

Service Manual

INTRODUCTION

This Service Manual has been put together to enable you to give your customer fast and dependable service with a minimum of difficulties for yourself. The reason you will be able to service this machine so efficiently is because all really time consuming problems that can turn up will probably be located on one of the two digital boards (I/O or Prozboard). These boards are so incredibly complex that, apart from very few exceptions, they have to be swapped if something goes wrong with them.

The machine is a fully digital synthesizer with analog filters. All its functions (e.g. waveform processing and sound modification) are controlled and executed by a computer.

What makes the WAVE what it is are the four boards plugged into the motherboard.

The heart of the machine is the CPU 6809 which is located on the I/O BOARD. Its intelligence (the machine program) is stored in four 2764 E-PROMS. They are plugged into sockets on the I/O BOARD and labeled 8, A, C, E. These are the E-PROMS that are exchanged in the event of a SOFTWARE UPDATE. Next to them you find the 2 E-PROMS labeled 4 and 6 which contains the WAVEFORM DATA.

The following manual should be sufficient help for you to restore a PPG WAVE to its normal working condition.

SOUND MISTAKES

In general there are two different kinds of sound mistakes that can arise in the PPG WAVE 2.3.

- a) Mistakes that occur in the computer.
- b) Mistakes that occur because of a defect in one of the 8 digital dual oscillators.

Here is a relatively easy test to determine which case is at hand:

- Turn on the machine and find a suitable sound in keyboard mode 0
- Press a key and hold it to determine if the sound is alright.
- After the keyboard has been turned on oscillator No. 1 is activated as soon as a key is pressed. Releasing the key and pressing it a second time activates oscillator No. 2. This makes it possible to step through the 8 oscillators one after the other.
- If the sound mistakes can be heard in regular intervals. (every eight time the key is pressed) the problem is probably a defect in one of the oscillators.
- If the mistake arises erratically it is usually a mistake in the computer.

A third problem can come from sounds that the customer has created himself. Certain natural electro acoustic effects (e.g. the modulation of certain parameter) can cause sound distortions that are than attributed to a defect in the synthesizer.

There are two ways to determine whether this is the case:

- a) Load the factory sounds from tape into the WAVE.
- b) Load the customer's sounds into a different WAVE and compare them to each other.

VARIOUS COMPONENTS OF THE WAVE 2.3 / 2.2

• 1) Power supply

The power supply consists of a transformer with an input of 220 V or 110 V (depending on the switch on the back panel) and outputs of 2 x 15 V with a common ground lead and a 1 x 10 V secondary.

These a.c.'s are converted to the following d.c.'s:
+12 V, -12 V and +5 V.

The voltage controllers 7812 and 7912 are on the mother board, 78H05 is mounted on the back panel.

The 5 V are converted to a higher voltage for the LCD. This current is an alternating current.

2) Analog panel

On the analog panel board are the corresponding pots and an mpx circuit.

Not on the board are the pots for "Master volume" and "Basis"

The adjustments for these pots cannot be stored in memory.

3) Digital Panel (TAS - board)

a) On this board is a PLA-circuit for the LC-display. This PLA communicates also with the "Numerical" and the "Display Select" keypads.

b) The "Intensity"-Pot for the LCD.

• 4) I/O Board

The following circuits and components are on this board:

- a) The A/D converter that changes the voltages from the analog panel board to digital values.
- b) Part of the Midi interface. The interface's buffer and optically coupled isolator are on a separate board mounted on the rear panel of the machine. Also mounted on this board is a resistor network and the jack sockets for the channel outputs.
- c) The multiplex keyboard interface.
- d) The connection to the digital panel.
- e) The RAM banks for the internal sound, the combi-program and the sequencer data. The power for these banks is supplied by a 4.8 V accumulator.
- f) The operating system E-proms (labeled: 8,A,C,E) and the wavetable E-proms (labeled: 4 and 6).
- g) A trimpot to adjust the range of all the pots on the analog panel board. The maximum value for these pots is "63" when turned to the extreme right. The adjusted value can be seen in the LCD.
- h) Three additional D/A converters that supply the power for the ADSR envelopes of the VCA, the VCF and the Resonance which are all on the voice cards. There are also various computer components on the board such as a CPU, a PTM, a VIA and a PIA.

• 5) PROZ Board

On this board in a PIA circuit for the "PPG - Communication Bus", the sound bank RAMs and various TTL and PAL components for the "Sound computer".

• 6+7) Voice Boards

On these 2 identical boards, that each hold 4 of the 8 voices, are the following circuits and components:

- 4 twelve bit D/A converters
 - 4 VCF ICs, model: SSM 2044
 - 2 Double VCAs, model: CEM 3360
 - A row of operational amplifiers, model: TL 084
 - Analog switches, model: CD 4066, for the processing of the envelopes.
 - Trim pots to adjust filters, resonance, cut off
- There are pots for each voice.

• 8) MB Mother Board

On this board are:

Parts for the +12V / -12V power supply

The power-on-reset circuit

The sync. in/out circuit

The after touch sensor circuit

The Audio Output matrix

The cassette interface circuit

PPG WAVE 2.3 ADJUSTING INTRODUCTIONS

- You must generally do all adjusting in 2.2 Mode -

The PPG WAVE 2.3 has fully digital tone-generators which need no tuning at all. Because of the pitch wheel which is an analog control there can be a total detuning of the instrument. Follow these instructions to get proper function.

Open the instrument as follows:

Remove the 2 screws on both sides of the WAVE 2.3's case.

Loosen the two screws at both posterior sides which work as hinges.

Lift the cover and remove the safety-plate of the printed circuit boards.

Now the instrument is ready for service.

1. Adjusting the A/D Converter of the analog controls

Call up any program and have a look into the ANALOG DISPLAY. Move one control to the right end position (full clockwise) and check the corresponding analog value. A full clockwise turned control must show the value "63". If not, you have to adjust the A/D Converter. Adjust the A/D trim control to show "63" just before the end position of the analog control. Make this adjustment before adjusting the Pitch Wheel (Bender).

2. Adjusting the Pitch Wheel

Call up any program that uses keyb. mode "0". Make sure that no detuning is set on the oscillators (DETUNE: 0). Choose Bender Intensity BI: "3". Whenever the Bender spreads from one limitation to the other, there are parts with no effect called "windows". One "window", for example, is at the center position. The center position of the wheel should be in the middle of this window. It can be adjusted by loosening the screw of the plastic wheel fixed on the potentiometer axis and adjusting the center position of the wheel exactly to the centre of the window.

3. Adjusting the filters

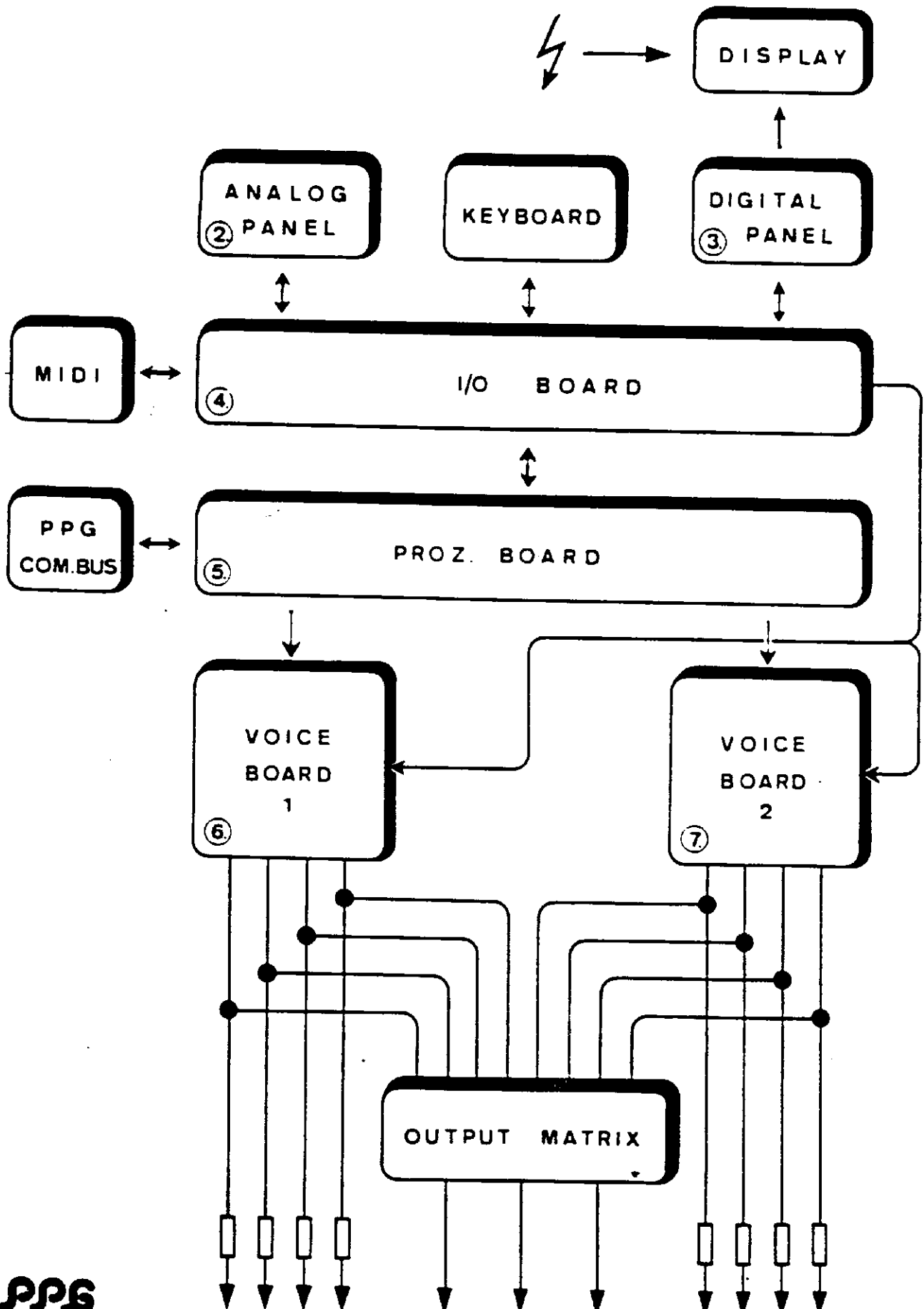
3.1. Adjusting the resonance intensity:

The instrument is opened and power is on. Call up program 74 group A (original PPG program). Tune the instrument to 440 Hz (TTUNE: 440). Choose group A for adjusting the resonance. After power is switched ON the voices of the PPG WAVE 2.3 are in the normal order. Each time you press a key the next is played. (in the sequence 1,2,3,4,5,6,7,8) Now press the first key in the centre of the keyboard and adjust the trimpot so that the filter resonance is directly before self-oscillation. Press the same key again and trim the next voice. Go through all the eight voices this way. It is important that they are all trimmed to the same intensity.

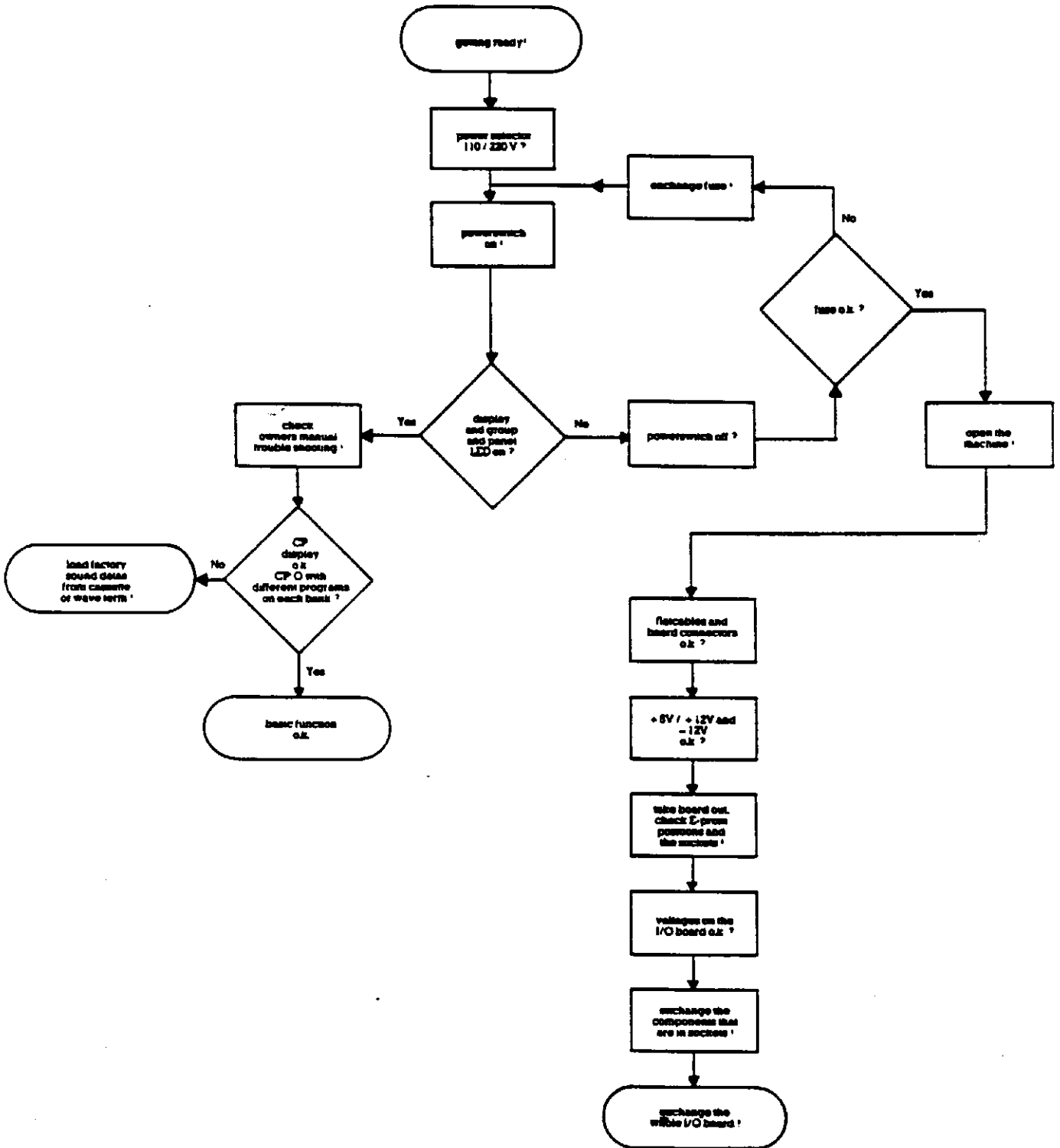
3.2. Adjusting the cut-off frequency of the filters:

Switch to group B (program 74). Press a key in the higher range of the keyboard and adjust the cut-off frequency so that it becomes equal to the fundamental frequency of the tone generator. Repeat the same procedure for all 8 voices.

