
Hohner-Service

Schematics

D 89

HOHNER

A WORLD OF MUSIC

Symphonie D89

C O N T E N T S

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1. Call up of the Self-Test-Program

To start the test program it is necessary to depress the upper pedal C at the same time as any registration button for 10 sec.

2. General flow of the program

The self-test starts with a restart of the organ - you will hear a "handclap". Now the different single tests will begin and upon test completion you will hear a rhythm instrument. The lamps of the register tabs will now switch on and off one after another.

If there is a fault the flash of the lamps will stop and you can see the fault as an Arrangeur-Rhythm codet number on the display. You can go at any time to the normal organ program by depressing the upper C on the lower manual.

3. Description of the single tests

3.1. RAM-Test

The RAM Memory (6116) will be tested through write-in and read-out of random numbers. If there is a fault you will see on the display the word "Disco".

3.2. MEG-Test

The amplitude, octave and waveform memory of the MEG circuit will be tested as described in 3.1. If there is a fault you will see on the display the word "Bossa Nova".

3.3. PROM-Test

This part of the program checks the check sums of the 3 EPROM memories. If there is a fault you will see on the display the word "Walzer" or "Country" (compare with chapter 4)

3.4. 10 MS Interrupt

If the 10 mS Interrupt is defective, you will see the word "Samba" on the display.

3.5. Rhythm Interrupt

If the Rhythm Interrupt is defective, you will see the word "March" on the display.

4. Indication of faults

The indication of a fault is coded an on Arrangeur Rhythm-please look to the selected lamp.

Indication of fault

Description

Walzer

EPROM 1 (D89 1.X)

Country

EPROM 2 (D89 2.X)

"X" is a number which can have
different numbers.

Disco

6116 - RAM

Samba

10 mS Interrupt

Bossa Nova

MEG Circuit

March

Rhythm Interrupt

Bestell-Nr.

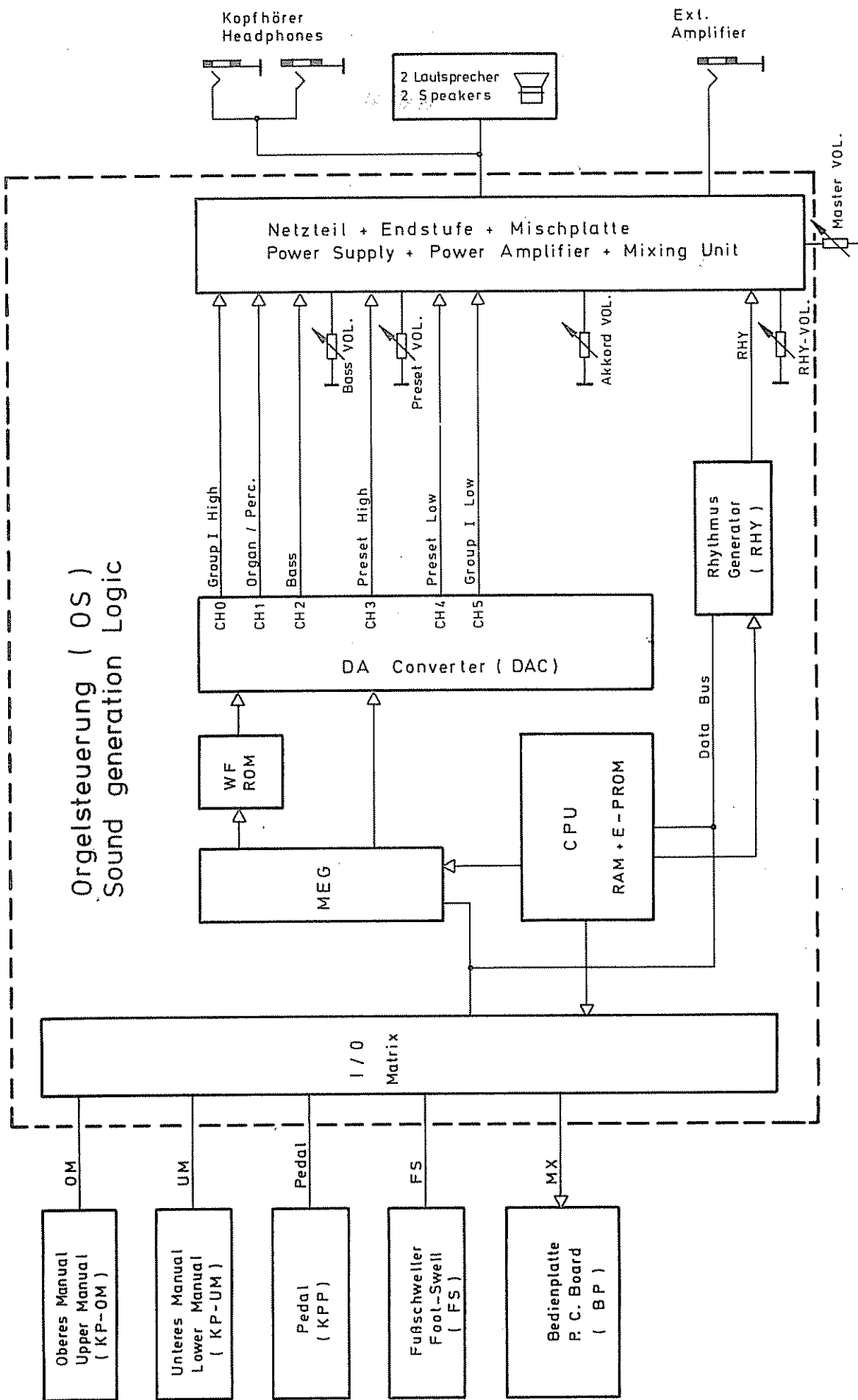
6 - 069.960 - 1001

Block - Schaltbild
block diagram

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Benennung:

für Type: SYMPHONIE D 89



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		Name, Kurz-Ze.	Name, Kurz-Ze.

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Bestell-Nr.

