PPG HDU SERVICE MANUAL

This Service Manual has been made to enable you to give your customer fast and efficient service with a minimum of difficulties for yourself. The reason you will be able to service this machine so effectly is because all really time consuming problems that can occur will probably be located on one of the four digital boards (MPU, CTR, WIDICON and TMS-board). These boards are so incredibly complex that, apart from very few exeptions, they have to be swapped if something goes wrong with them.

The HDU is a fully digital machine exept from the A/D and D/A converters. Because the HDU is able to do different tasks at the same time, e.g. loading sound data from the hard disk, playing the material back through the D/A converters, performing an audio effect with this material, receiving parameter inputs from the remote-commander, and performing visual control on the LC display, there are different processors to do all these jobs at the same time.

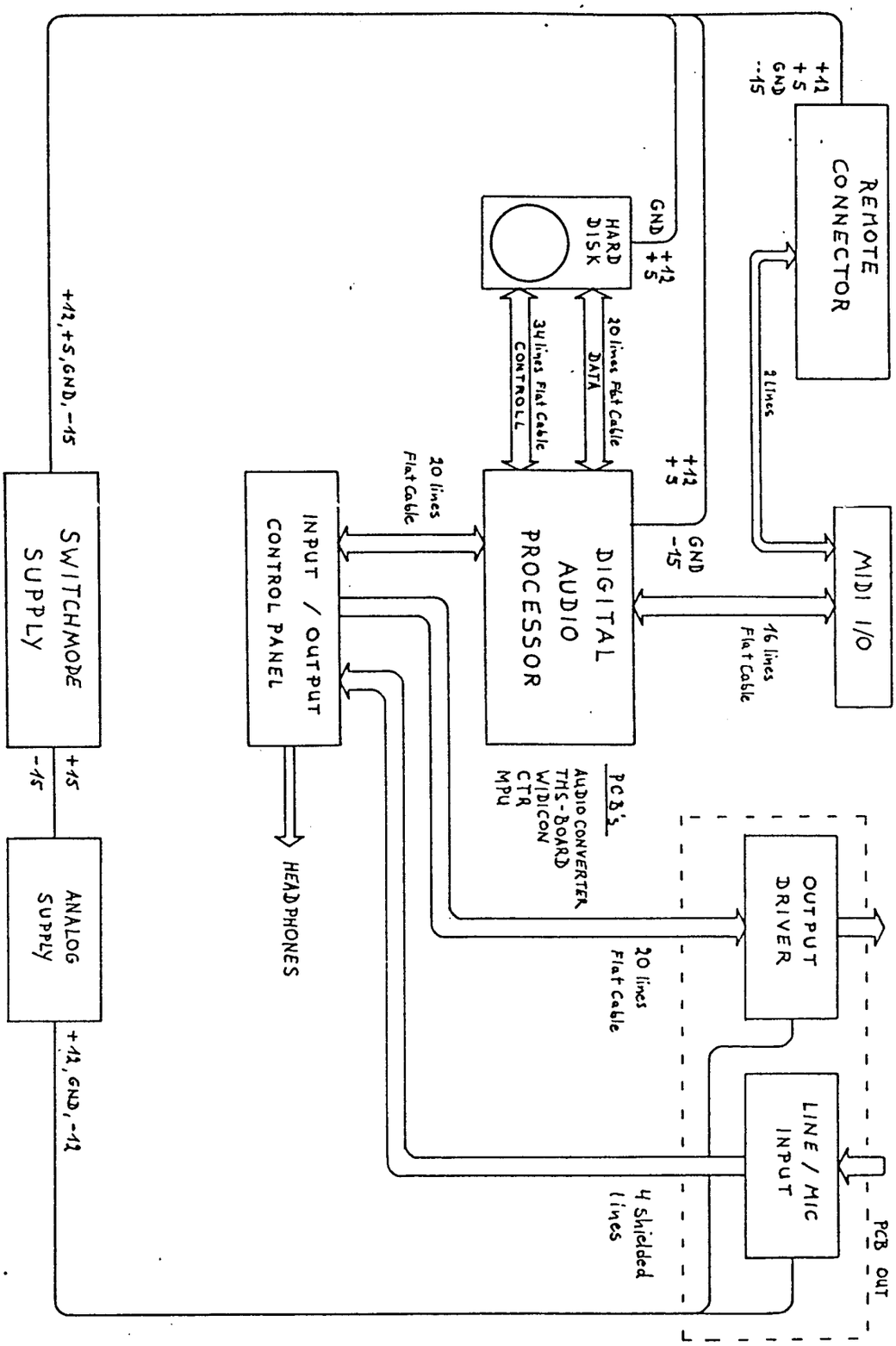
a. a 68000 processor to supervise all processes in the HDU.

b. a 68000 processor in the remote commander to do the display actions as well as the handling of user inputs and the communication to the HDU.

c. a Hard Disk controller to control disk actions and to do data transportation into one of the DMA-RAM`s.

d. two TMS 320 signal-processors to perform all kinds of audio-data processing and data movement from the A/D and to the D/A converters.

HDU - BLOCKDIAGRAM



The following is a more detailed description of the four digital boards in the HDU and their functions to give you some hints for finding out faulty boards.

To have access to the P.C.Boards in the card cage of the HDU, you have to open the frontpanel and also remove the top panel of the HDU. You than have access to the card-security-price which must be removed also.

NOTE:

The bus-system of the motherboard of the HDU is not linear connected through all the slots. It is therefore necessary to keep the cards in the same order as the are installed.

All boards have the following power supply voltages on the same pins:

```
GND -15                  +5        +5                      GND
 00-........//........++           ++........//.........00
 00+........//........++           ++........//.........00
GND +12                  +5        +5                      GND
```

The first slot (at the bottom) is reserved for a hardware expansion and is not used in the standard hardware-set.

1. MPU board:

This board is located in the second slot (from bottom) in the PCB cage.
It contains the 68000 processor,
up to one megabyte RAM, build up of 256 kbit IC`s,
up to 8 EPROMS 128/256 kbit
a PIA (Parallel Interface) 68A21
a Timer 68A40
and the BUS Interface with 6 pcs. 74LS245

The control and timing is done by the PAL`s 1 to 5.
The 68000 main processor does the overall control of the HDU. The 68000 uses the dynamic RAM to store all the effect program data, the audio recording directory the data for the 6 songtables as well as the 100 softkey records.

When the HDU is powered up, or reset through the reset knob at the frontpanel, the entire machine program is loaded from the EPROMS into the RAM and is then executed only in RAM.

The PIA with the corresponding drivers are forming the PPG communication bus interface. The timer is mainly used to generate an periodic interrupt of 400 usec.

2. CTR board:

This board is located in the 3rd slot from the bottom. It contains a dualported RAM which is used to transfer data between the 68000 and the TMS signal-processors. It also includes three ACIA`s 68A50 (serial interface). These are used for the two MIDI-Ports and the Remote Commander, which also makes use of the MIDI data format.

3. WIDICON board:

This board is located in the 4th slot from the bottom. It is probably the most important board in the HDU. It contains the winchester controller and the Buffer RAM which is used for all data transfers from and to the winchester drive. This RAM is dualported and has 4 DMA Channels: 1 for the 68000
1 for the Hard disk controller
2 for the 2 TMS 320 signal processors

The WIDICON also contains the master timing circuitry which is based on a 20 Mhz Cristal Oscillator.

4. TMS board:

This board is located in the 5th slot from the bottom. It has the two signalprocessors and the necessary timing and control generation on it. This board is responsible for all sound processing as well as for data transfers from the A/D and to the D/A converters.

As already mentioned above, these four digital p.c.boards are extremly complex, and it can only be recommended to find the faulty board by changing it against one board of your service board set.