BLOCKDIAGRAM

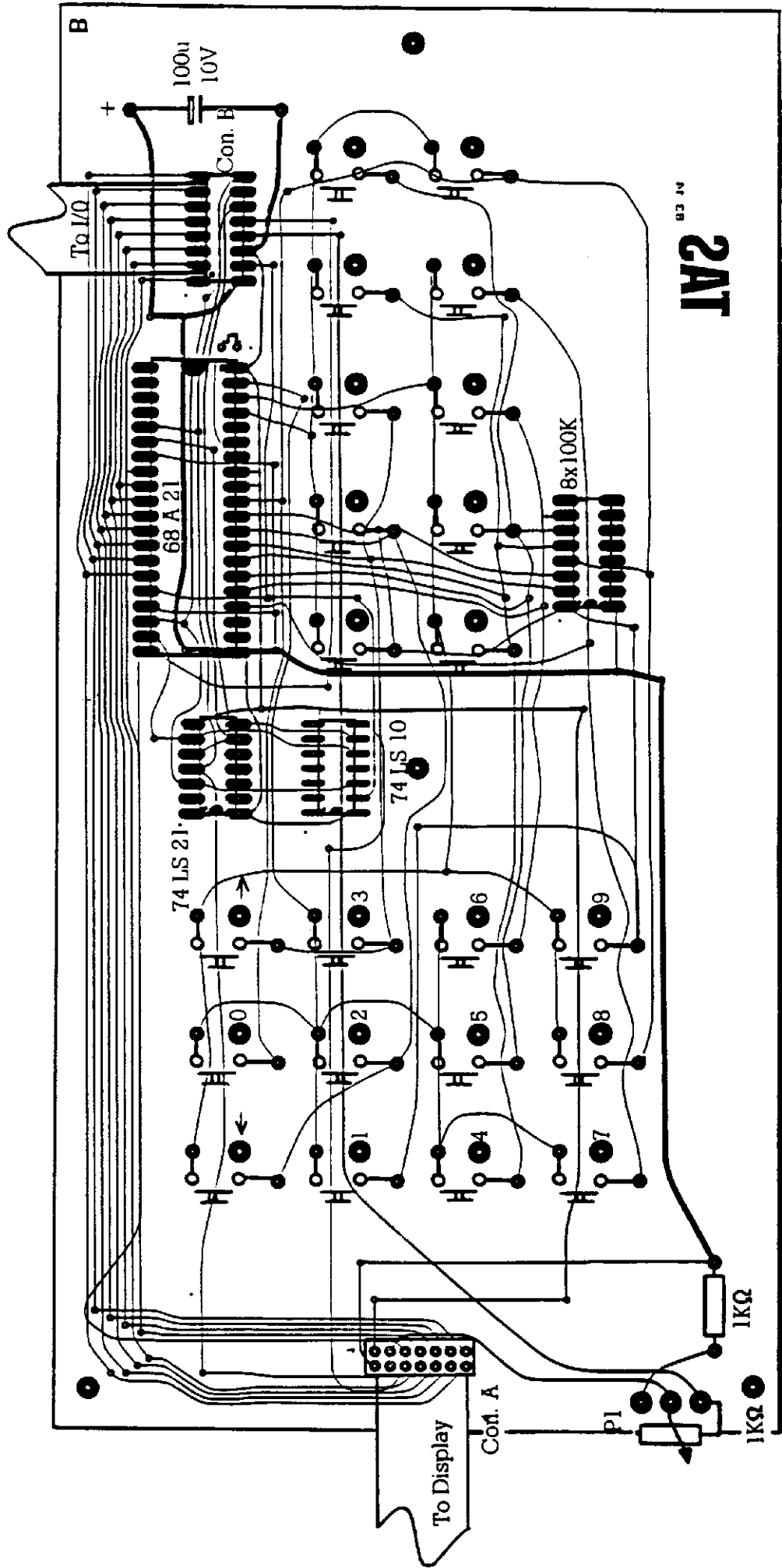


TROUBLE SHOOTING FLOW CHART



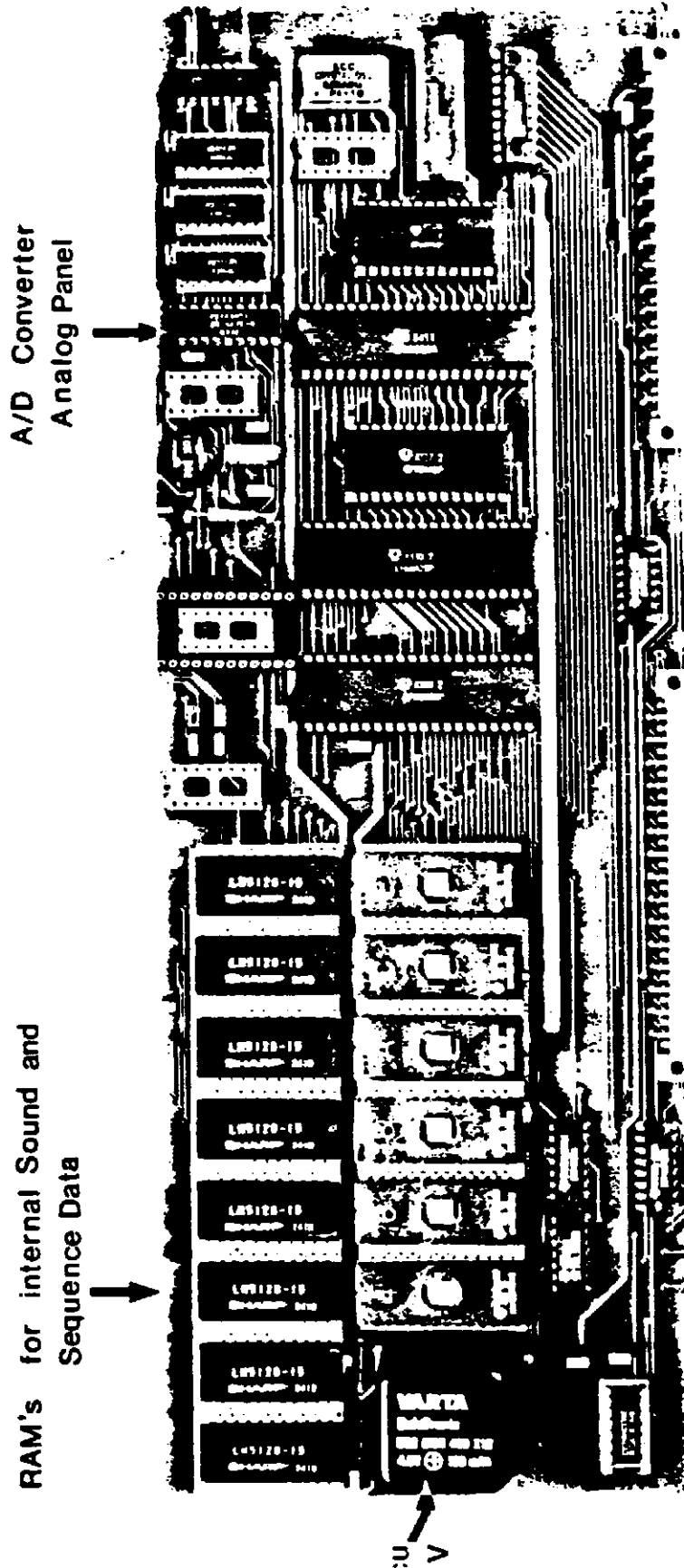
996

DIGITAL PANEL BOARD (TAS - BOARD)



red circuit lines - solder side

I/O Board 2.3



A/D Converter
Analog Panel

RAM's for internal Sound and
Sequence Data

5V

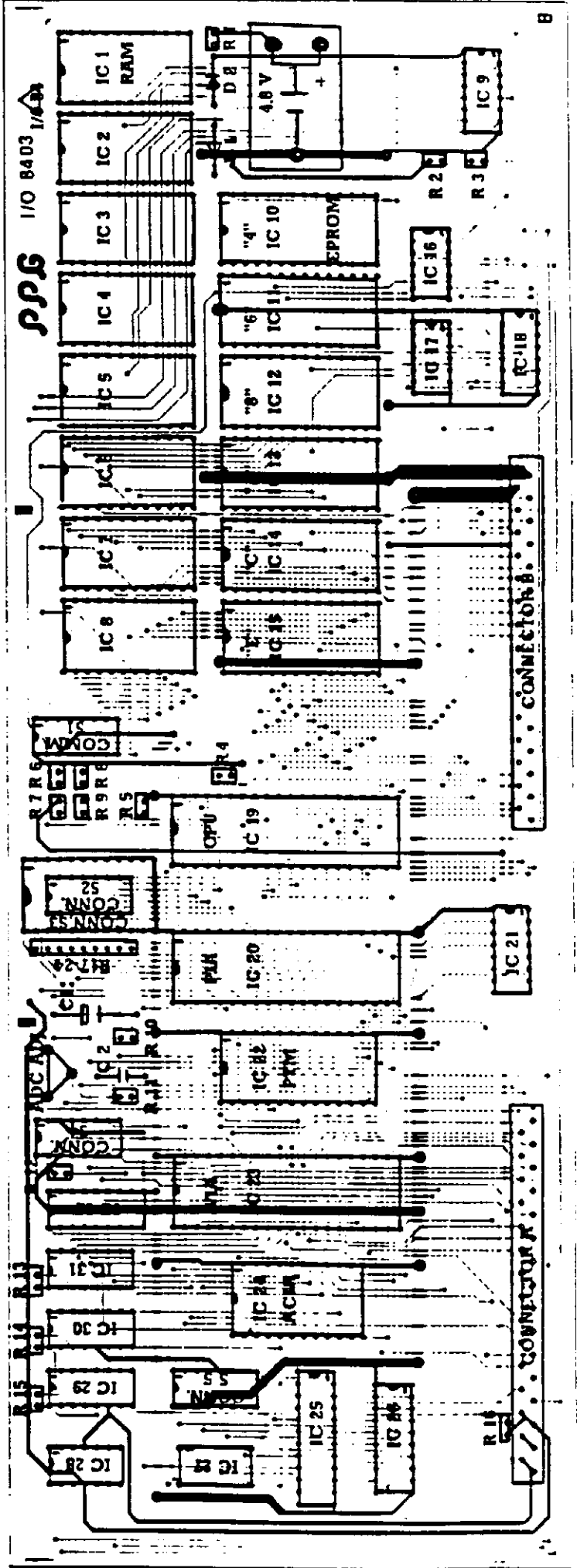
- E - Proms 4 and 6 = Wave tables
- E - Proms 8, A, C, E = Operating Instructions

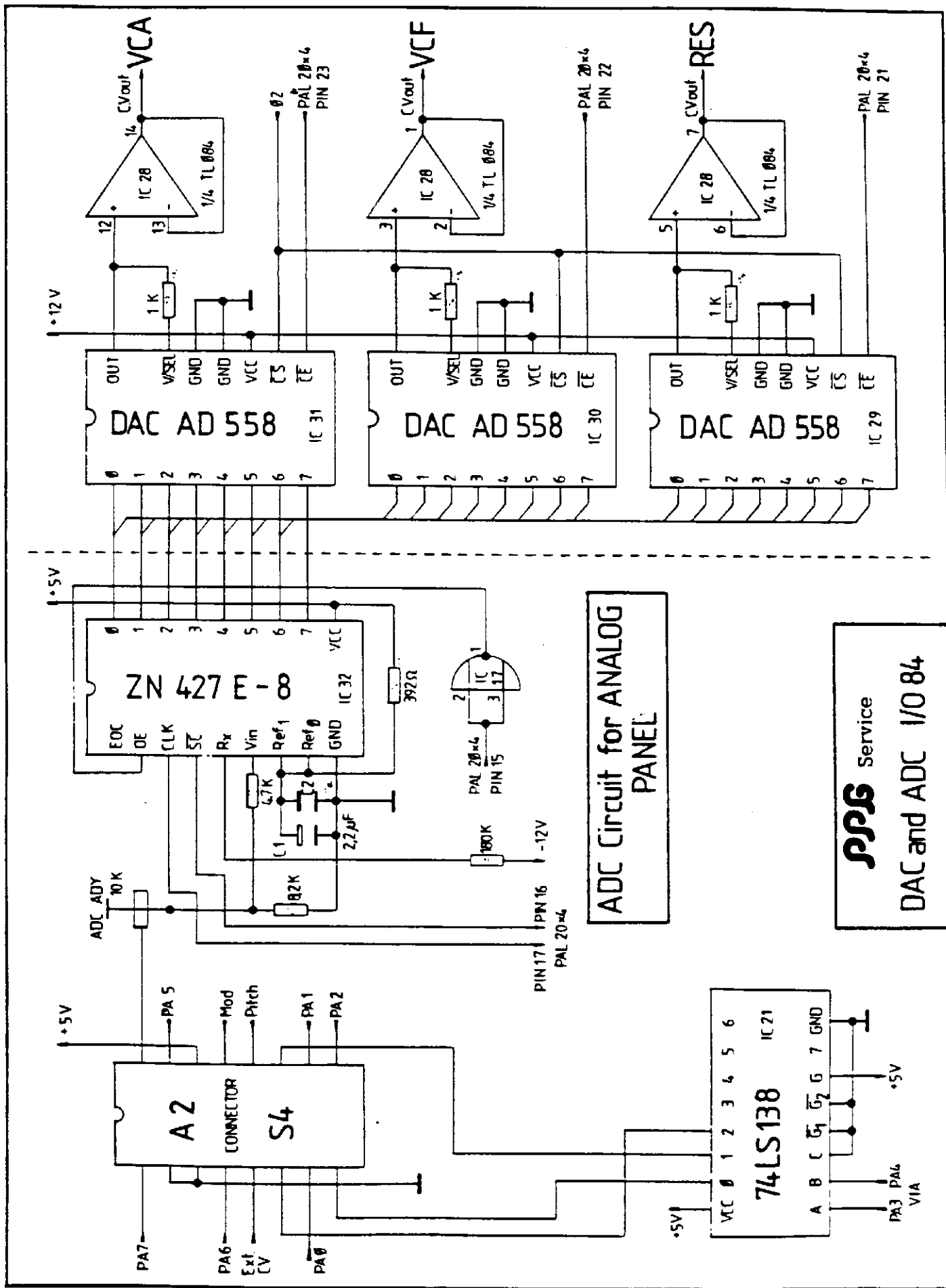
"I/O" CONNECTOR S 4

1	LED Second Panel
2	GND
3	GND
4	LED "B"
5	Ext CV In
6	IC 76 Enable
7	IC 74/75/76 - A Bit
8	IC 74 Enable
9	IC 74/75/76 - C Bit
10	IC 74/75/76 - B Bit
11	IC 75 Enable
12	Pitch Wheel CV In
13	Mod Wheel CV In
14	+5 V
15	LED "A"
16	Multiplex CV OUT

