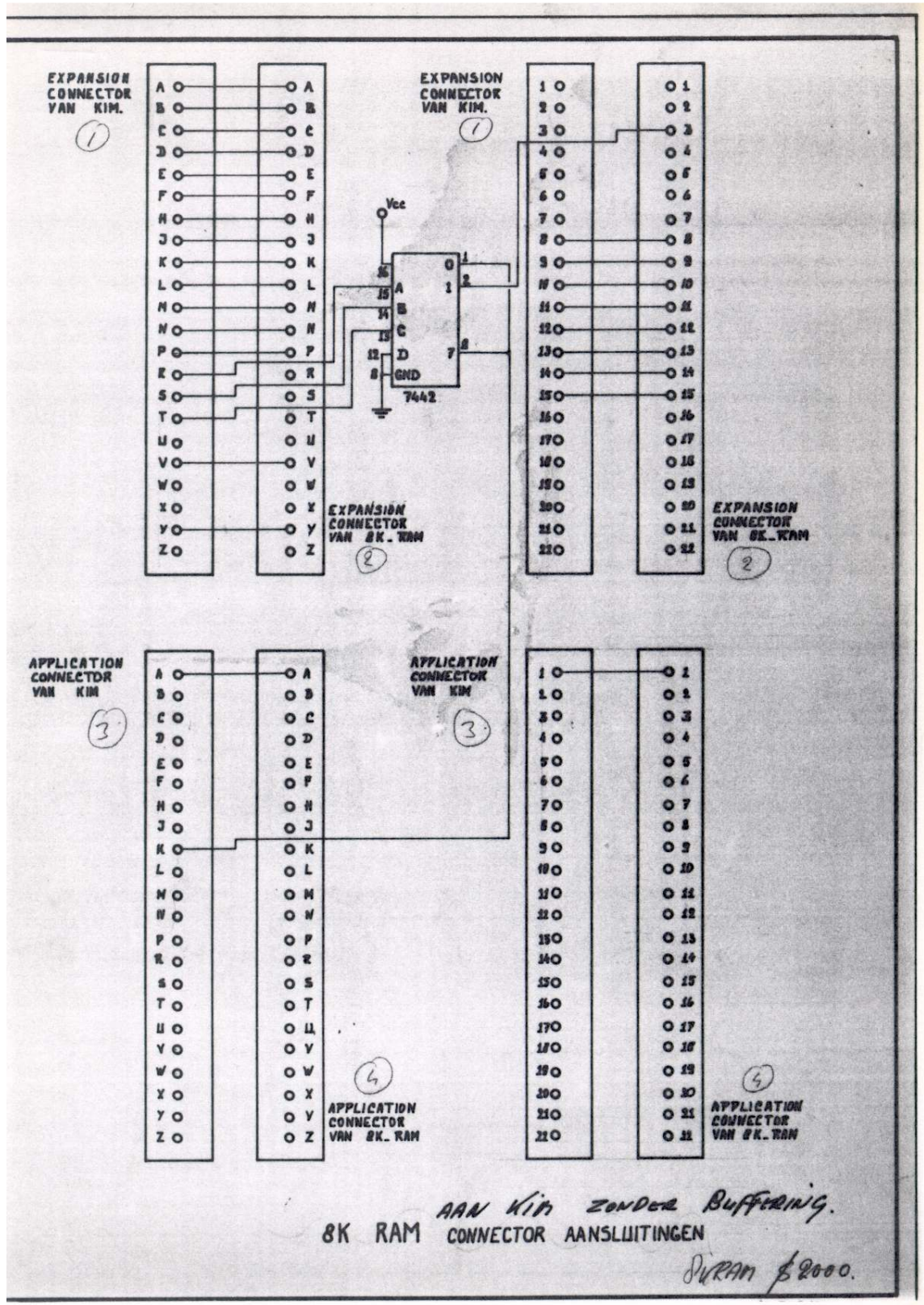
T4 KIM-1 expansion system



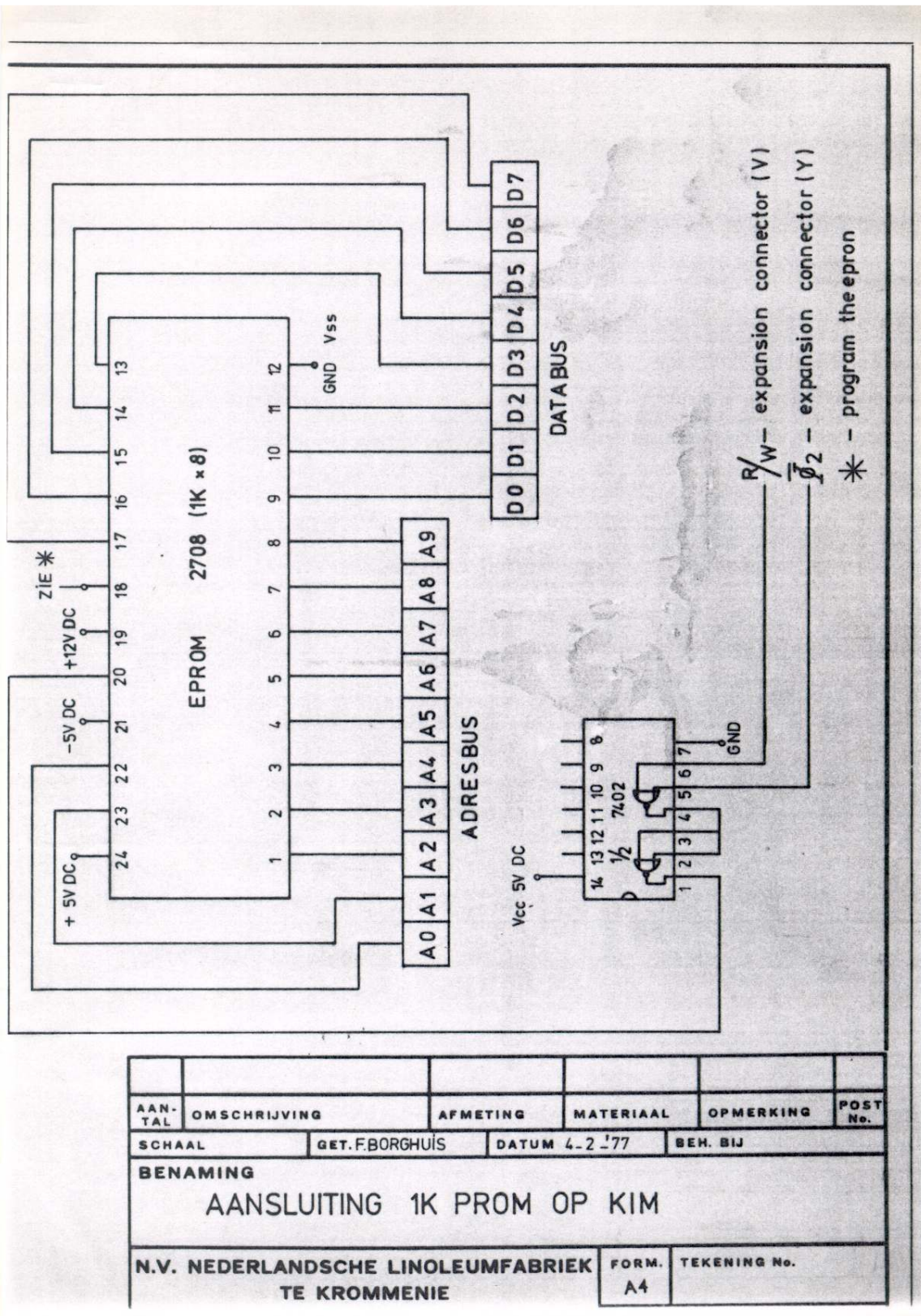
T4 KIM-1 expansion system



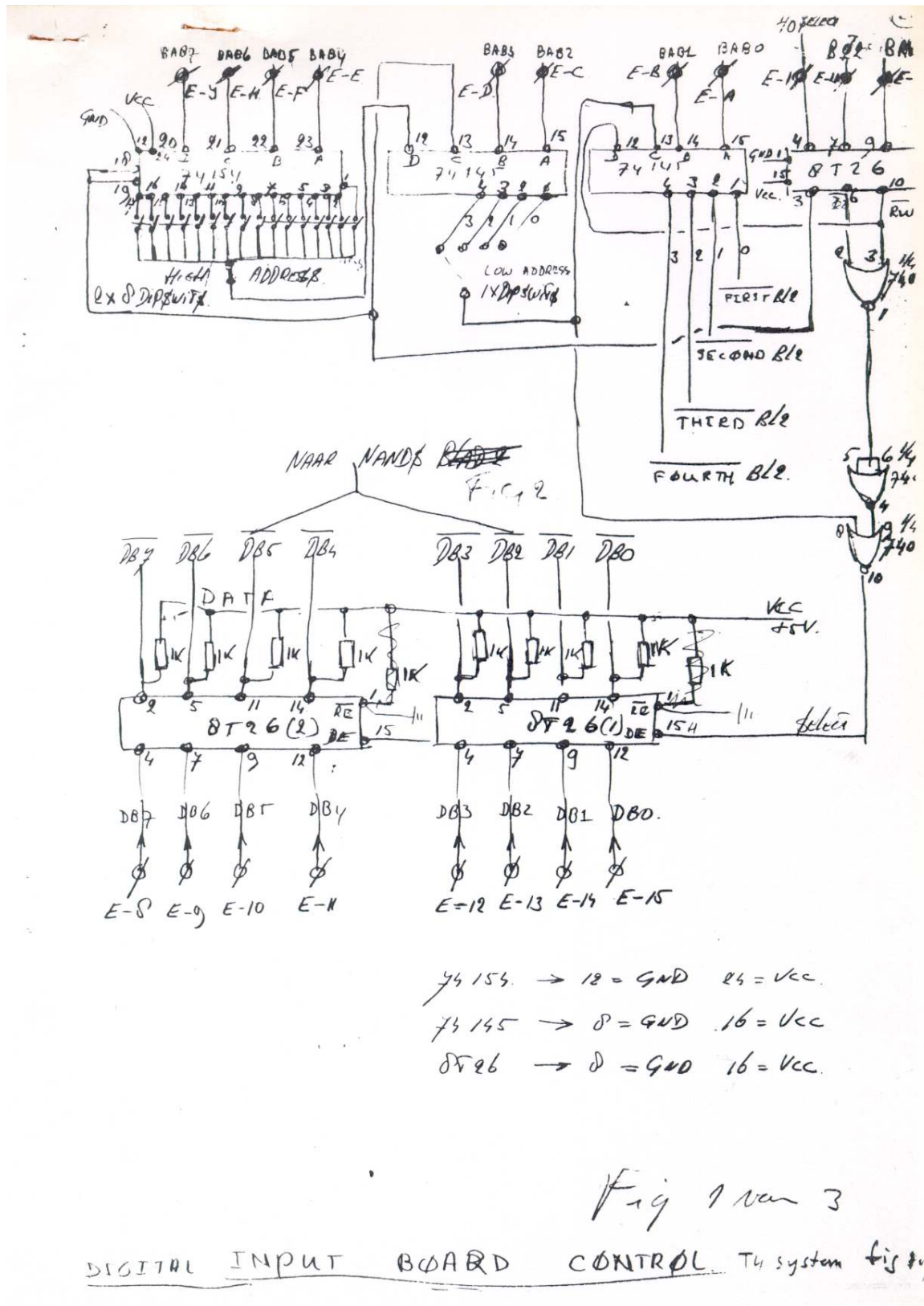
T4 KIM-1 expansion system



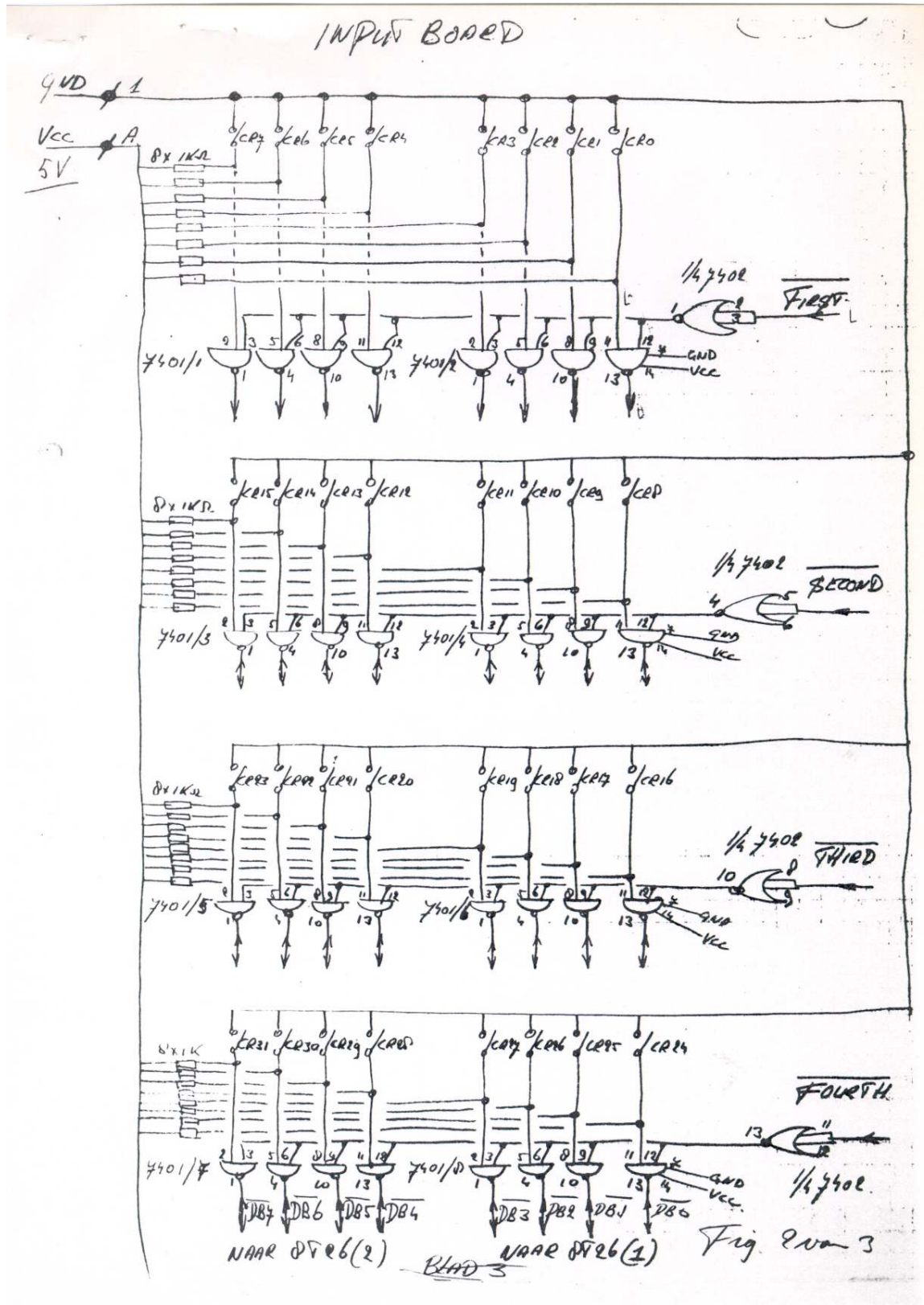
T4 KIM-1 expansion system



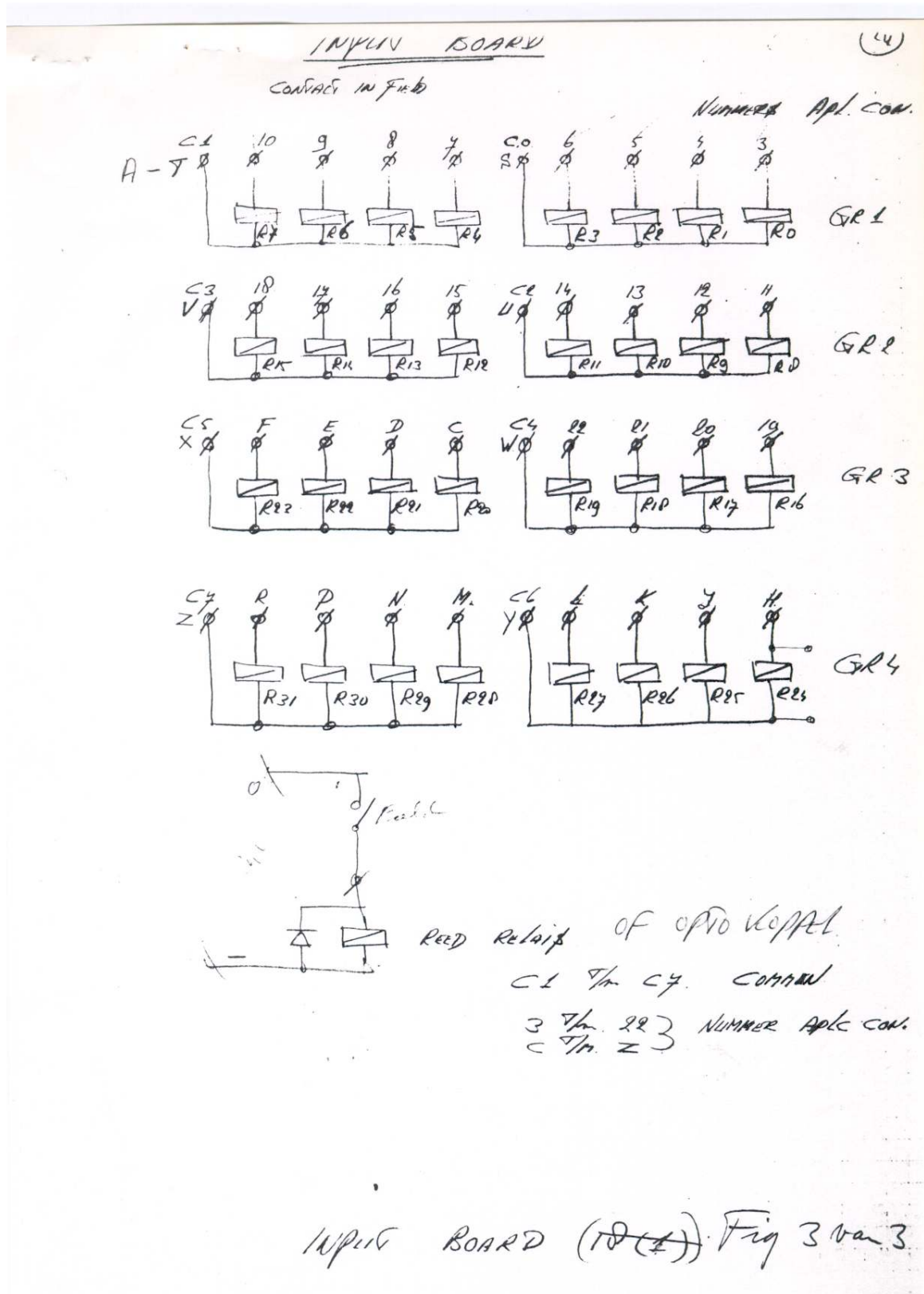
T4 KIM-1 expansion system