The AUDIO CONVERTER and Interface boards

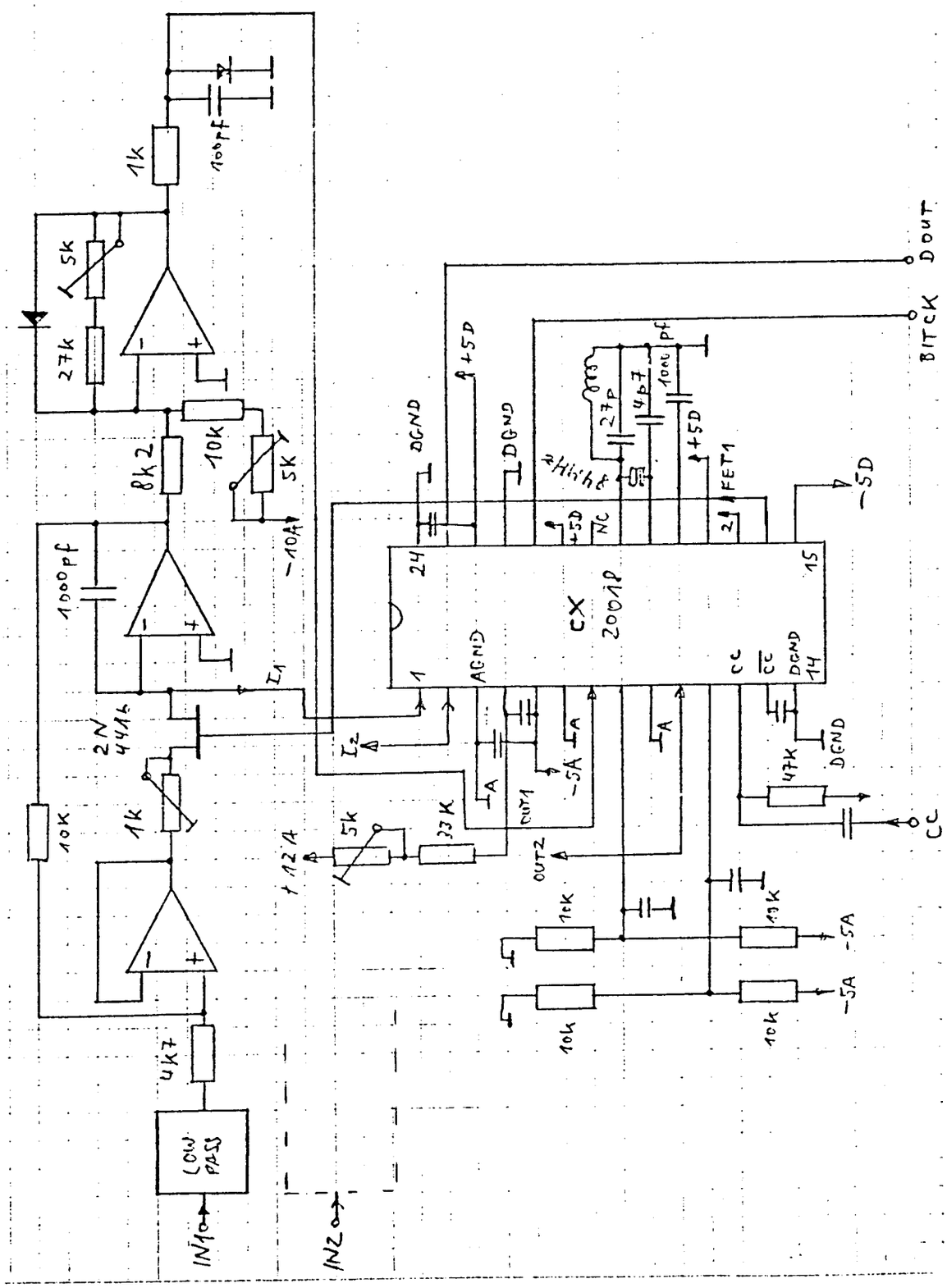
The circuit diagrams for these boards are shown on the next pages of this manual.

The AUDIO CONVERTER board is located in the last slot at the top of the card cage. It contains two Sony CX 2017 dual 16 bit D/A converters and one Sony CX 2018 dual A/D converter.

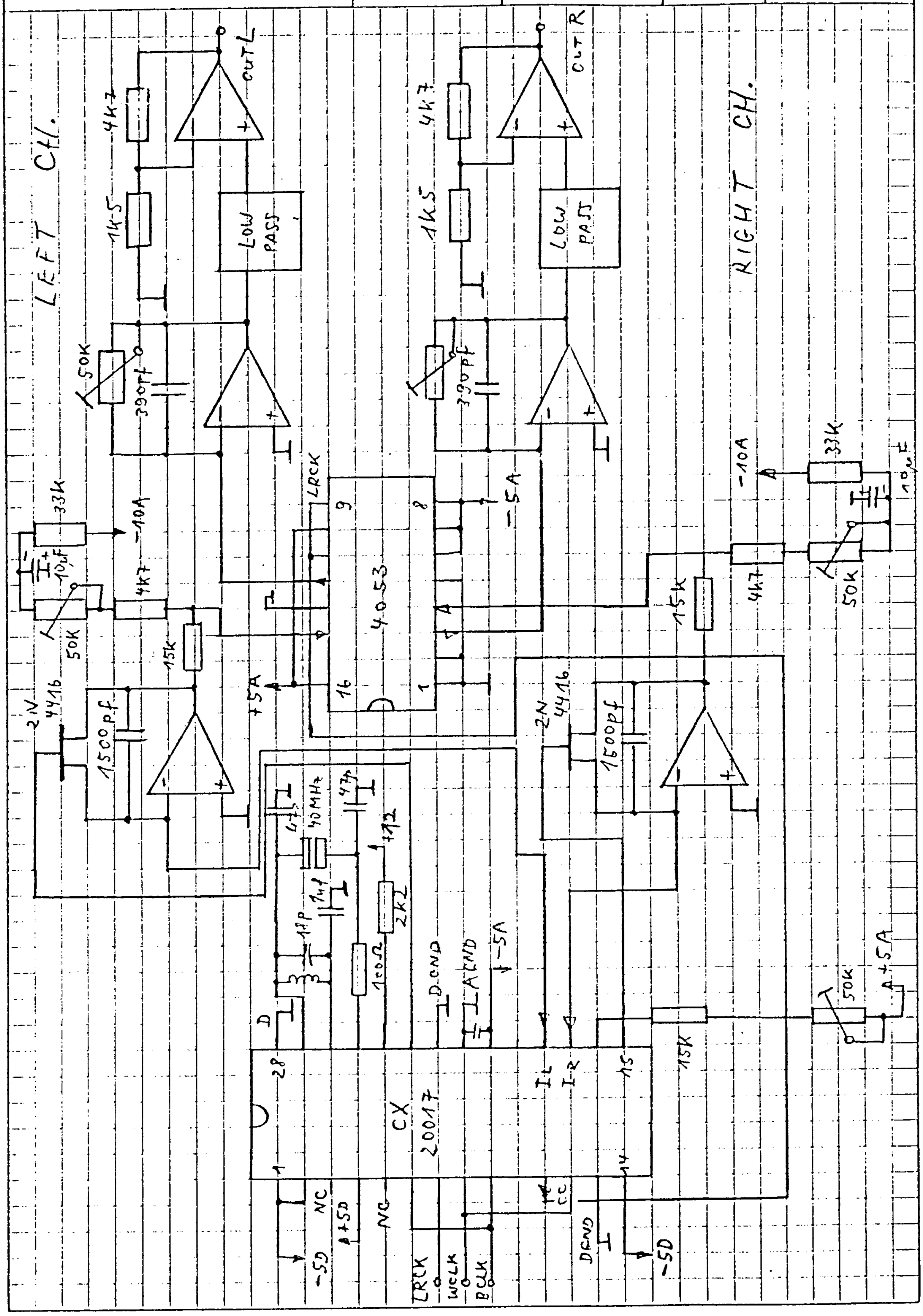
The audio data is entering the board in 16 bit parallel format and is then transfered into a serial data stream, which is feed into the D/A converters. In opposite a serial data stream is supplied from the A/D converter and is feed into a shift register which converts it into 16 bit words, which are going onto the bus-connecter.

The timing diagrams of the conversion process are shown below.