PPG

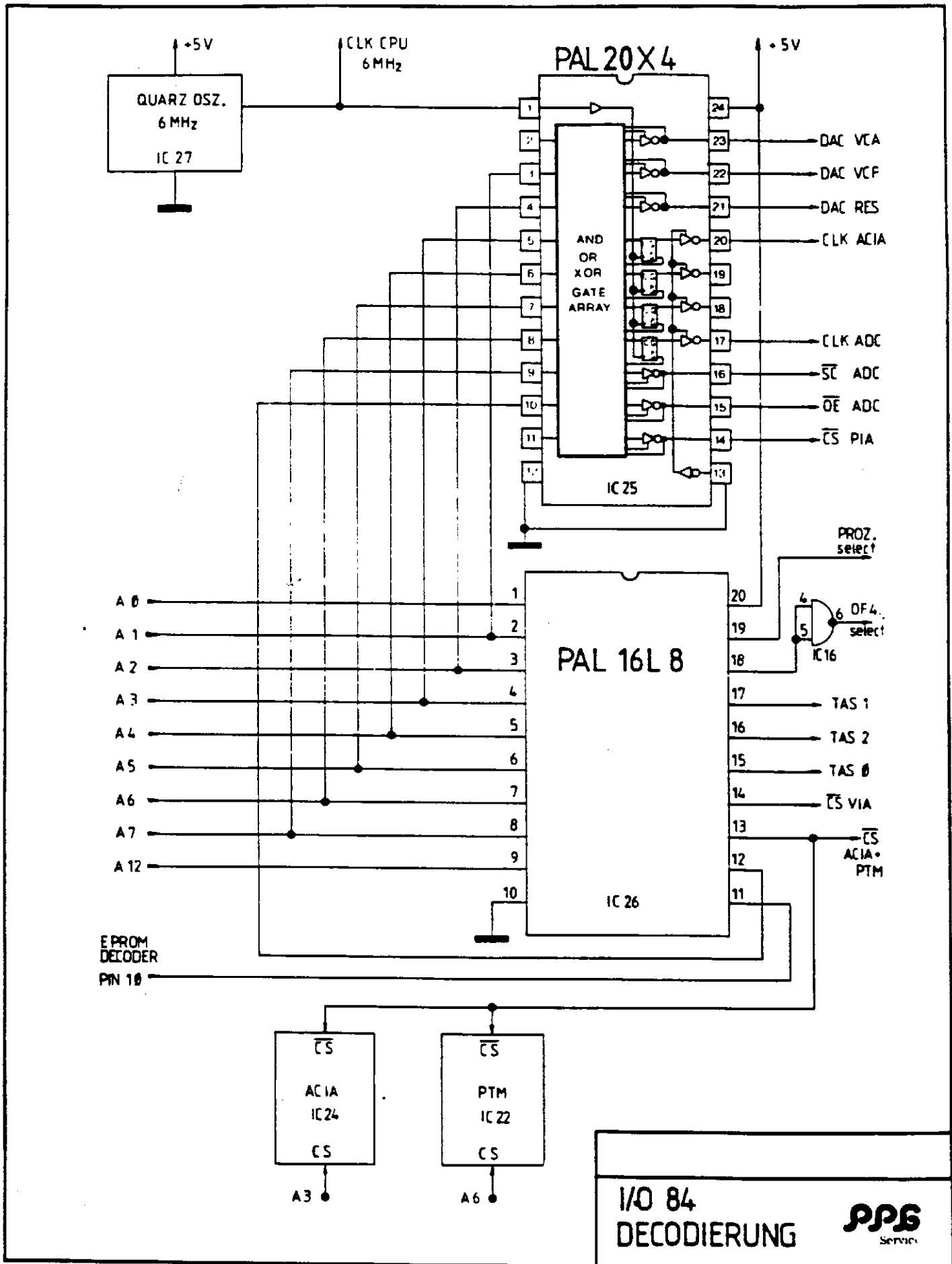
THE I/O BOARD 2.3

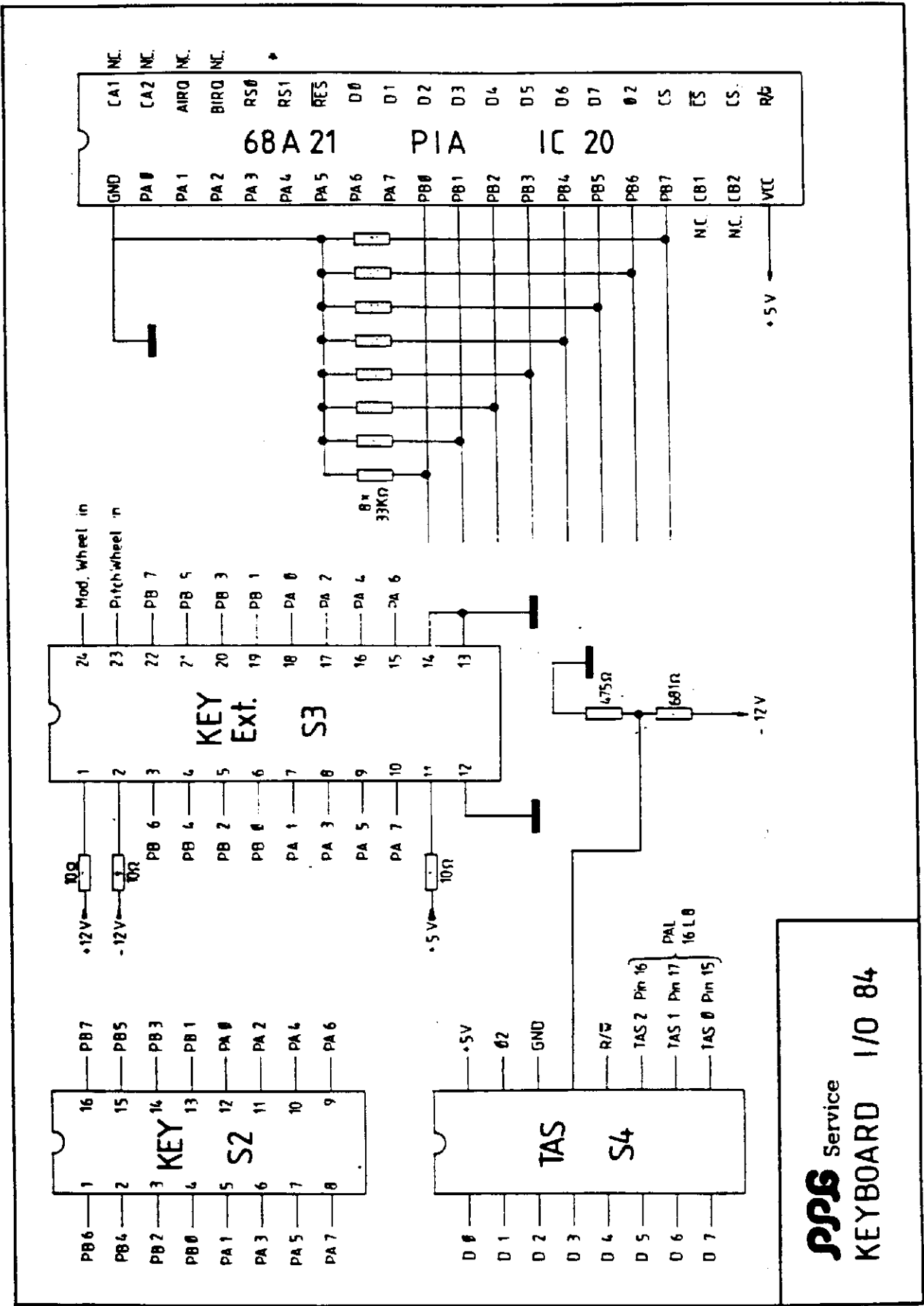




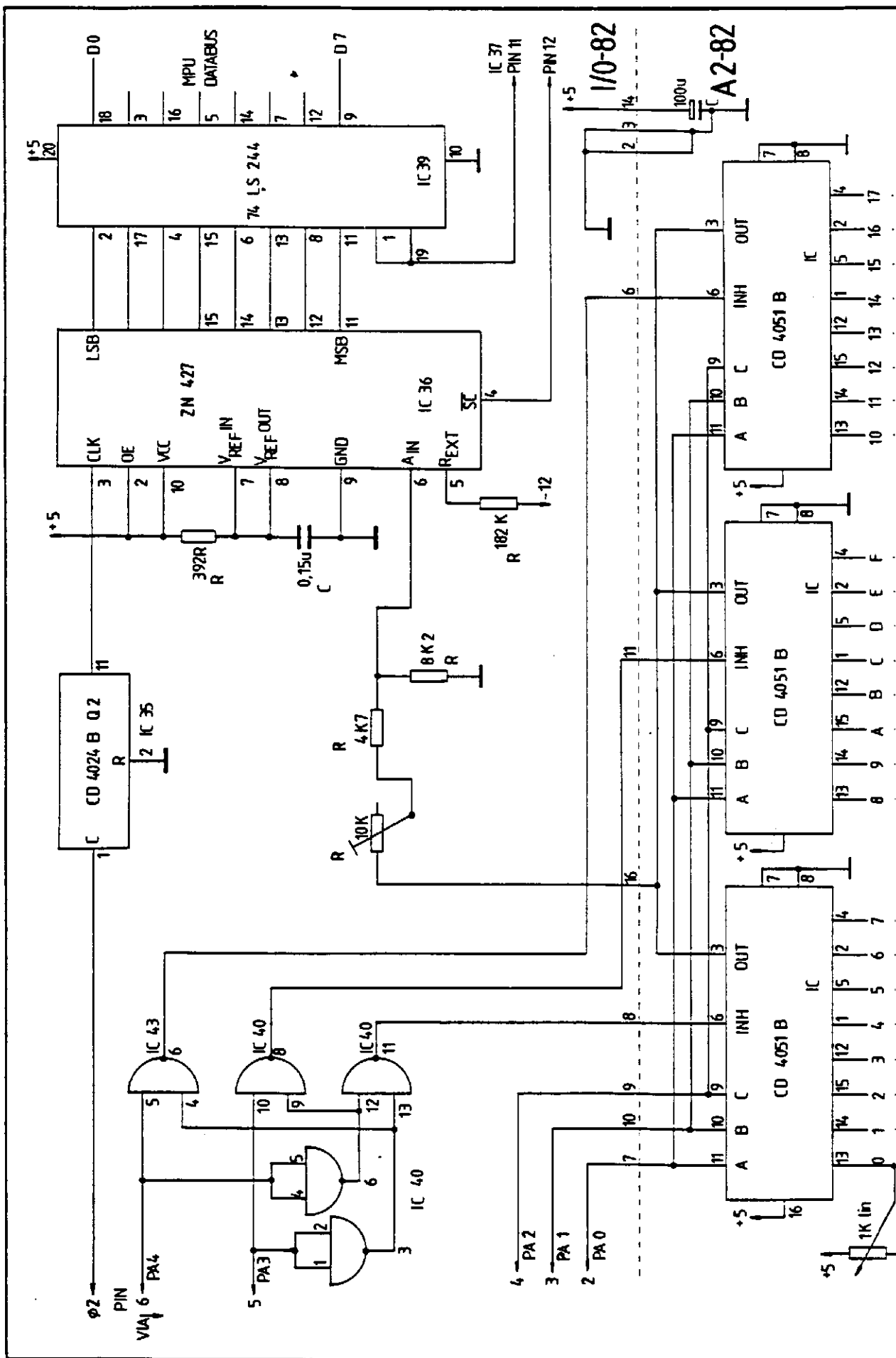
ADC Circuit for ANALOG
PANEL

pps Service
DAC and ADC I/O 84



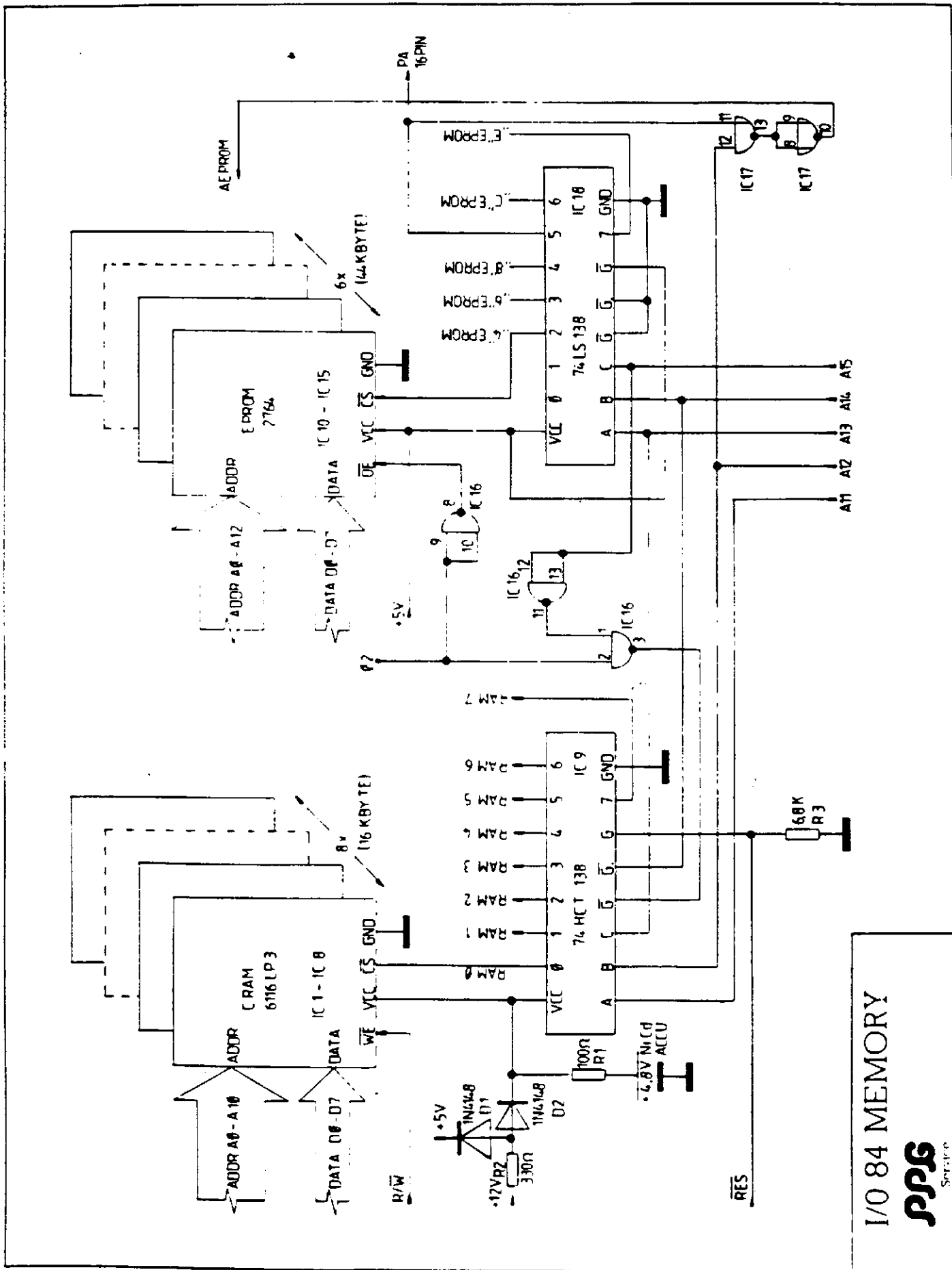


SPS Service
KEYBOARD I/O 84



PPS Service
Analog Panel Circuit
with A/D Converter on I/O

Analog Channels

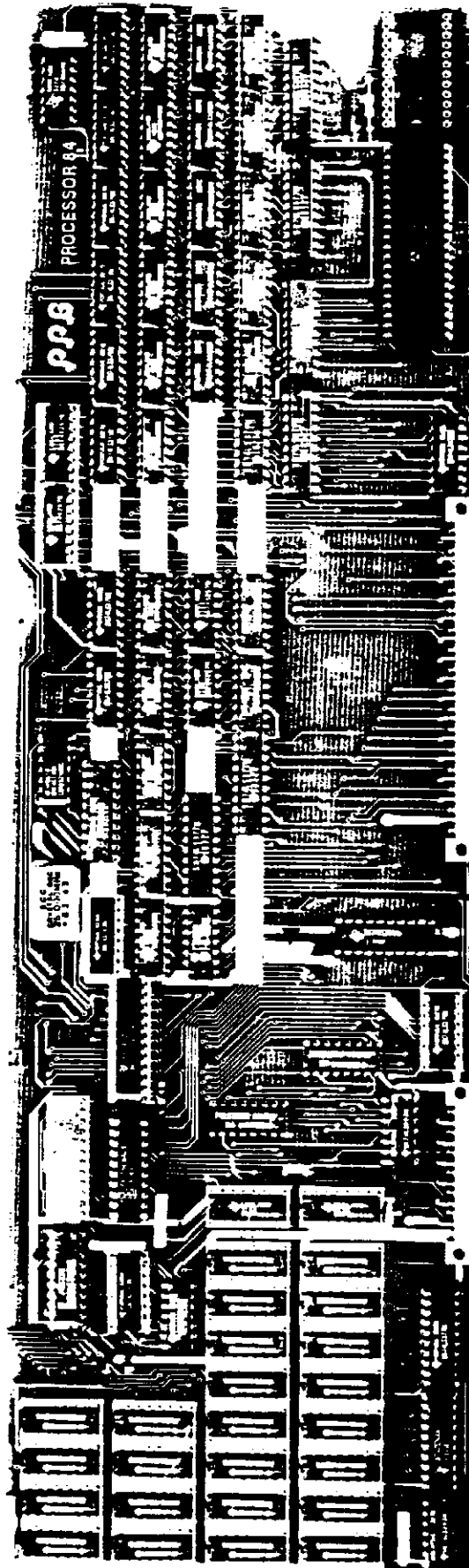


I/O 84 MEMORY

pps
Sensore

Proz. Board 2.3