6-069.450-30

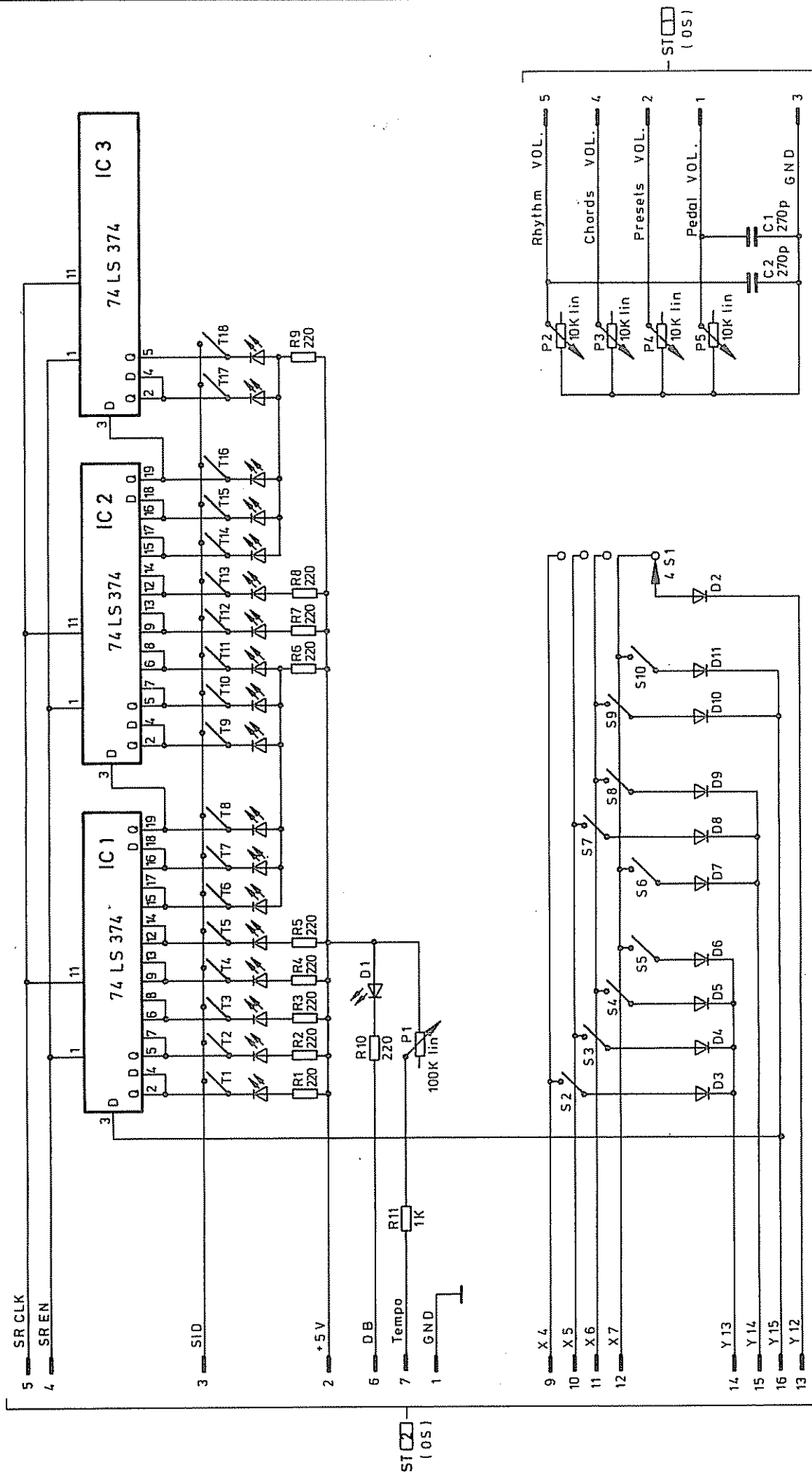
Bedienplatte (BP)
p.c. board

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Arrangeur

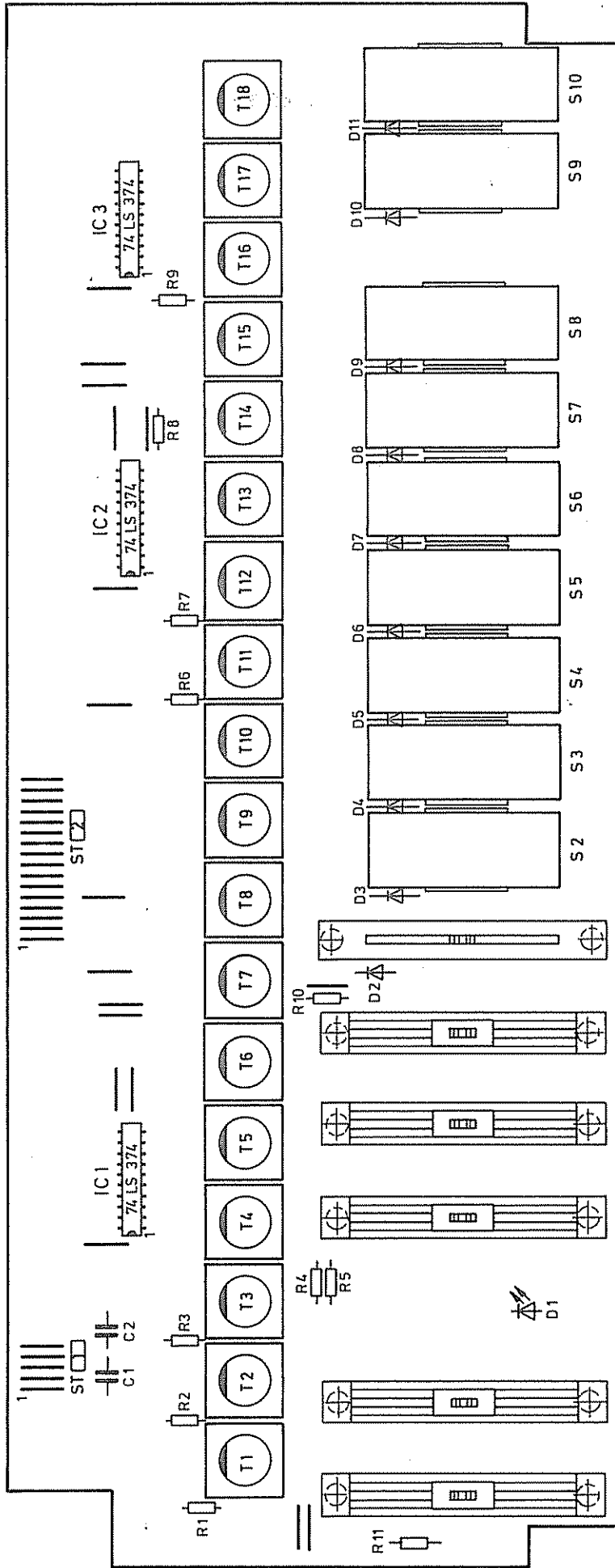
- Einfinger Single Finger
- Tastenstart Key Start
- Memory
- Auto Bass
- Auto Chords

Rhythmus Rhythm.

- Bossa Nova Rumba
- Samba Slow Rock
- Disco Rock
- Swing Boogie
- Country Foxtrott
- Walzer / Waltz Marsch / March
- Auswahl Selector

Festregister Presets

- Höhnerchord
- Klavier Piano
- Westernklavier Honkytonk
- Vibraphon Vibes
- Akkordeon Accordion
- Streicher Strings



P1 Tempo

P2 Lautstärke Volume

P3 Chords

P4 Festregister Presets

P5 Pedal

4 S1 Unteres Manual Lower Flutes

16' 8' 4' 2' Nachklang Sustain

4' Percussion Perc.

Ensemble

Ein / Aus ON / Off

Tremolo Chorus

Rhythmus Rhythm.

Lautstärke Volume

Flöte Flutes

Percussion Perc.

Flöten Effekt Flutes Animation

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Leiterpl. unbestückt: / 6-060.695-0201

Kontaktplatte und Pedal (KPOM, KPUM, KPP)
contact p.c. board, pedal

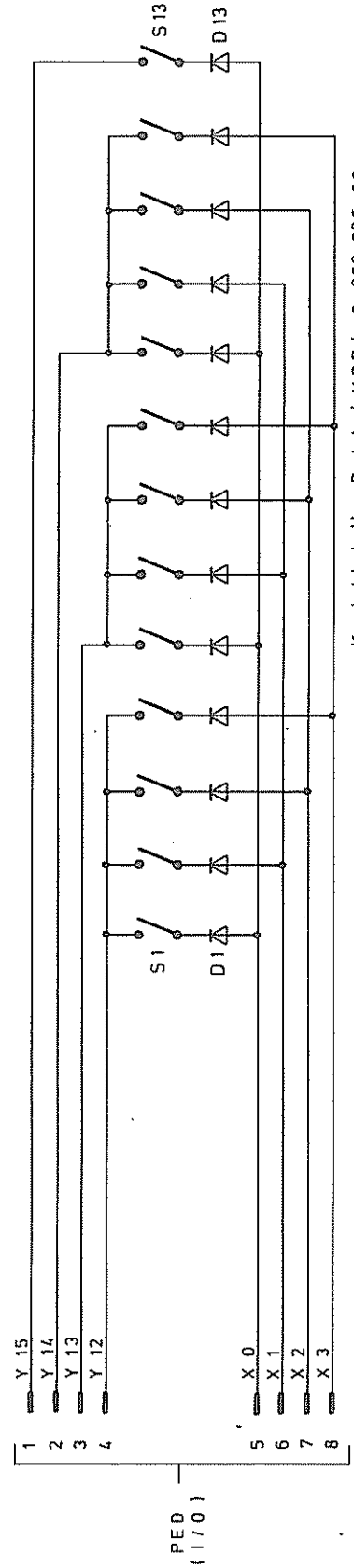
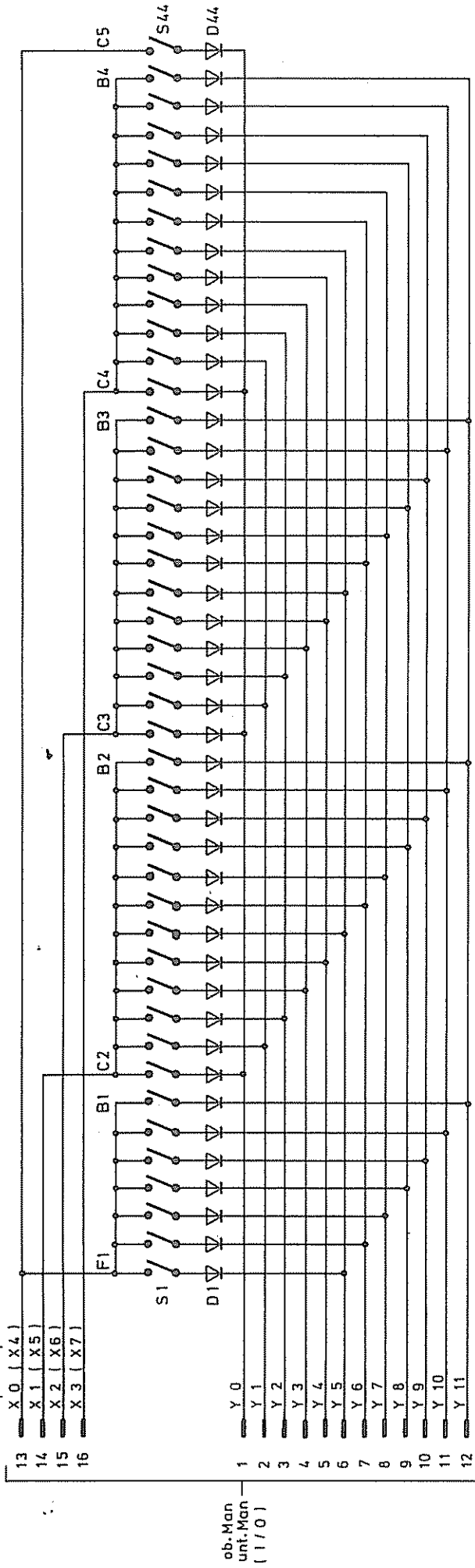
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D89
für Type: SYMPHONIE D90 - D96