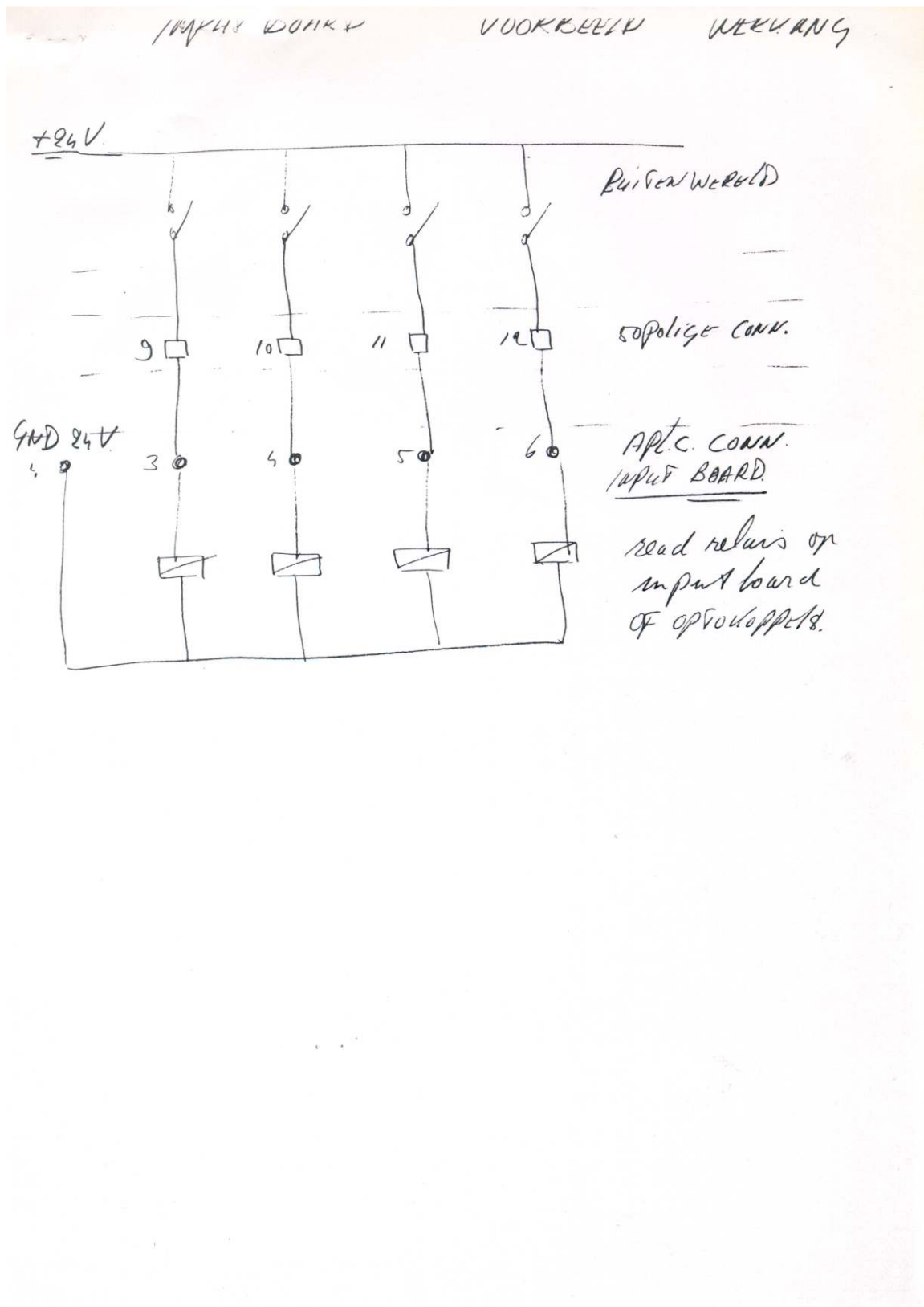
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system

INFLY BOARD

Appl conn.

A - 3 -
4 -
5 -
6 -
7 -
8 -
9 -
10 -
11 -
12 -
13 -
14 -
15 -
16 -
17 -
18 -
19 -
20 -
21 -
22 -
A - C -
D -
E -
F -
H -
I -
K -
L -
M -
N -
P -
R -
S -
T -
U -
V -
W -
X -
Y -
Z -

50 pin conn.