SOUND - RAM BANKS

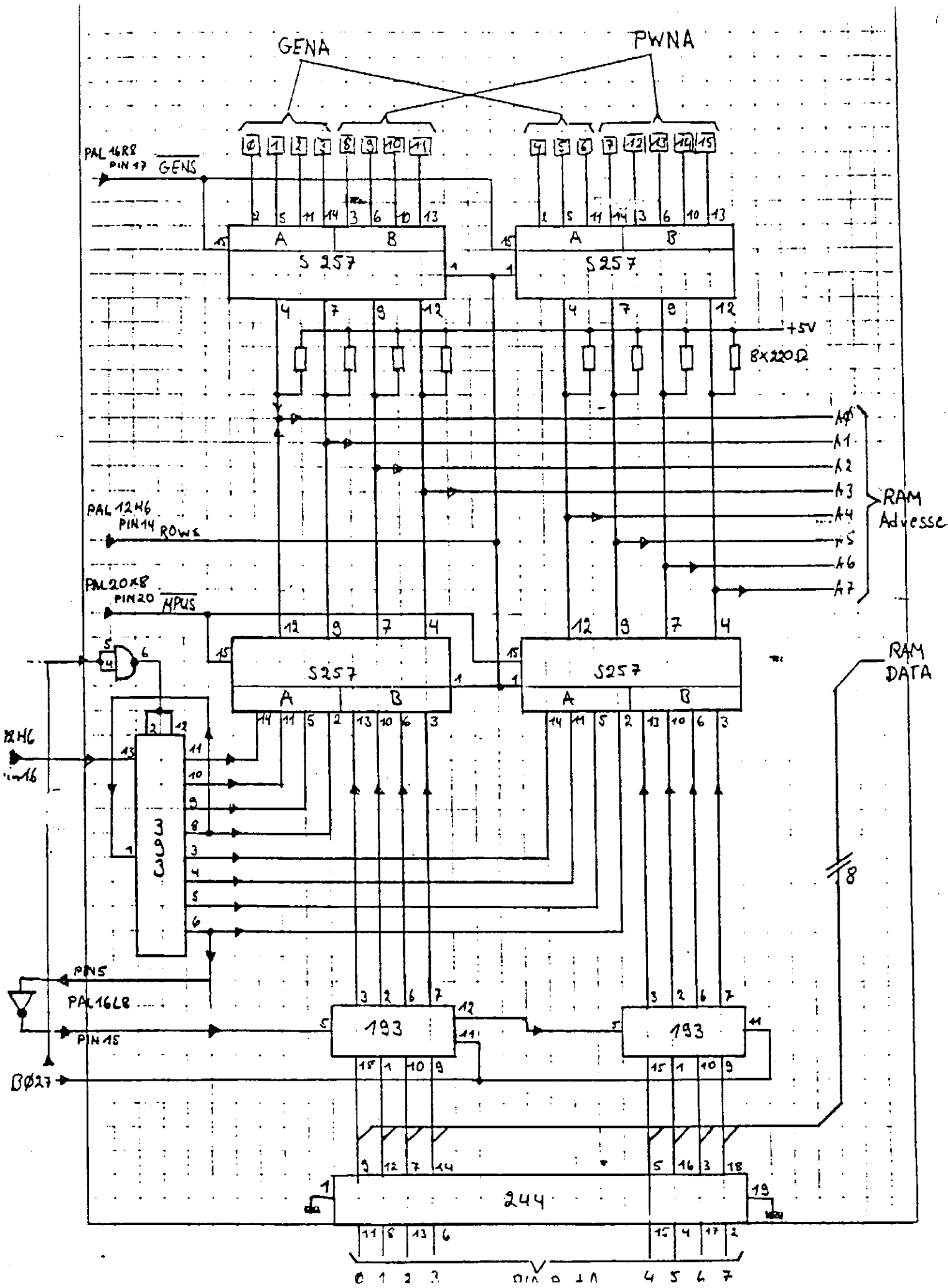


! Irregular Sound - Dropouts
or Distortions:

If this Capacitor is 330 pF
exchange it to 680 pF !

Com. bus PIA

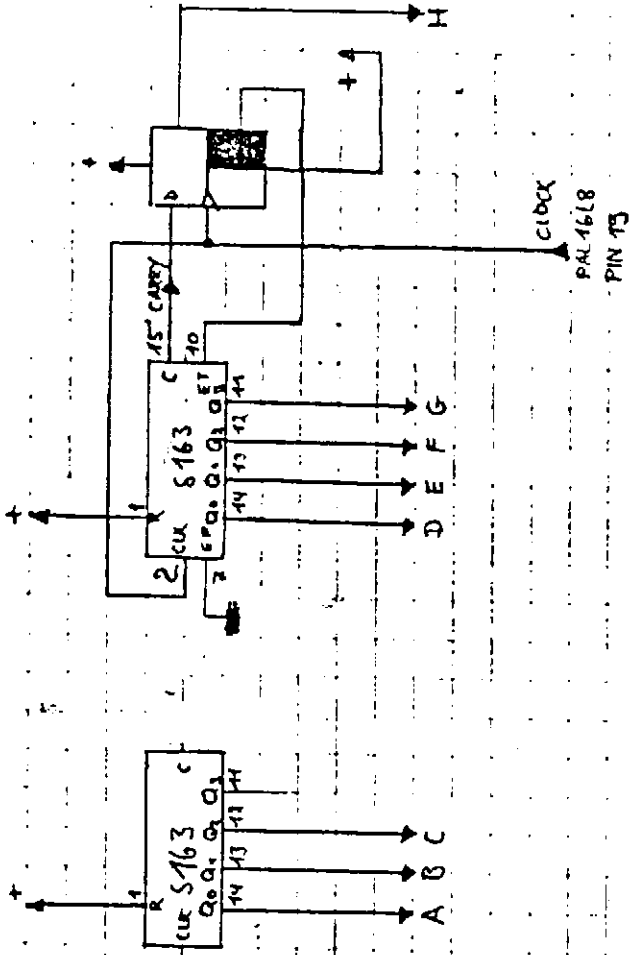
Com. bus Connector



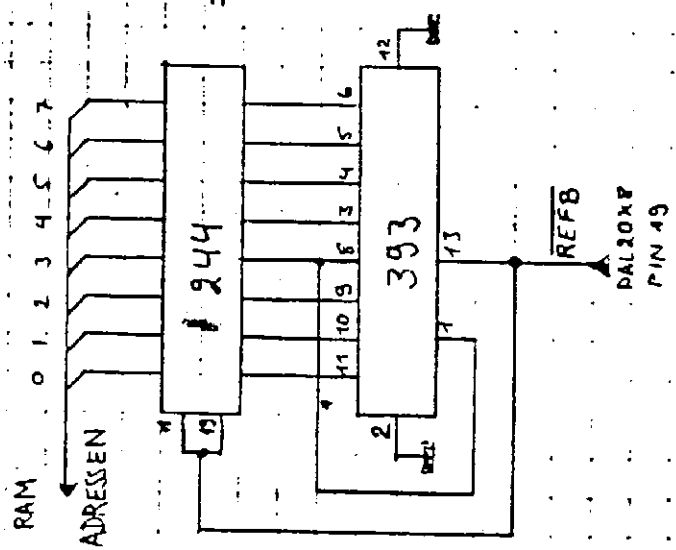
PROZ 83

27.01.84

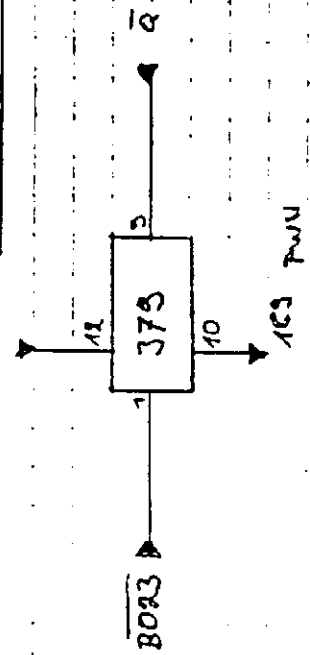
PHASENERZEUGUNG



D-RAM REFRESH



DØ GEN Enable

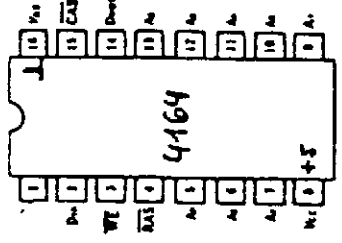


PRO283

TON (Summary)