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oberes Manual
upper manual
unteres Manual
lower manual

Alle Dioden 1 N 4148
all diodes 1 N 4148



Kontaktplatte Pedal (KPP) 6-060.695-02

Änderungen vorbehalten

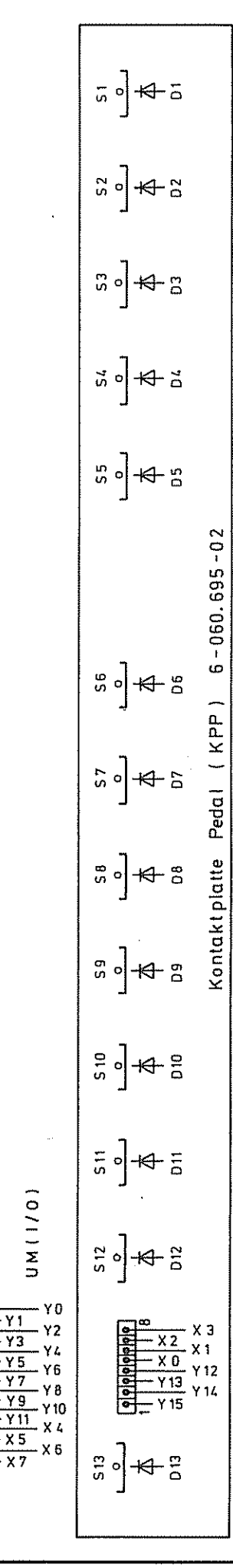
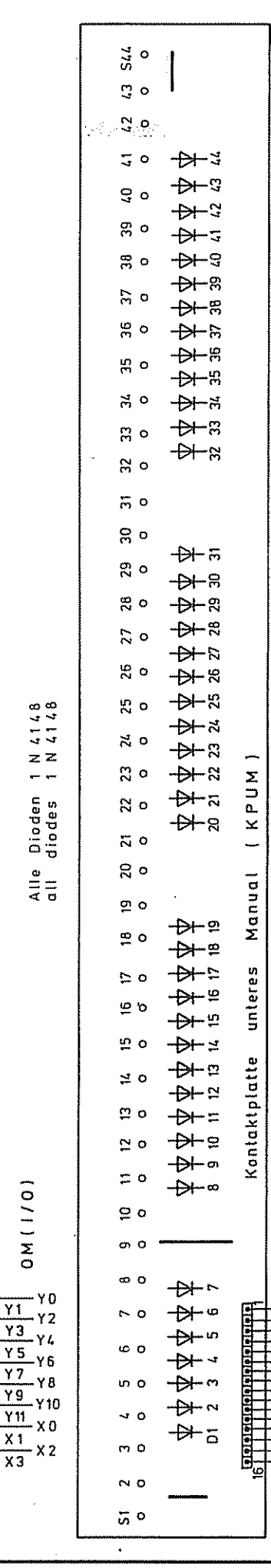
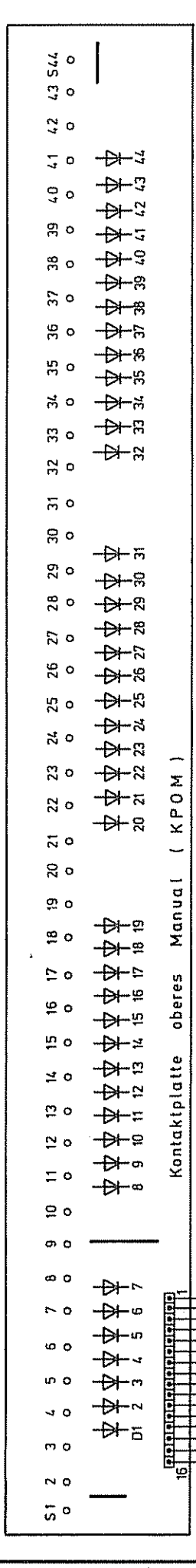
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 Leiterpl. unbestückt:

Kontaktplatte und Pedal (KPOM, KPUM, KPP)
 contact p.c. board, pedal

Benennung: **MATTH. HOHNER AG**
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D89
 für Type: **SYMPHONIE D90 - D96**



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Symphonie D 89

	Y ₀	Y ₁	Y ₂	Y ₃	Y ₄	Y ₅	Y ₆	Y ₇	Y ₈	Y ₉	Y ₁₀	Y ₁₁	Y ₁₂	Y ₁₃	Y ₁₄	Y ₁₅
X ₀	C ₅					F ₁	Fis ₁	G ₁	Gis ₁	A ₁	B ₁	H ₁	C	E	Gis ₁	C ₁
X ₁	C ₂	—	—	—	Oberes Manual Upper Manual			—	—	—	—	H ₂	Cis	Pedal F	A	
X ₂	C ₃	—	—	—	—	—	—	—	—	—	—	H ₃	D	Fis	B	Rhythm. Start
X ₃	C ₄	Cis ₄	D ₄	Dis ₄	E ₄	F ₄	Fis ₄	G ₄	Gis ₄	A ₄	B ₄	H ₄	Dis	G	H	
X ₄	C ₅					F ₁	Fis ₁	G ₁	Gis ₁	A ₁	B ₁	H ₁	Vo- lume UM	16'		
X ₅	C ₂	—	—	—	Unteres Manual Lower Manual			—	—	—	—	H ₂		8'	4' Perc.	
X ₆	C ₃	—	—	—	—	—	—	—	—	—	—	H ₃		4'	Ensemble	Chorus ON/OFF
X ₇	C ₄	Cis ₄	D ₄	Dis ₄	E ₄	F ₄	Fis ₄	G ₄	Gis ₄	A ₄	B ₄	H ₄		2'	Sust.	Tremolo

Benennung

für Type **SYMPHONIE D 89**

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Matrixbelegung
Matrix Organisation

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SOUND GENERATION LOGIC (OS)

This board comprises:

- a.) Microcomputer 8085 with clock generator
- b.) EPROM max 12 K
- c.) BUS and control signal drivers
- d.) MEG circuit with clock generator
- e.) D/A Converter
- f.) Rhythm generator with D/A Converter
- g.) Watch dog timer
- h.) 10mS Real Time Interrupt
- i.) I/O MATRIX
- j.) Mixing unit + power amplifier + power supply

I/O:

Two types of scanning are used:

- Matrix scanning
- Serial Scanning

Matrix scanning:

The matrix scanning uses the 1960 concept of diode array memory well known to those familiar with DTL logic. The microprocessor "sees" a diode array memory, the fuses being replaced by the contacts.

The memory format is 16 words of 8 Bits (see matrix organisation).

The word decoding is done like any memory by a decoder IC-11 connected by the address lines. The decoder will select one word from the matrix ($Y_0 - Y_{15}$).

The corresponding word data ($X_7 - X_0$) is read by the CPU with the signal RDMX.

$\overline{\text{RDMX}}$ is a connection of the signals $\overline{\text{ENMX}}$ and $\overline{\text{RD}}$ and drives IC - 17 and IC - 6.

Note diode D 4 allowing the direct connection of foot switches for rhythm start.

The matrix organisation sheet is very useful to find a hardware fault in the matrix area.

For example, if all notes of the upper keyboard, upper octave are playing together this results in a X_3 matrix line shortened to ground or IC-17 - 74C244 defect.

For example, if all E notes are not playing, check if strings 16' and lower manual volume work. If not, this results in a cut on Y_4 or a defect IC-11 - 74154.

Note: Scanning is difficult to observe with an oscilloscope as the scanning scheme is not straight forward ($Y_0 - Y_{15}$).

Serial scanning:

- LED display cycle

An exclusive scanning scheme is used which combines switch detection and LED display (patent applied for).

The scanning is under microprocessor control using signals SRCLK - IC-8, SREN - IC - 10, Y_{15} (matrix) data for the shift register.

SREN is low thus enabling the shift registers 74LS374. The display pattern is shifted using SRCLK to shift Y_{15} data into the shift registers.

- Switch scanning

At regular time intervals SREN is brought high for a short time. All the 74LS374 outputs will be tristate, all LED will extinguish.

SID is tested. If zero, this means no switch is ON. If one, SRCLK is clocked, then SREN is brought low.

This sets all 74LS374 outputs to 1.