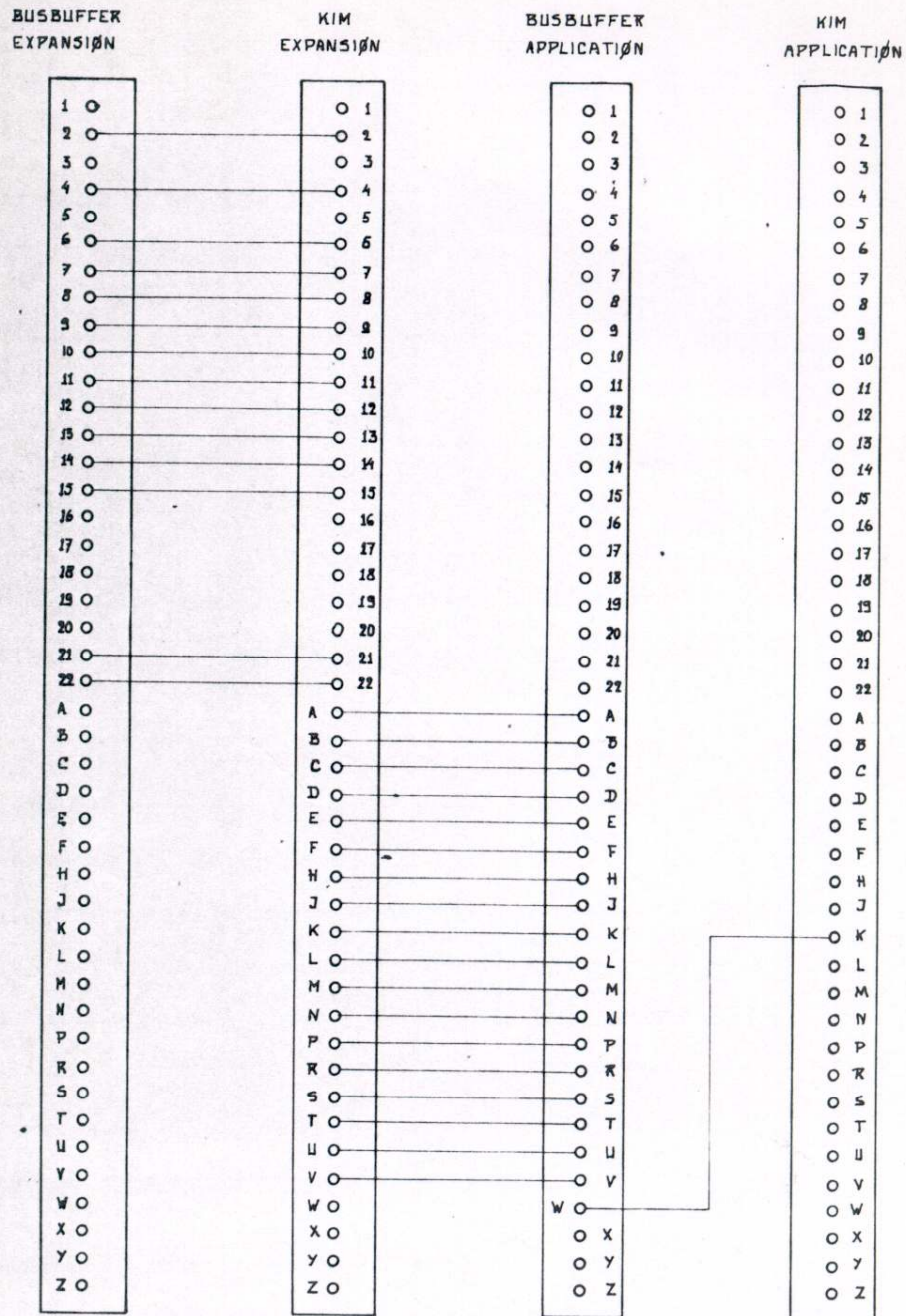
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48

ALG Volat imp. 1-2-3-4 (-24V)
" " " 5-6-7-8 "
" " " 9-10-11-12 "
" " " 13-14-15-16 "
" " " 17-18-19-20 "
" " " 21-22-23-24 "
" " " 25-26-27-28 "
" " " 29-30-31-32 "

T4 KIM-1 expansion system

		INPUT CONN 50 Pin 16	APPLICATION CONN. INPUT BOARD
INPUT	1	1	A-3
"	2	2	-4
"	3	3	-5
"	4	4	-6
"	5	5	-7
"	6	6	-8
"	7	7	-9
"	8	8	-10
"	9	9	-11
"	10	10	-12
"	11	11	-13
"	12	12	-14
"	13	13	-15
"	14	14	-16
"	15	15	-17
"	16	16	-18
"	17	17	-19
"	18	18	-20
"	19	19	-21
"	20	20	-22
"	21	21	-C
"	22	22	-D
"	23	23	-E
"	24	24	-F
"	25	25	-H
"	26	26	-J
"	27	27	-K
"	28	28	-L
"	29	29	-M
"	30	30	-N
"	31	31	-P
"	32	32	-R
		33	
		34	
		35	
		36	
		37	
		38	
		39	
		40	-S
		41	-T
		42	-U
		43	-V
		44	-W
		45	-X
		46	-Y
		47	-Z
		48	
		49	
		50	
ALG.		1-2-3-4	
"	V	5-6-7-8	
"	V	9-10-11-12	
"	V	13-14-15-16	
"	V	17-18-19-20	
"	V	21-22-23-24	
"	V	25-26-27-28	
"	V	29-30-31-32	
ATTN AAN GND 24 Volts			
			Application CONN
			A-A = VCC 5V
			A-B = N.C.

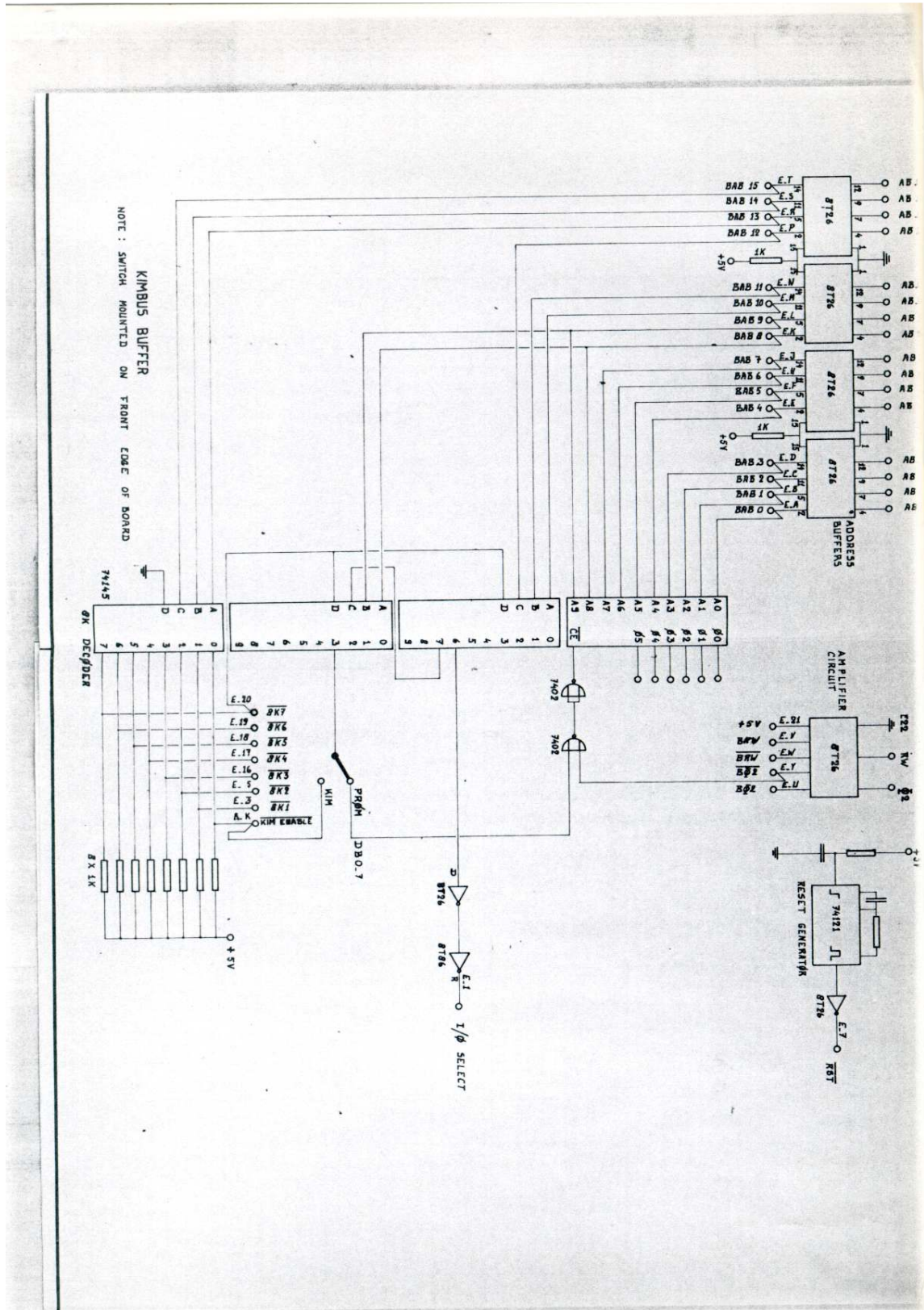
T4 KIM-1 expansion system



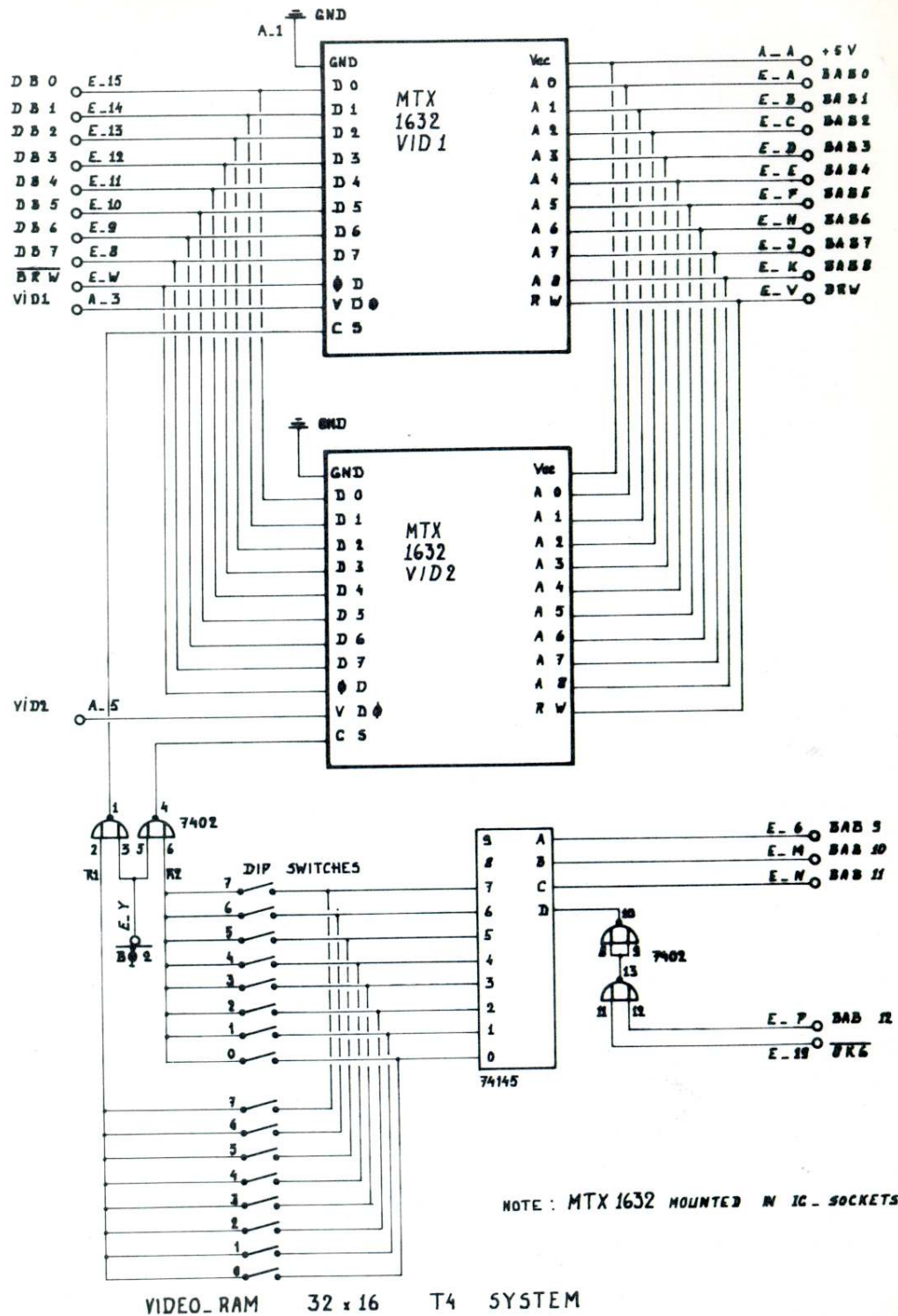
ALL OTHER MODULES IN THE SYSTEM HAVE THEIR
EXPANSION CONNECTOR WIRED PIN FOR CORRESPONDING
TO THE BUSBUFFER EXPANSION CONNECTOR.