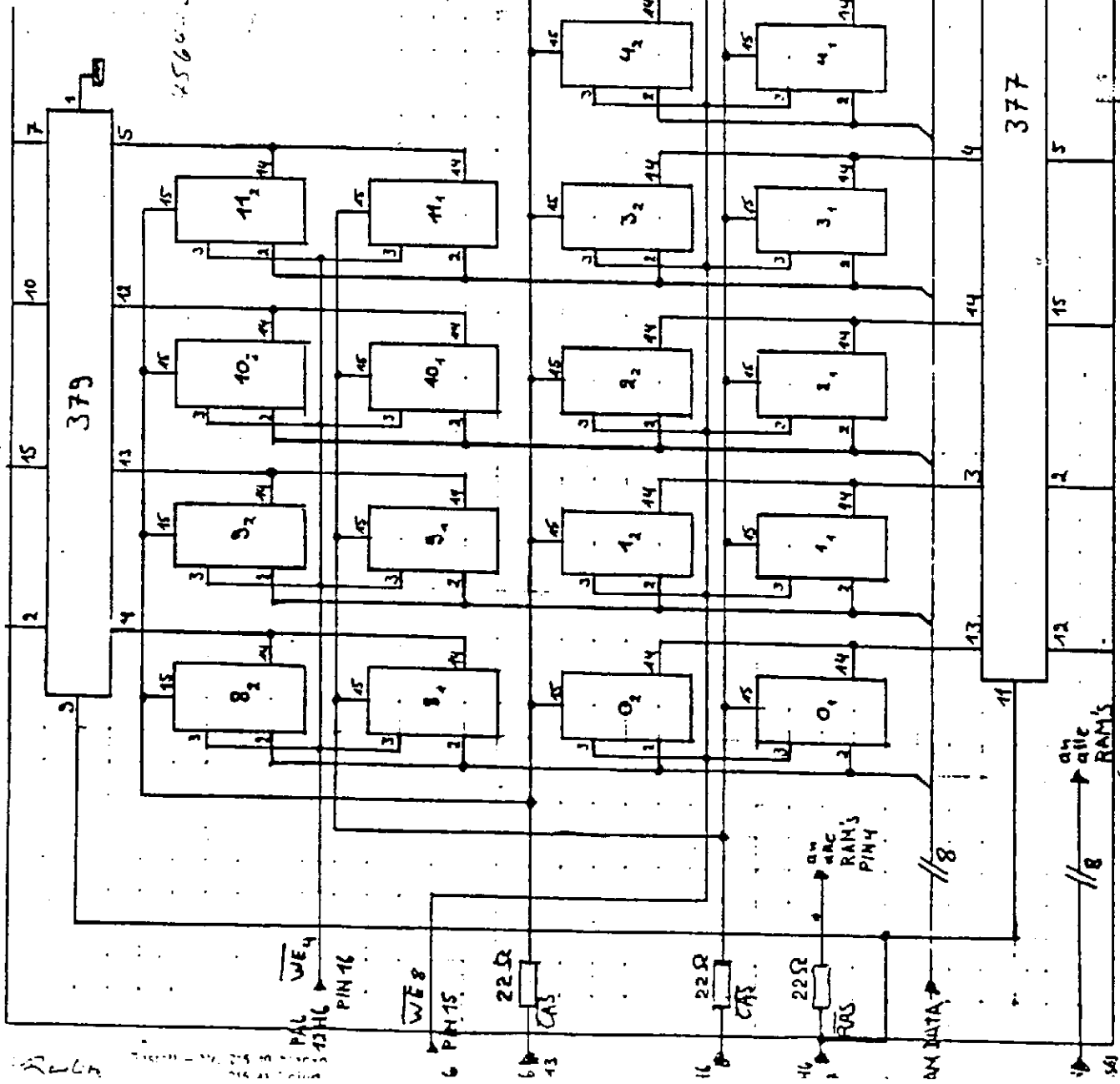
RAM

12.9.83



(Top View)

A ₀ -A ₁₁	Address Inputs
CAS	Column Address Strobe
Dis	Data In
Dout	Data Out
RAS	Row Address Strobe
WE	Read/Write Input
Vcc	Power (+5V)
Vss	Ground
A ₁₂	Refresh Address Strobe



(TO ALL RAMS)

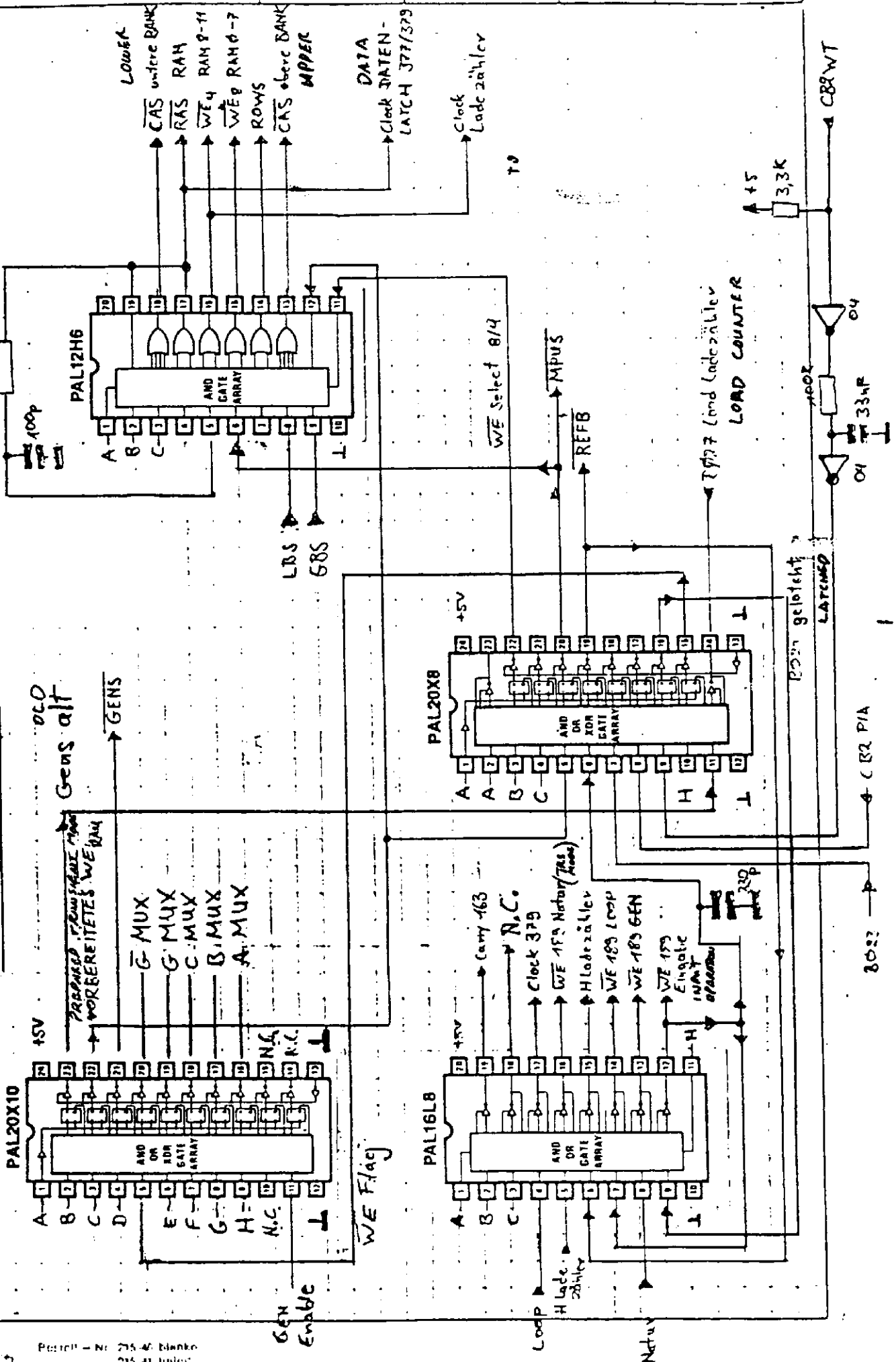
RAMS CONTAIN UNVARIABLES
FOR 2000 WAVE FORMS

11311

27.01.84

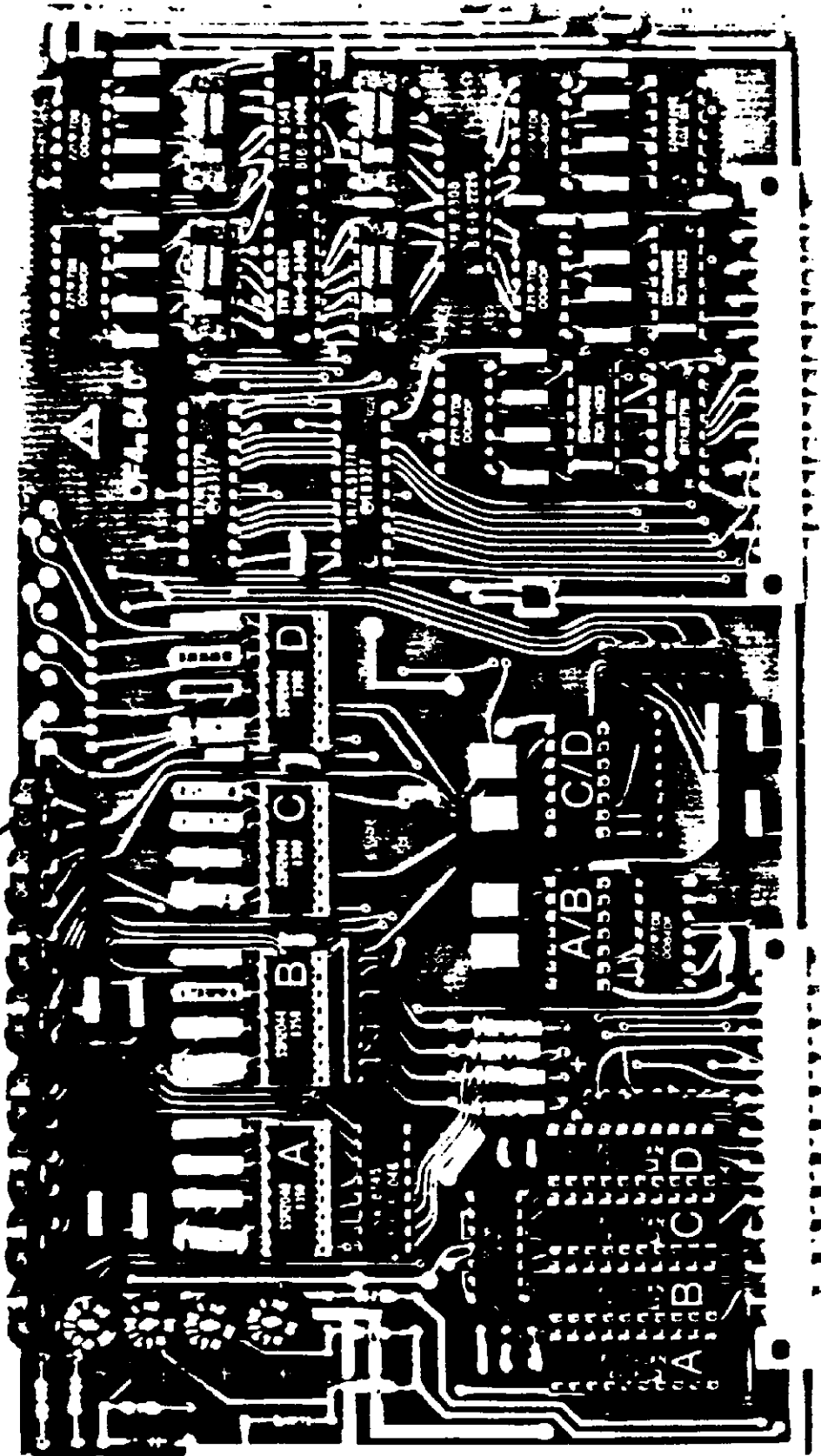
PROZ - STEUERUNG

CONTROL



OF 4 12 Bit

**to prevent a short circuit which can be caused
by the metal framework touching the solder point
please cut the circuit line
on the component side of the board**

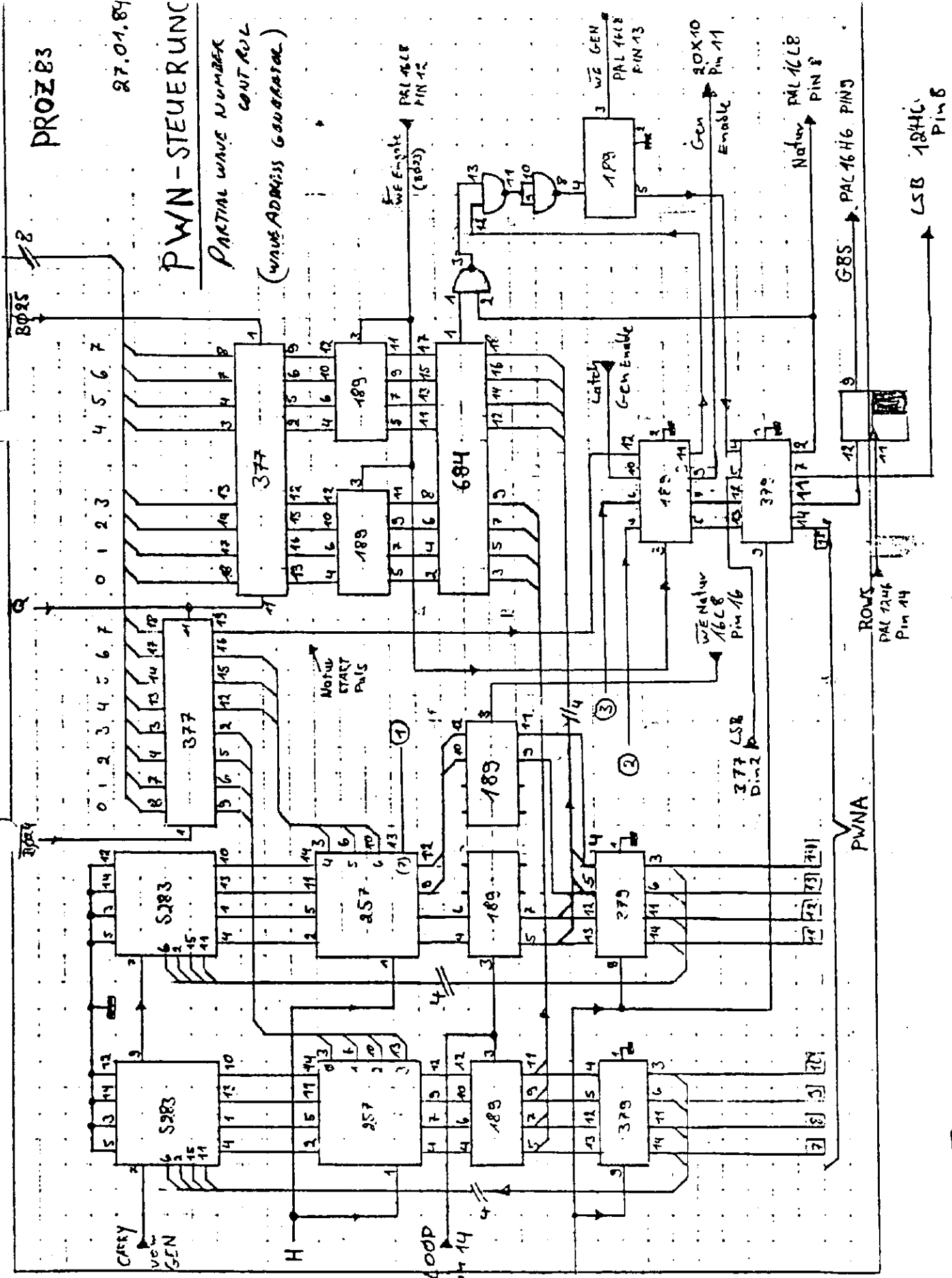


PROZESS

27.01.84

PWN-STEUERUNG

PARTIAL WAVE NUMBER
CONT. RUL
(WAVE ADDRESS GENERATOR)