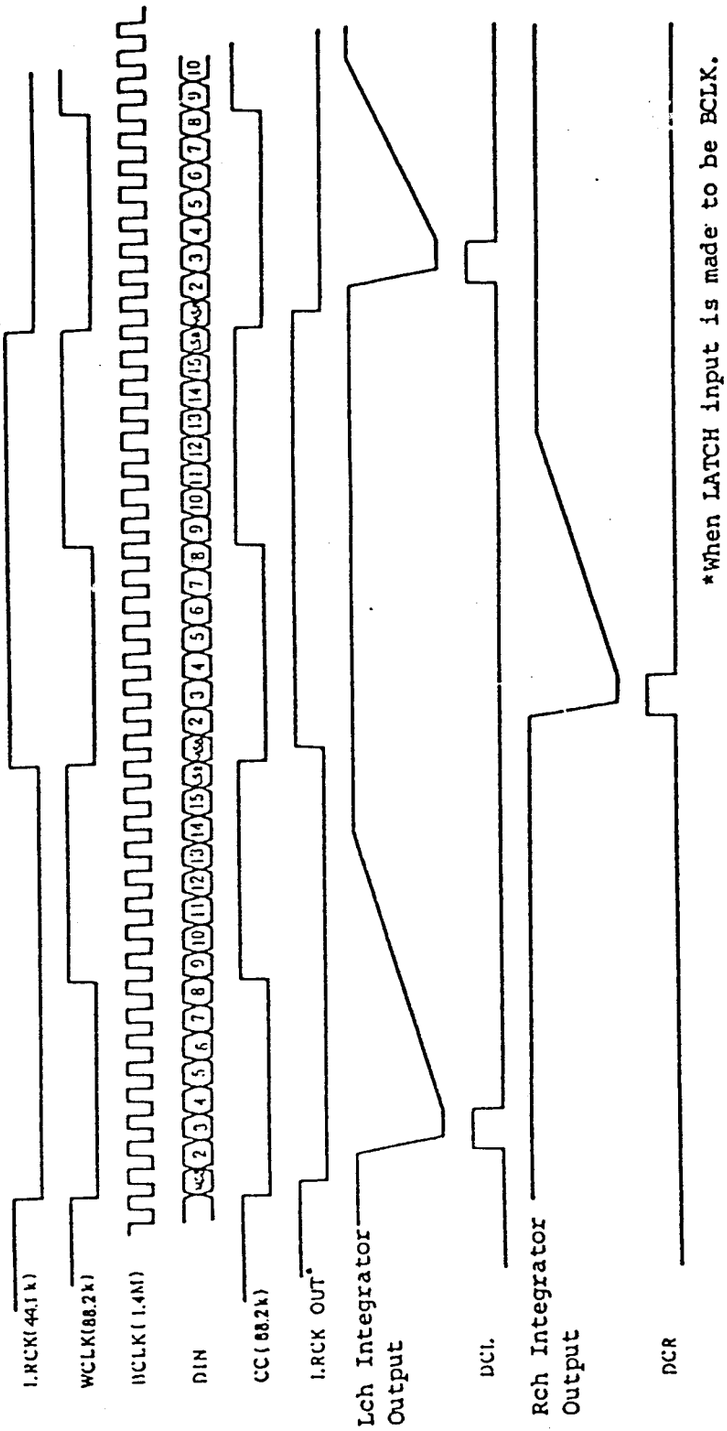
A/D - Conv. 5.86


1k
100pf
5k
27k
10k
8k2
5K
-10A
1000pf
2N 4416
10K
1k
4k7
LOW PASS
IN1
IN2
I1
I2
1214
5k
33K
CX 20010
AGND
DGND
+5D
-5D
NC
FET1
OUT1
OUT2
-5A
47K
CC
DGND
19K
10k
BITCK
DOUT

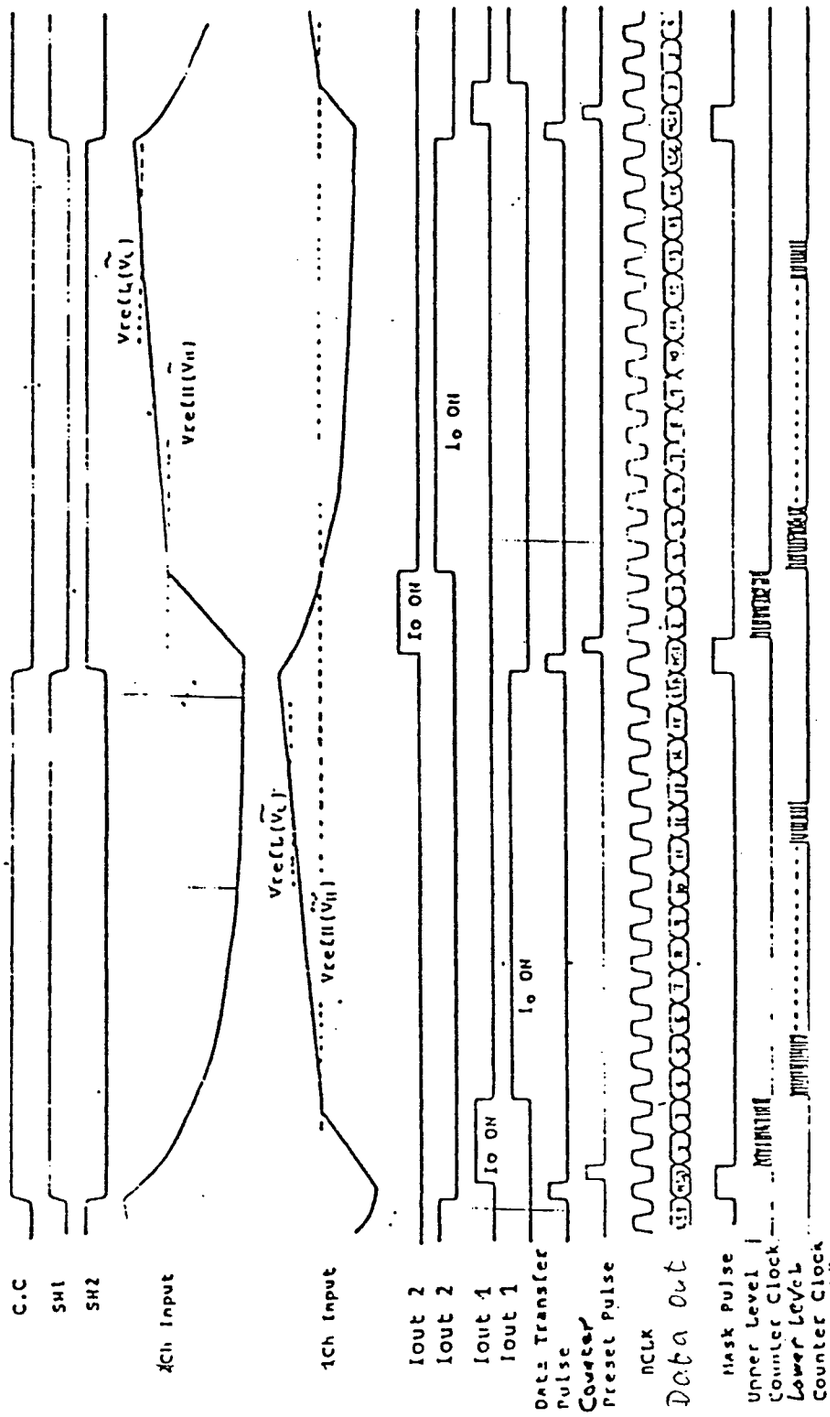
Name	Klasse	Datum		Seite
D/A - Conv.		5.86		Blatt

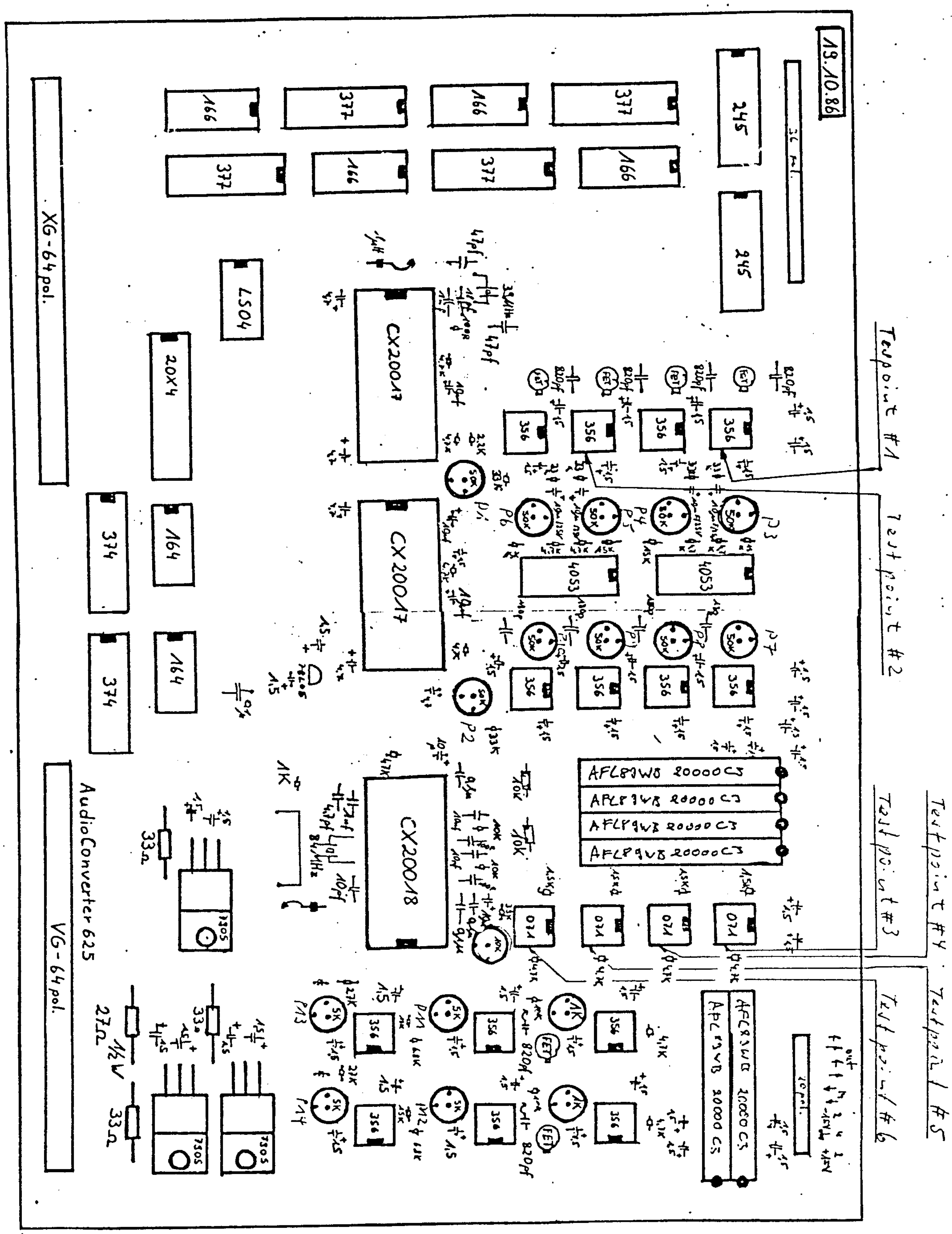


Operation timings of the D/A converter:



Operation timings of the A/D converter:




19.10.86
XG-64pol.
VG-64pol.
AudioConverter 625
CX20017
CX20018
Testpoint #1
Testpoint #2
Testpoint #3
Testpoint #4
Testpoint #5
Testpoint #6
AFL89WB 20000C3

Adjustements of the AUDIO CONVERTER board:

The following adjustments are to do on this board for proper audio conversion:

1. power up the HDU and wait until the message "HDU is ready" appears in the display. Wait approx. 10 minutes to let the machine warm up.

