My Philips PM5330

Philips PM5330 RF Generator



Figure 1 The PM5330

Contents

1 General 3
1.1 1Ω resistor 3
1.2 Fan motor & Short circuit 3
1.3 Error 62 3
1.4 Fan motor problem 4
1.5 Electrolytic capacitors 5
2 Power Supply 6
2.1 Transformer 6
2.2 Power Supply Board 6
3 Main Board 9
3.1 Microcontroller board 12
3.2 Standard time base 13
3.3 MOD-VAR-UNIT 14
4 Keyboard / Front Panel 16
5 Program Interface Boards 18
5.1 IEEE-IIC BUS-INTerface aka PM9548 19
5.2 RS232 Interface aka PM9549 20
6 Stereo boards 22
6.1 Stereo board1 22
6.2 Stereo board2 23
7 RDS/ARI boards 24
7.1 RDS Board 1 24
7.2 RDS Board 2 27
8 RF Part 28
8.1 RF1 29
8.2 RF2 29
8.3 RF3 30
8.4 RF4 31
8.5 RF5 31
9 Attenuator 32

1 General

My PM5330:
Type	PM5330/921
NC	9452 053 30921
NO	LO 576028

This document first briefly describes my repairs followed by detailed information that makes it possible to reassemble all internal connections.
Also, I drew schematics of 4 boards. Those can be found on the website:
https://frank.pocnet.net/other/sos/Philips_PM5330/index.html
Also the operating manual and the program manual can be found there.

1.1 1Ω resistor

I got the PM5330 a few years ago (2020) and it had a sticker 'Defect (no startup)'. The 5V power was gone and I found the problem rather quickly: the 1 Ohm resistor in the 5V power supply was open. I replaced the 1 Ohm resistor and it started up very well.

1.2 Fan motor & Short circuit

The second problem was the fan motor speed and the +5V acting weird. Y thought maybe an electrolytic capacitor was the problem. So, I had a look inside but as I was checking stuff, I placed the connector of the Stereo module one position off. These connectors have nu means of preventing misplaced reconnecting them. Smoke was the result. I was lucky. I found all the series resistors in the power supply that were burnt and after replacing them the PM5330 was working again. But the fan motor was still acting weird and so was the 5V power supply.

1.3 Error 62

The next thing that happened was that the PM5330 suddenly stopped working while I was using it. The display stated Error 62. The user manual stated thar Error 62 means 'phase-locked loop 2 does not lock'. I thought, this is the end. There are many PLLs in the PM5330… How to find this fault? Which one is PLL 2? I tried finding service data but unfortunately Philips nor Fluke had any service data. No service data found on the internet. After a long time, I tried to find Error 62. I was very lucky. Someone had the same problem 15 Years ago and there was even an email address. After some emails and some tests, we found the failing amplifier module and the solution. The measured dc voltage at the input was 0 Volt. So the resistor to the base of the input transistor had to be the problem. There is a resistor in the OM2045 amplifier module that seems to be week. On the internet there are more people with a failing OM2045 aka OM345. See:
https://ea4eoz.blogspot.com/2017/09/repairing-om345-hybrid-module.html

So, I placed a 4k7 resistor across pin 1 and 5 and WOW the PM5330 was alive. See Figure 2.

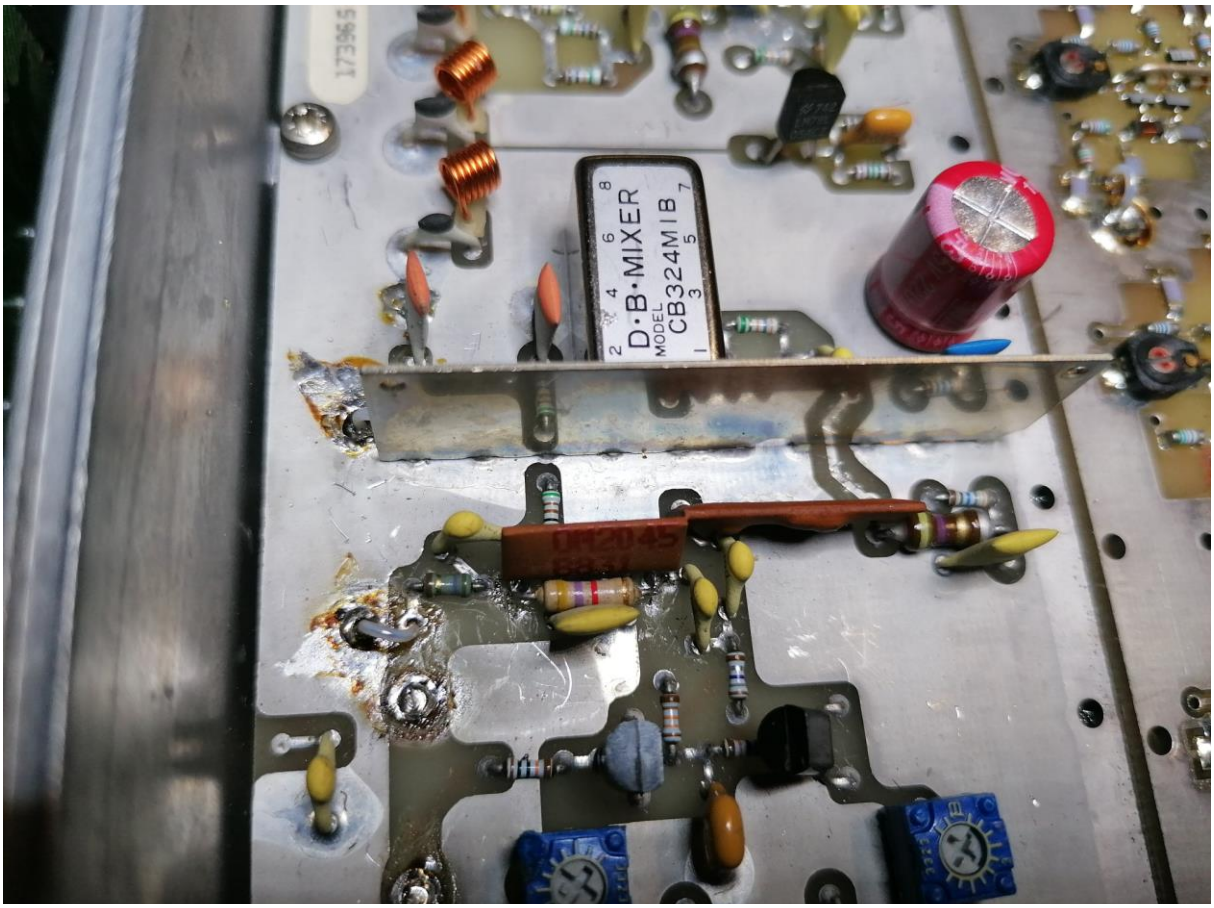


Figure 2 Error 62 problem Solved, a 4k7 resistor added.

1.4 Fan motor problem

The fan motor still had the same problem. The speed varied and the 5V sometimes went very low. My idea was that maybe an electrolytic capacitor was failing. So, I replaced all electrolytic capacitors. See Chapter 1.5 for the details of all electrolytic capacitors. However, no success.

So, I took the power supply board and I noticed the rectified voltage was strange. Finally, I found that the bridge-rectifier for the 5 Volt supp-y had one failing diode. It acted more as an instable Zener diode. After replacing the bridge-rectifier also this problem was solved.
Finally, I had a good working PM5330.

1.5 Electrolytic capacitors

Here is the list of all (73) electrolytic capacitors in my PM5330 and I replaced them all.

Table 1 List of original electrolytic capacitors / board

Loction	Req (73)	Electrical	Philips type ?
RF Part	9	220µ 25V	2222 036 56221
Main board	14	22µF 63V	2222 036 58229
Main board	4	47µF 35V	2222 036 90094
Main board	6	100µF 16V	2222 036 55101
MOD VAR UNIT	8	22µF 63V	2222 036 58229
Microcontroller	1	47µF 35V	2222 036 90094
Time base	3	22µF 63V	2222 036 58229
Attenuator	2	47µF 10V	2222 036 54479
Power supply	3	6800µF 35V	Mitsubishi
Power supply	1	220µF 50V	Mitsubishi
Power supply	6	22µF 63V	2222 036 58229
Power supply	2	100µF 16V	2222 036 55101
Stereo board 1	3	22µF 63V	2222 036 58229
Stereo board 2	0		
IEEE-IIC board	1	100µF 16V	2222 036 55101
IEEE-IIC board	2	47µF 35V	2222 036 90094
IEEE-IIC board	1	2200µF 25V	2222 021 16222
KeyBoard	4	47µ 25V	2222 021 26479
RDS/ARI1	3	47µ 25V	2222 021 26479
RDS/ARI2	0		

Table 2 List of electrolytic capacitors / required

Required	Electrical	Case dxh, pitch	Alternative part
9	220µF 25V	R, 9x11, 5	860160575020 Würth
34	22µF 63V	R, 5x11, 2.5	860160673012 Würth
9	47µF 35V	R, 5x11, 2.5	860160573007 Würth
9	100µF 16V	R, 5x11, 2.5	860160473011 Würth
1	220µF 50V	R, 10x17, 5	860160675026 Würth
3	6800µF 35V	R, 30, 32, 10	Rubicon 35VXG6800MEFCSN30X30 Nichicon LGY1V822MELB30 Vishay/Dale MAL209030103E3
1	2200µF 25V	A, 15, 31, 35	Vishay / BCC MAL202116222E3
7	47µF 25V	A, 4.7, 10.5, 15	Vishay / BCC MAL202136479E3

Ordered:
10x Würth 860160575020 = Mouser 710-860160575020
40x Würth 860160673012 = Mouser 710-860160673012
10x Würth 860160573007 = Mouser 710-860160573007
10x Würth 860160473011 = Mouser 710-860160473011
2x Würth 860160675026 = Mouser 710-860160675026
3x Rubicon 35VXG6800MEFCSN30X30 = Mouser 232-35VXG6800MEFCSN3
2x Vishay / BCC MAL202116222E3 = Mouser 594-2222-021-16222
10x Vishay / BCC MAL202136479E3 = Mouser 594-2222-021-36479