WIRING KIM / BUSBUFFER

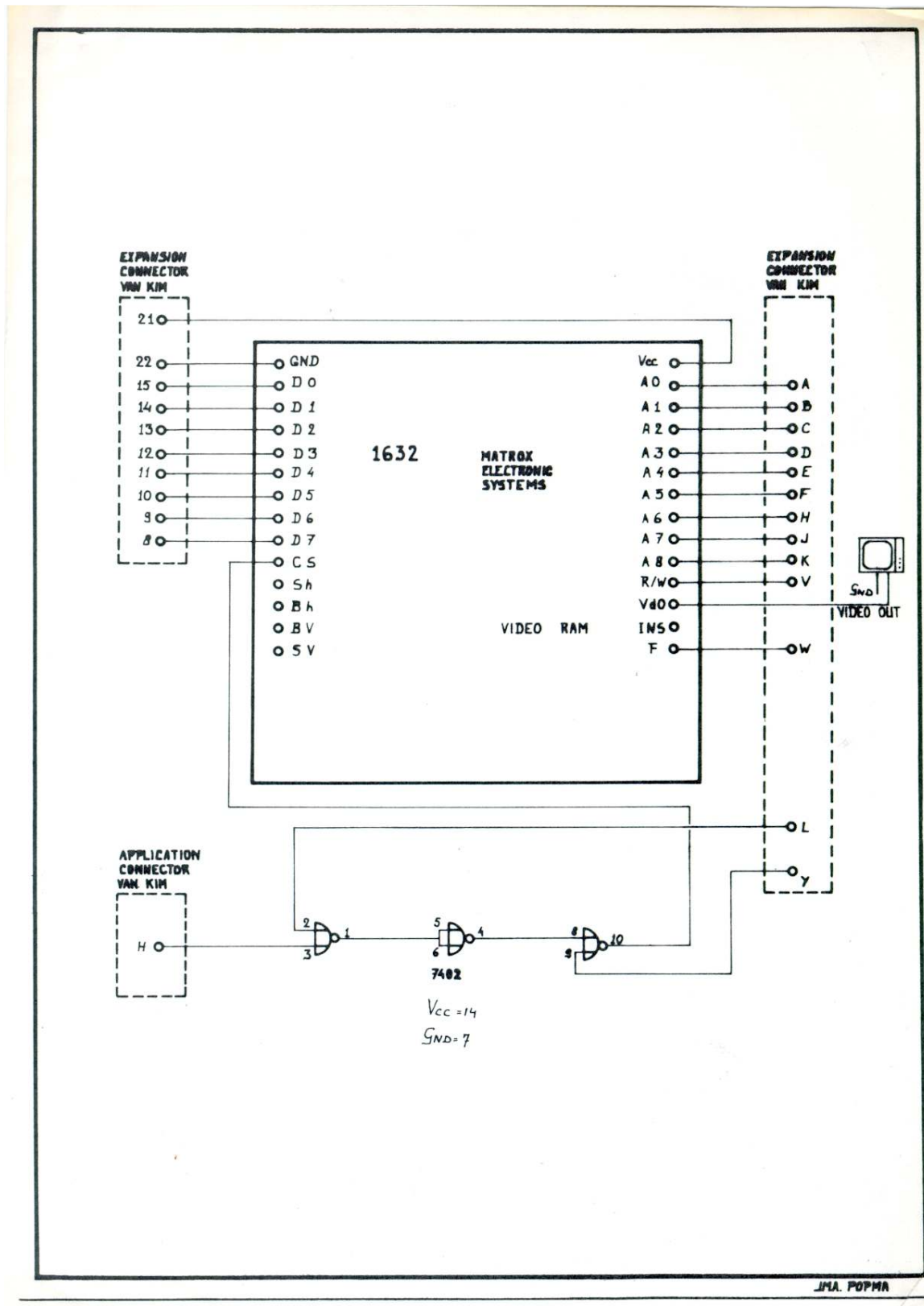
T4 KIM-1 expansion system



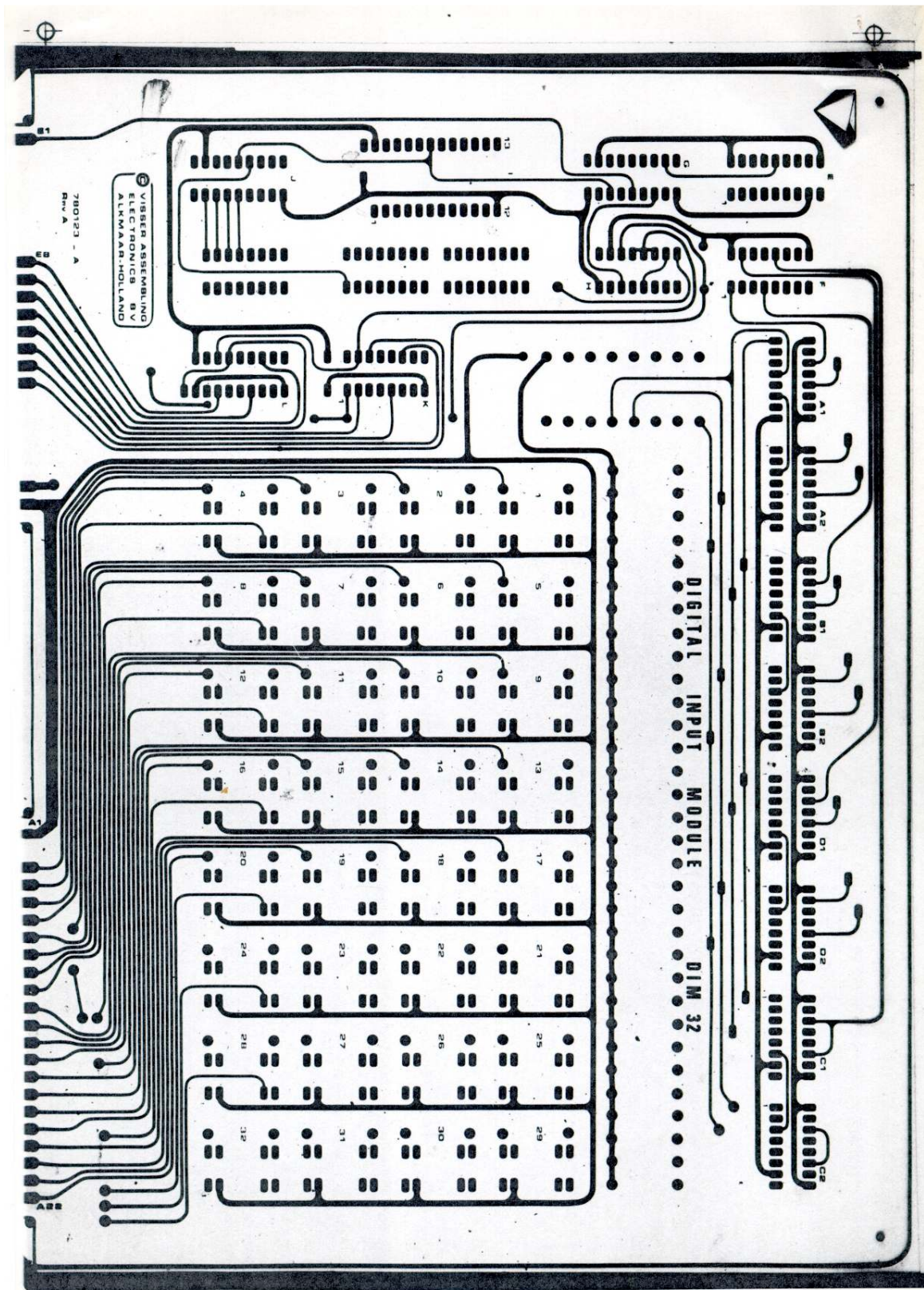
T4 KIM-1 expansion system



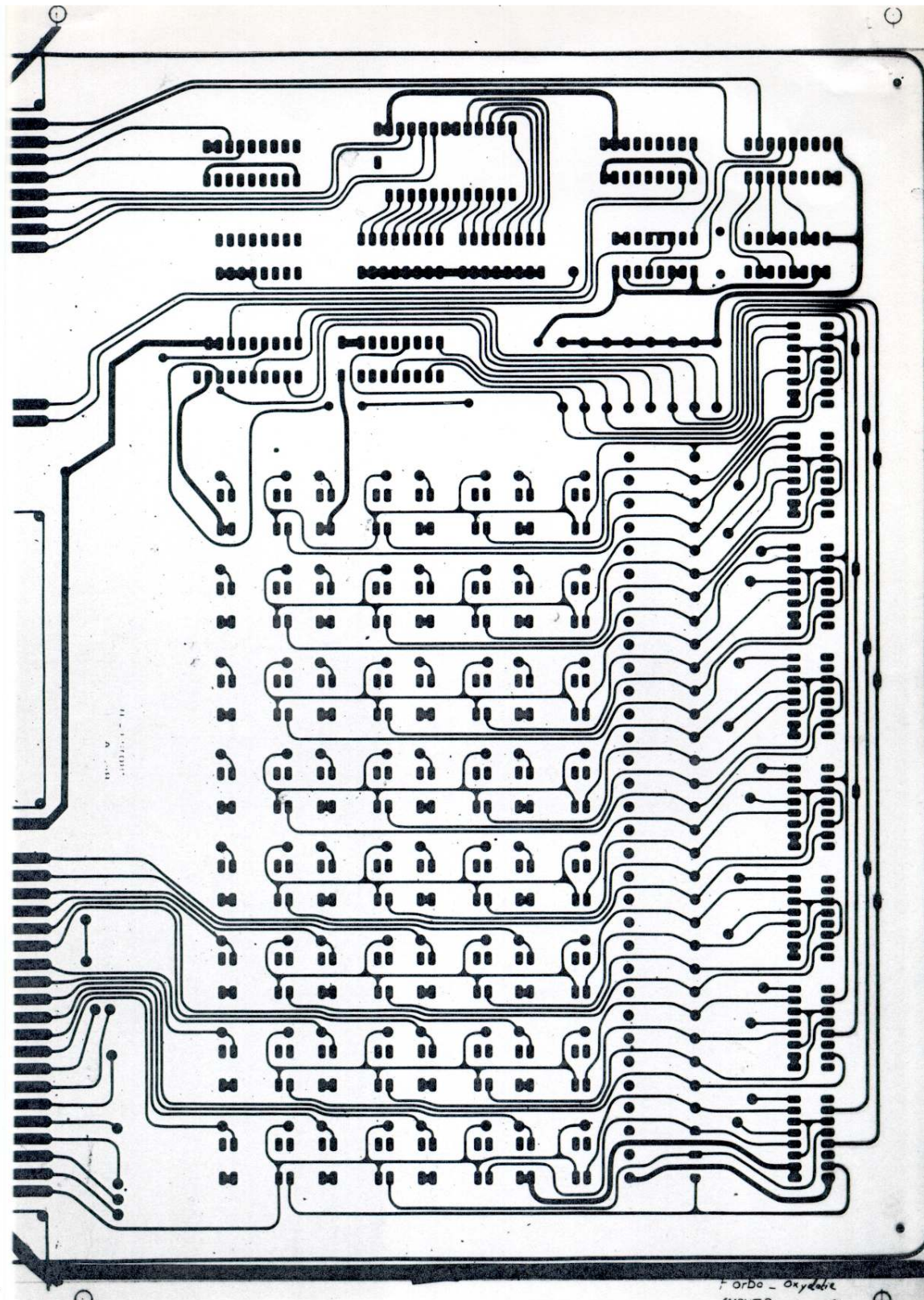
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system

BUFFER BOARD

Schwarzer

014409.

MONITOR PROGRAM. "H.M."

§ 44a Vehicle

NIR

START ADDR IN PROM BUFFER BOARD

ADR. PRGM: BUFFERBAND → FC00 - FFFF

RESERVED VECTOR

FFFC.

FFFD

low.

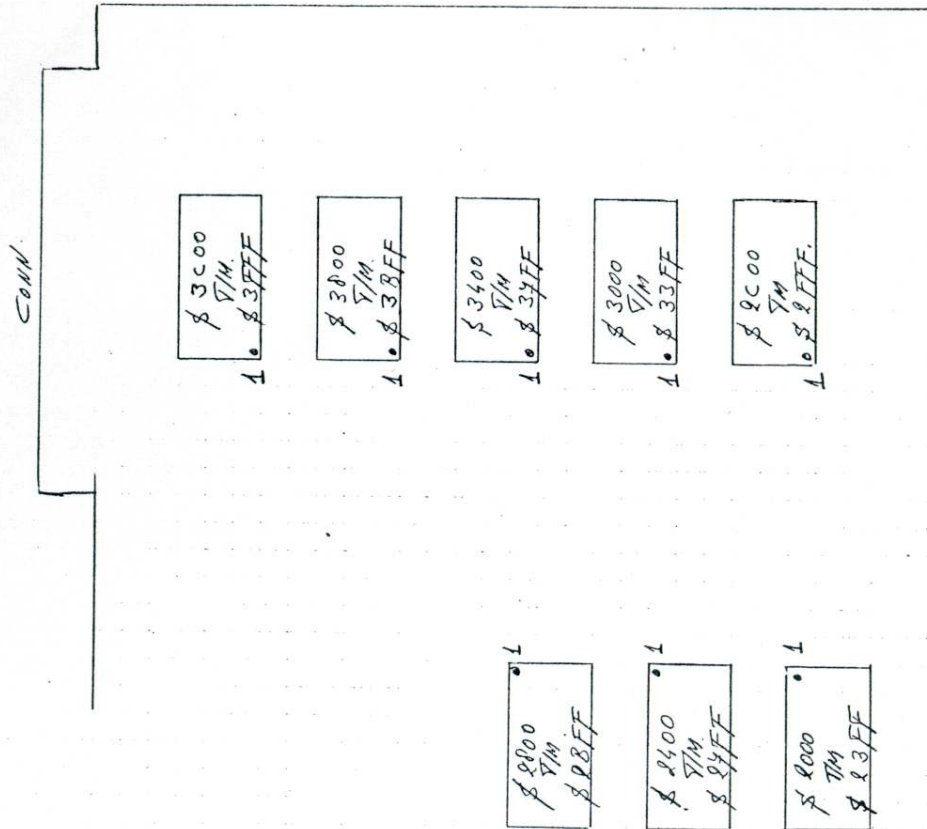
17

Dr. 4000 - 00.