2. enter program 009 (ALL OFF) on Page 2. This program sets all four D/A converters to zero.

All testpoints in the following description are Pin 6 of the marked IC`s.

D/A Zero Adjustment:

3. Measure with an oscilloscope at testpoint 1. Adjust with trimpot 1 to get a positive peak of 4 volts.

4. Measure at testpoint 2, and adjust with trimpot 2 until a positive peak of 4 volts is set.

5. Measure at testpoint 3, and adjust with pot 3 to exact 0 volts. Do the same for testpoint 4,5,6 corresponding to pots 4,5,6.

A/D Zero Adjustment:

6. enter PAGE 1, set the machine to RECORD and go until the message "Waiting for Start" appears in the display. Do not start. Set the rotary switches at the frontpanel to 0 db setting. Do not supply any audio signal to the inputs of the HDU.

7. Measure at testpoint 3, and adjust with pot 11 to exact 0 volts.

8. Measure at testpoint 4, and adjust with pot 12 to exact 0 volts.

D/A Output level Adjustment:

9. Reset the HDU with the reset button.

10. Enter Program 008 (direct through) on page 2.

11. Supply a sine wave signal with approx. 1kHz and approx. -10 db level to Input 1 of the HDU.

12. Measure the 1. Output and adjust with Trimpot 7 so that the output has exact the same level as the input signal. Do the same for outputs 2,3,4 and corresponding trims 8,9,10.

A/D Distortion Adjustment:

13. Enter Program 000 (direct through stereo) on page 2.

14. Insert a small audio signal at the inputs and adjust with pots 13 and 14 for minimal audible distortion.

Overflow LED Indicator Adjustment:

15. Set the IN and OUTPUT attenuators at the front both to 0 db.

16. Insert a -5 db sine wave into one of the inputs. Adjust the thresehold with the trimpot on the FRONTPANEL P.C.B.

The Analog Interface boards

The In and Output Drivers and Amplifiers which provide the right levels for the A/D and D/A Converters are located on seperate p.c.boards which are mounted at the front, and backpanel of the HDU.

The microphone preamplifier and the Output drivers are located at the back panel closely to the IN and OUT XLR connectors.

The preamplification is done by a special IC, the SSM 2015. The gain of this circuit can be adjusted with the rotary switch at the back.

The outputs of the SSM 2015 as well as the outputs of the balanced line input amplifiers are fed to the front and are connected to the FRONTPANEL pcb.

Here the signals can be adjusted with the input attenuator to +10, 0, -10 and -30 db level. The output of this circuit is then fed into the AUDIO-CONVERTER board.

The four outputs of the AUDIO-CONVERTER board go back to the FRONTPANEL pcb. and are again adjusted to meet -30, -10, 0, and +10 db levels.

The headphone amplifier and the overflow circuit are also located on the FRONTPANEL board.

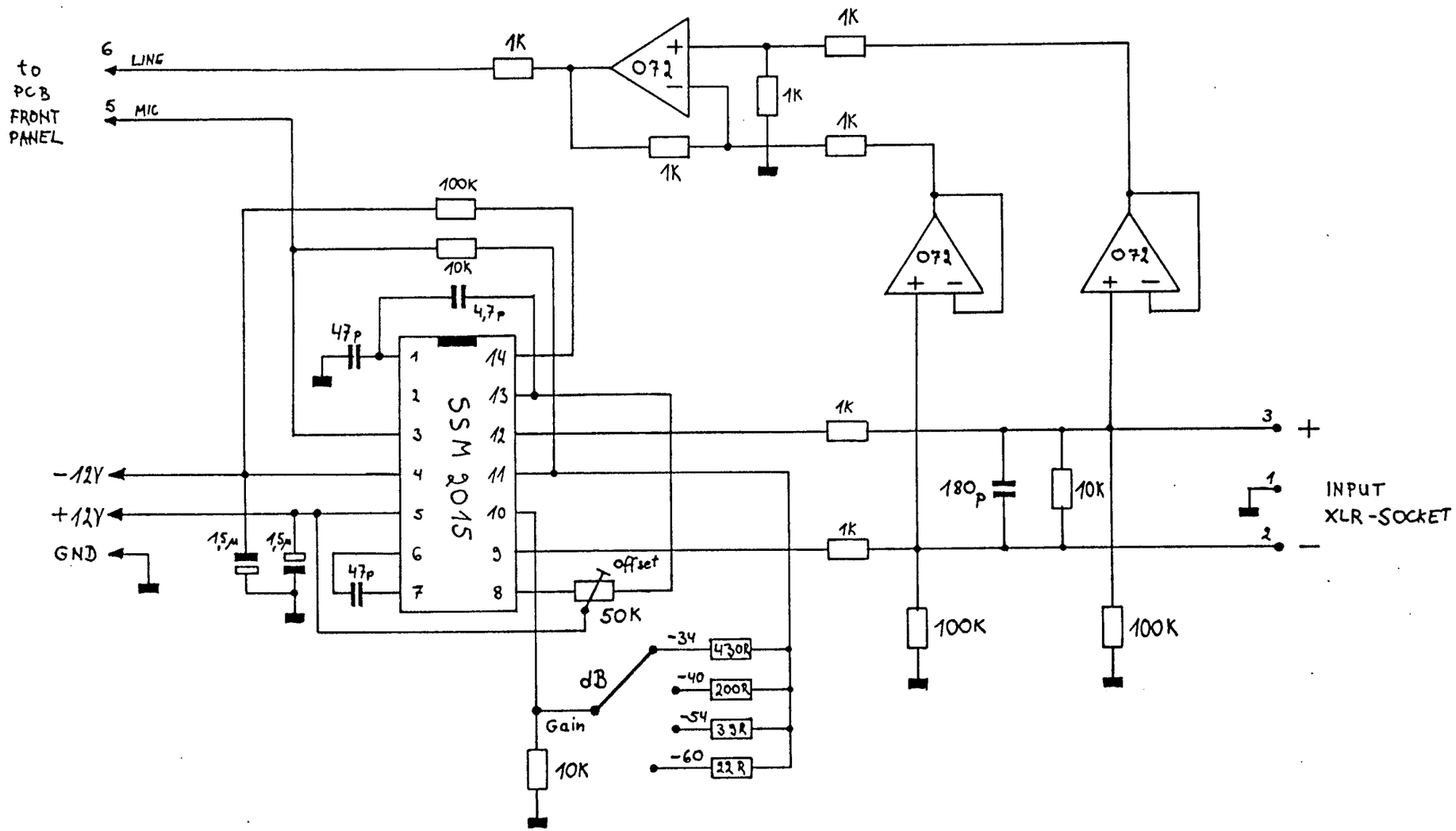
The adjusted four output signals are fed back to the Output driver board at the back of the HDU. Here they are converted to balanced outputs which are output to the XLR plugs.

Diagrams of the described circuits are shown below.