2 Power Supply

2.1 Transformer

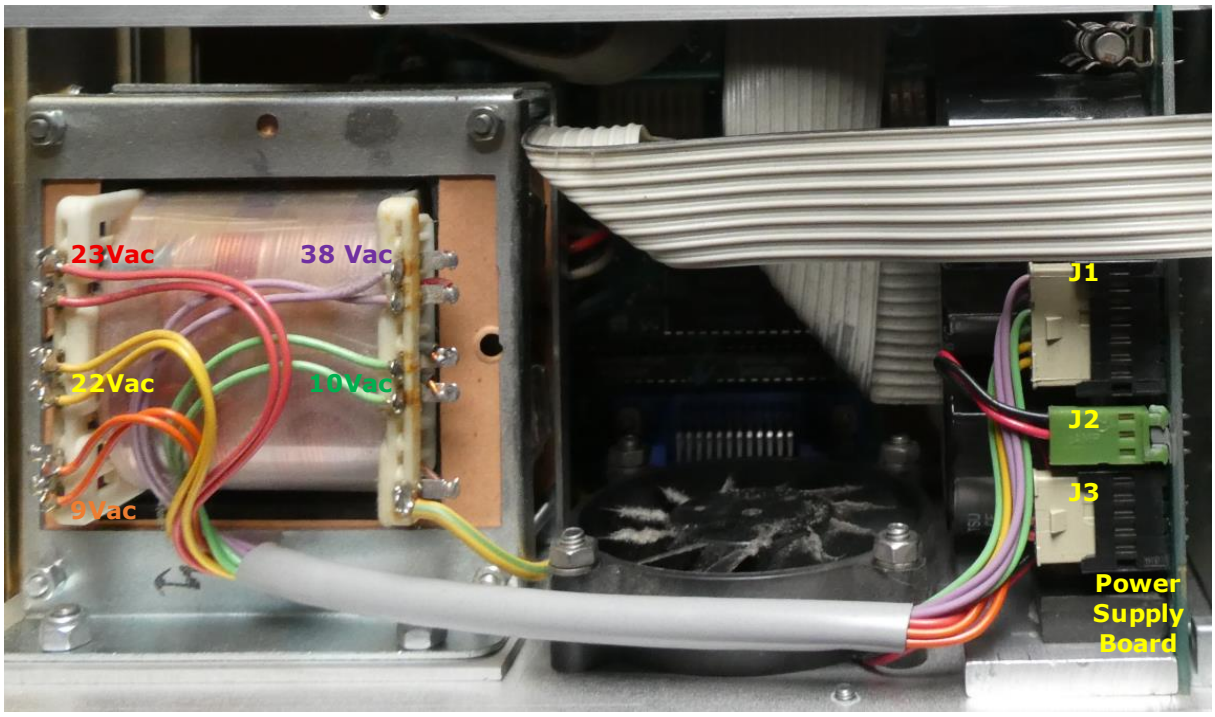


Figure 3 Connection Mains transformer to Power Supply board

12nc : 4012 000 11161
Sticker : H012714200

2.2 Power Supply Board

General info

12NC PCB	4012-110-11657
Sticker	173799 EX/ /Tk/Ex/b/2/3

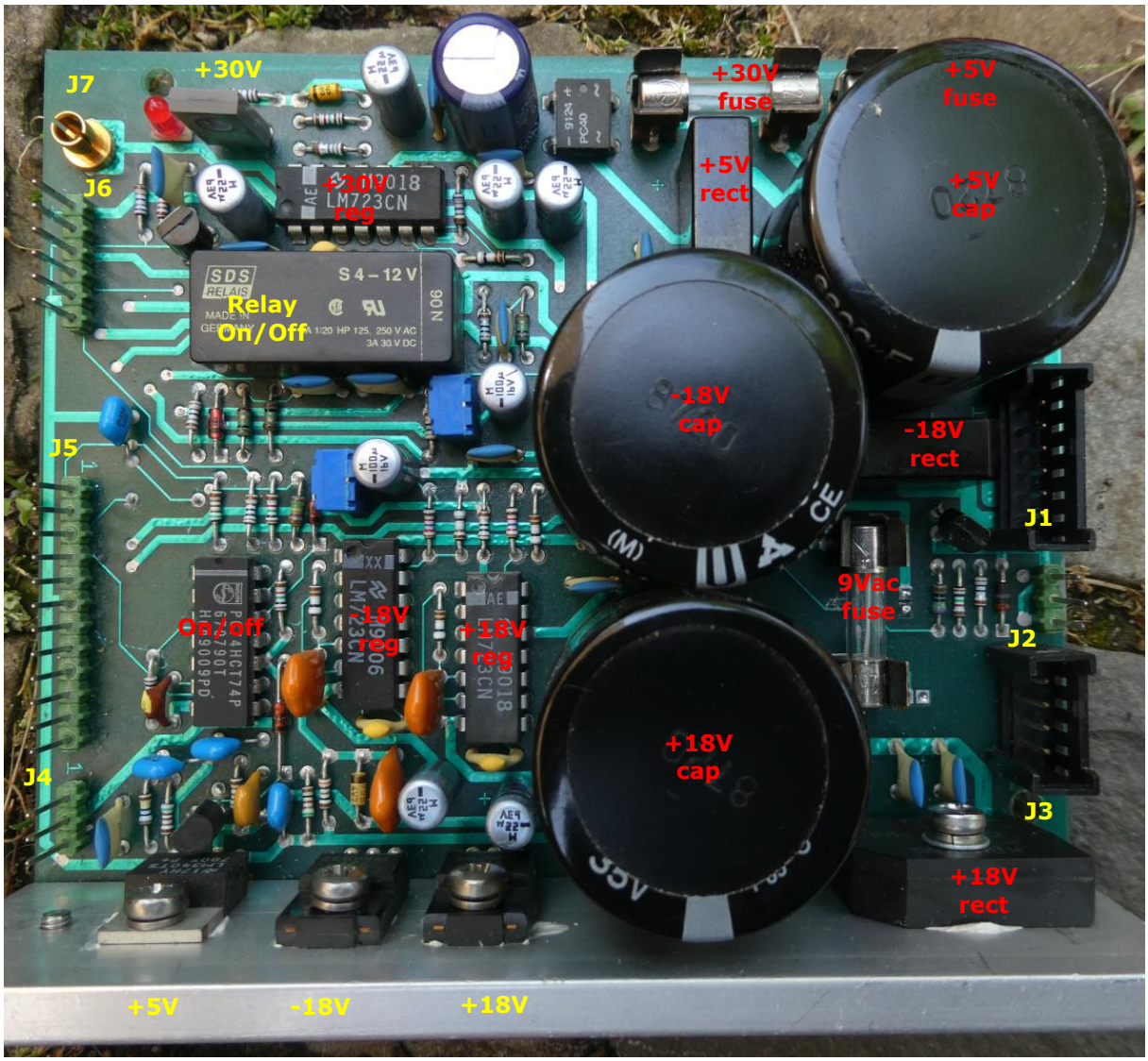


Figure 4 Power Supply board, several items

Table 3 X? J1 pinning Transformer to Power supply board

1	38Vac1	Purple	For +30V regulator
2	38Vac2	Purple	For +30V regulator
3	10Vac1	Green	For +5V regulator
4	10Vac2	Green	For +5V regulator
5	22Vac1	Yellow	For -18V regulator
6	22Vac2	Yellow	For -18V regulator

Table 4 X? J2 pinning Connector to fan

1	Fan-
2	Fan+
3	Fan- (not used)

Table 5 X? J3 pinning Transformer to Power supply board

1	9Vac1	Orange	For IEC625 or RS232 interface
2	9Vac2	Orange	For IEC625 or RS232 interface
3	23Vac1	Red	For +18V regulator
4	23Vac2	Red	For +18V regulator

Table 6 X? J4 pinning Connector to RF Part

1	-18V
2	GND
3	+18V

Table 7 X? J5 pinning (Flat cable to main board)

1	9Vac2
2	9Vac1
3	Not used
4	POK (power ok)
5	Clock 74HC74PW-3 function unknown (debounce?)
6	GND
7	+5V
8	+18Vs via 1Ω (Always on, even if switched off)
9	GND
10	+18Vr via 1Ω
11	GND
12	-18Vr via 1Ω

Table 8 X? J6 pinning to Front panel

1	GND
2	-18Vr
3	+18Vr
4	Something with the 74HC74 on the power board
5	GND
6	On-Off switch on front panel switches to GND

Table 9 X? J7 pinning coax P to main board

1	+30V via coax P to X82 main board
2	GND shield coax

The power supply uses LM723 ic's for +18, -18 and _30 Volts. The +5V is regulated by a LM340T-5.0.

Power supply for the Communication Interface Board is AC from the transformer and goes to the Communication Interface Board via the connectors on the main board. It is regulated on the Communication Interface Board at the isolated side of some opto couplers. This way the interface connection is isolated from the rest of the PM5330.

Note: The 0V (GND) is connected to the PM5330 housing via the LM340T-5.0 as it has no isolation.

3 Main Board

Table 10 Tekst on the pcb

12NC PCB	4012 110 18262
Sticker	06373 L/O/E/ / /

The main control board is placed in an aluminum housing at the bottom side of the PM5330.