20

Bylage alg. T4 map
adres Selectiegevens

T4 KIM-1 expansion system

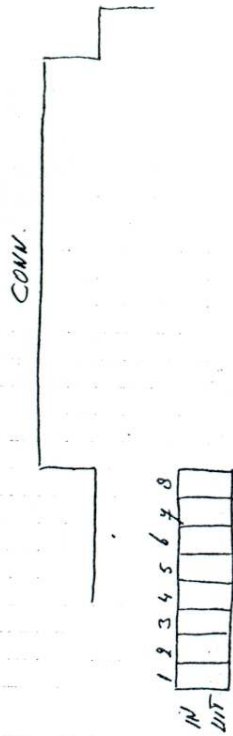


From. operating
EN. INDELING.

T4 KIM-1 expansion system

SELECTIVE FROM BOARD.

SELECTIVE SWITCH.



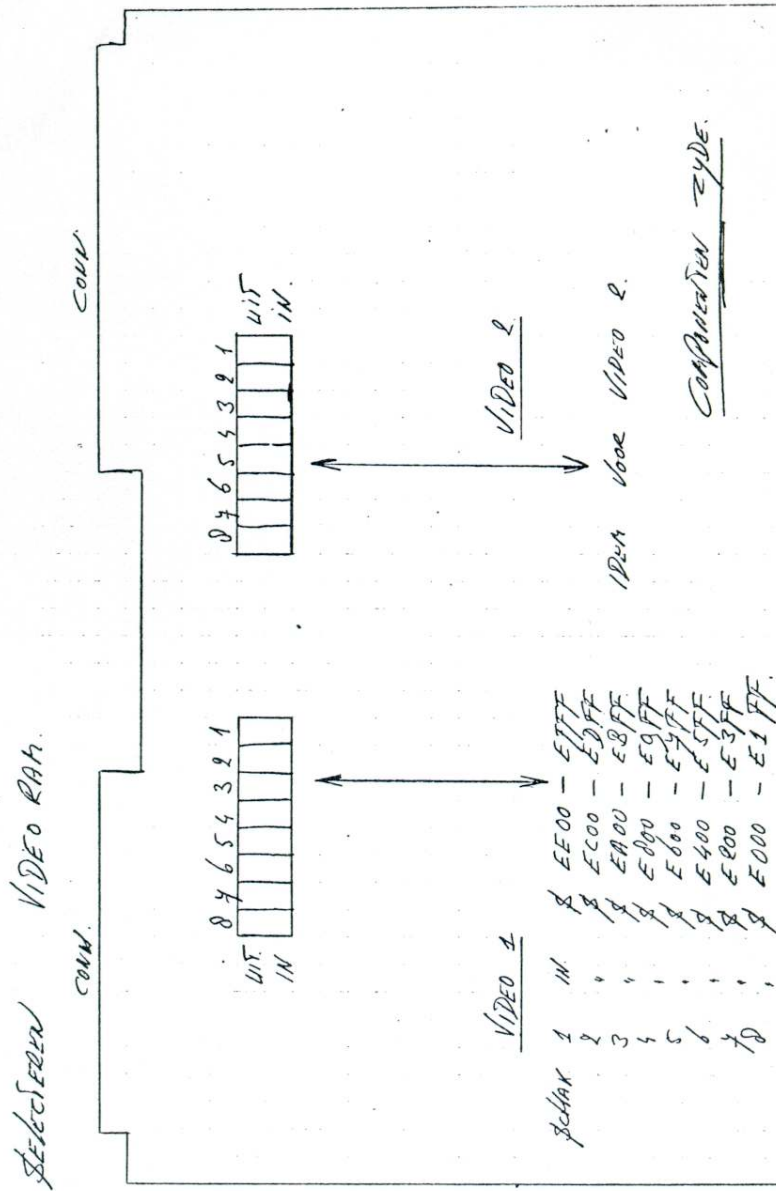
FOR SELECTION OF IN ALL MODES OF I/O.

SELECTOR

2	N	4000	1/4	5 FFF
3	"	2000	1/4	3 FFF
4	"	1000	1/4	FFF
5	"	0000	1/4	D FFF
6	"	A000	1/4	B FFF
7	"	8000	1/4	9 FFF

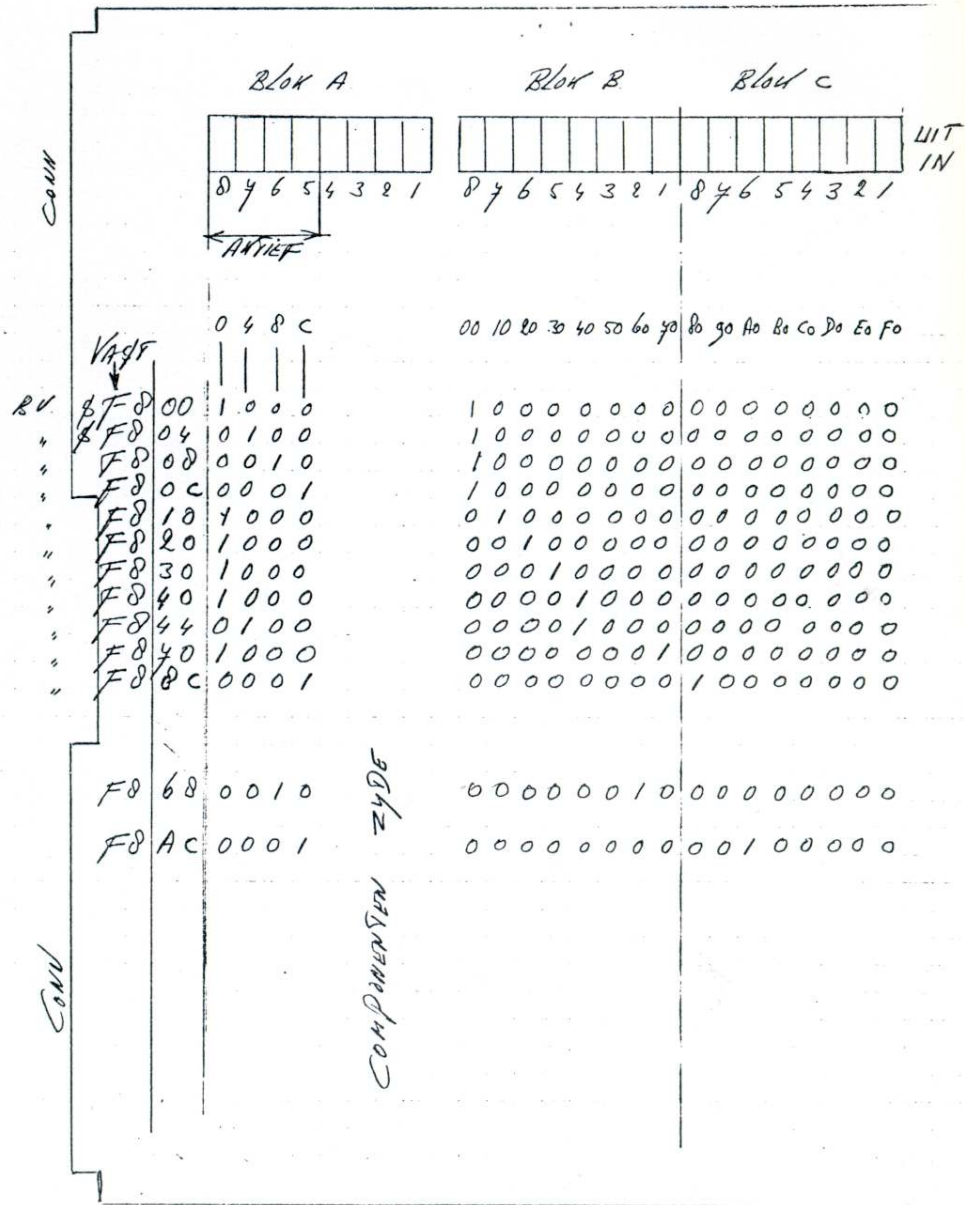
CON. POK. 24DE.