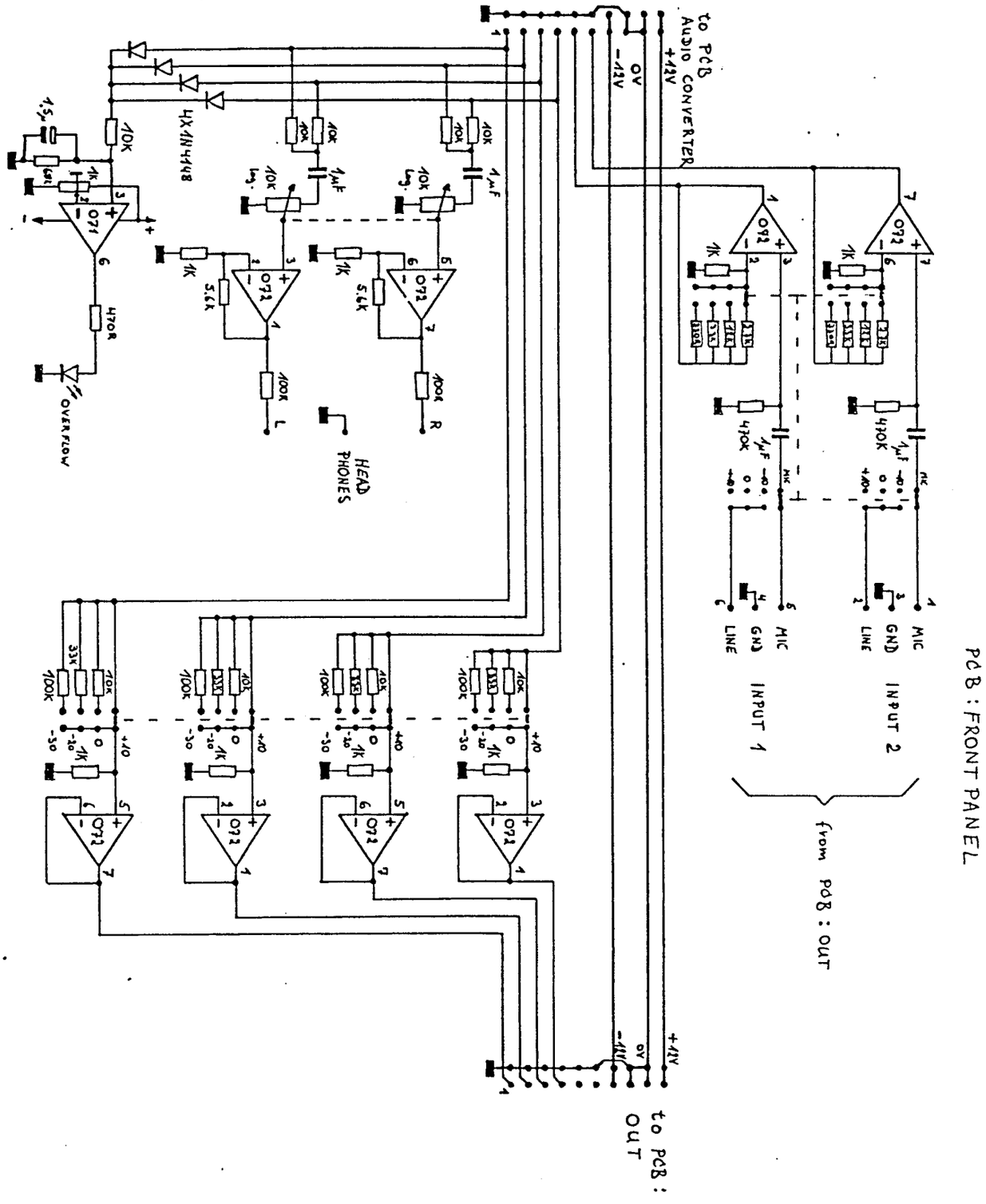
MIC / LINE PRE AMP.

CHANNEL 1

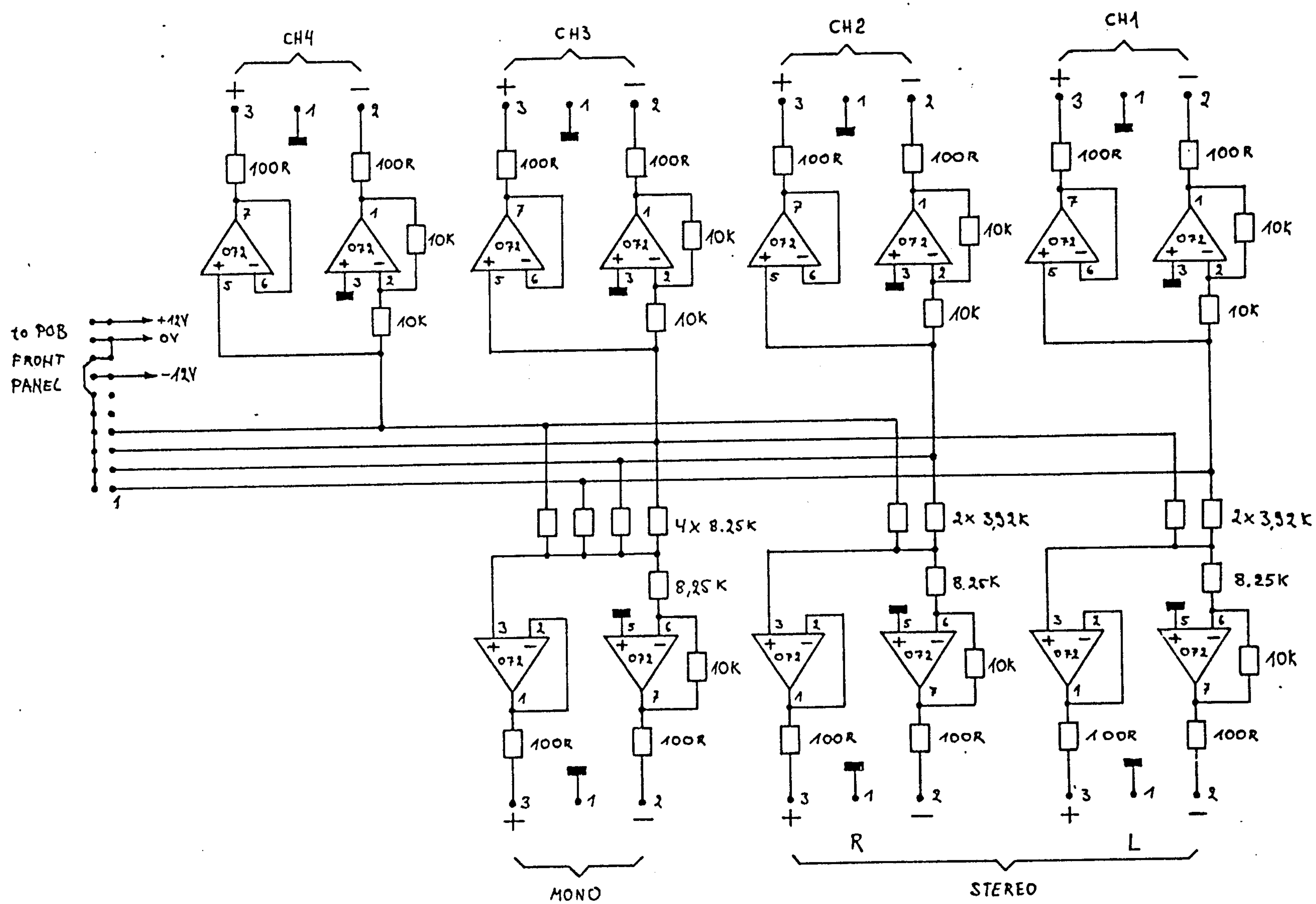
PCB : OUT



ANALOG IN/OUT ATTENUATORS



OUTPUT DRIVERS PCB:OUT 640



The COMMANDER

The remote commander of the HDU is a complete computersystem itself. The communication with the HDU is done via MIDI type interface, which also uses the MIDI data format. All commands from the COMMANDER to the HDU as well as handshake and other messages from the HDU back to the COMMANDER are in the format of Exclusive Messages making use of the PPG ID number.

All the components are mounted on a single p.c.board inside the commander. There are the following functional blocks:

1. The 68000 processor

2. A RAM 1/2 Mbyte RAM block build up out of 256 kbit D-Rams.

3. Four 256 kbit EPROMS containing the software for the commander.

4. One PIA 68A21 (parallel Interface) controlling the keypad, the A/D converter channel select for inputting the pots.

5. One ACIA 68A50 (serial interface) for the communication between HDU and COMMANDER

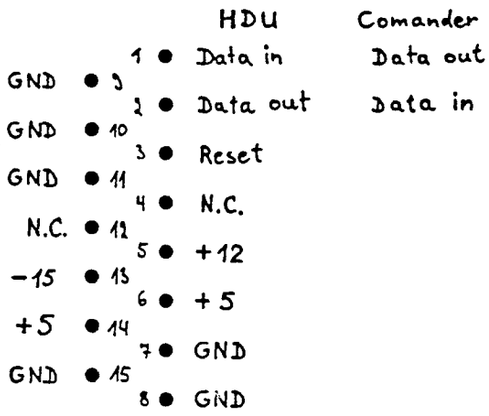
6. One PTM 68A40 (Timer) for generating interrupts

7. One HD 61830 display controller for the l.c.d. This IC is soldered at the backside of the commander PCB. The display controller is working together with a 6116 static RAM.

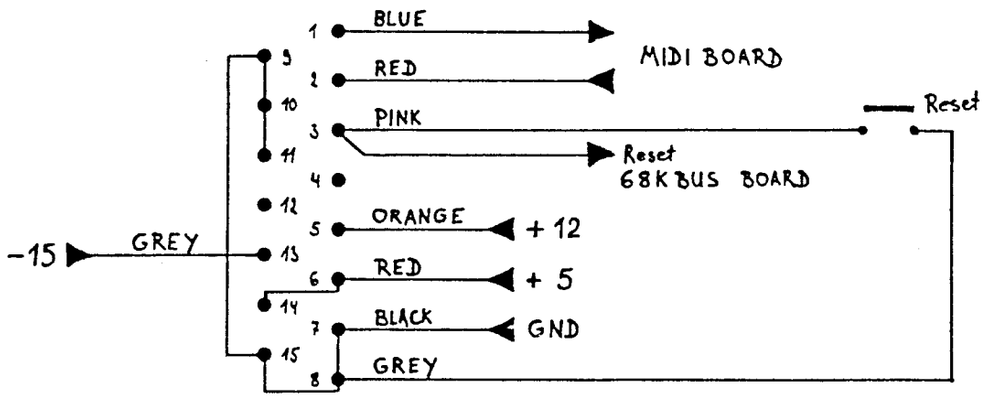
8. All the timing and address select is done by the PAL`s 1-4. The circuit diagram of these IC`s is shown on the next page.