Y_{15} is set to zero and SRCLK is clocked until SID is zero. The count of SRCLK pulses gives the number of the actuated switch.

The operation then resumes to normal display.

The switches with LED serial scanning are completely under program control through addressable latch IC-10.

CPU:

The CPU clock is generated on chip 8085 by means of an X-tal (6,144Mc).

The clock frequency as generated by the X-tal is divided by 3 (IC-5 - 74HC74). This results in a clock signal CK. CK is used for the clock of the gate array IC-26 - CGR90 (integrated control logic of the rhythm generator).

10mS Real Time Interrupt:

This interrupt is used by the program to generate various sound envelopes (attacks, sustains, vibrato, portamento). The interrupt is generated with IC-6 - 74LS123.

Watch dog timer:

This device is used in case of erratic transient or undetected software fault which may cause the program to enter an endless loop or halt condition. Then a TRAP interrupt will generate from IC-6 - 74LS123.

On half of one-shoot IC-6 is used on the TRAP input. IC-6 is triggered from the signal RDMX if the matrix scanning is running.

Rhythm Interrupt:

The rhythm interrupt for the microprocessor is generated from the timer IC4-555.

The signal \overline{WR} comes to the De-Multiplexer IC-8-74LS155 which generates \overline{WRRY} "Load dates" for the rhythm generator (Gate array CGR90).

MEG (integrated sound generator)

The MEG-IC includes a 32 voices digital Synthesizer which is under the control of the microprocessor. Each of the 32 Synthesizer voices is able to produce up to 8 octave related signals.

The microprocessor controls the MEG-IC with the multiplexed signals AD₀ - AD₇. The signal AWA 0-7 includes time multiplexed waveform addresses and amplitude values. If the WALE signal is logic "1" this means that waveform addresses and during logic "0" that amplitude values will be transmitted.

The WALE signal loads the address to IC-2-74LS373 and generates with the signals WA8-WA11 the address of a waveform. It is possible to address 16 different waveforms.

With the next positive slope of the signal H2 will be transmitted the contents of the waveform address, the amplitude values and the output select information to the registers IC-18, IC-20 and IC-21. This information gets transmitted to the D/A Converter.

The signal $\overline{\text{LDAC}}$ is necessary to start the D/A cycle.

The main clock signal for the MEG-IC is generated with L1 and C56-C58 and an internal clock generator on the chip.

The tuning of the organ can be adjusted with L1 (see adjustment procedure).

For the control of the MEG-IC four further control signals are necessary:

$\overline{\text{RD}}$	- "Read Dates")	
$\overline{\text{WR}}$	- "Write Dates")	from the CPU
ALE	- "Address Latch enable")	
MEG	- MEG-enable - IC-7-74LS139)	

D/A Converter

The D/A conversion receives amplitude information AMPL, waveform information DA, output select (channel) information OS and a sampling signal $\overline{\text{LDAC}}$.

For each $\overline{\text{LDAC}}$ signal, an output sample is produced with following formula:

$$V_{(os)t+1} = V_{(os)t} + V_0 \text{ AMPL.DA}$$

$$V_{(os)t+1} = \text{being the voltage after the } \overline{\text{LDAC}} \text{ signal on the selected output OS}$$

$$V_{(os)t} = \text{being the voltage before the } \overline{\text{LDAC}} \text{ signal on the selected output OS}$$

$$V_0 = \text{being a constant}$$

To do this, AMPL 0-7 is converted to analog by IC-22 and the corresponding analog current is fed to analog multiplier IC-23, DA 0-7 is converted to analog by IC-19 and the corresponding analog currents are fed to analog multiplier IC-23.

IC-23 is a two quadrant analog multiplier followed by an amplifier giving the results $V_0 \text{ AMPL DA}$ which is fed to input of analog multiplexer IC-37 Pin 3.

Depending on the OS value, the previous signal is switched to the corresponding channel integrators thus achieving the required function.

Rhythm Generator with D/A Converter

This board generates 16 different rhythm instruments sounds on 1 channel - RHY.

The sound generation is fully digital and uses live recorded sounds.

Principle:

The sound is generated at a 22 k c/s sampling rate with a 6 channel time multiplex scheme. Each channel time is further divided in 16 micro-program steps.

The sounds are stored permanently into 32 k bytes of ROM memory in straight 8 bits linear coding. This ROM memory also contains special codes allowing to jump to a given memory address (loops like ROLL) or to stop the sound output at the end of a sound.

The digital to analog conversion uses an 8 bit D/A converter IC-31 followed by an analog multiplexer and sample and hold circuitry.

The 3 channels are mixed to give 1 channel, RHY.

POWER SUPPLY, POWER AMPLIFIER, MIXING UNIT

Only one board is used for the power supply, power amplifier and the mixing unit.

The mixing unit includes 5 active low pass filters IC-34, IC-40, IC-38 and boosts the weak signals from the D/A Converter.

The rhythm signal RHY is fed to the summing amplifier IC-35 - uA 741.

The signal NF-ALL is fed to IC-35 - uA 741 and they to IC-36 - BA6110.

IC-33 - STK080 is used as a power amplifier.

The control signal "squelch" is fed about T1 to IC-36 - BA6110 (noisegate active if the organ is not played).

All DC voltages are generated from the power supply.

Bestell-Nr.

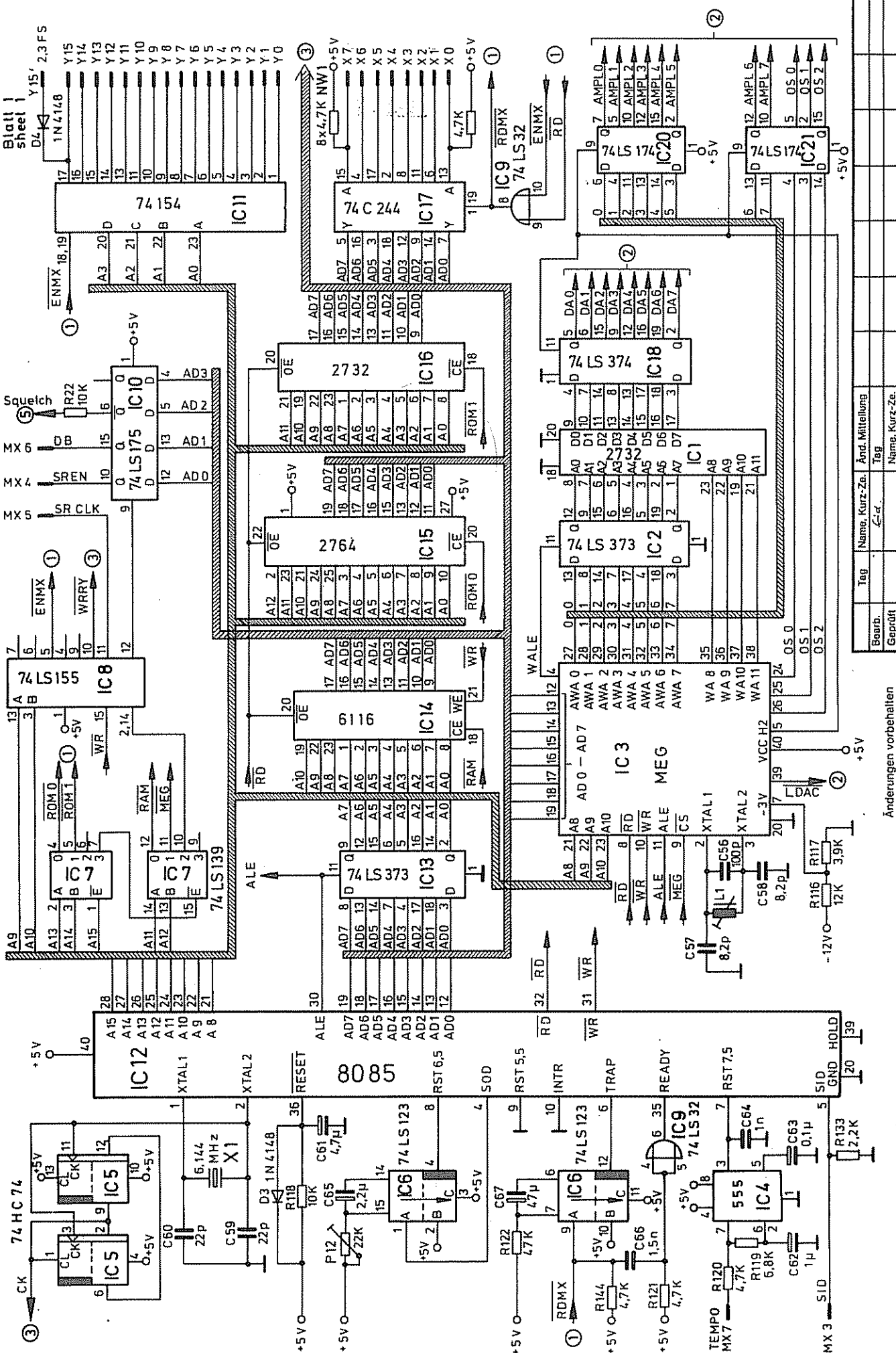
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Orgelsteuerung (OS)
sound generation logic