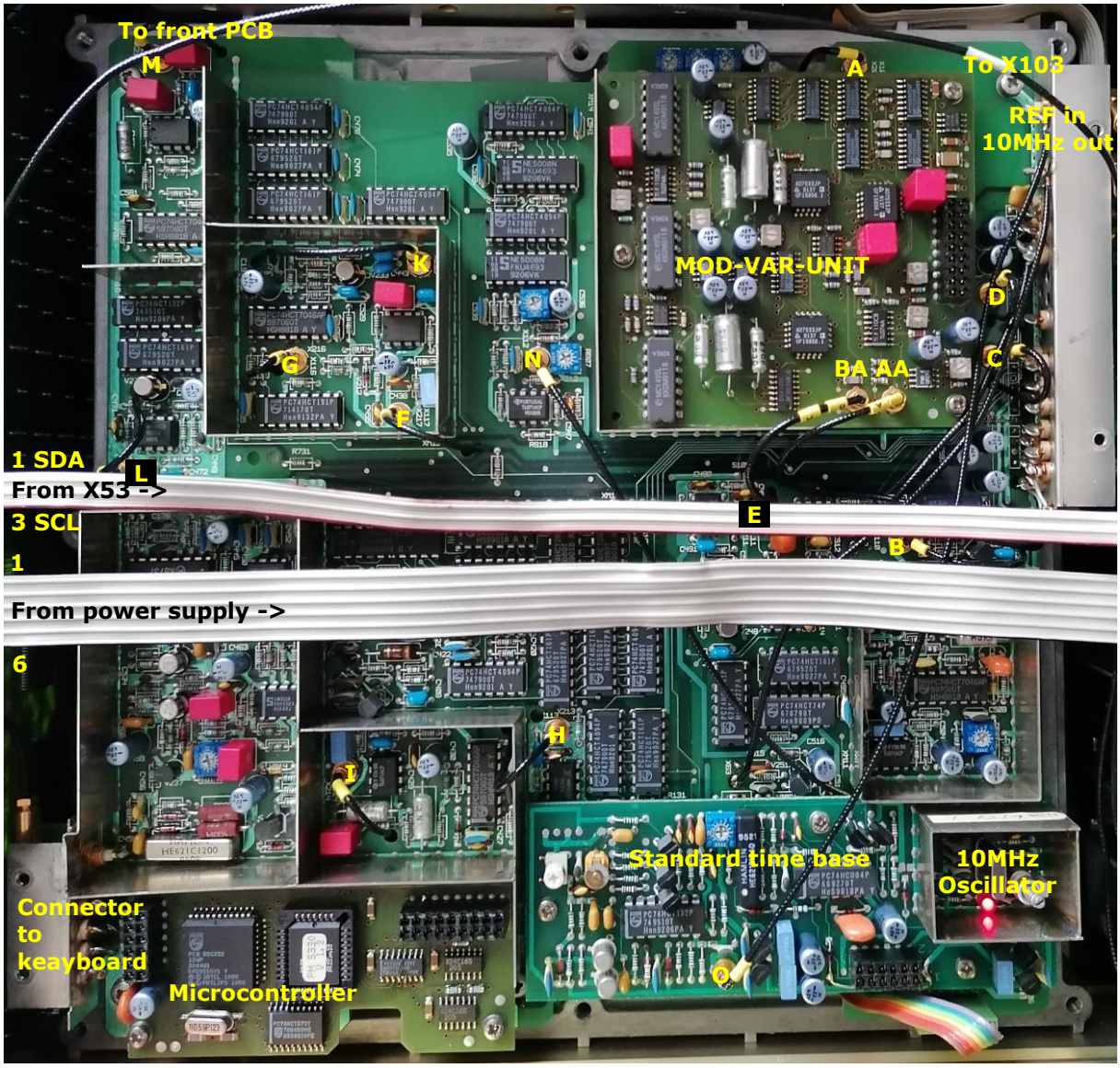


Figure 5 Main Board

Table 11 List of Connections main board

Connector number	Connect to	Function
X101 = X201	Coax	To Stereo board 2, soldered
X102 = X202	Coax	To RDS/ARI2 soldered
X103 = X203	Coax	Front BNC: Mod In
X104 = X204	Coax	Rear BNC: Sweep Out
X105 = X205	Coax	Rear BNC: Mod Out

X106 = X206	Coax	To Stereo coder 1st board, scomp. side
X107 = X207	Coax D	Unknown
X108 = X208	Coax A	Unknown
X109 = X209	Coax C	Unknown
X110 = X210	Coax B	Unknown
X111 = X211	Coax E	Unknown
X112 = X212	Coax N	Unknown
X113 = X213	Coax H	Unknown
X114 = X214	Coax I	VCO control voltage
X115 = X215	Coax K	Unknown
X116 = X216	Coax G	Unknown
X117 = X217	Coax F	Unknown
X118 = X218	Coax L	Unknown
X119 = X219	Coax M	VCO control voltage
X36	7 pin hdr to RF Part	Colored flat cable
X52? connector	8 pins 1e	Flat cable to IEEE-IIC bus interface
X51? connector	8 pins 1e	Flat cable to Stereo coder & RDS grenrator
X? soldered	12 pins 1e	Flat cable from power supply board
X? soldered	6 pins 1e	Flat cable to Attenuator
X53 connector	3 pins 1e	Flat cable to front panel
X65 pin header	12 pins 2x6 1e	To µC board
X67 pin header	18 pins 2x9 1e	To µC board
X81 wire to SMB	SMB connector	Counter in BNC front
X82 Coax soldered feed through capacitor	COAX P	To power supply board J7 on schematic diagram
X551 ext X501 int feed through capacitor	4p 1e Soldered	
X552 ext X502 int feed through capacitor	5p 1e Soldered	
X553 ext X503 int feed through capacitor	5p 1e Soldered	
X554 ext X504 int feed through capacitor	5p 1e Soldered	
X555 & X505 Feed through capacitors	8p soldered then connector 8x 2.54	To front panel 10 pins ribbon cable 2 more pins on Main-board to Keyboard (power ?)
X? SMB	from rear via SMB to O at the 10MHz osc board	Rear BNC: REF in
X63 SMB	Coax from X63 via SMB to	Rear BNC: 10MHz out

Table 12 X? pinning to flat cable to attenuator

1	SDA	
2	SCL	

3	nc	
4	- opamp	Supply opamp on Attenuator board
5	GND	
6	+5V	

Table 13 X65 pinning to µC board

1		a.o. 3.3µF on µC pcb
2	+5V Vdd	
3	P1.3	
4	P1.5	
5	P1.3	
6	P1.2	
7	P1.7/SDA	
8	P1.6/SCL	
9	P3.1/~TxD (via 2x HCT132)	HCT132-8 on µC pcb
10	P1.0	
11	P3.0/~RxD (via HCT132)	HCT132-6 on µC pcb
12	P3.2/~INT0	

Table 14 X67 pinning to µC board

1	GND Vss	
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15	RST	
16		
17		
18		

Table 15 X53 pinning to Keyboard

1	SDA_Display	
2	GND	
3	SCL_Display	Pin 3 is the brown wire !!

3.1 Microcontroller board

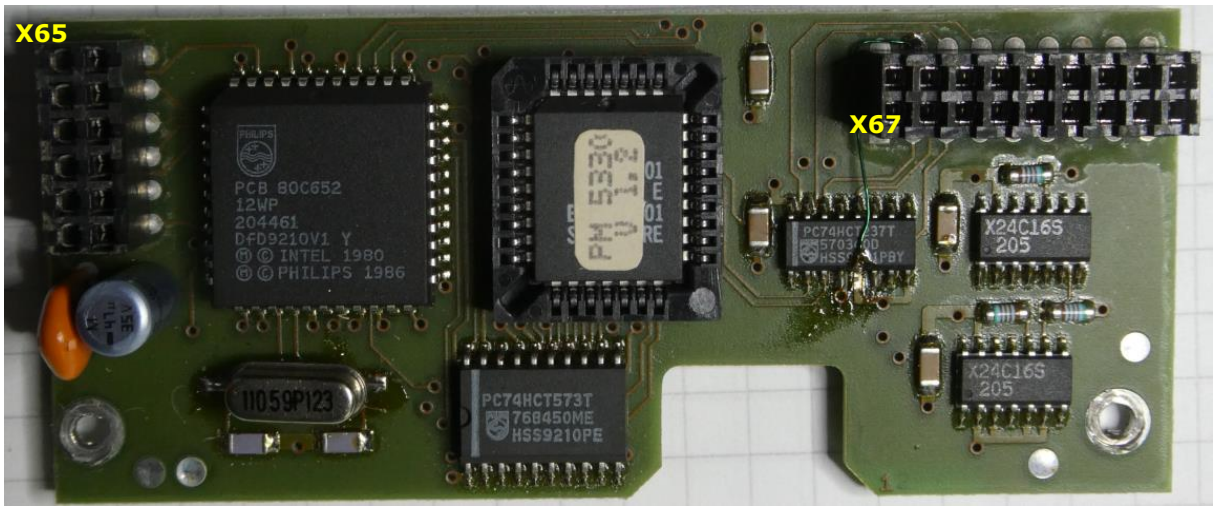


Figure 6 Microcontroller Board

Table 16 Components on the µC board

12NC PCB	4012-110-13501
Sticker	12552 L/R/O/ / /
EPROM Sticker	PM 5330 V 1.2
Microcontroller	Philips 80C652 12WP
OTP EPROM 128Kx8B	ST MC27C1001 12C1
XTAL 11 MHz (measured)	110 59P123
Octal D-type transparent latch; 3-state	Philips PC74HCT573T
3-to-8 line decoder, demultiplexer with latches	Philips PC74HCT237T
2x flash 2Kx8B	Xicor X24C16S
Quad 2-input NAND Schmitt trigger	Philips PC74HCT132T
32Kx8B static cmos ram	NEC D43256AGU-10LL
1x	Philips Elco 036, 47µ35V
1x	Philips Tantaal 3µ3 16V

3.2 Standard time base

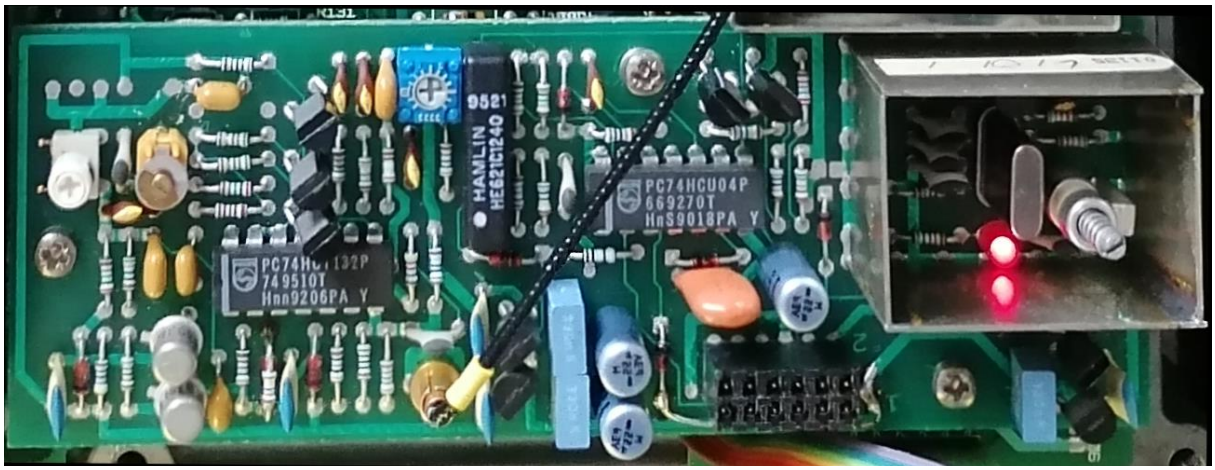


Figure 7 Standard time base

General info

12NC PCB	4012-110-11966
Sticker	01135 L/O/ /

Table 17 X64 pinning to µC board

1	GND1	J101
2	+18Vsb	
3	GND1	
4	-18V	
5	+18V	
6	GND	
7	+5V	
8	EXTREF	High if external ref in signal
9	GND	
10	10MHz1	From 74HCU04-4
11	10MHz2	From 74HCU04-2
12	Not used	