Note that also the power supply for the commander is coming via the connection cable to the HDU. It is therefore not possible to prolong this cable. If a longer connection between HDU and COMMANDER is demanded, we recommend to supply the COMMANDER with a separate power supply, and only connect pins 1, 2, 3 and 9, 10, 11 of the communication connectors.

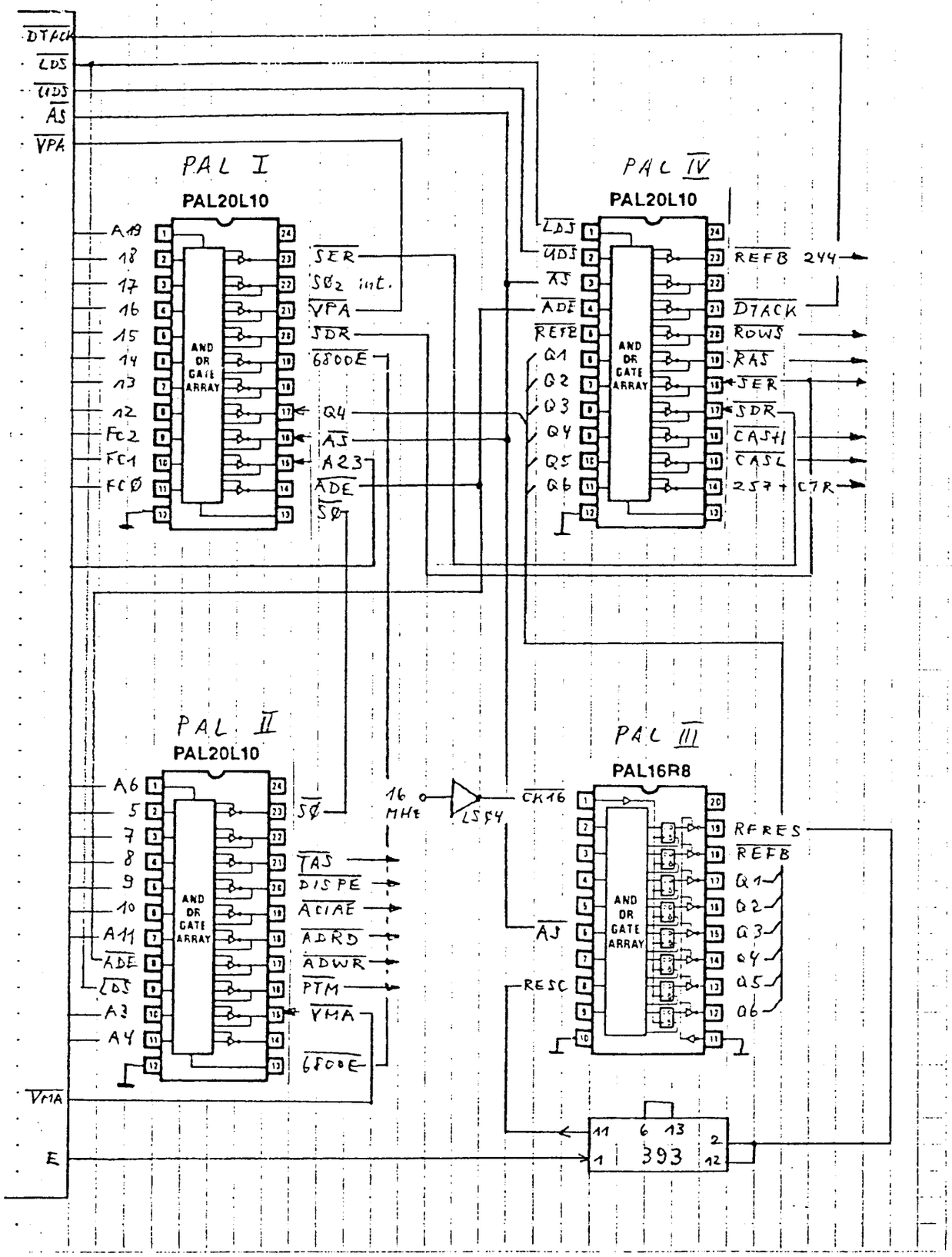
REMOTE / COMANDER - CONNECTOR



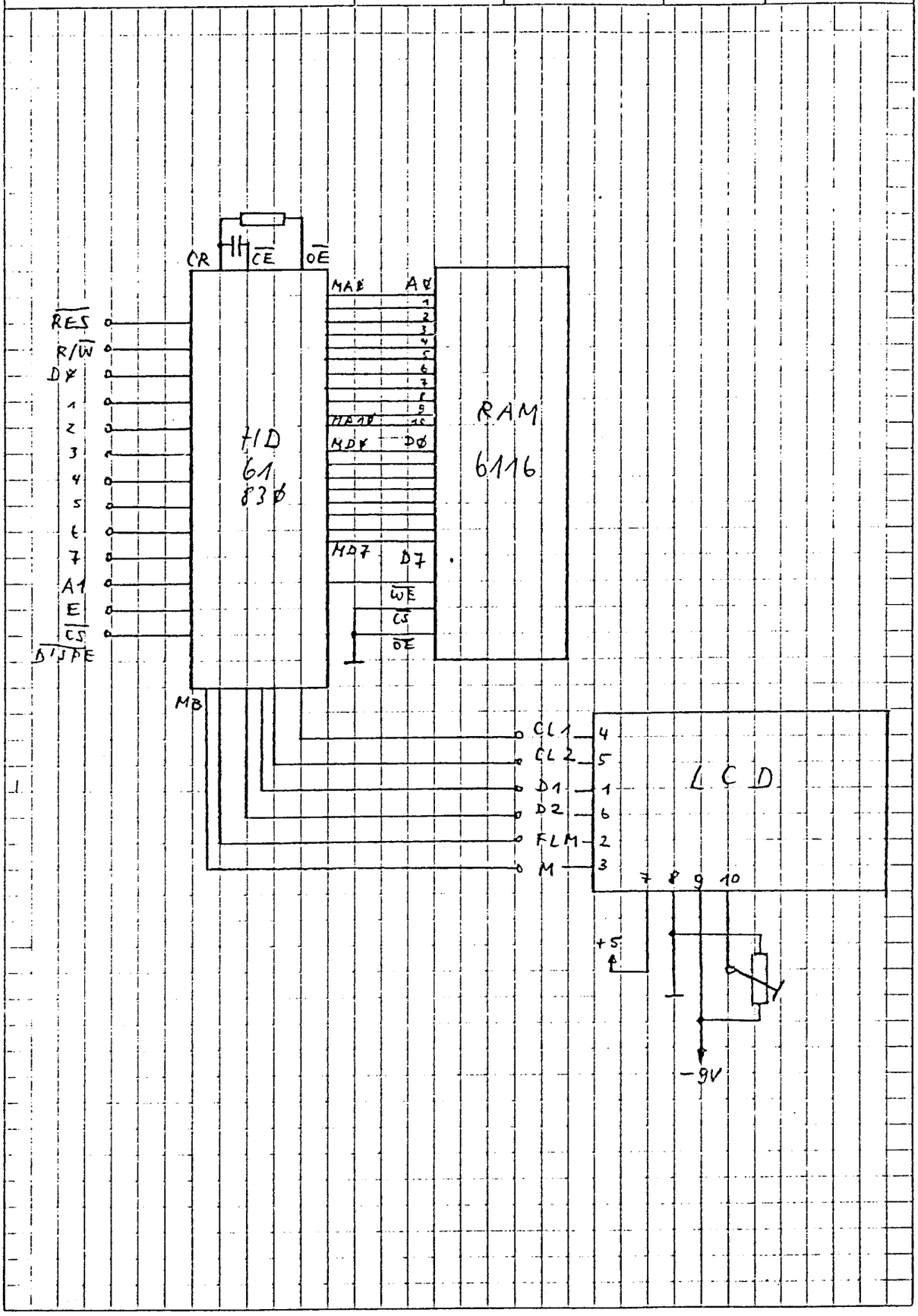
WIRING ON HDU - CONNECTOR



COM HDU 7.86


DTACK
LDS
UDS
AS
VPA
PAL I
PAL20L10
A19
18
17
16
15
14
13
12
FC2
FC1
FC0
AND OR GATE ARRAY
SER
SØ2 int.
VPA
SDR
6800E
Q4
AS
A23
ADE
SØ
PAL IV
PAL20L10
LDS
UDS
AS
ADE
REFB
Q1
Q2
Q3
Q4
Q5
Q6
REFB 244
DTACK
ROWS
RAS
SER
SDR
CASH
CASL
257 + C7R
PAL II
PAL20L10
A6
5
7
8
9
10
A11
ADE
LDS
A3
A4
SØ
TAS
DISPE
ACIAE
ADRD
ADWR
PTM
VMA
6800E
16 MHz
LS74
PAL III
PAL16R8
CK16
AS
RESC
RFRES
REFB
Q1
Q2
Q3
Q4
Q5
Q6
VMA
E
11 6 13 2
1 393 12