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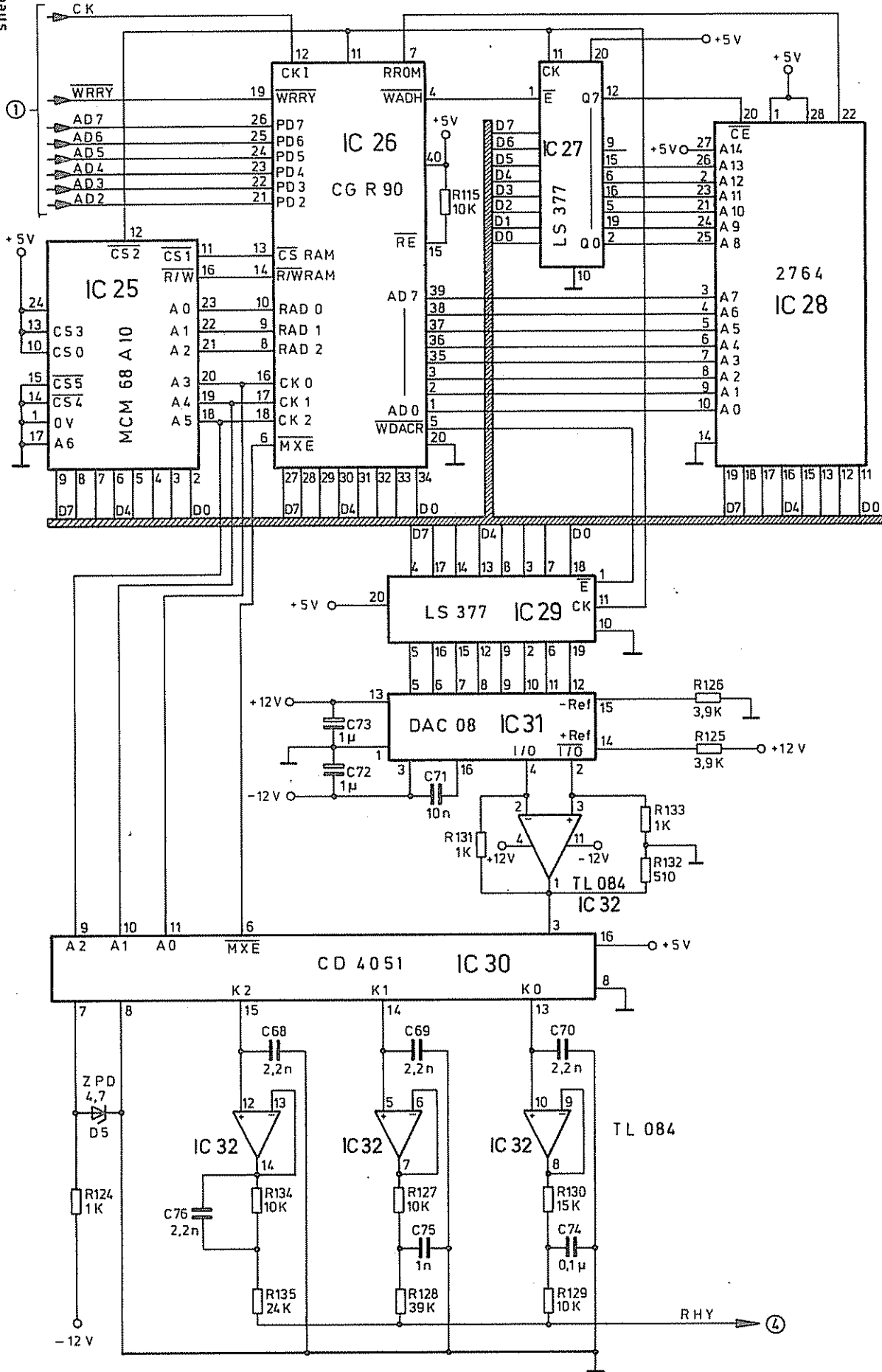
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Blatt 3
sheet 3



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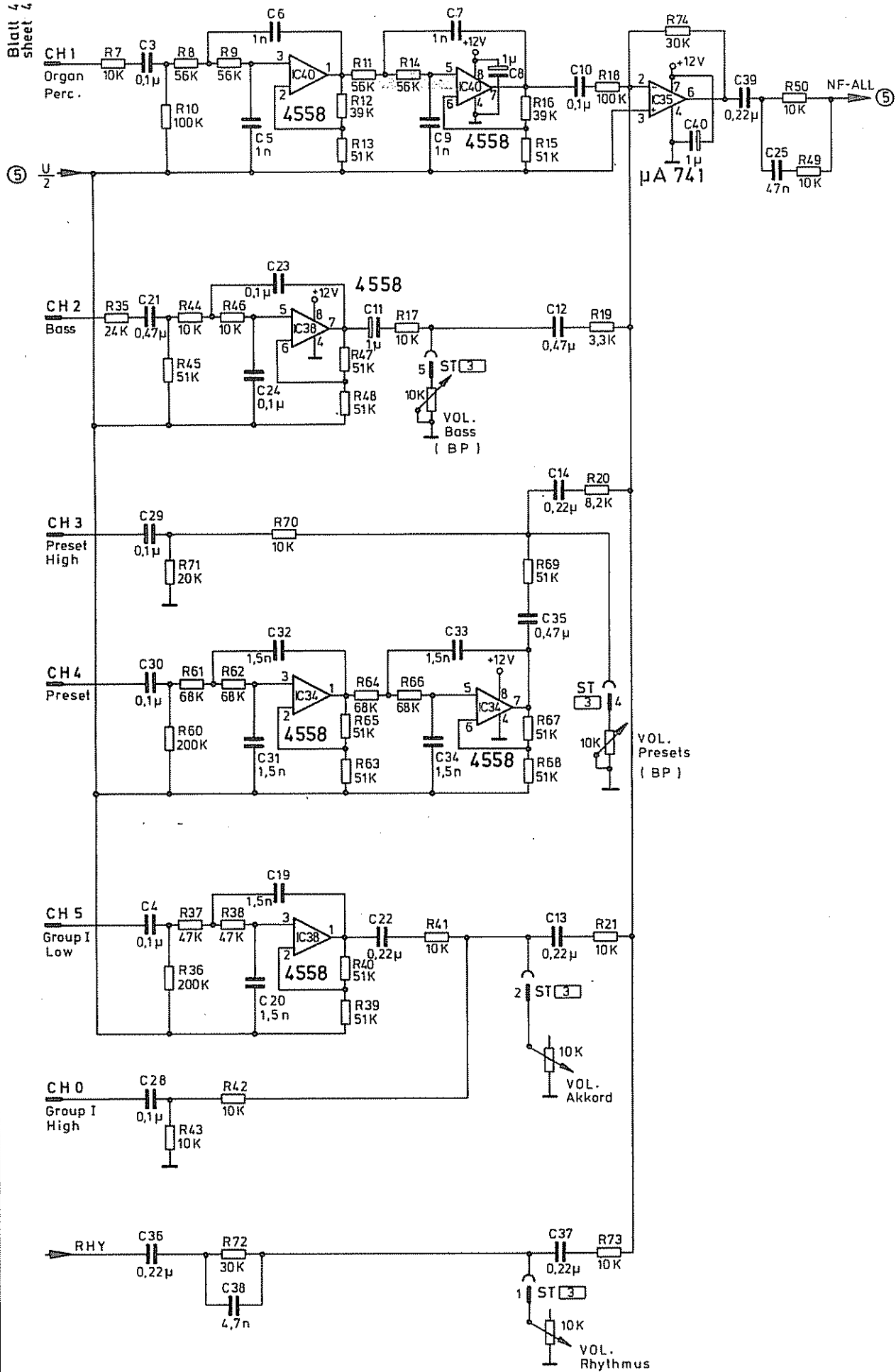
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Orgelsteuerung (OS)
sound generation logic