T4 KIM-1 expansion system

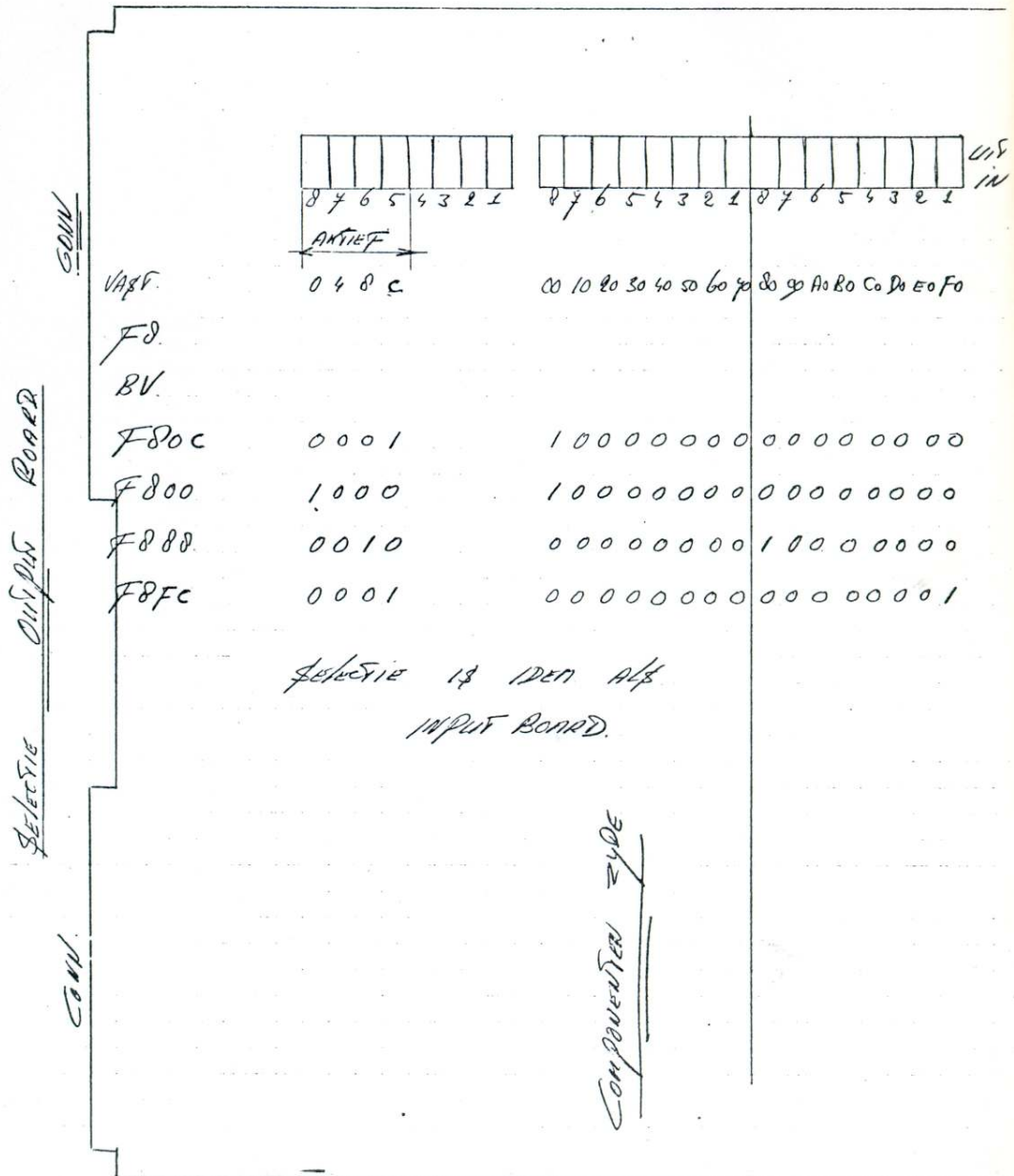


T4 KIM-1 expansion system

SELECTED INPUT BOARD



T4 KIM-1 expansion system



LET OP

By OUT PUT MODELLE

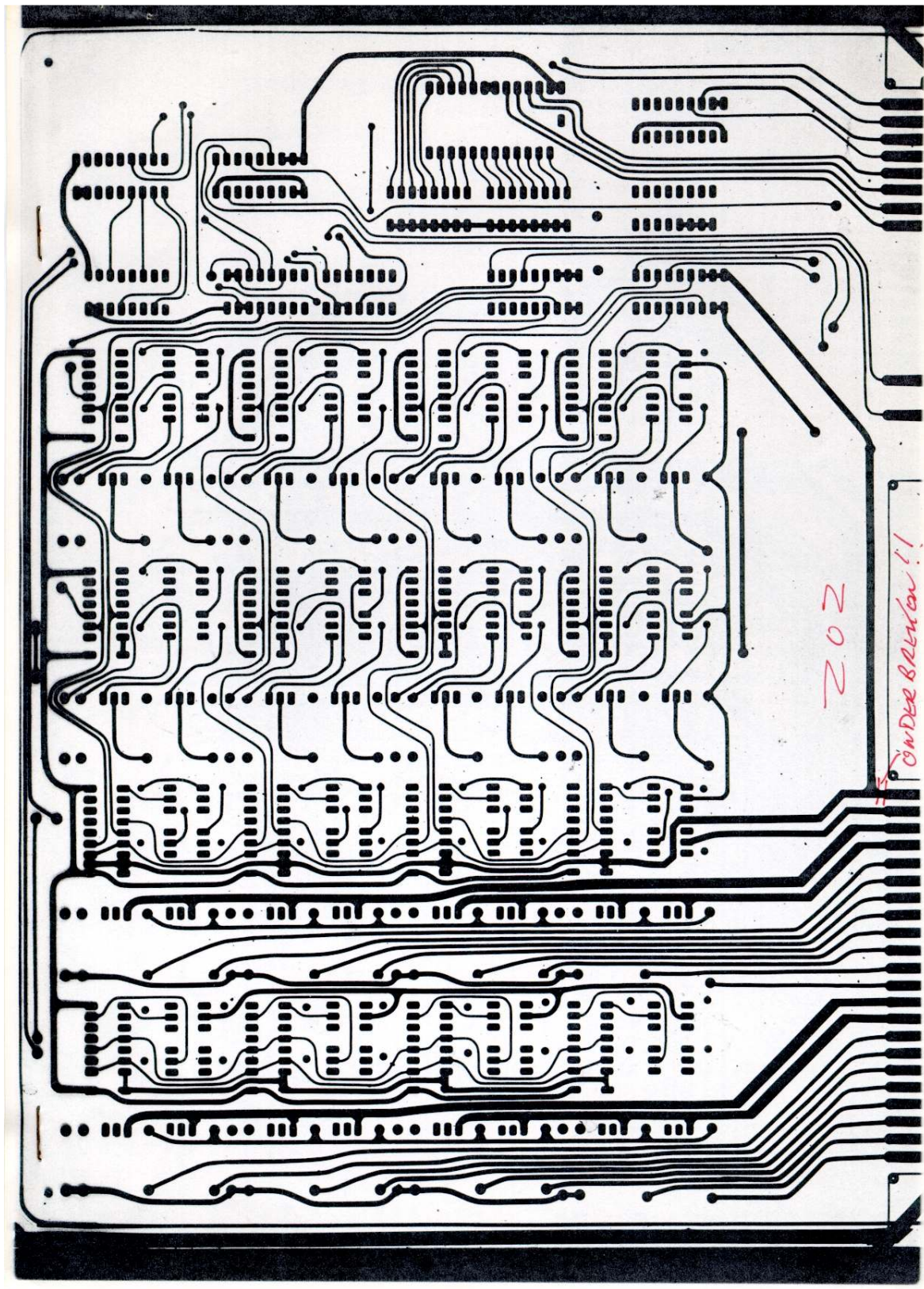
2 BANEN ONDER BREKEN
ZOA/B IN ROOD AANGEGEVEN.