Table 18 X? pinning to µC board

1	Coax O to Rear Ref In	J102
2	GND	

Relay: Hamlin HE621C1240 obsolete
Transistors: 2x 2N4035, more

3.3 MOD-VAR-UNIT

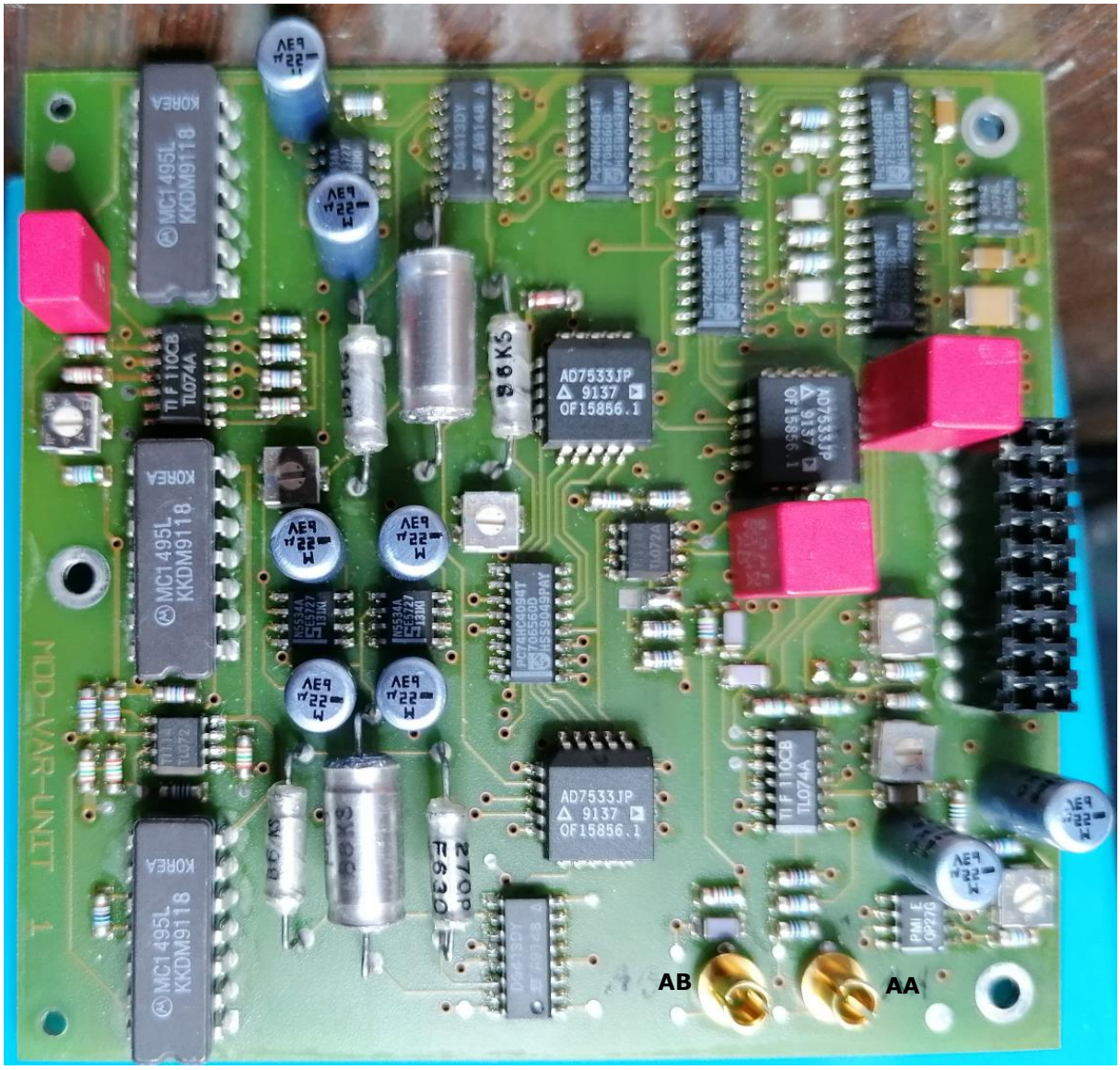


Figure 8 MOD-VAR-UNIT

Table 19 Tekst on the pcb

12NC PCB	4012-110-13284
Sticker	9226 L/R/O/V/ /
	MOD-VAR-UNIT

De MOD-VAR-UNIT is via een 2x9 pins connector verbonden met get main board. Ook zijn er nog twee coax verbindingen met label AA en AB.

Table 20 Used IC's

MC1495L	Multiplier
TL072A	Op amp
TL074A	Op amp
N5534A	Op amp
DG413DY	Analog switches
PC74HC4094T	Shift register ser in par out
AD7533JP	8bit adc
PC74HC4053T	Analog switches
OP27G	Op amp
LM78L15ACM	Volt reg

4 Keyboard / Front Panel

Table 21 Tekst on the pcb

12NC PCB	4012-110-13451
Sticker	11631 L/S/O/E/ /
At the front	KEYBOARD PM5328A

260712: Interesting, so there are similar generators. Checked and indeed, there was a PM5327 and a PM5328.

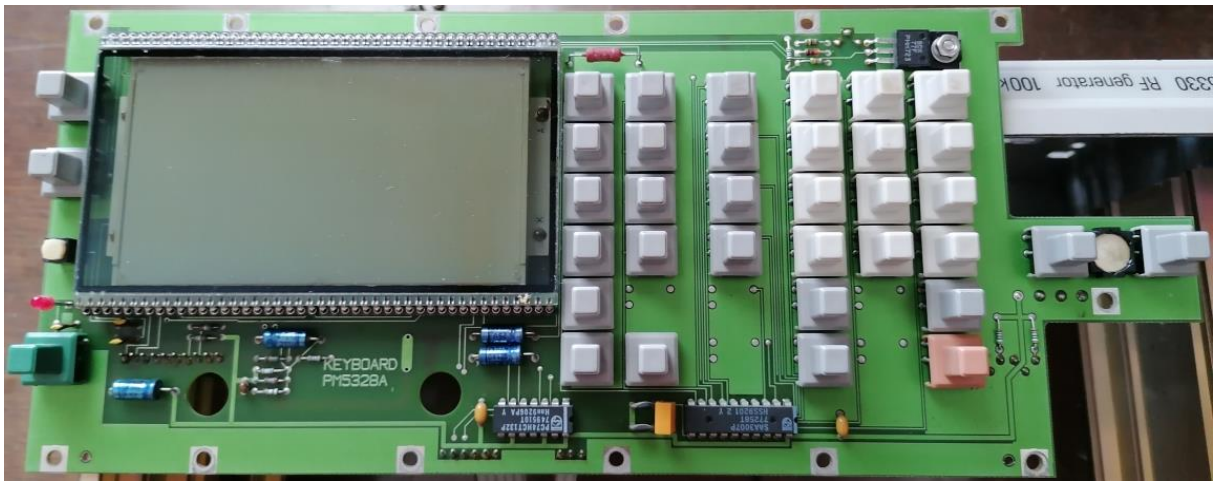


Figure 9 Keyboard Component side



Figure 10 Keyboard Solder side

The rotary encoder wires can be soldered from the board.

Table 22 3 pin connector to main board rear (X53)

1	SDA	I^2C for the display
2	GND	
3	SCK	

Table 23 6 pin connector to Power supply

1		
2		
3		

4		
5		
6		

Table 24 10 pin connector to main board front

1		
2		
3		
4		
5		
6		

5 Program Interface Boards

There are optional two communication boards available for the PM5330.

- PM9548 GPIB interface
- PM9549 RS232 interface

My PM5330 has a PM9548
Found on the web about these interface boards

Table 25 X52? 8 pin connector to Program Interface Board

1	?	
2	+5V via 37 Ohms somewhere	
3	GND	
4	?	
5	?	
6	?	
7	9Vac for Isolated part of the Interface	
8	9Vac for Isolated part of the Interface return	

5.1 IEEE-IIC BUS-INTerface aka PM9548

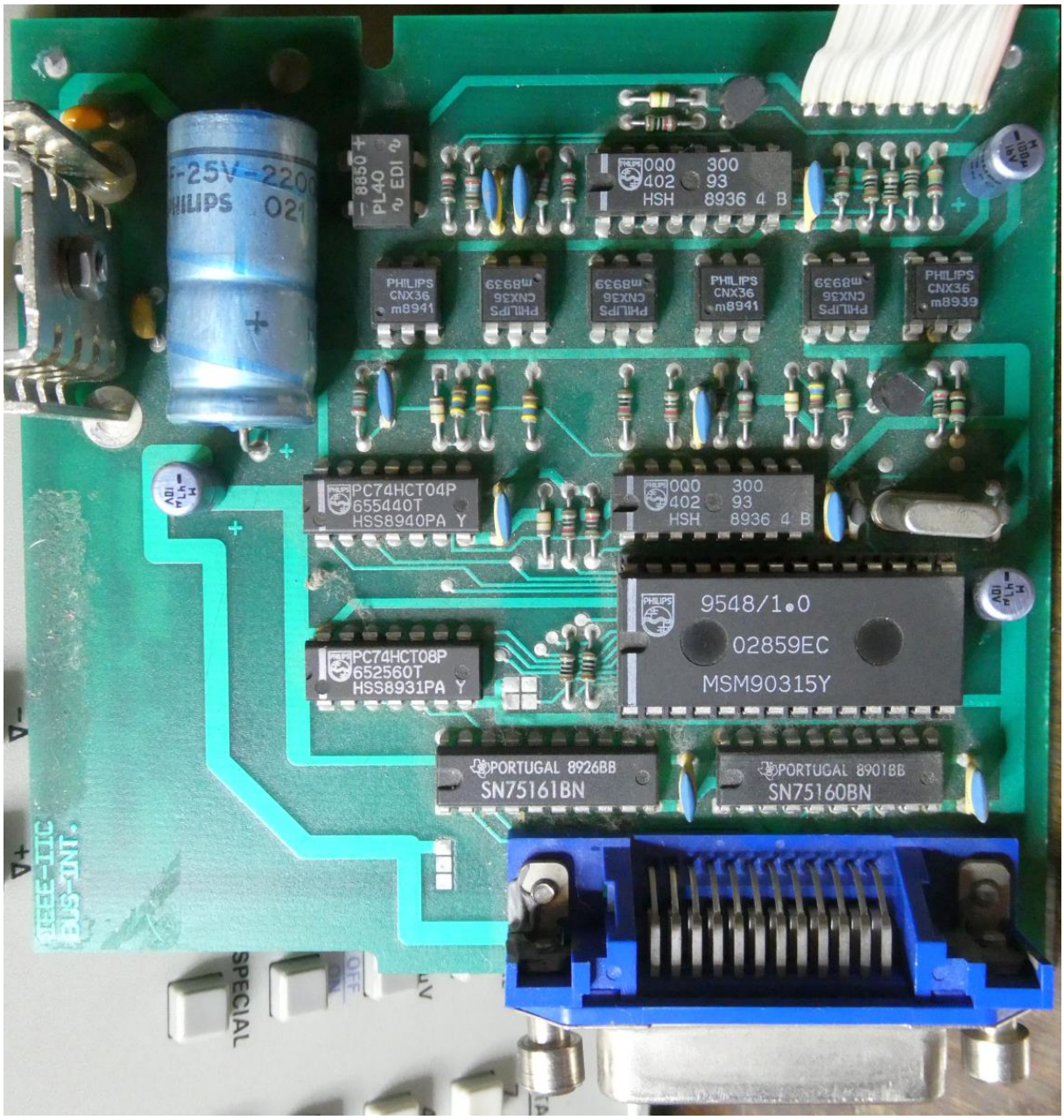


Figure 11 IEEE-IIC Bus-interface aka PM9548

Table 26 Tekst on the pcb

12NC PCB	4012 110 11873?
Sticker	84280 EX ¥ Tk Ex b 2 3
Type:	PM9548
NC:	9452 095 48001
NO:	LO 571252
	Made in Germany

This board has some OQ types. Those are IC's used by Philips intern.