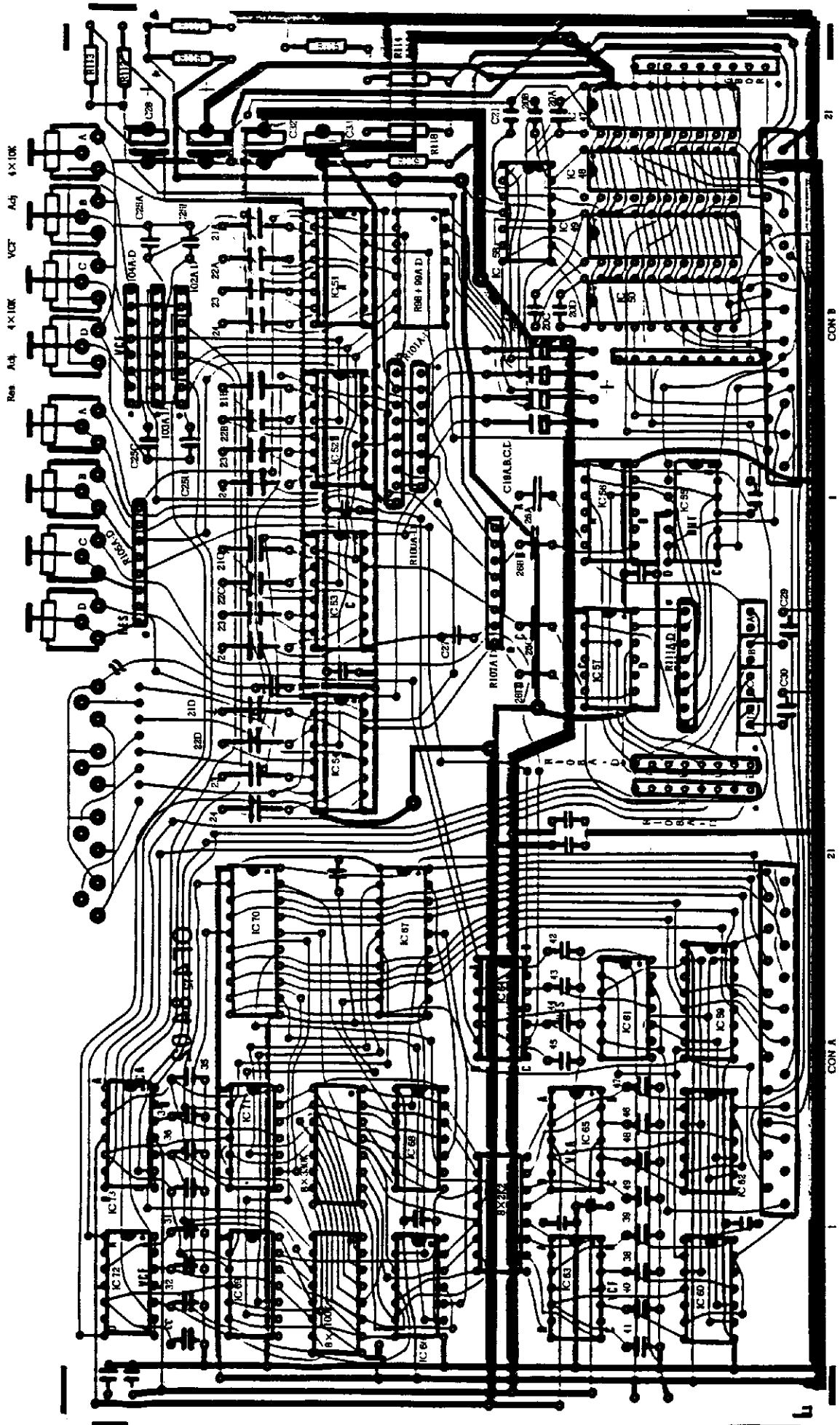


Rechn. - Nr. 215 48 blank
 215 41 linien
 215 4 kariert
 215 4 rauiert

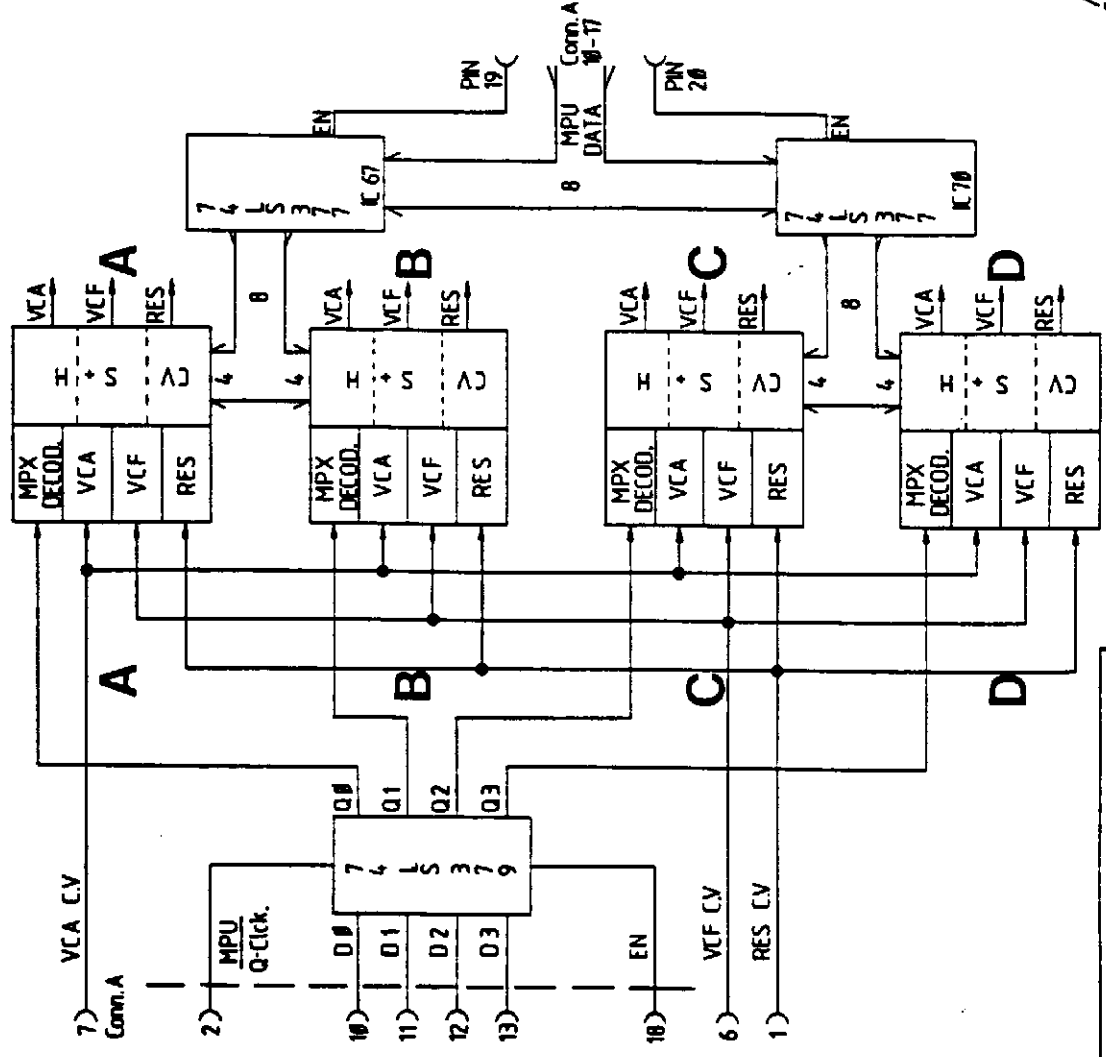
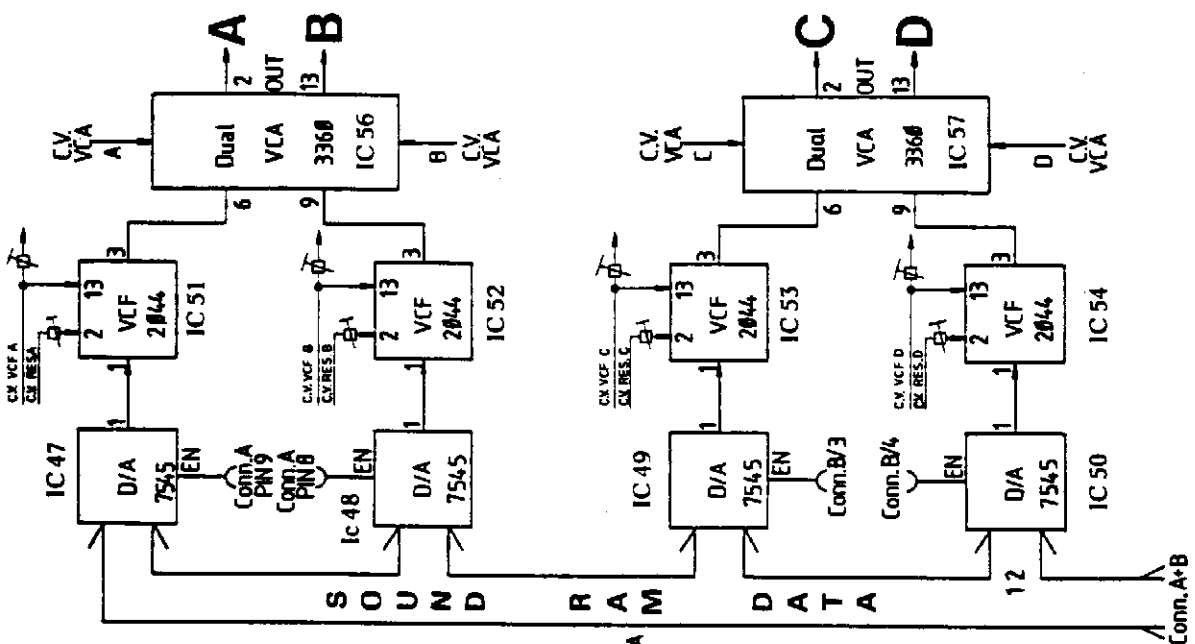
WE NATURAL - NATURAL SOUND - TRANSIENT SOUND - TRS MODE