OP LAY OUT

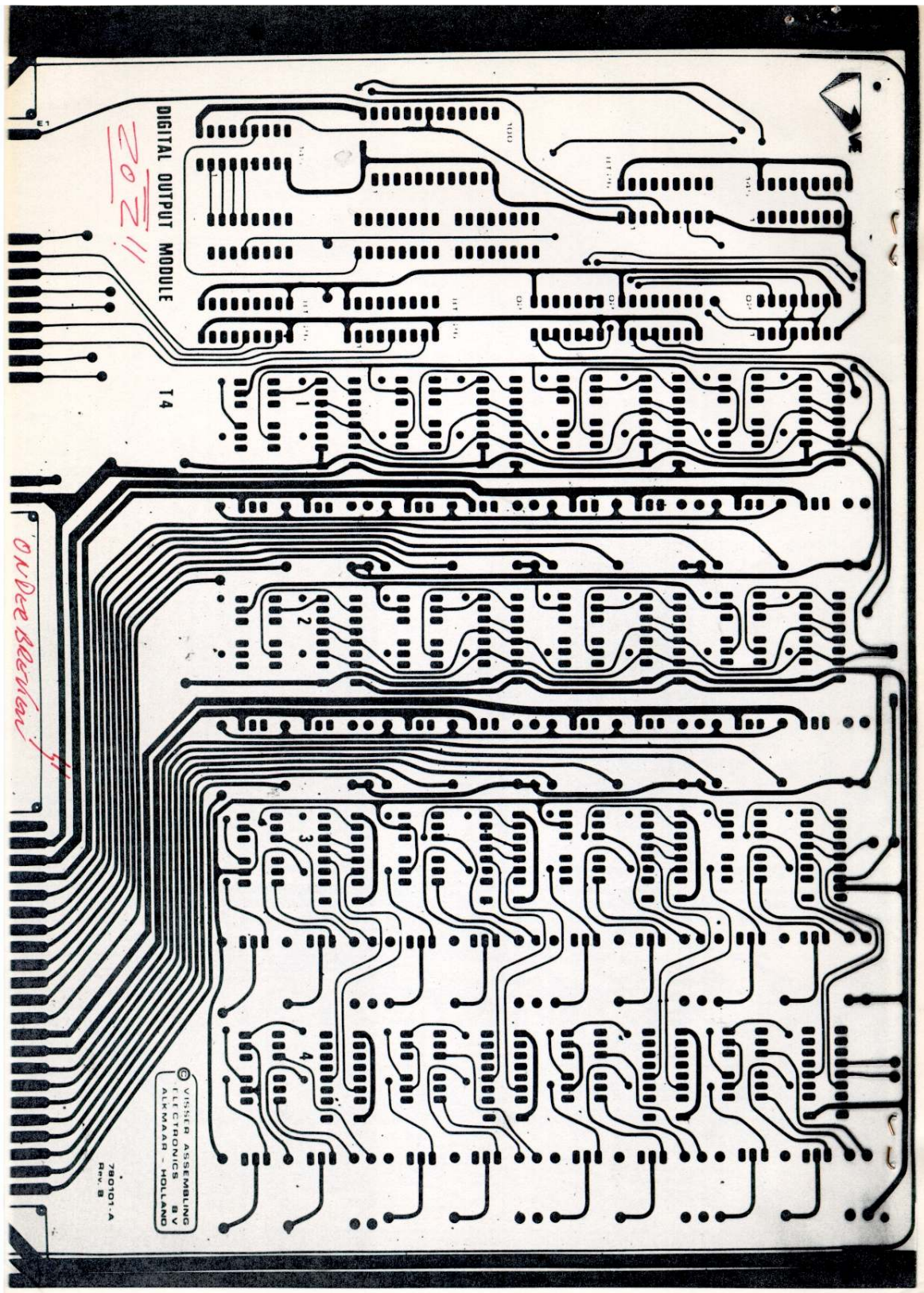
DIT N.N.M. EXTERNE

26 V = SPANNING
↓
GELYK

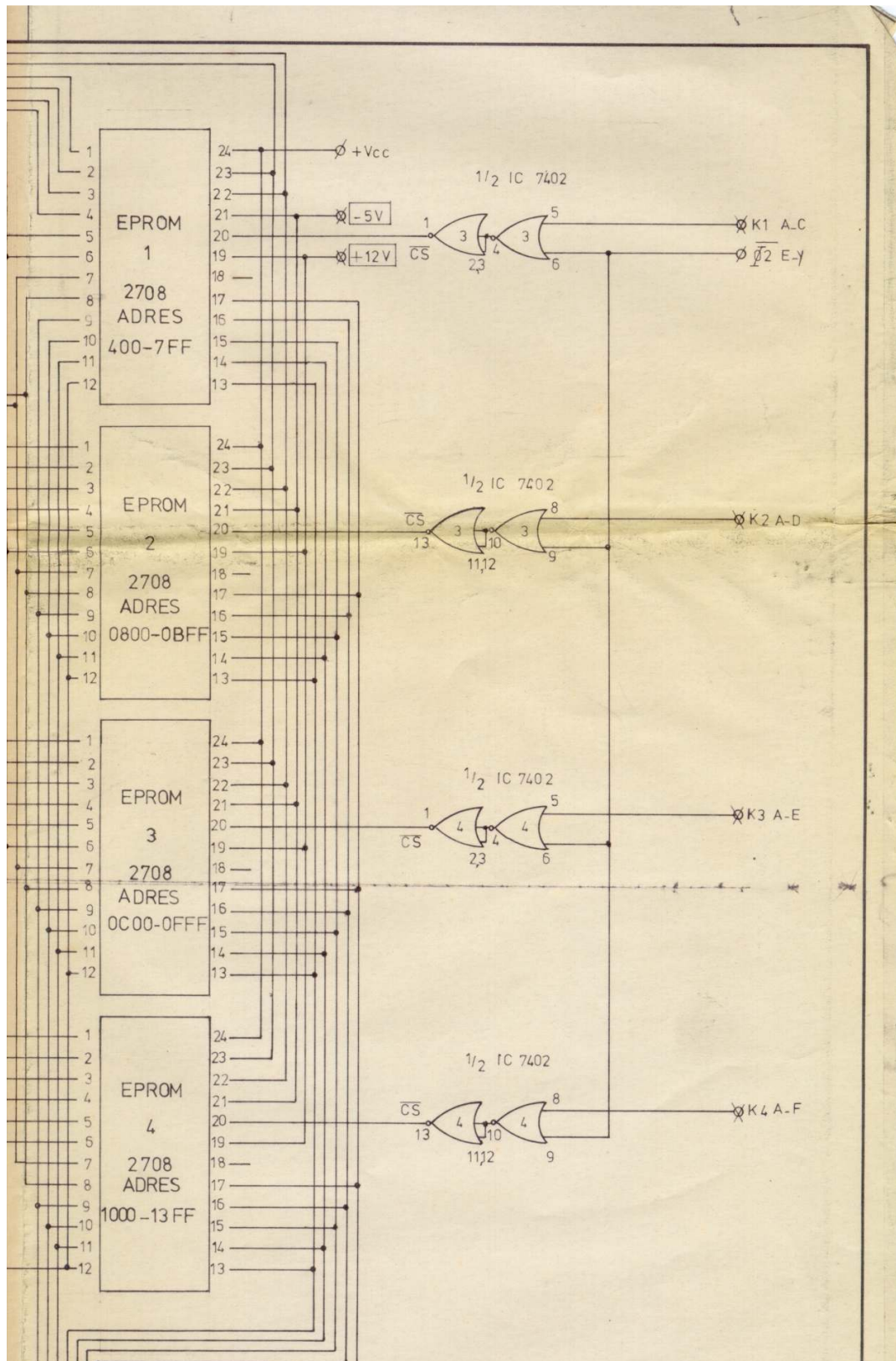
T4 KIM-1 expansion system



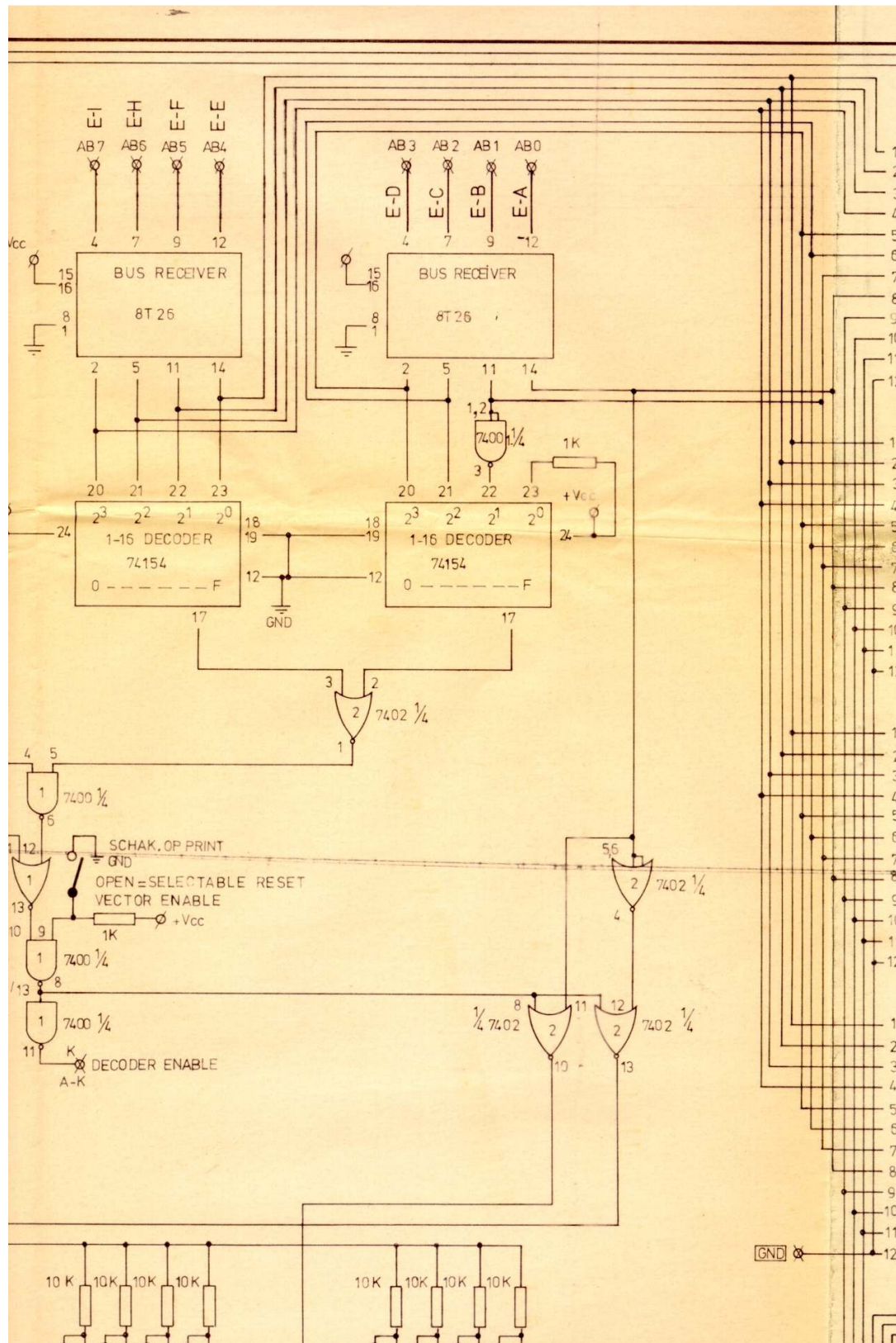
T4 KIM-1 expansion system



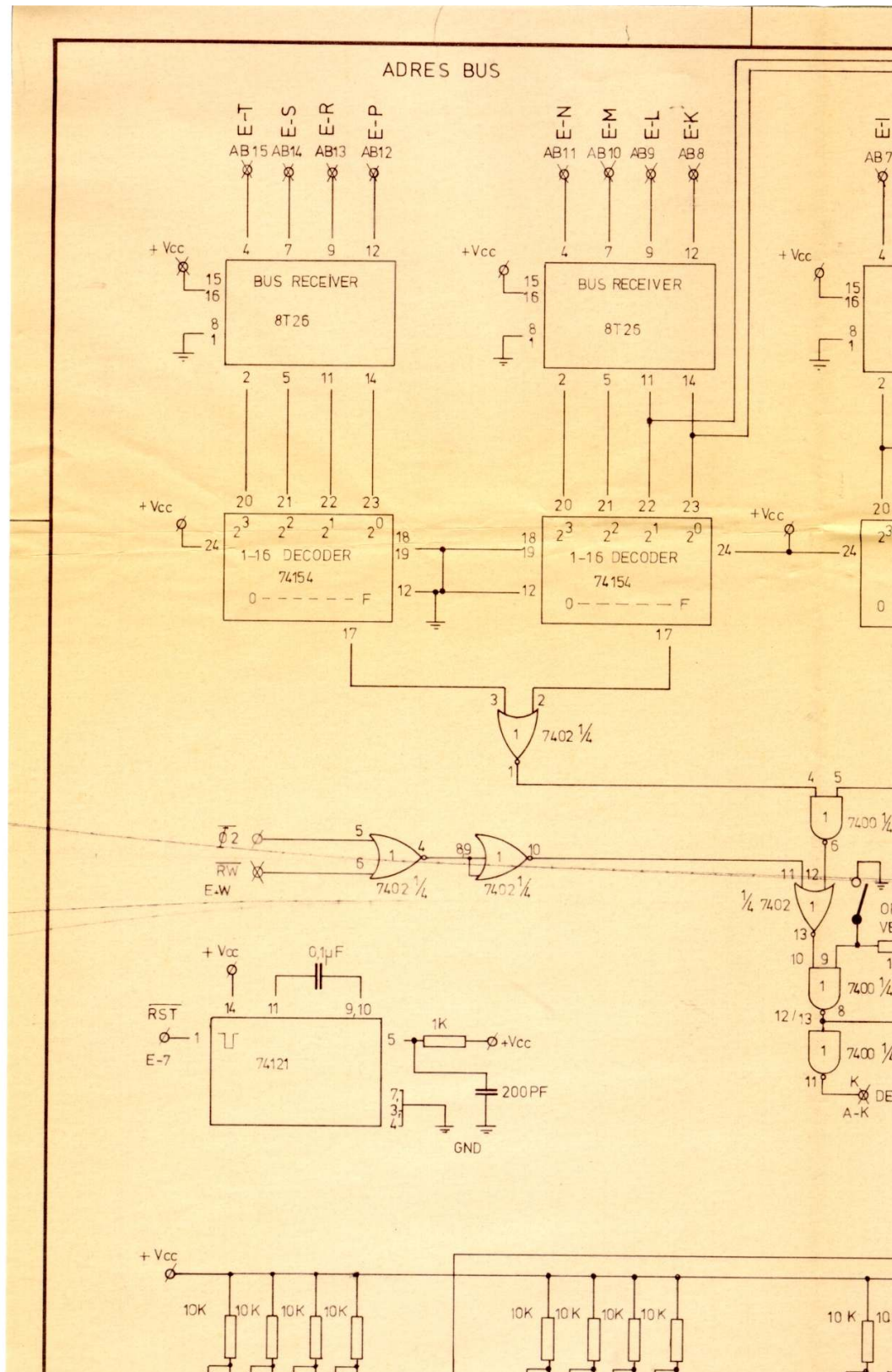
T4 KIM-1 expansion system



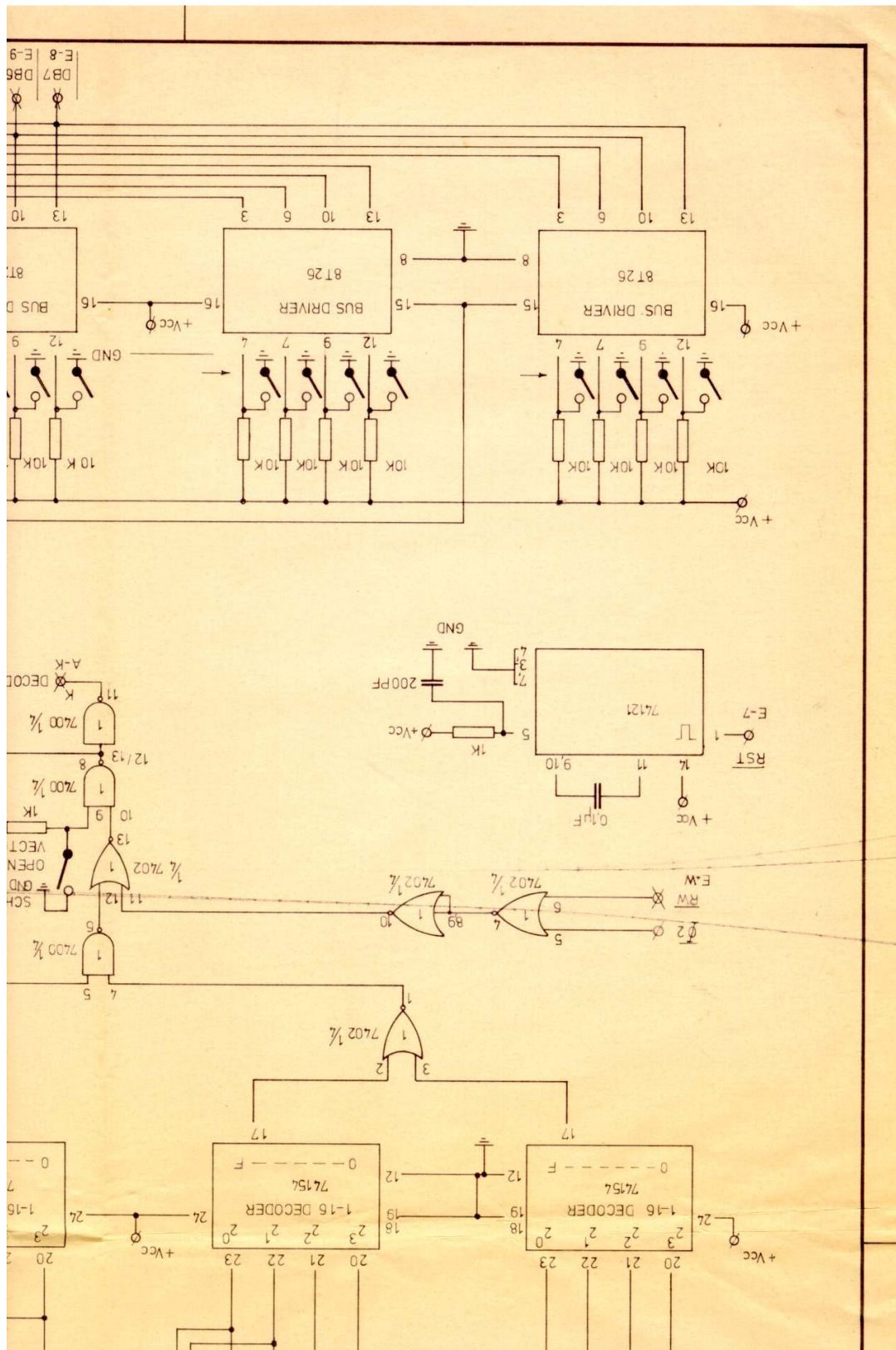
T4 KIM-1 expansion system



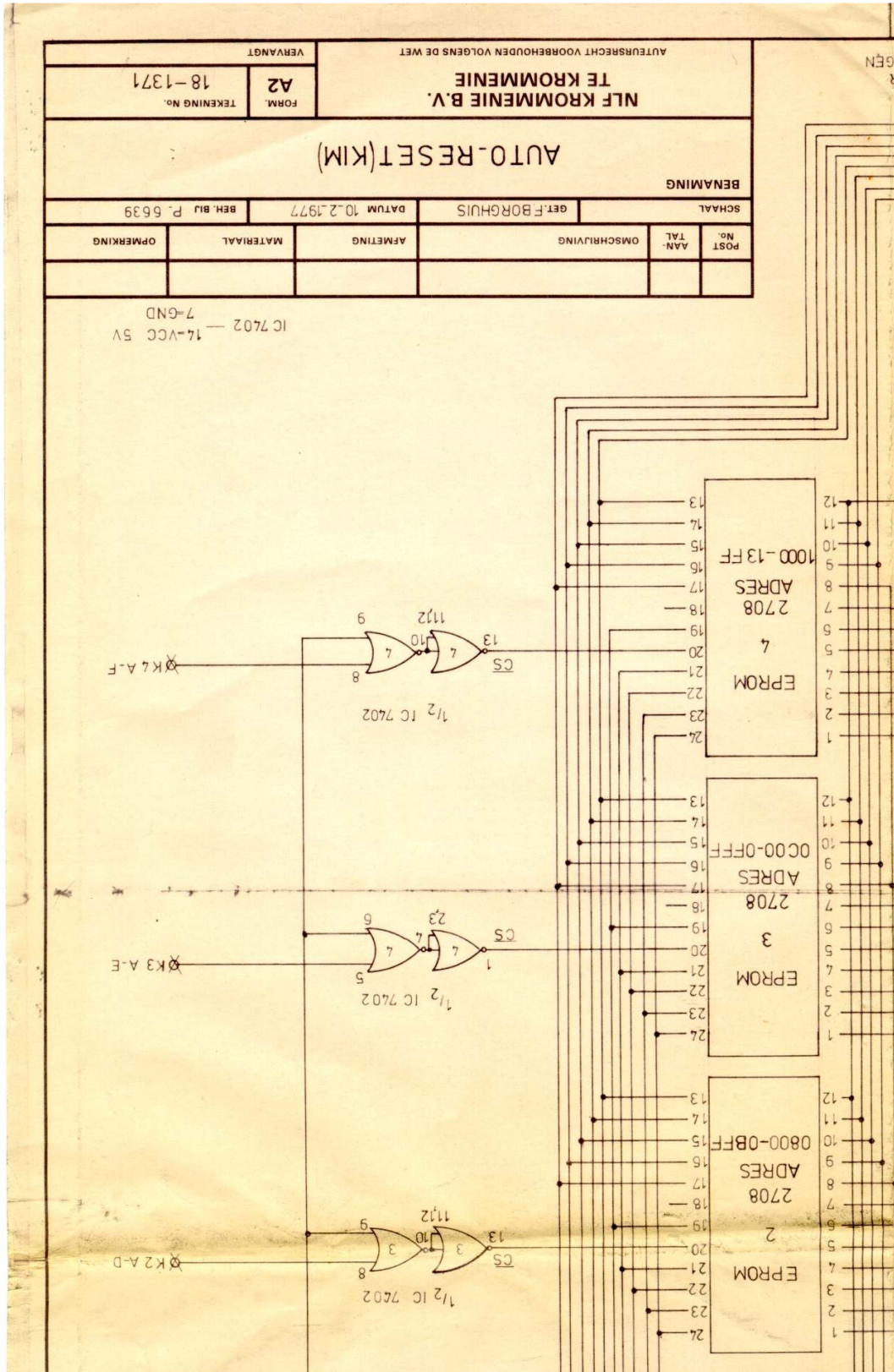
T4 KIM-1 expansion system



T4 KIM-1 expansion system



T4 KIM-1 expansion system



V.A.E. BV

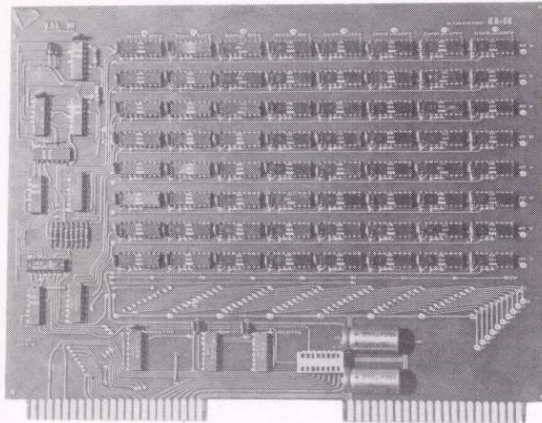
TOUSSAINTSTRAAT 7

ALKMAAR



TEL: 072 — 126652

PRELIMINARY DATA:



NEW !

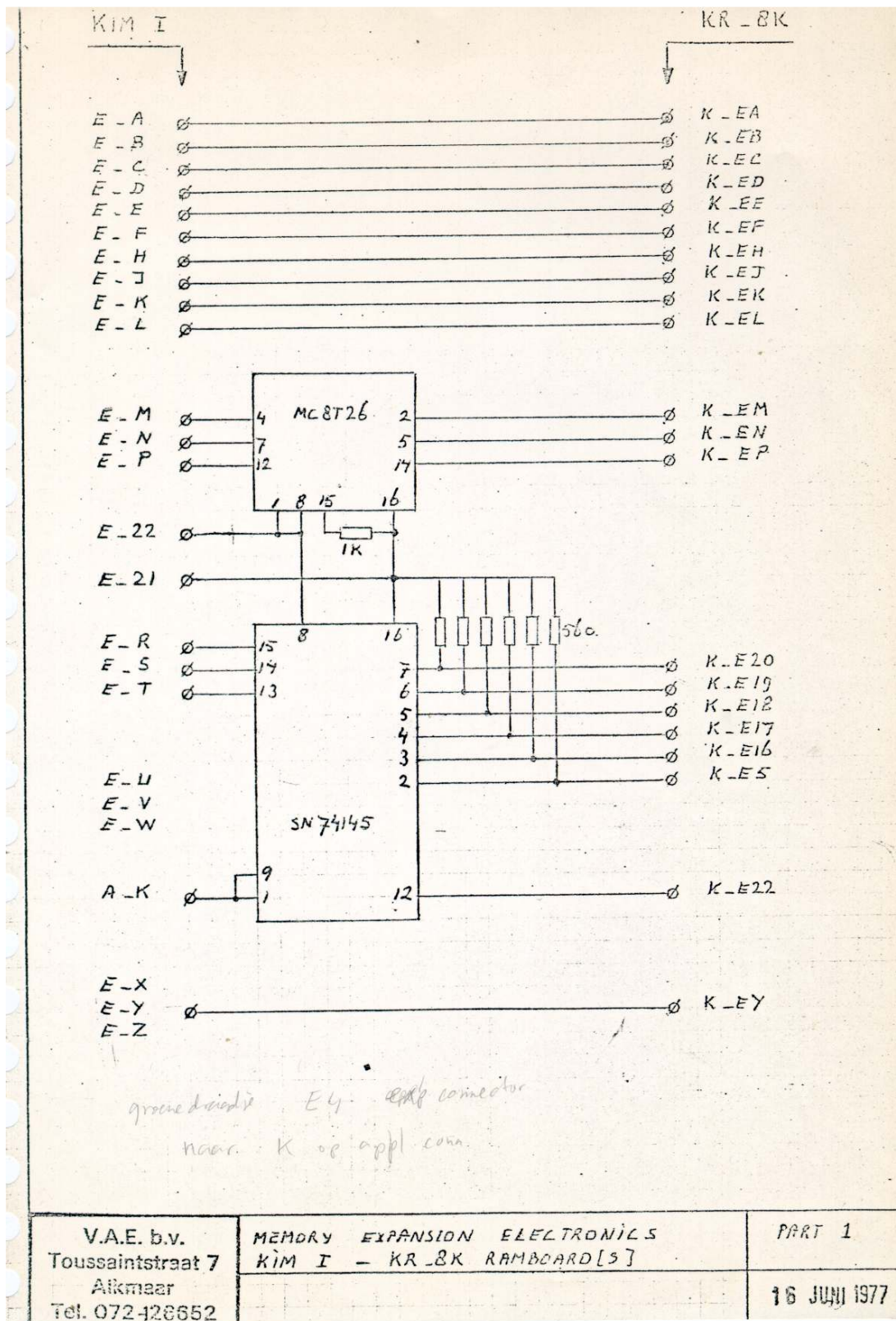