There is one for sale here : [PM9548]

5.2 RS232 Interface aka PM9549

This board is not in my PM5330. It can be placed instead of the IEEE-IIC BUS-INTerface.

PM9549 is an RS232 interface.
There is one for sale here: [PM 9549 Phillips Scientific RS232 Interface Module]
Part Number: LO 659B13

PM9549 Photos from www.artisantg.com



Figure 12 PM9549 component side

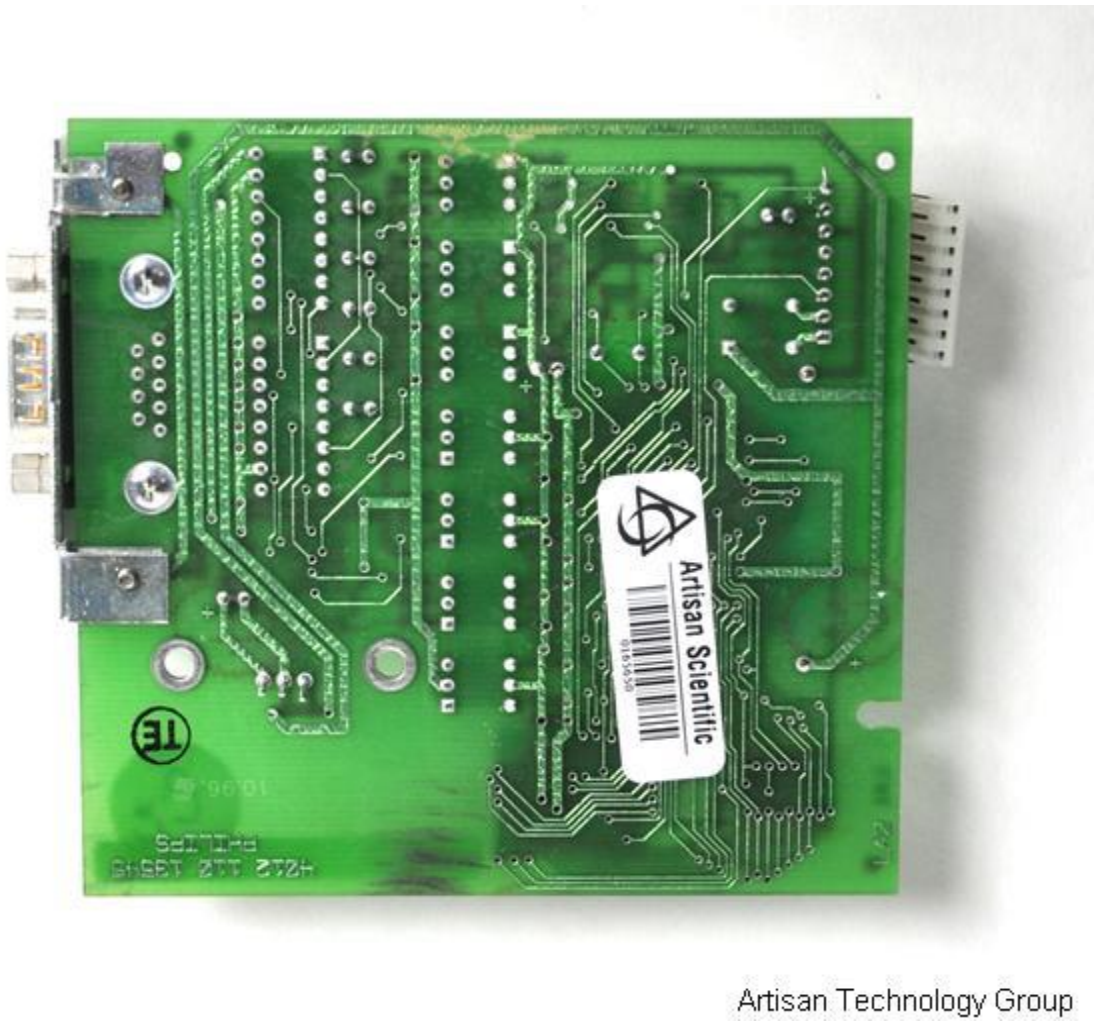


Figure 13 PM9549 solder side

6 Stereo boards

6.1 Stereo board1

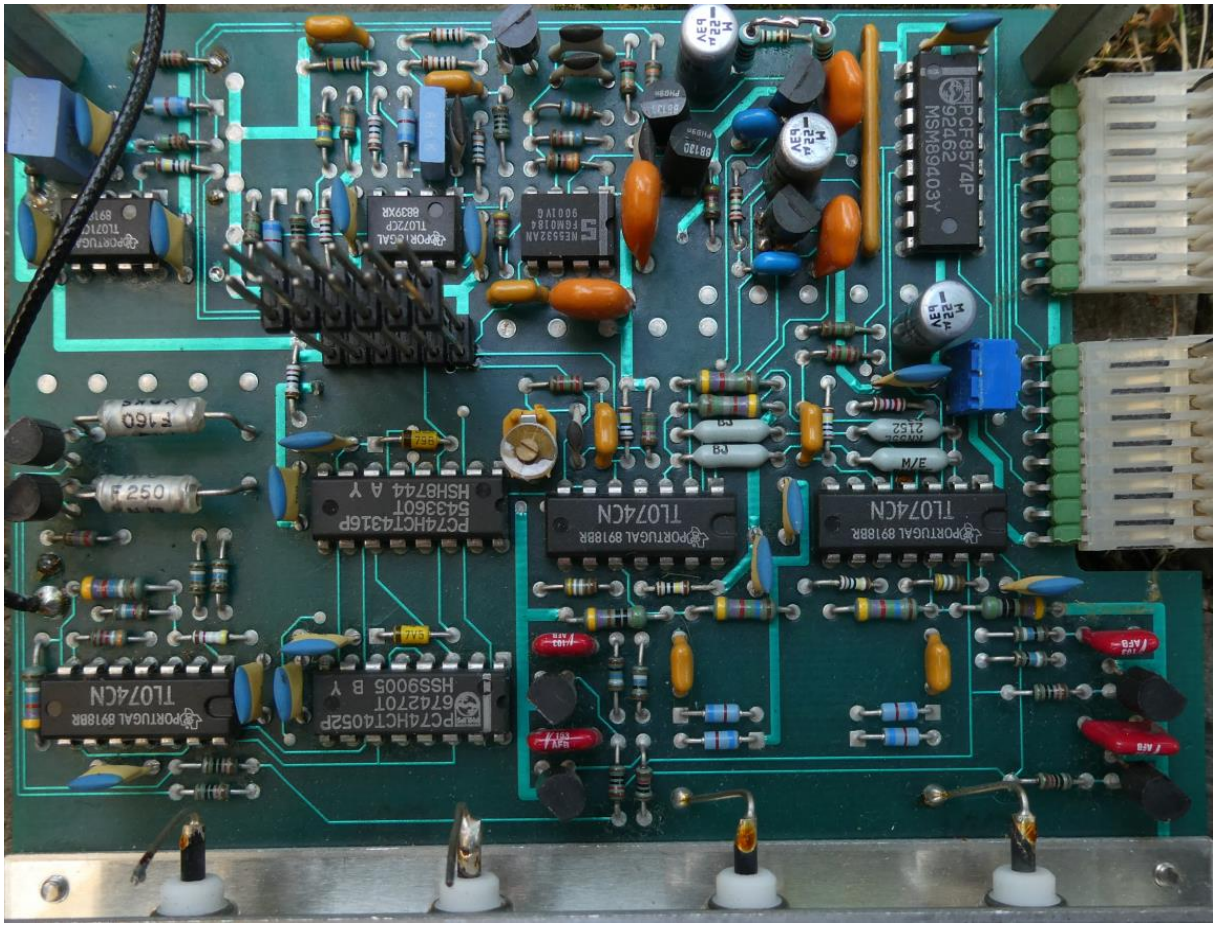


Figure 14 Stereo board 1

Table 27 Tekst on the pcb

12NC PCB	4012-110-11912
Sticker	99625 EX Ɏ Tk Ex b 2 3

Stereo board 1 is the one that is connected to the main board with an 8 way ribbon cable. It also has an extra connector to connect to the RDS boards. Stereo board 1 has a coax to main board X106