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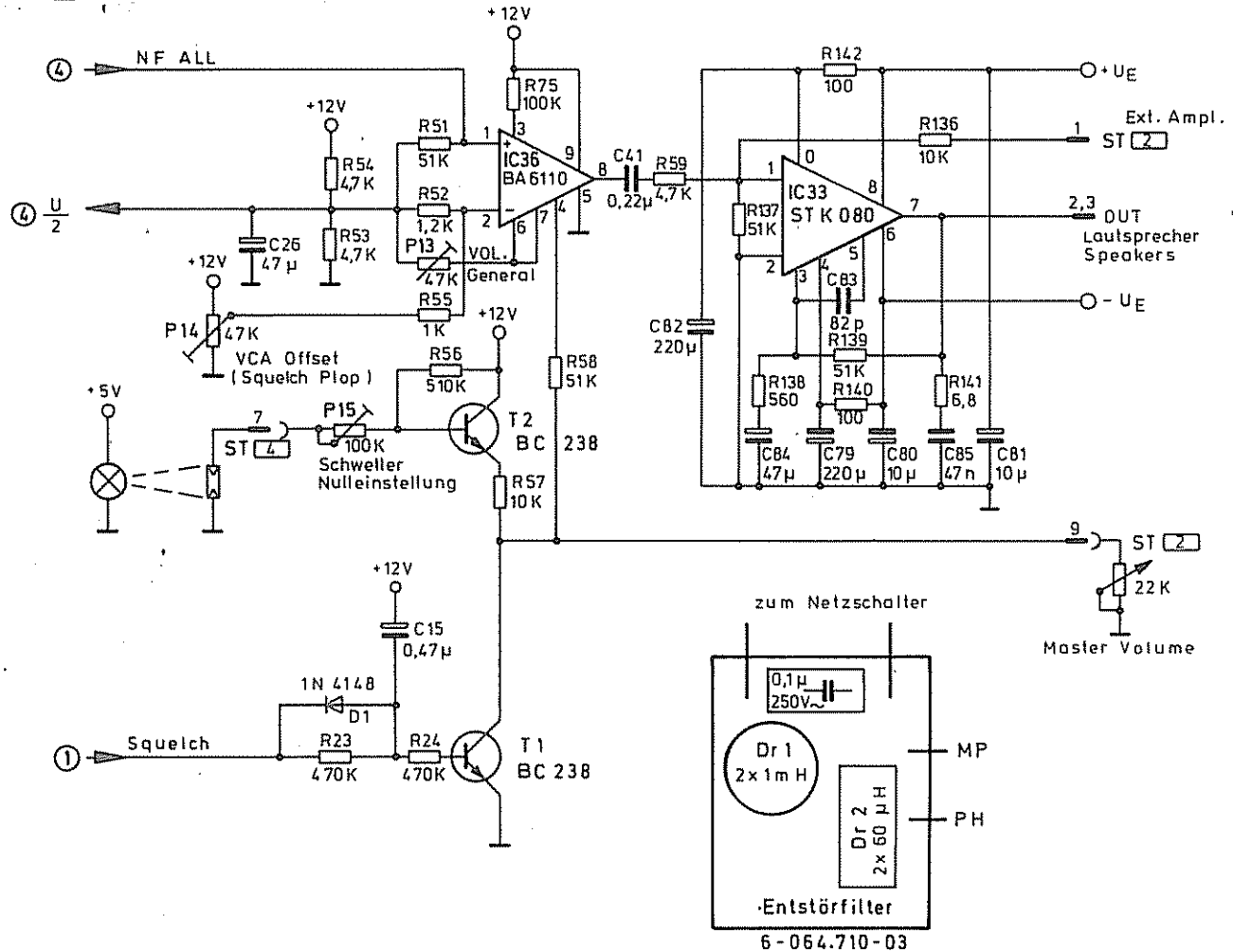
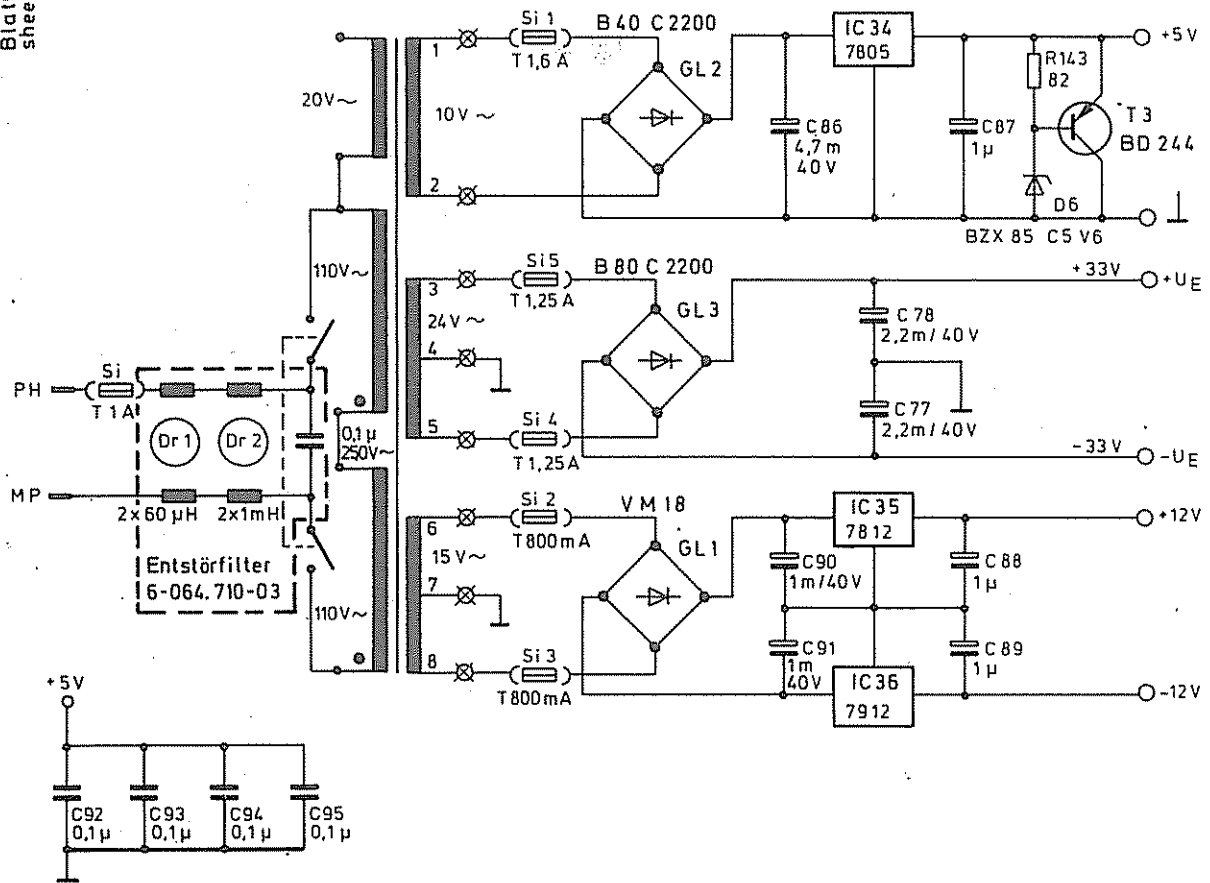
Orgelsteuerung (.OS)
sound generation logic

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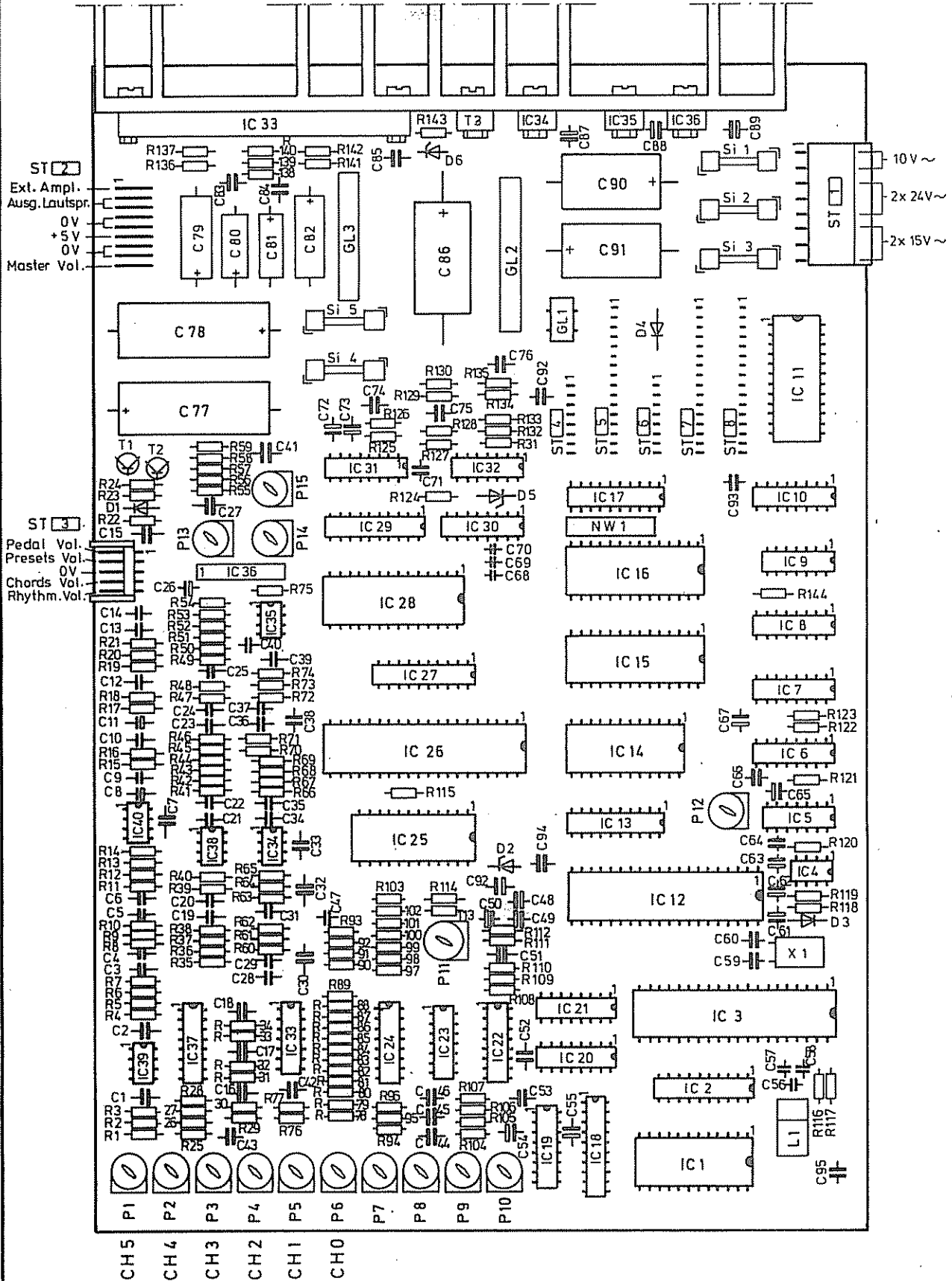
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Orgelsteuerung (OS)
sound generation logic