Name: COM - Display | Klasse | Datum | | Seite / Blatt



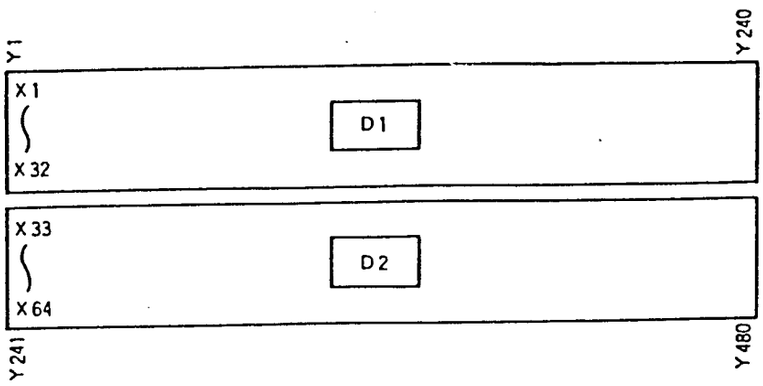


Fig. 4 Correspondence between display and data

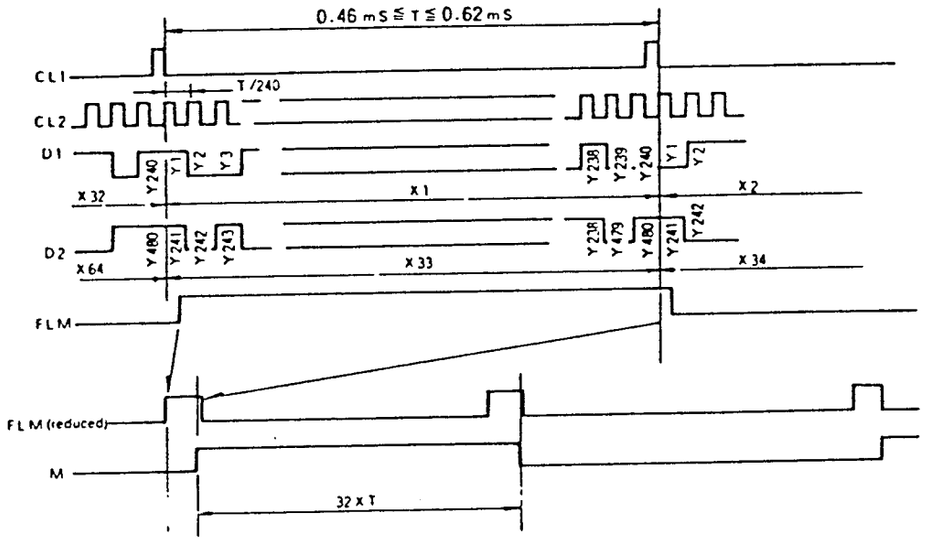


Fig. 5 Standard interface timing

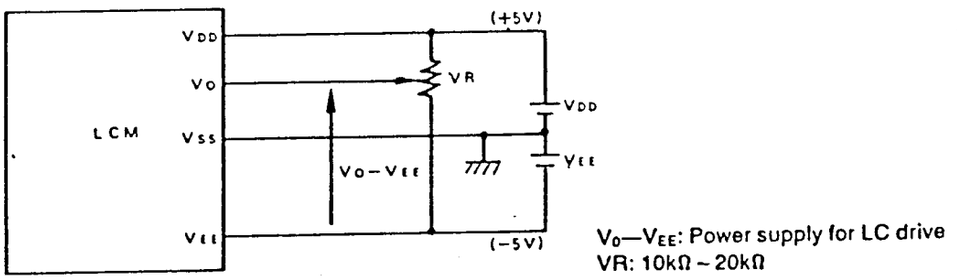
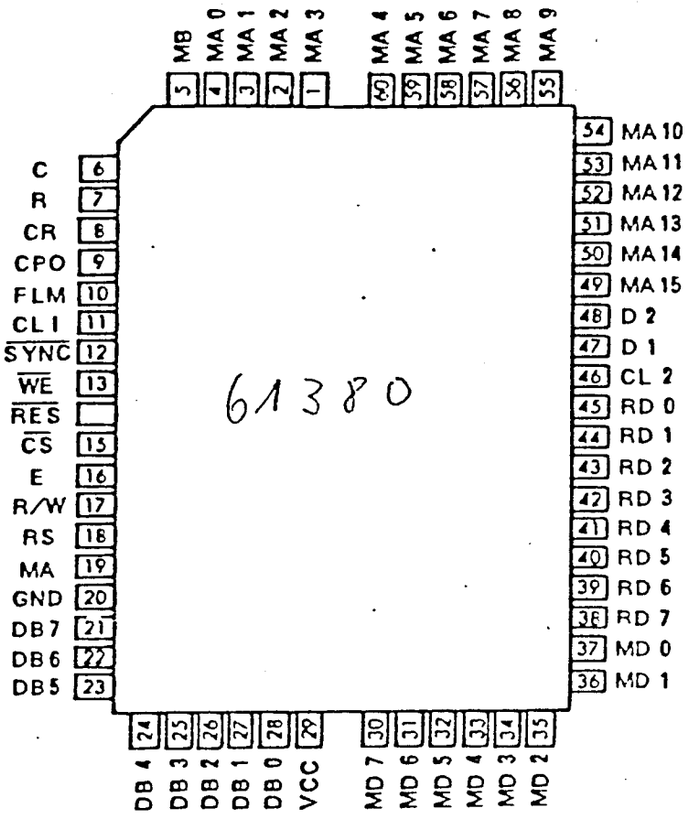
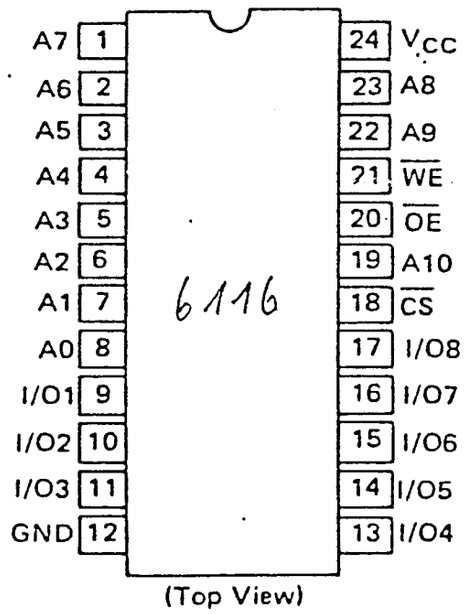


Fig. 6 An example of a power supply



(Top View)



(Top View)

The HDU power supply:

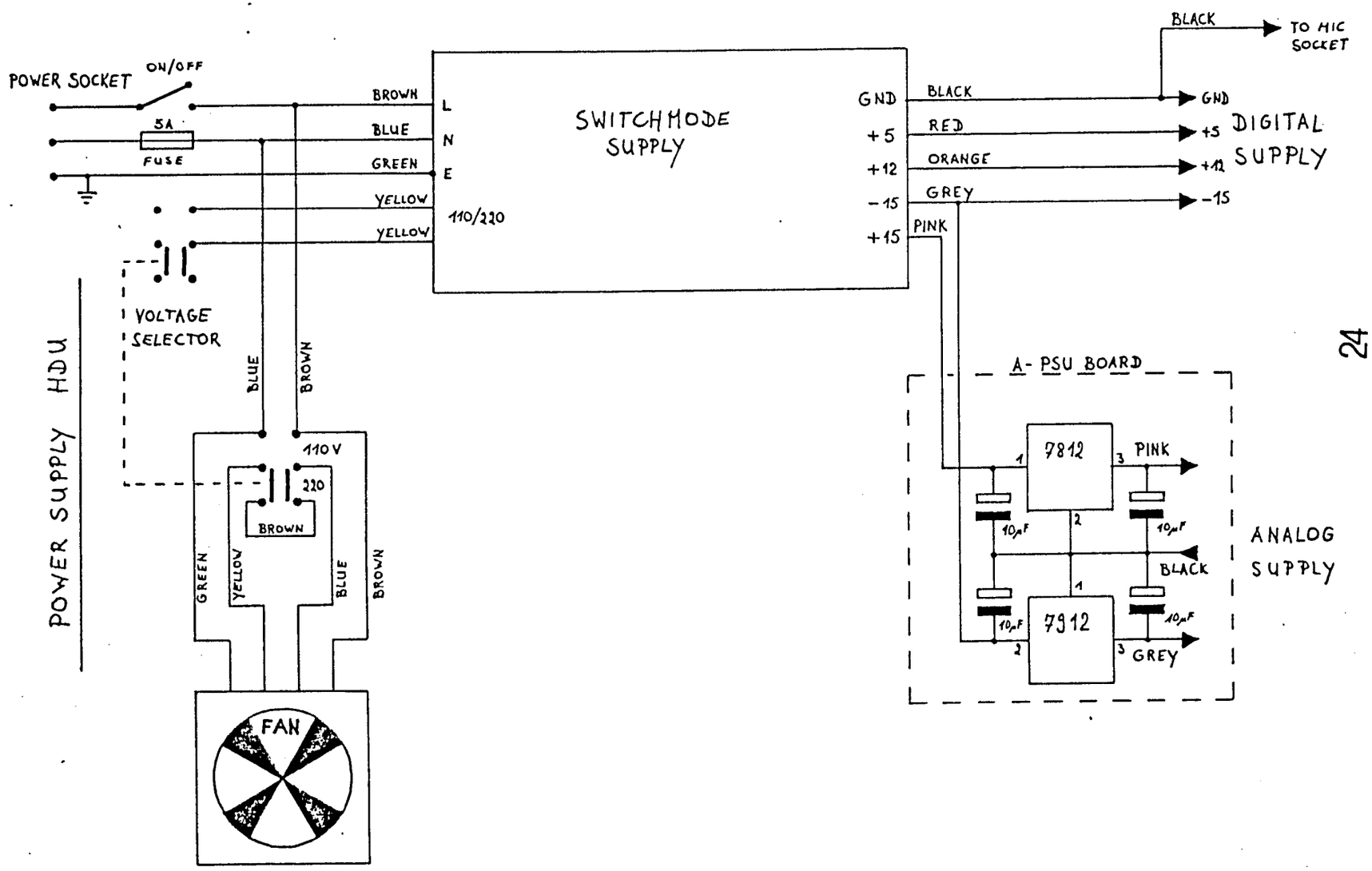
Because of the high power consumption of the circuits of the HDU, a Switch Mode Power Supply is used. This is a complete building block which is not manufactured by PPG.