6.2 Stereo board2

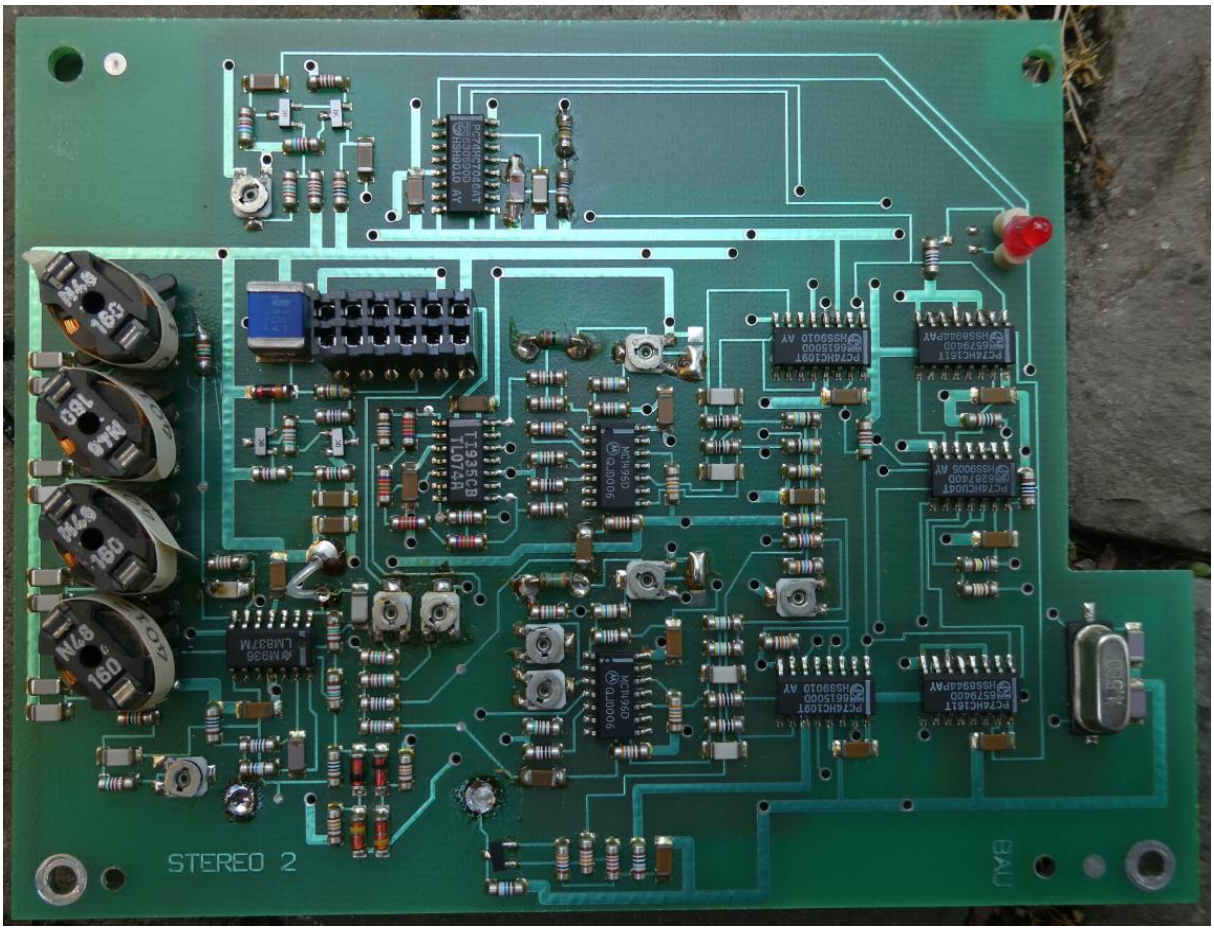


Figure 15 Stereo board 2

Table 28 Tekst on the pcb

12NC PCB	
Sticker	90004 EX ¥

Stereo board 2 has a coax to X101
It connects to stereo board1 with a 12 pins dual row b2b connector

7 RDS/ARI boards

7.1 RDS Board 1

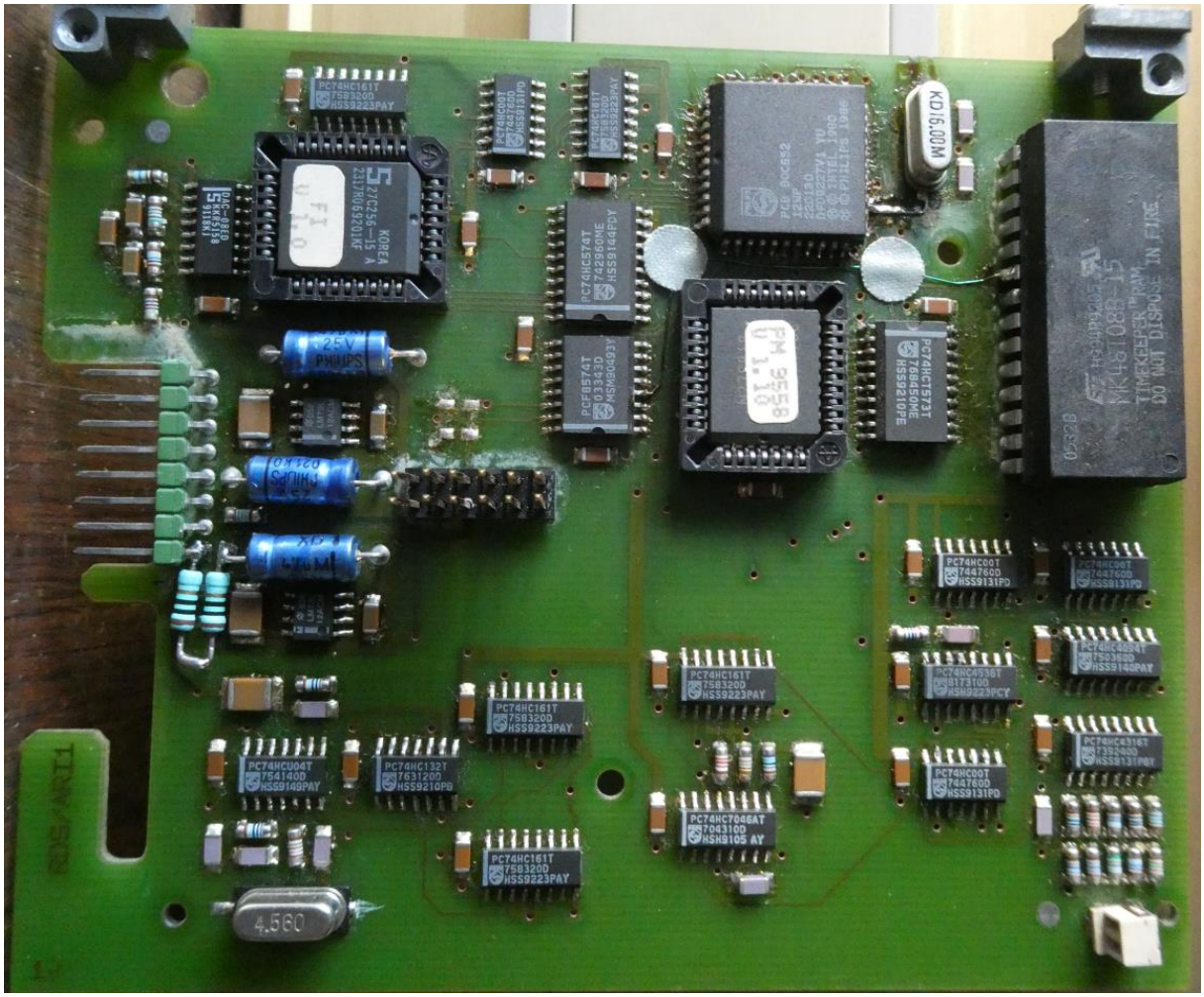


Figure 16 RDS/ARI1 board

General info

12NC PCB	4012-110-12404
Sticker	17734 L/R/O/E/ /
Micro Controller	Philips 80C652 12WP

This board has 3 connections

A 12 way dual row header	To RDS board 2
A 6 pin header to the main board via the stereo coder boards	Power & I^2C & ?

Connector from mainboard

1	+18Vr
2	-18Vr
3	SDA
4	SCL
5	?
6	?
7	GND
8	+5V

Connector to RDS Board 2

+12V	1	2	?
GND	3	4	GND
-12V	5	6	+5V
?	7	8	?
?	9	10	?
114kHz	11	12	114kHz

+18 is connected via a 7.5Ω resistor to a LM78L12ACM so the voltage on the unit is +12V
-18 is connected via a 21.5Ω resistor to a LM79L12ACM so the voltage on the unit is -12V
The 7.5 Ohm resistor was overheated. Replaced by 20 Ohm (2x 10Ω in series)

SDA & SCL lead to PCF8574T and to the 80C652
The PCF8574T pin 4 (P0) is connected to the reset of the 80C652
This means that the master first should wrut a '0' to P0 to enable the 80C652 to run.
P0 also goes or E-not of the TimeKeeper/Ram MK48T08B-15

OTP-EPROMs:
Next to the 80C652 is OTP-EPROM number 2 (number 1 is on the µC board)
The other one, OTP-EPROM number 3 is the one next to a DAC-08, bottom left side of the photo
EPROM2 Label PM 9558 V 1.10 Intel? N27C010
EPROM3 Label FI V 1.0 Signetics 27C256-15A (label niet over type nummer)