PPG

OF 4-12 BOARD



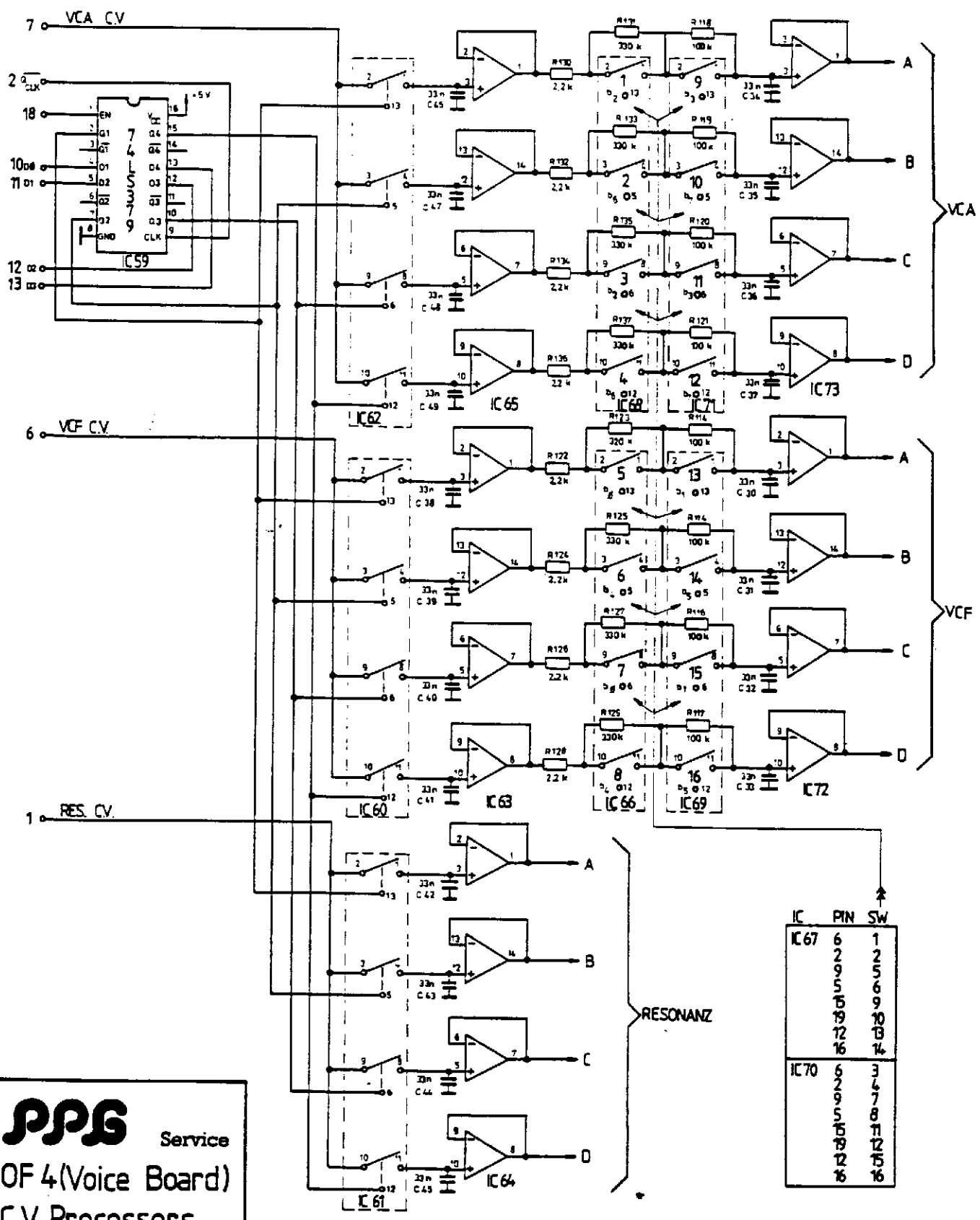
red circuit lines - solder side



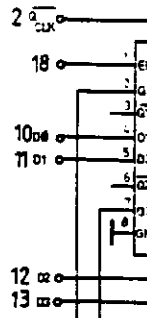
BLOCKDIAGRAM OF 4/12 VOICE BOARD



OF4 CONN. A



7 VCA CV



6 VCF CV

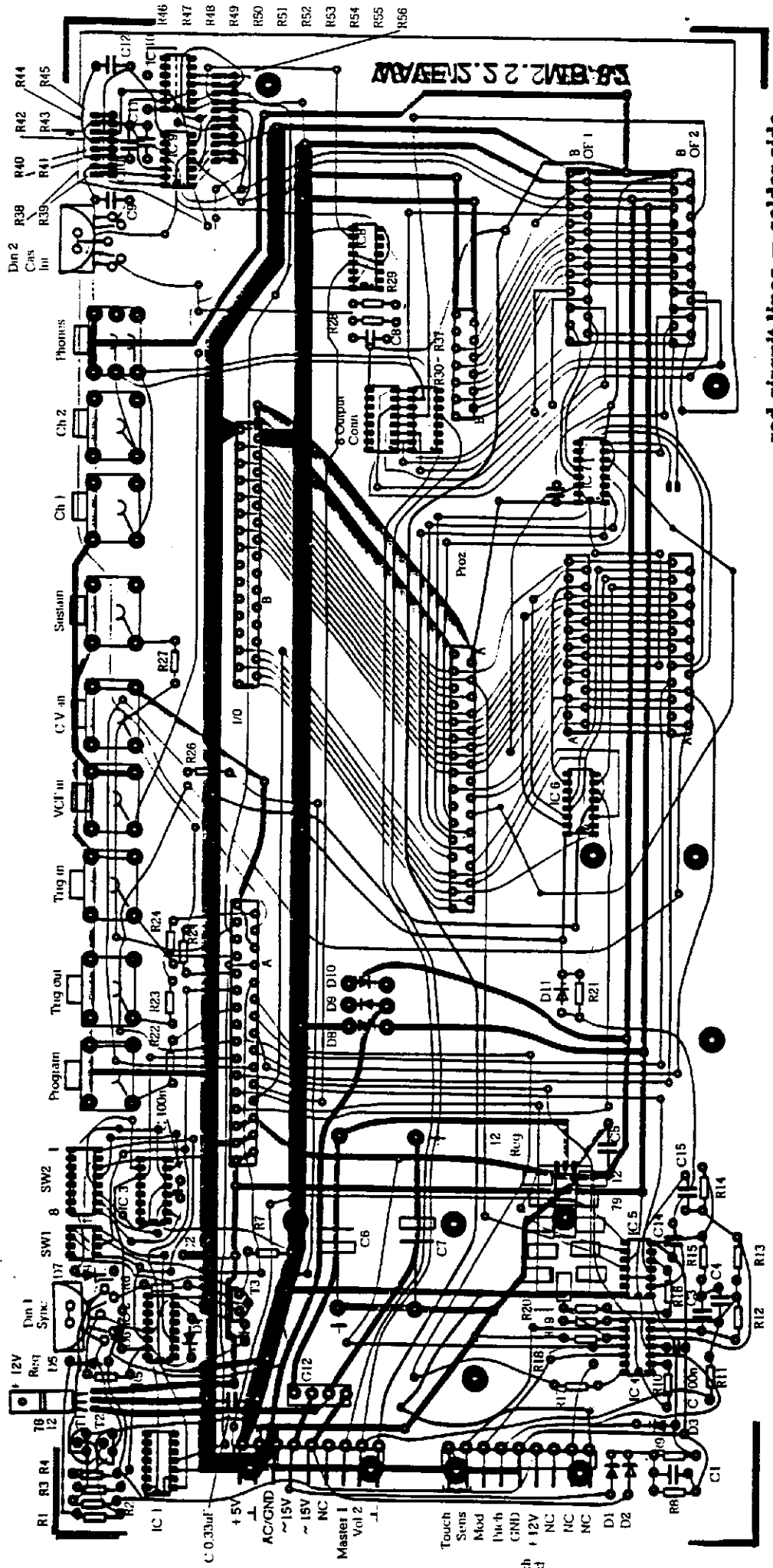
1 RES. CV

IC	PIN	SW
IC 67	6	1
	2	2
	9	5
	5	6
	8	9
	12	10
IC 70	6	3
	2	4
	9	7
	5	8
	8	11
	12	16

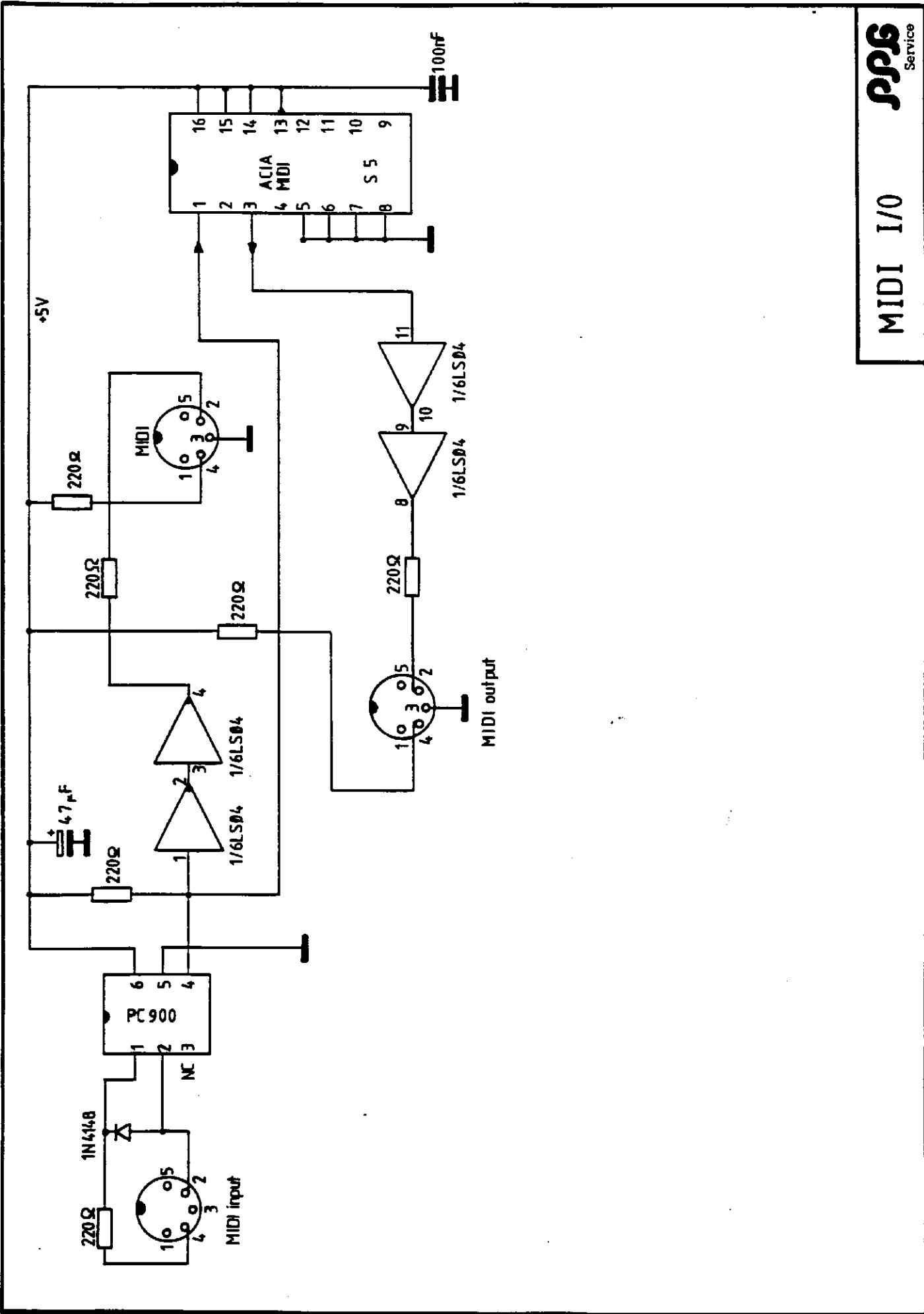
PPG Service
OF 4 (Voice Board)
C.V. Processors

PSG

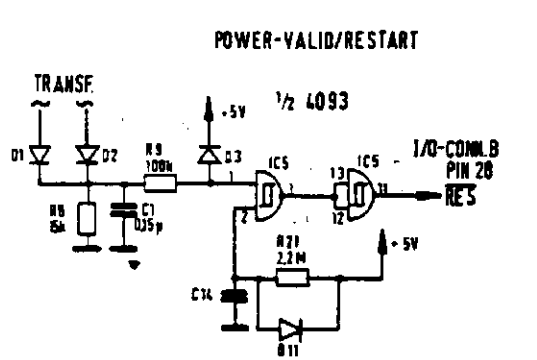
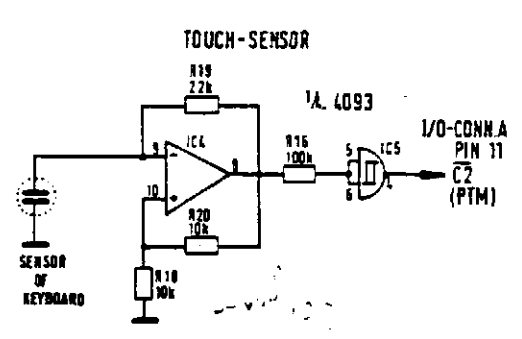
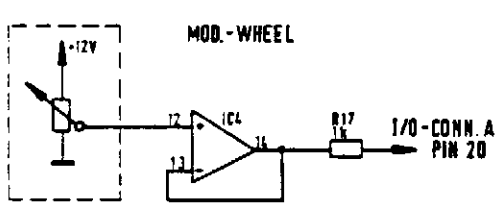
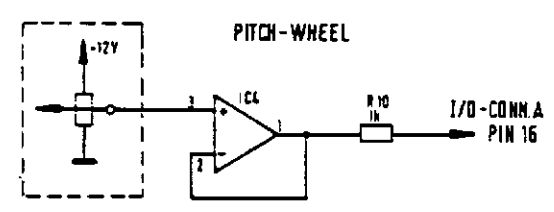
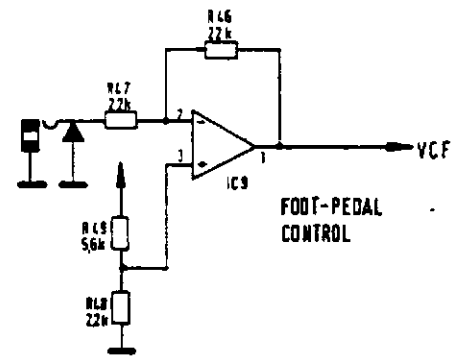
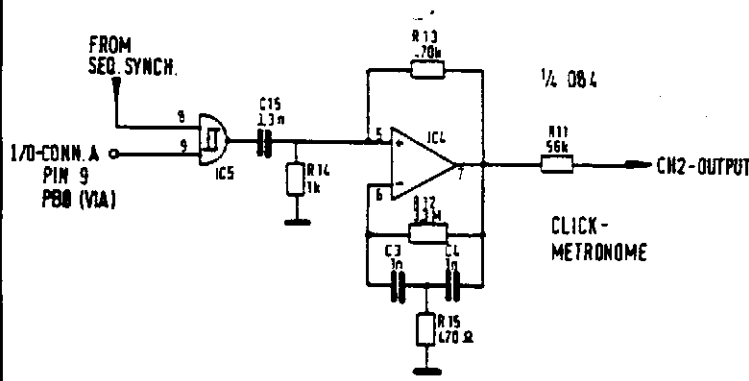
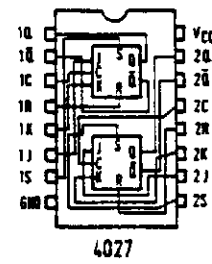
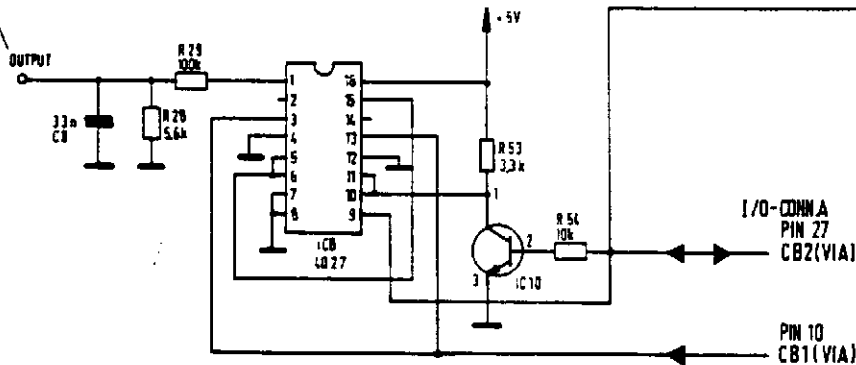
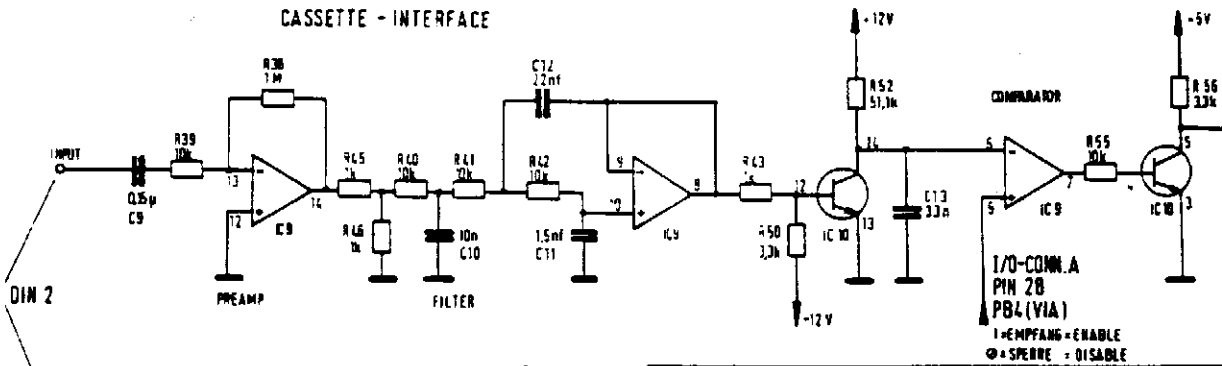
WAVE 2.3 MOTHER BOARD WAVE 2.2 MOTHER BOARD 82