It has its own fuse (besides the one on the backpanel of the HDU). The output voltages are:

+5 volt 24 amp.
+12 volt 5 amp.
+15 volt 2 amp.
-15 volt 2 amp.

From the + and - 15 volts a + and -12 volts, regulated to the ground of the analog circuits are generated. This is necessary to guarantee a minimum of noise from the analog circuits.

Note that the ground for these regulators is coming from the AUDIO CONVERTER board ! If the connectors are taken off from the AUDIO CONVERTER board the regulation cannot work.


POWER SOCKET
ON/OFF
5A
FUSE
BROWN
BLUE
GREEN
YELLOW
YELLOW
L
N
E
110/220
SWITCHMODE SUPPLY
GND
+5
+12
-15
+15
BLACK
RED
ORANGE
GREY
PINK
BLACK
TO MIC SOCKET
GND
+5
+12
-15
DIGITAL SUPPLY
VOLTAGE SELECTOR
BLUE
BROWN
110V
220
BROWN
GREEN
YELLOW
BLUE
BROWN
FAN
POWER SUPPLY HDU
A- PSU BOARD
7812
7912
10µF
PINK
BLACK
GREY
ANALOG SUPPLY

The Winchester Drive of the HDU

The Winchester Drive is a 5 1/4 inch formfactor 85 Mbyte Hard disk drive type DK 511-8 from Hitachi. It has 10 heads and can access 823 cylinders. Specifications are listed below.

Lifetime is guarantied with 5 years or 20000 hours, see point 9 of the specs.

When the drive is powered down it automatically restores the heads in a save parking position. The shock resistance is about 10 times smaller when the drive is in operation, see point 4 of the specs.

The drive is supplied with +5 volts 2 amp. peak and +12 volts 5 amp. peak.

During formatting the bad tracks are memorised and after the formatting process they are written down on track 0 of the drive. After a power up reset or a manual reset this bad sector map is copied into RAM and the driver software takes care of it when acessing any tracks.

The trackmap can be displayed on the Commander display, by moving the cursor to the field: LOAD OLD WORLD on Page 0, then rolling to: GET SYS INFO by pressing the + key several times and then pressing EXecute.

Initializing the Winchester drive

There are some software repair utilities for the winchester drive.

In Software Version 1 these utilities can be found on the DIAGNOSTIC Page 0.02, and are as follows:

INIT DIRECTORY:

If for any reasons the directory of the recording files is not repairable anymore, and no backup from a good directory was made, this utility can be used. It initialises just the directory of the recording system, not the effect arrangements and not the softkey records and the songs.

FORMAT:

It should not be necessary to format the whole drive. However if by any accident this is unavoidable, use the FORMAT function on Page 0.02. This procedure takes about one hour, and you have to wait until the drive is stopping with headmovements (the typical sound).

3. SPECIFICATIONS

3.1 Major Specifications

No.	Item		Specifications DK511-8	Units
1	Total storage capacity	Un-formatted	85.7	MB
		Formatted	67.4	
	Capacity/track (unformatted)		10,416	Bytes
	Capacity/surface (formatted)		6.74	MB
	Sector capacity (formatted)		256	Bytes
	No. of sectors/track		32	
	No. of disks		6	
	No. of heads	Data heads	10	
		Servo head	1	
	No. of cylinders		823	
2	Access time (nominal value)	Average	23	ms
		Maximum	45	
		Minimum	6	
3	Average latency		8.3	ms
	Disk rotational speed		3,600 ± 1%	RPM
	Data transfer rate		625	KB/ sec.
	Recording density		9,250	BPI
	Track density		925	TPI
	Recording method		MFM	
	Data transfer method		MFM	
	Start-up time		Approx.25	Seconds
4	Dimensions		146(W) x 82.5(H) x 203(D) <5.75(W)x3.25(H)x8.00(D)>	mm <inches>
	Weight		Approx. 3.4 <Approx. 7.5>	kg <pounds>
5	Power supply *1		+12V ± 5% 5A : peak 2.5A: average during operation +5V ± 5% 2.0A	

NOTE 1: The DC input power is specified at the connector J3 on the DK511 printed circuit board.

3.2 Ambient Conditions and Reliability

No.	Item		Specifications DK511-8
1	Temperature	Operating	5 to 45°C (41 to 113°F)
		Non-operating	-20 to 50°C (-4 to 122°F)
		Shipment/storage	-40 to 60°C (-40 to 140°F)
	Temperature gradient		10°C/hour (18°F/hour)
2	Humidity	Operating	8 to 80%
		Non-operating	8 to 90%
	Maximum wet-bulb temperature		29°C (84.2°F,non-condensing)
3	Vibration	Operating	0.25G or less
		Non-operating	0.5G or less
4	Shock	Operating	2G or less (10msec, half sine wave)
		Non-operating	20G or less (10msec, half sine wave)
5	Atmosphere		No corrosive gas or saline atmosphere
6	Acoustic noise		50 dB or less except when start-up, stop, and seek. Measured at a distance of 1 m by selecting level A (slow) of the vibroscope.
7	Altitude above sea-level	Operating	3,000 m or lower (10,000 feet or lower)
		Non-operating	12,000 m or lower (40,000 feet or lower)
8	MTBF		Expected 20,000 hours or longer
	Information error rate (after 10 retrials)		Recoverable : 10^{-10} times/bit Unrecoverable: 10^{-13} times/bit
	Seek error rate		10^{-6}
9	Life		5 years or 20,000 hours, whichever is sooner under careful storage or handling. Contact start/stop operations: up to 10,000 times.

Software News

PPG dealer's information, march 87

Version 1.4.5 for PPG HDU

Although all the new functions mentioned here will be described in the next manual, we 'd like to give you a brief preview .

1. Page 0.02 (Diagnostic)
   is totally redesigned and prepared for streamer control.
   The **FORMAT** function has become more comfortable now.
   The new dialog is as follows:

   - set cursor to **FORMAT**
   - press **EX** > Format total ?
   - 1/0 > Are you sure ?
   - 1/0 > Format in progress ?

The **FORMAT** operation will take approx. 1 hour. The formatted cylinder is shown in the display. During this time there's no other operation possible with the HDU (freezed cursor).
When the format function is finished the display shows: **Format complete**. The cursor is now enabled and the next usefull thing to do is the **INITDIR** function to format the recording directory.

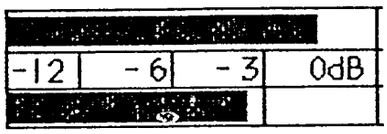
All other functions on this Page are disabled until the Tape Streamer is available (V1.5).

2. On Page 1 a few details are to mention which increase the power and flexibility of the HDU .

2.1 The time of the Start Cue (>**TIM**) has been extend from one hundredth to one thousandth second.
There is one more digit on the display to set the Start Cue with a resolution of 1 msec..

The fine cutting works as follows
Set the cursor to the new 3-digit field and press **EX**.
Change the value with +/- and press **EX** again.
You will hear the result immediately.

2.2 To control the recording level a new **VU-Meter window** is displayed during the pre-montitoring.



The metering is directly taken from the A/D converters.
When the record starts the normal track sheet will occur on the display.

2.3 The function **CU** (key "B") has another function when no playback and recording is running.
Pressed in this mode , the next defined M-file is loaded.
This **C**all up **U**nknown M-file function is a kind of intelligent search function.

3. At Page 3 (and 5) the immediate editing via pots has been disabled in order to avoid undesired edits on finished songs.
Safety first .....

4. The new Page 5 is the SMPTE Time based Song Editor. The outline of the display is similar to the MIDI Page 3.
The most important feature is the internal clock.
With this feature it is possible to realize SMPTE oriented. cutting and blending without an external SMPTE generator.
Because of that the dialog on the **TEST** and **LOAD** function is enlarged to the question **EDIT ?**. If you press 1(=yes) the HDU memorizes the time you start your M-files.
If you answer 0 (=no) , you hear only the "playback" and no editing is possible.