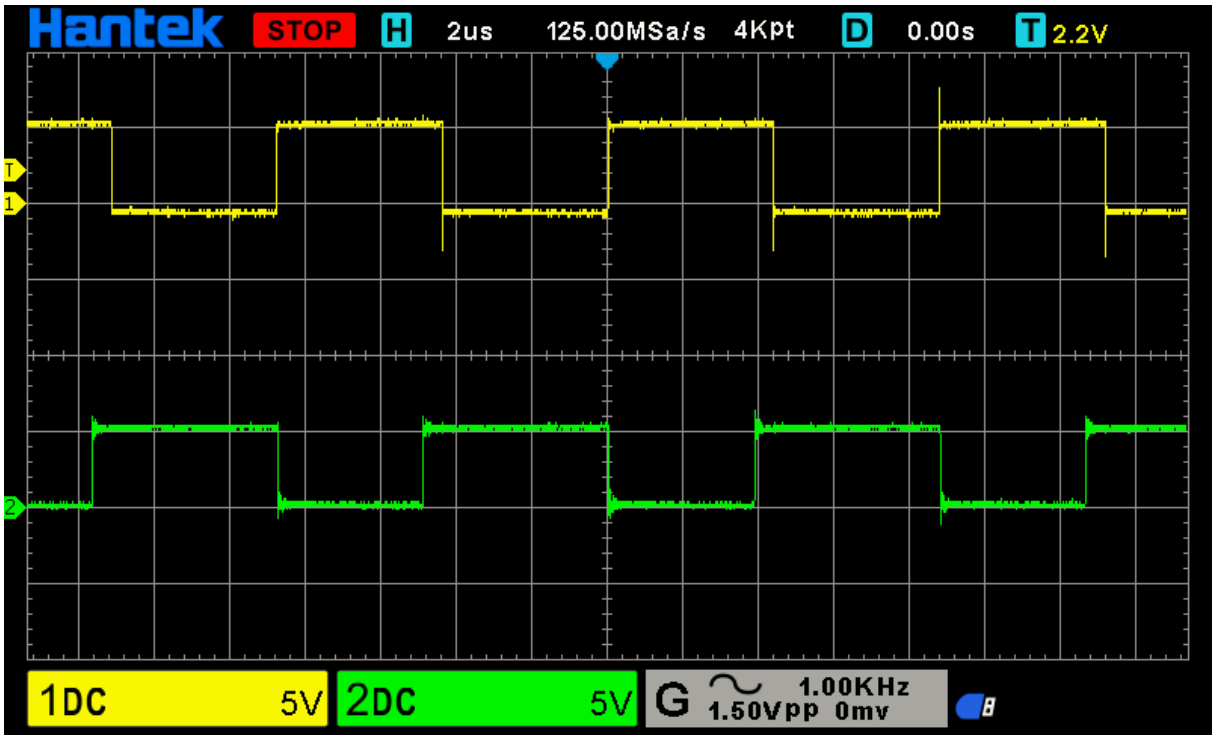


Figure 17 114kHz signal

7.2 RDS Board 2

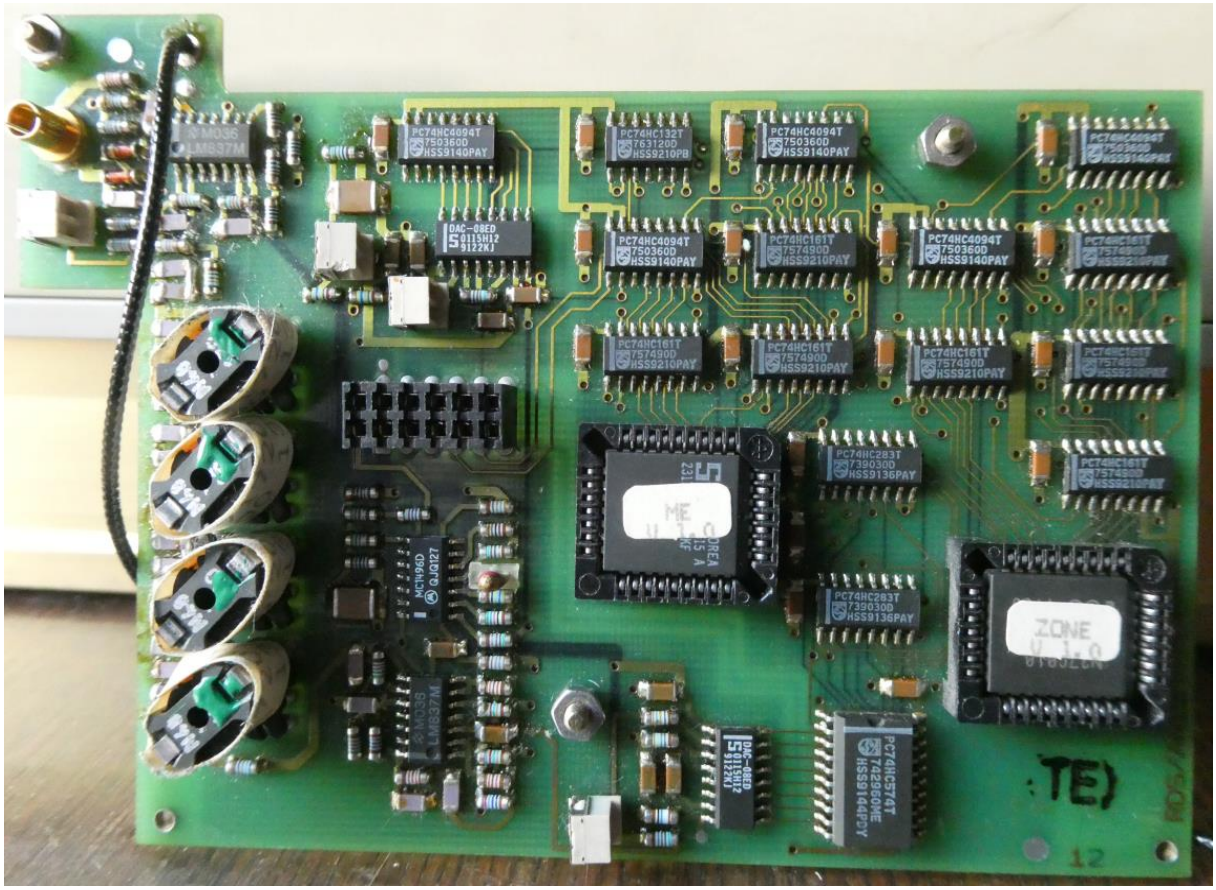


Figure 18 RDS/ARI2 board

12NC PCB	4012-110-12414
Sticker	17584 L/R/O/E / /

This board has 3 connections

A 12 way dual row receptacle	From RDS board 1
A soldered coax cable to the main board	X102 = X202
A coax connector to the rear panel	BNC connector RDS OUT

OTP-EPROMs:
The OTP-EPROM in the centre of the board is OTP-EPROM number 4 (Signetics)
The OTP-EPROM on the right side on the photo is OTP-EPROM number 5
EPROM4 Label ME V 1.0 Signetics ???????15A
EPROM5 Label ZONE V 1.0 Intel? N27C010

The Microcontroller has a 16MHz crystal
The other Crystal is 4.560 MHz

8 RF Part

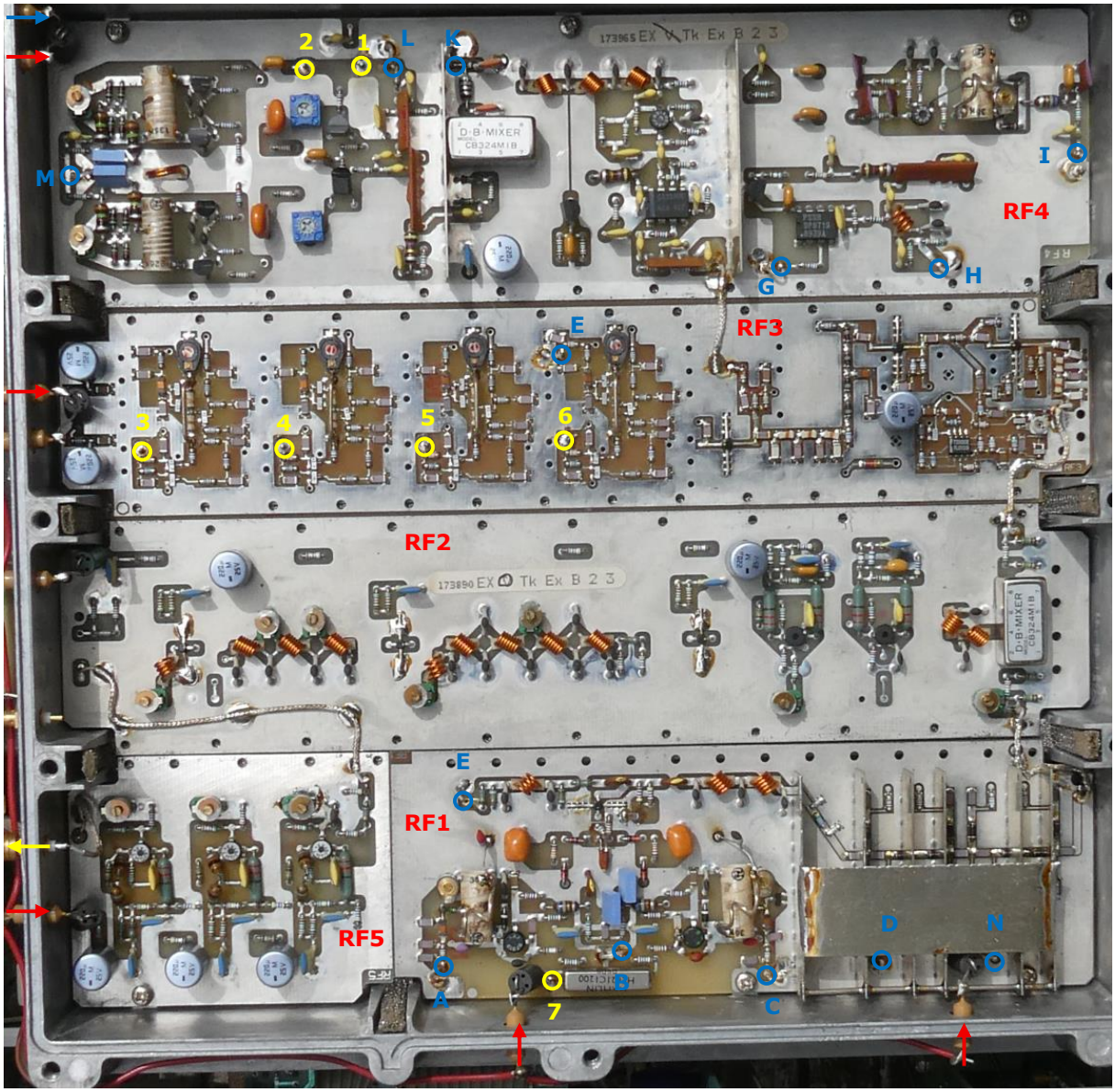


Figure 19 RF Boards

The aluminum cover is fixed with 12 M4 screws. On the cover is a warning that if opened, recalibration is required.

There is a warning on the cover:

Attention: The Instrument has been calibrated by the factory. If you open this screening cover, the instrument must be recalibrated.
The bottom cover screens the digital print, it may be opened without recalibration.

The 12nc number of the aluminum box is 4012 101 2712 Probably last digit not shown for some reason.

There is a ribbon cable 7 wires from the mainboard X36 to the RF part.

The position of each wire connection is depicted in Figure 19 by the numbered yellow circles. The actual ribbon cable has colors also used with resistors: 1..7 is brown to purple.

8.1 RF1

There was no need to take RF1 from the box as there are no electrolytic capacitors to be replaced in that board. So, no info from the the other side.