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Sound generation logic - Input/output Connectors

PIN	Upper Manual	Lower Manual	PED	MX	FS
1	Y0	Y0	Y15	OV	+5V
2	Y1	Y1	Y14	+5V	Y0'
3	Y2	Y2	Y13	SID	Y0'
4	Y3	Y3	Y12	SREN.	X3
5	Y4	Y4	X0	SRCLK	X2
6	Y5	Y5	X1	DB	OV
7	Y6	Y6	X2	TEMPO	Foot Swell
8	Y7	Y7	X3	RHY-VOL	OV
9	Y8	Y8		X4	
10	Y9	Y9		X5	
11	Y10	Y10		X6	
12	Y11	Y11		X7	
13	X4	X0		Y12	
14	X5	X1		Y13	
15	X6	X2		Y14	
16	X7	X3		Y15	

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Benennung:

Kopfhöreranschlußbuchse

D89

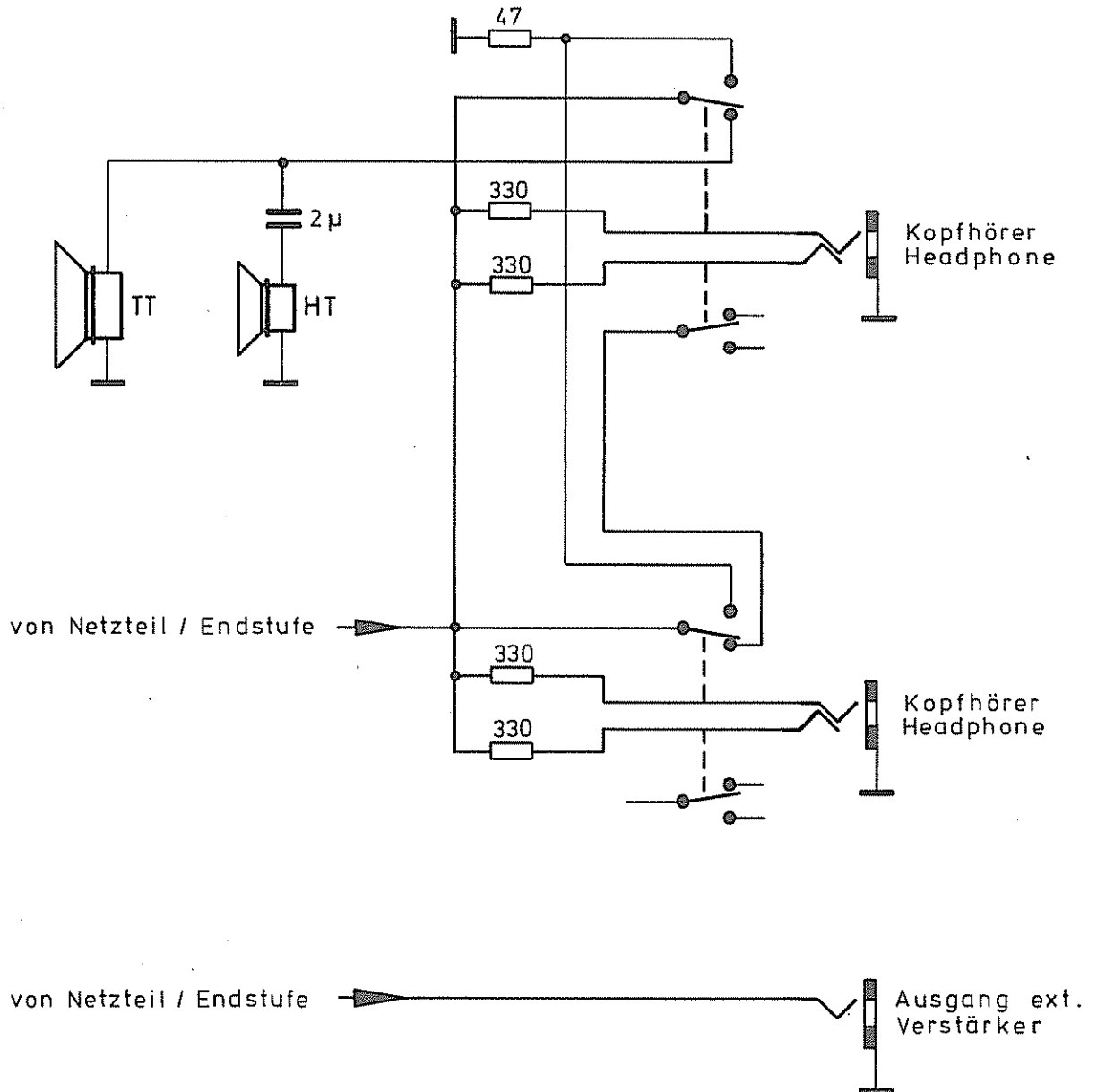
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Bestell-Nr.

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Geprüft			Name, Kurz-Ze.						

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Benennung:

Fußschweller (FS)
foot swell

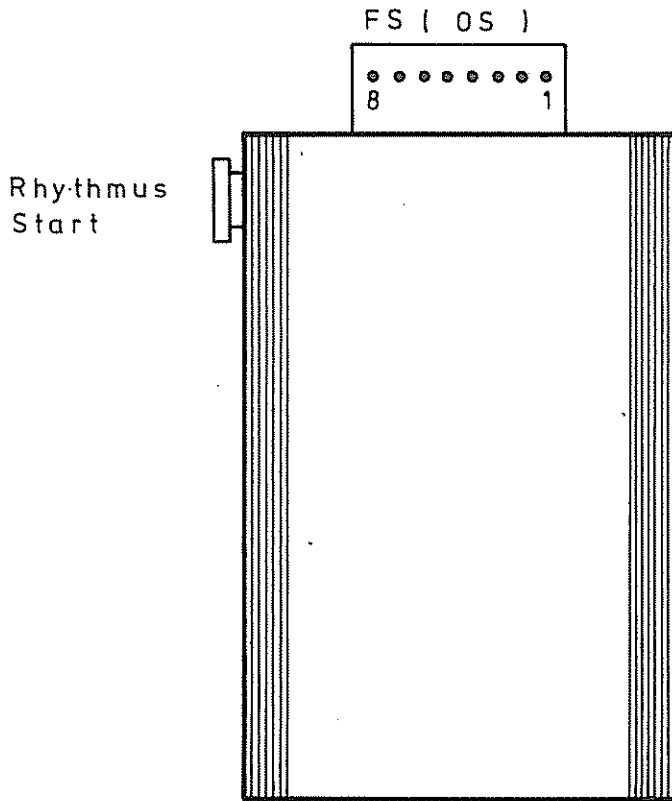
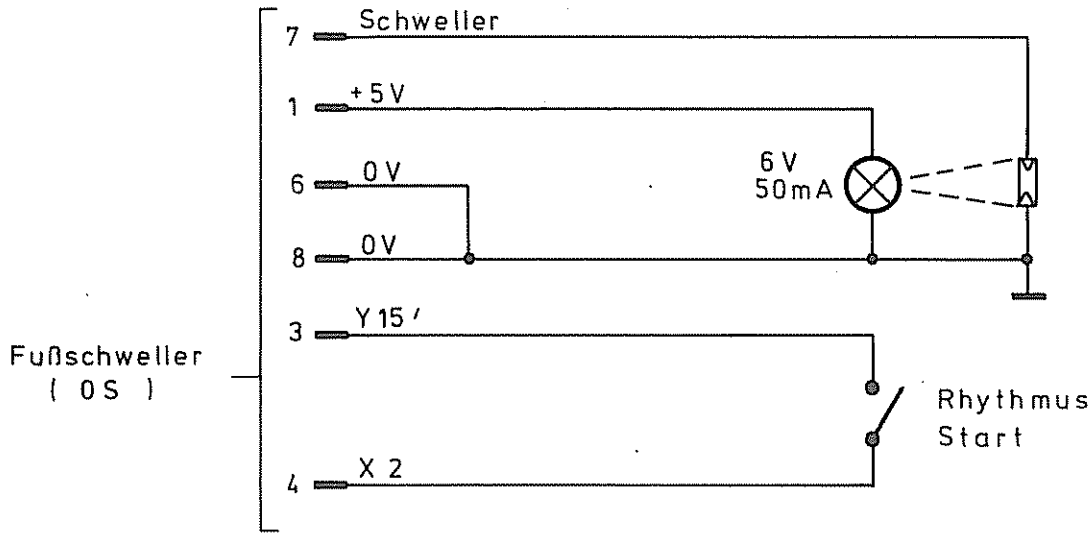
für Type: SYMPHONIE D 89