RAMBOARD

KR 8K

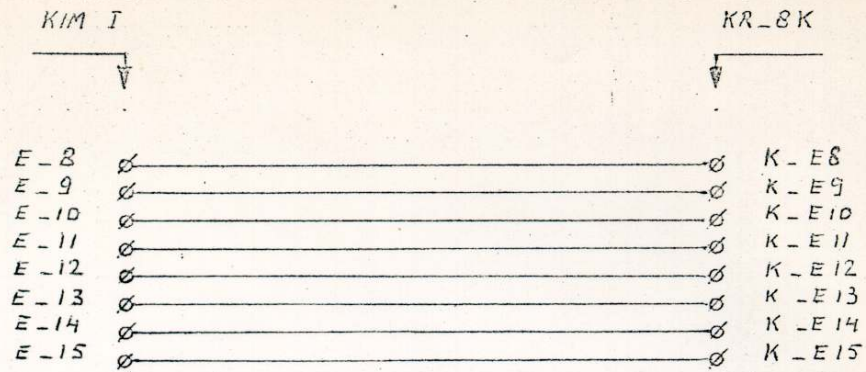
KR 8K RAMBOARD FOR KIM I MEMORY EXPANSION

- Fully buffered address bus
- Fully buffered data bus
- Fully assembled and tested
- Board select dip switch on the board
- With ram/rom switch
- Select indication LED on board
- Power required: Only 5 volt - 2 ampère
- Price: On request
- Delivery: Within four weeks

T4 KIM-1 expansion system



T4 KIM-1 expansion system



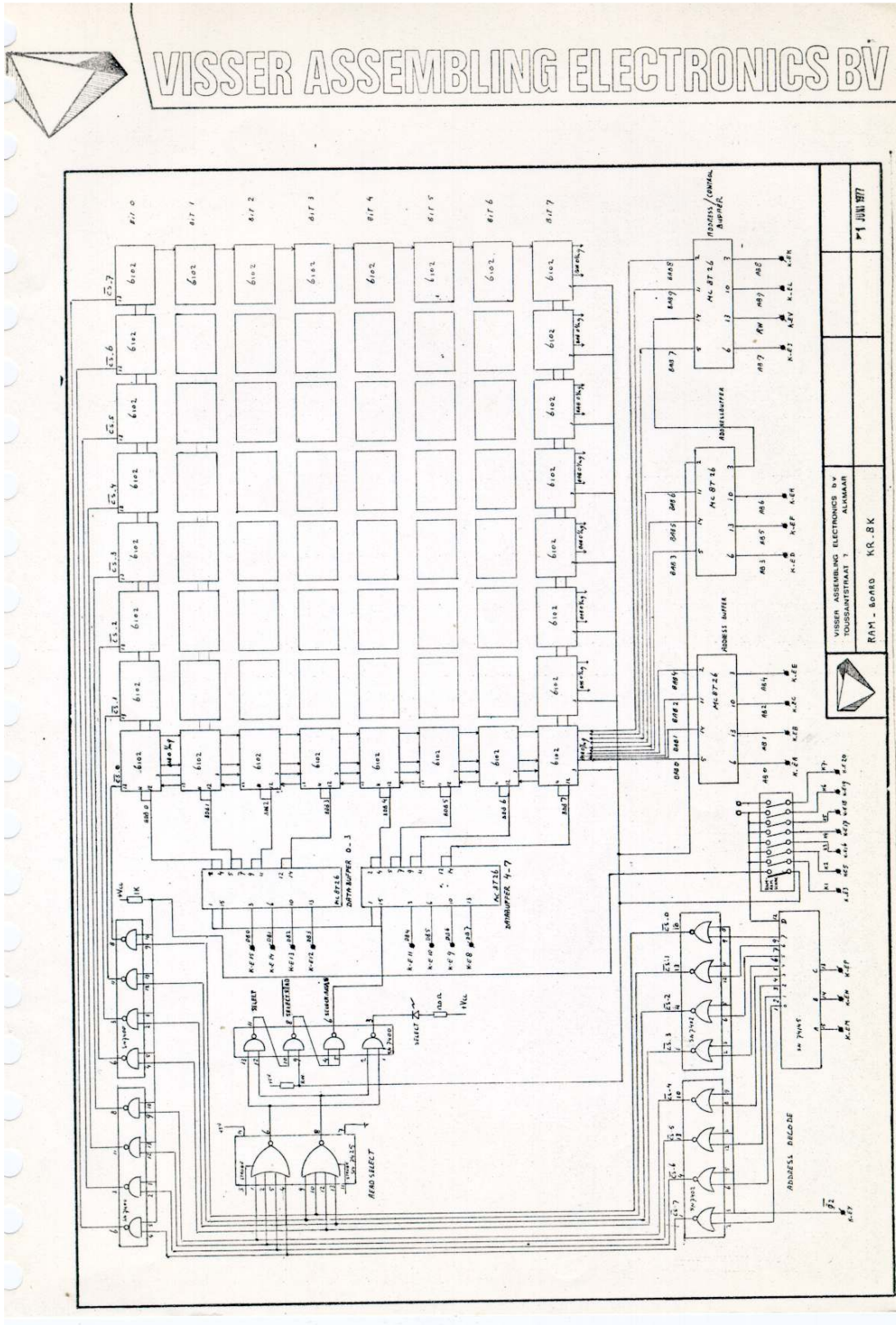
V.A.E. b.v.
Toussaintstraat 7
Alkmaar
Tel. 072-426652

MEMORY EXPANSION ELECTRONICS
KIM I - KR-8K RAMBOARD [S]

PART 2

16 JUNI 1977

T4 KIM-1 expansion system



T4 KIM-1 expansion system