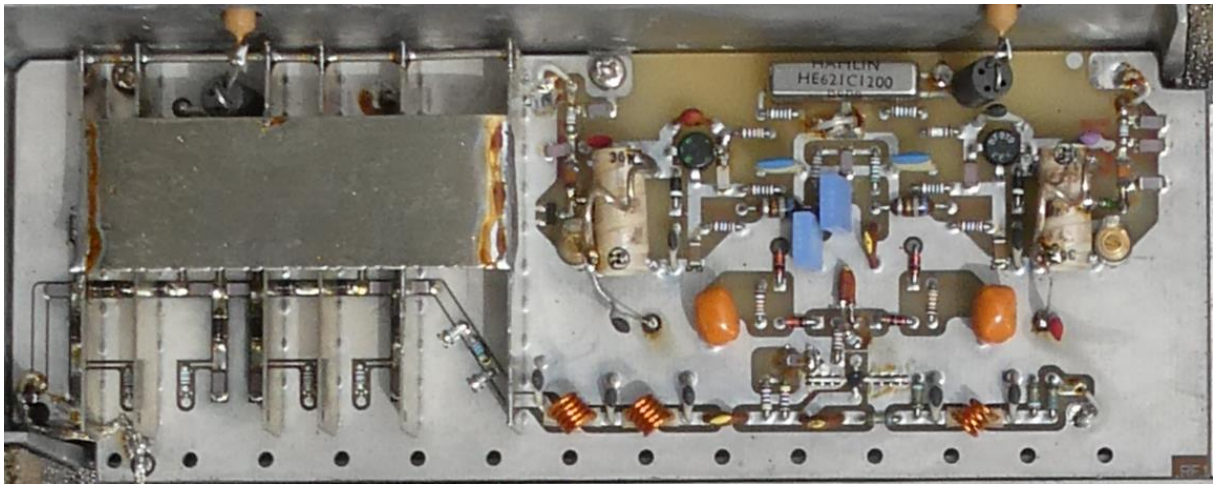


Figure 20 RF1 Board component side

8.2 RF2

Table 29 Tekst on the pcb

12NC PCB	4012-110-11895
Sticker	99625 EX ¥ Tk Ex b 2 3

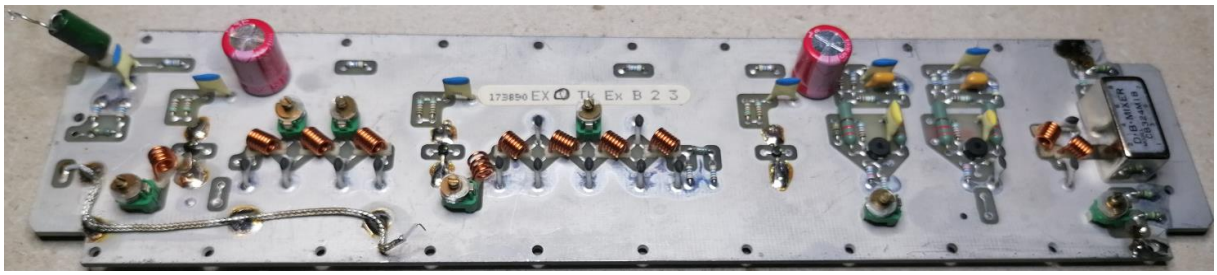


Figure 21 RF2 Board component side

8.3 RF3

Table 30 Tekst on the pcb

12NC PCB	4012-110-11664
Sticker	148753 EX V

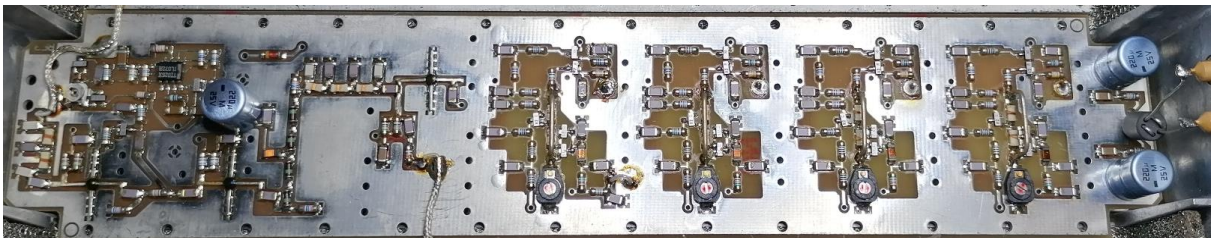


Figure 22 RF3 Board component side

Table 31 RF3 SOT23 Marking codes

Marking code:	Type: (probably)
1K	BC848B
A2	BAT18
A3	BAS16
A91	BAS17
R2	BFR93A
S1	BBY31
S2	BBY40

260820 AI about the 4 black devices with green band:
Probably varicap: **Part Numbers:** This is highly likely a **BA585**, **BB731**, **BB535**, or similar RF/HF tuning device packaged in an **SOD-80 / Mini-MELF / LL34** form factor. [1, 2] That specific topology confirms the exact function of the circuit. With 4 varicaps in series, arranged **cathode-to-input** on one end and **cathode-to-output** on the other, with the control voltage injected directly between the middle two via an RF-blocking inductor, this is a **Voltage-Controlled RF/HF Phase Shifter** (or a constant-impedance variable delay line). This configuration is brilliant for high-frequency signal processing because it relies entirely on the TL072 JFET operational amplifier to provide a variable reverse-bias voltage. This alters the overall capacitance of the series chain without drawing current or loading down the HF line. [1]

Note: The circuit around the two 4-pin amplifiers on the left side of Figure 22 is getting rather hot. Seems to be normal.

8.4 RF4

Table 32 Tekst on the pcb

12NC PCB	4012-110-11645
Sticker	173965 EX V Tk Ex b 2 3

(The 4 in the 12NC number is uncertain.)

The RF4 has 4 thin film amplifiers:
2x OM2045
2x OM2050

The RF4 board is supplied by ±18Vdc from the power supply board (J4 in Figure 4).

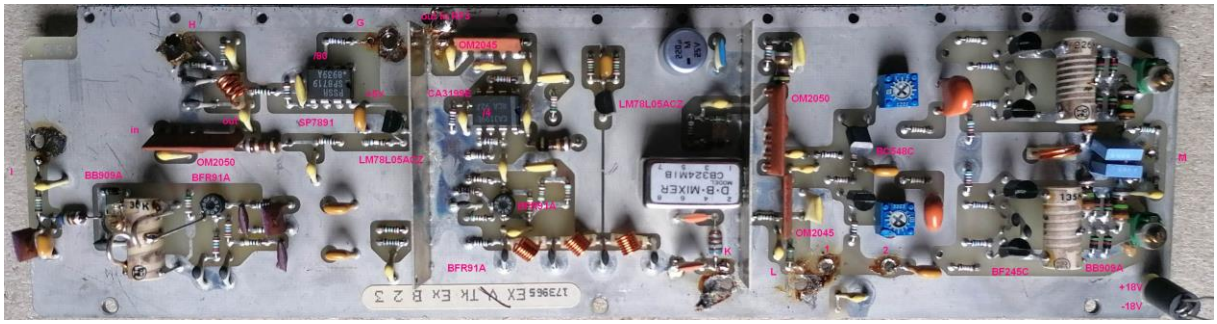


Figure 23 RF4 Board component side

8.5 RF5

Table 33 Tekst on the pcb

12NC PCB	4012-110-11903
Sticker	00284 L/O/E/ / /

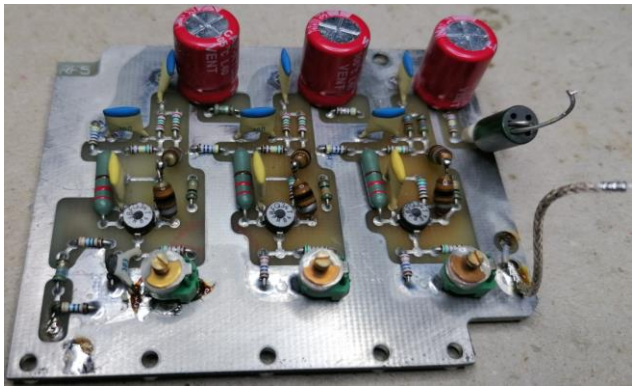


Figure 24 RF5 Board component side

9 Attenuator

The output of the Attenuator is also the output of the PM5330.
The BNC connector goes through a hole in the front panel.
Input from the HF part is done by a copper coax using two SMB connectors.
The connection with the Main Board is a 6 way flat cable using 2.54 pitch connector at the Attenuator side. The other end of the 6 way flat cable is soldered to the main board.
Wire 1 in the flat cable is also 1 on the Attenuator and on the main board. The Main Board and the Attenuator both have a square pad indicating number 1.

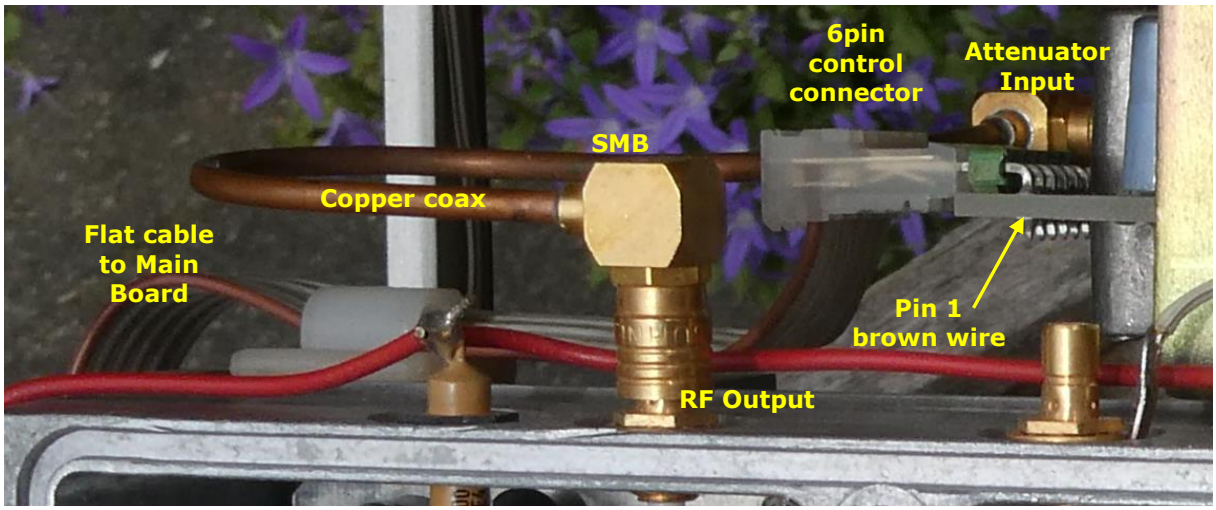


Figure 25 Attenuator Connections

Table 34 Tekst on the pcb

12NC PCB	4012 110 11577
Sticker	156091 EX ¥ Tk Ex b 2 3

There are probably 6 relays. I did not open the aluminum housing with the actual attenuator.
IC PCF8574P I^2C I/O expander
IC TL072CP Dual Low-Noise, FET-Input Operational Amplifiers
5x BC558C
2x BC548C

Table 35 X? pinning flat cable to main board

1	SDA	
2	SCL	
3	nc	
4	- opamp	
5	GND	
6	+5V	

PCF8574:
Pin 12 = P7 is 0V
11k8 PCF8574P to base
90k9 base to +5V



Figure 26 RF3 Board component side