Bestell-Nr.

Leiterpl.
bestückt:

Leiterpl.
unbestückt:

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Änderungen vorbehalten

	Tag	Name, Kurz-Ze.	Änd. Mitteilung						
Bearb.		G.d.	Tag						
Geprüft			Name, Kurz-Ze.						

GLOSSARY

A 0-15	ADDRESS BUSS
AD 0-7	Mux Address + Data Buss
ALE	Address Latch Enable
AMPL	Amplitude
AWA	Address Memory-wave form
CH	Channel
CK	Clock 480nS
ENMX	Enable Matrix
FR	Preset
GR	Group
I/O	Input/Output
LDAC	Load DAC
H2	Clock MEG 750nS
MEG	MEG Enable
OS	Output Select
RD	Read Data
RDMX	Read Matrix
RYINT	Rhythm Interrupt
RHY	Rhythm Channel
SQUELCH	Squelch
SID	Serial Input Data
SRCLK	Shift Register Clock
SREN	Shift Register Enable
TRAP	Non Maskable Interrupt
Wale	Wave form Address latch enable
WF	Waveform
WR	Write Data
WRRY	Write Rhythm Data
X, Y	Matrix Buss

Parts List for D 89

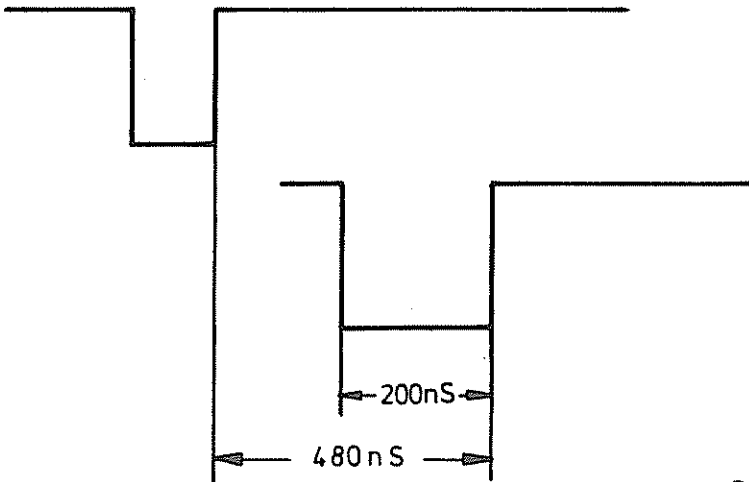
Board	Type	Quantity	Material-No.
Soundgeneration logic, OS	EPROM 2732 cod.	1	6-069.420-3003
"	EPROM 2732 cod.	1	-3004
"	EPROM 2764 cod.	1	-3005
"	EPROM 2764 cod.	1	-3006
"	MEG	1	6-068.420-4104
"	CGR 90 (Gate Array)	1	-6604
"	P8085A	1	617 735
"	RAM 6116 P	1	617 780
"	MCM 68 A 10	1	617 770
"	HEF 4051 BP	1	617 756
"	TL 084	2	617 738
"	DAC 0801	3	617 739
"	MC 3346	1	617 757
"	CD 4051	1	617 737
"	BA 6110	1	617 773
"	RC 4558 PS noiseless	3	617 691
"	STK 080	1	617 743
"	TL 082	1	617 742
"	LM 555	1	617 731
"	7812 UC	1	617 604
"	7912 UC	1	617 700
"	7805 UC	1	617 699
"	uA 741	1	617 609
"	SN 74154N	1	617 012
"	SN 74C244	1	617 776
"	SN 74HC74	1	617 785
"	SN 74LS32N	1	617 672
"	SN 74LS123N	2	617 668
"	SN 74LS139N	1	617 758
"	SN 74LS155N	1	617 673
"	SN 74LS174N	2	617 695
"	SN74LS175N	1	617 717
"	SN 74LS373N	2	617 728
"	SN 74LS374N	1	617 715
"	SN 74LS377N	2	617 730

Material description	Material-No.
Key pestle	6-068.450-3104/0
Housing of push button	.450-3103/9
Rocker switch green complete	.451-24
Rocker switch black complete	6-062.453-2500/0
Rocker switch white complete	6-067.451-46
Slide switch 4-times	0-606.721
Push button black	6-068.450-9002/0
Rotary Knob black with Lid black	0-622.880
Potentiometer 22 kOhm with power on/ff switch	0-611.676
" " 1 kOhm lin.	0-611.574
" " 10 kOhm lin.	0-611-647
" " 25 kOhm lin.	0-611.691
" " 47 kOhm lin.	0-611.724
" " 100 kOhm lin.	0-611.755
Woofers	0-622.576
Tweeter	0-622.580
Fuse holder	0-604.403
Fuse eye	0-604.600
3-pin jack stereo	0-606.254
2-pin jack	0-606.259
Lamp 6 V 50 mA	0-607.527
Fuse slow blow 1,25 A Träge	0-604.242
" " " 1,6 A Träge	0-604.215
" " " 0,8 A Träge	0-604.212
Key green	6-068.451-4601/0
" white	-3501/0
" grey	6-401.450-2701/0
" dark-grey	6-068.451-3401/0
" black	.450-3301/0
" yellow	.451-3201/0

ADJUSTMENT PROCEDURE OF D 89

Sound generation logic, OS:

- Play middle "A"
- Adjustment with L1
- Frequency = 440 Hz (Organ pitch to be controlled with pitch controller device)
- Adjustment of the 10mS Interrupt:
- Measurement at IC-6 Pin 4 (74LS123)
- Adjustment with P12 (adjust for 10mS repetition rate)
- Adjustment of the D/A Converter (Oscilloscope):
- Registration Flute 2', press one key of the highest octave



200nS Adjustment with P8, MP2

480nS Adjustment with P7, MP1

- Adjustment of the Symmetry (Oscilloscope):



- Adjust the amplitude with P9 for $2 V_{SS}$ at MP3
- Adjust the symmetry with P10 at MP3
- Another possibility to adjust the symmetry:
 - Register 2' Flute, press one key of the highest octave
 - Adjustment with P10 (you will hear no Blob if the adjustment is correct)
- Adjustment General Blob:
 - Registration Flute with sustain, press one key on the upper manual
 - Adjust P11 for middle position
 - Adjust P11 for minimum general blob
- Adjustment for the channels 0-5 ($P_0 - P_{15}$):
 - Channel designation:
 - CH0 - Group I, Treble
 - CH1 - Flutes and Percussion
 - CH2 - Bass
 - CH3 - Presets (high), Registration Western Piano
 - CH4 - Presets (low), Registration Piano
 - CH5 - Arrangeur Group I, Registration Bossa Nova, Vibes, press key "F" on the lower manual

- Adjustment of the VCA-Offset (Squelch-Blob) with 14
 - Press a key for a short time
 - If the noisegate adjustment is correct you will hear no blob (out if the noisegate works)
 - Adjust P15 to the desired initial volume
-
- Volume adjustment for the different channels (Oscilloscope):
 - Connect the oscilloscope to the power amplifier output
 - Foot-swell on maximum
 - Register Flutes 16' and 8' without Leslie, press key "A" on the 2nd octave
 - Adjust the voltage at the power amplifier output on 12 V_{ss} with P13 (General Volume)