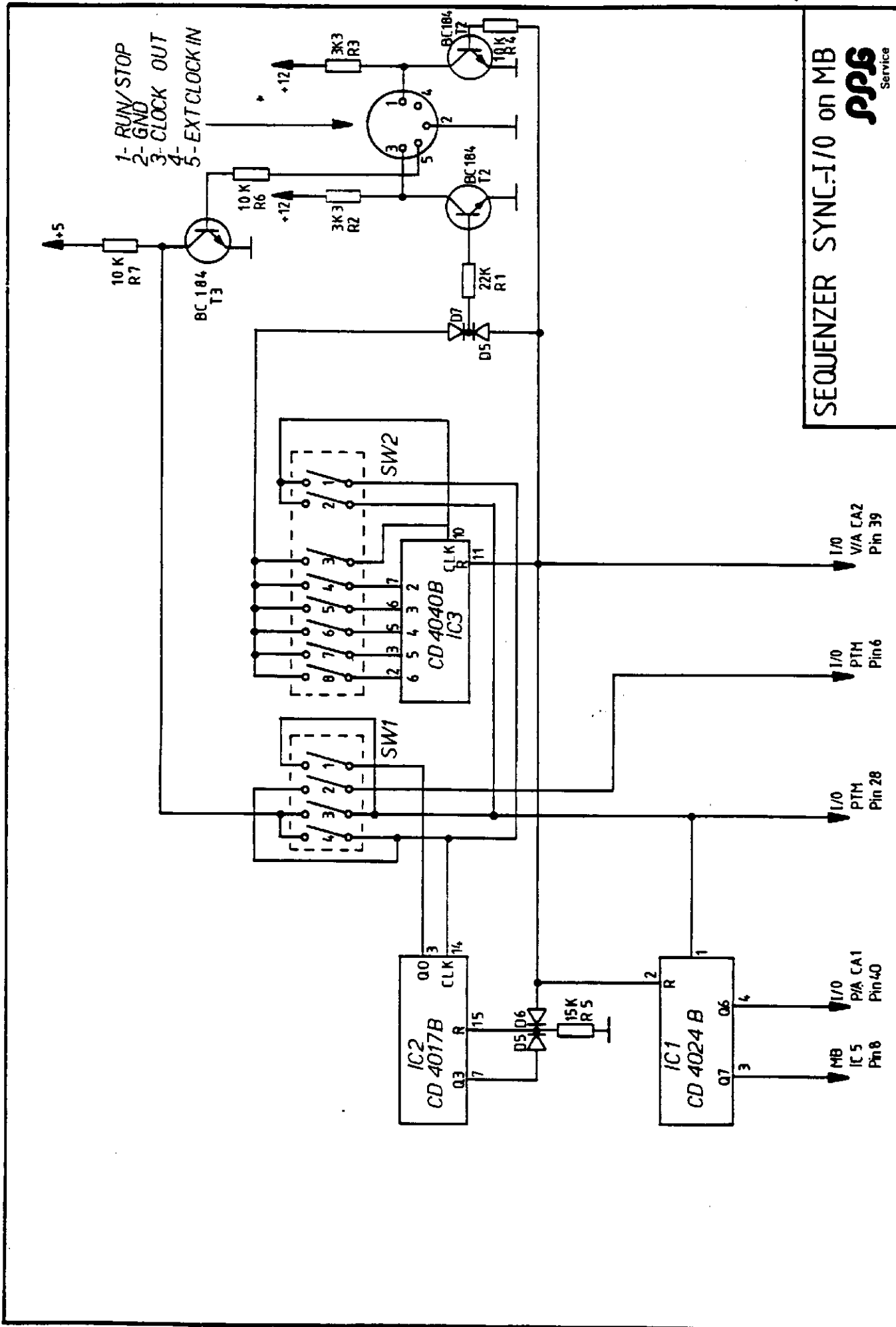
red circuit lines - solder side



CASSETTE - INTERFACE

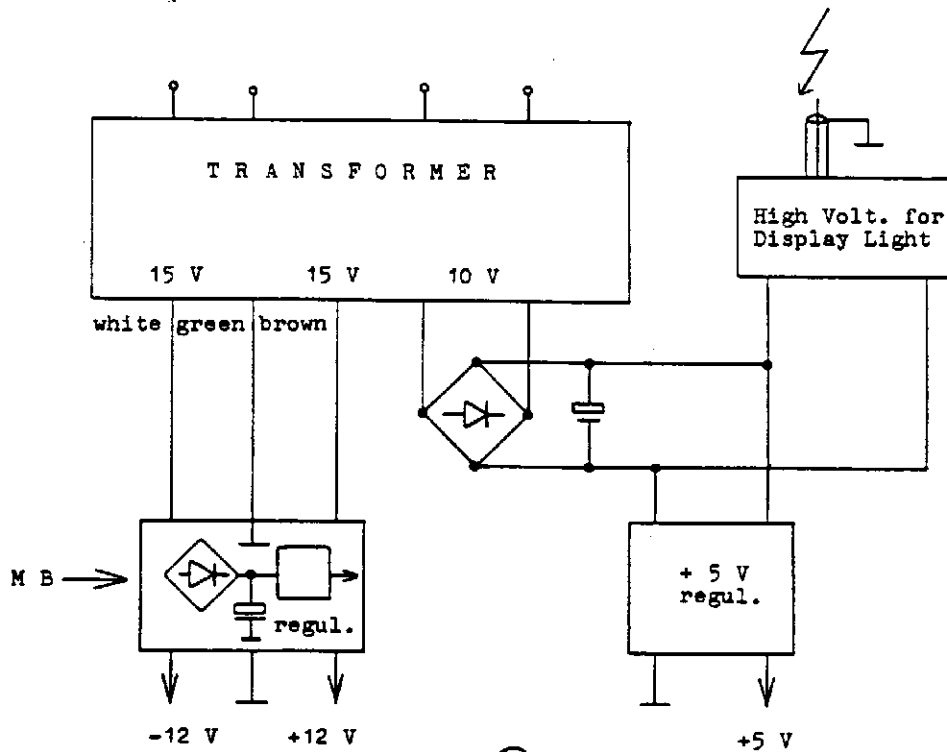
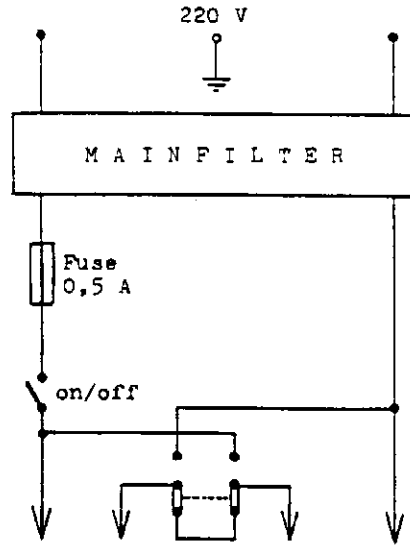
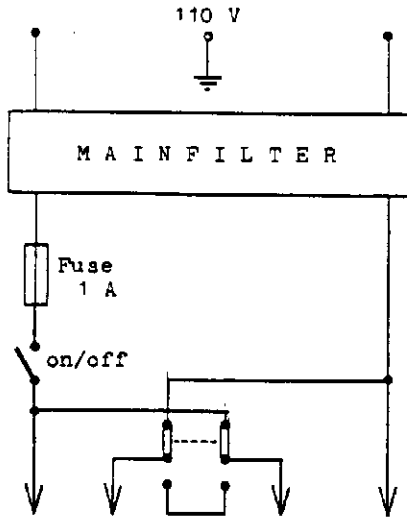


PPS
 Service
CIRCUITS ON MB



SEQUENCER SYNC-I/O on MB





①

POWERSUPPLY

POWER SUPPLY PART LIST

	Order No.
Mainfilter	PS - 301
Fuse 1 A	PS - 302
Fuse 0,5 A	PS - 303
On - Off Switch	PS - 304
220 V/110 V Switch	PS - 305
Transformer	PS - 306
Rectifier +/- 12 V	PS - 307
Capacitor 1000 uF/40 V	PS - 308
Voltage Regulator 7812	PS - 309
Voltage Regulator 7912	PS - 310
Rectifier +5V	PS - 311
Capacitor 1000 uF 16 V	PS - 312
Voltage Regulator 7805	PS - 313
Display Transformer	PS - 314
Complete +5V/Display Transformer Board (including 7805)	PS - 333

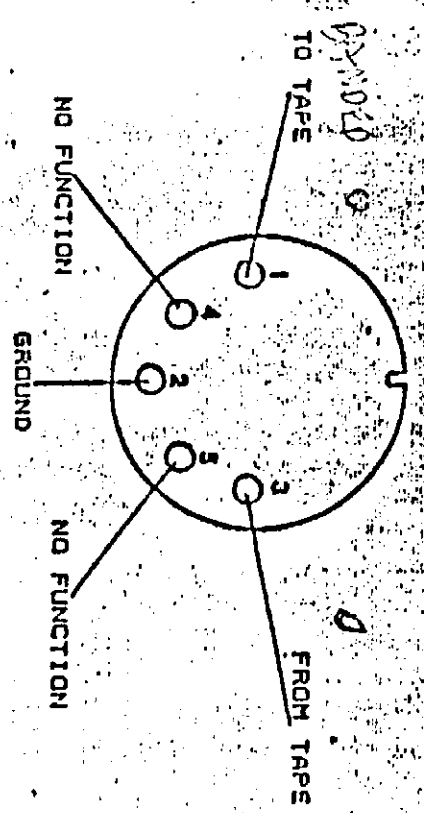
PCB: "MB" to "I/O" CONNECTOR A

1	+ 12 V
2	+ 12 V
3	GND
4	GND
5	- 12 V
6	- 12 V
7	B03X · B04X
8	B02X
9	PB0 via Metronom push under
10	CB1 via Cassette Interface Clock
11	C2 Timer Dyn Sensor in
12	Ext start Sequencer
13	CA2 via Reset Sequencer
14	CV OUT - VCF
18	CV OUT - VCA
19	PB7 VIA Footswitch - Program
20	Mod Wheel CV In
21	C1 Timer Clock divider (1/3) In
22	O3 Timer Sequence Clock
23	Ext CV In
24	CA1 PIA Sequencer Sync
25	PB5 VIA Trigger Out
26	GND CV In
27	CB2 VIA Cassette-Interface seriell DATA I/O
28	PB4 VIA Cassette-Interface enable
29	PB3 VIA Sustain
30	PB2 VIA Trigger In
31	GND CV In

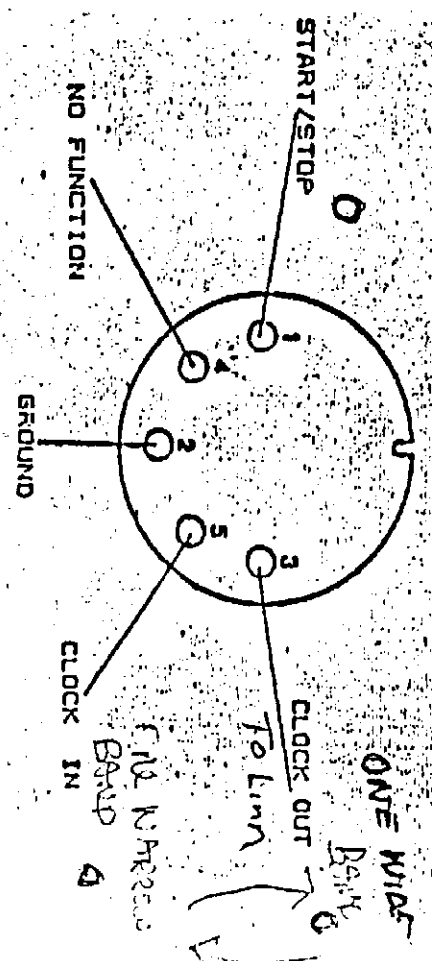
PCB "MB" to "I/O" CONNECTOR B

1	A 0	MPU-Adress Bus
2	A 1	"
3	A 2	"
4	A 3	"
5	A 4	"
6	A 5	"
7	A 6	"
8	A 7	"
9	A 8	"
10	A 9	"
11	A 10	"
12	A 11	"
13	A 12	"
14	A 13	"
15	A 14	"
16	A 15	"
17	D 0	Data Bus
18	D 1	"
19	D 2	"
20	D 3	"
21	D 4	"
22	D 5	"
23	D 6	"
24	D 7	"
25	FIRQ	
26	IRQ	
27	E (02)	
28	RES	
29	R/W	
30	+5V	
31	GND	

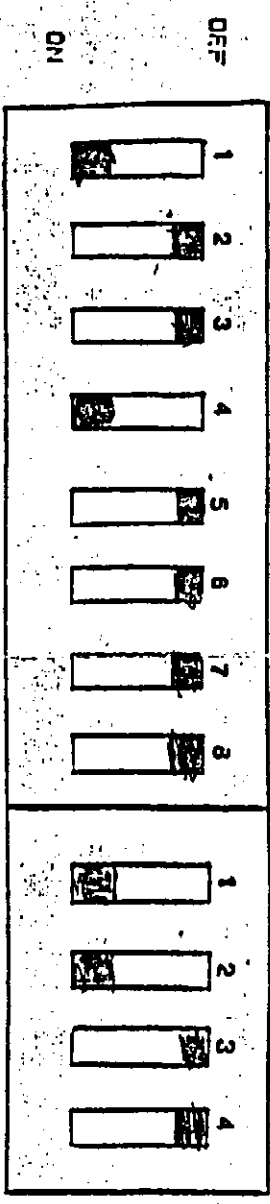
CASSETTE INTERFACE
DIN WIRING DIAGRAM



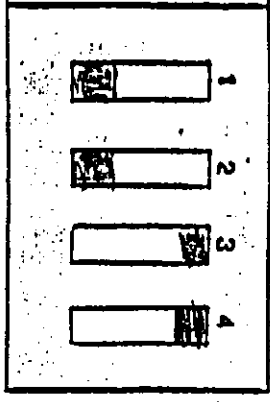
CLOCK INTERFACE
DIN WIRING DIAGRAM



EIGHT SWITCH BOARD



FOUR SWITCH BOARD



CLOCK DIVIDER

15 Drive Disk
Lenny

OSCAR clock
RING - OUT
TIP - IN

