

FREQUENCY SYNTHESIZER
(90 to 120MHz)

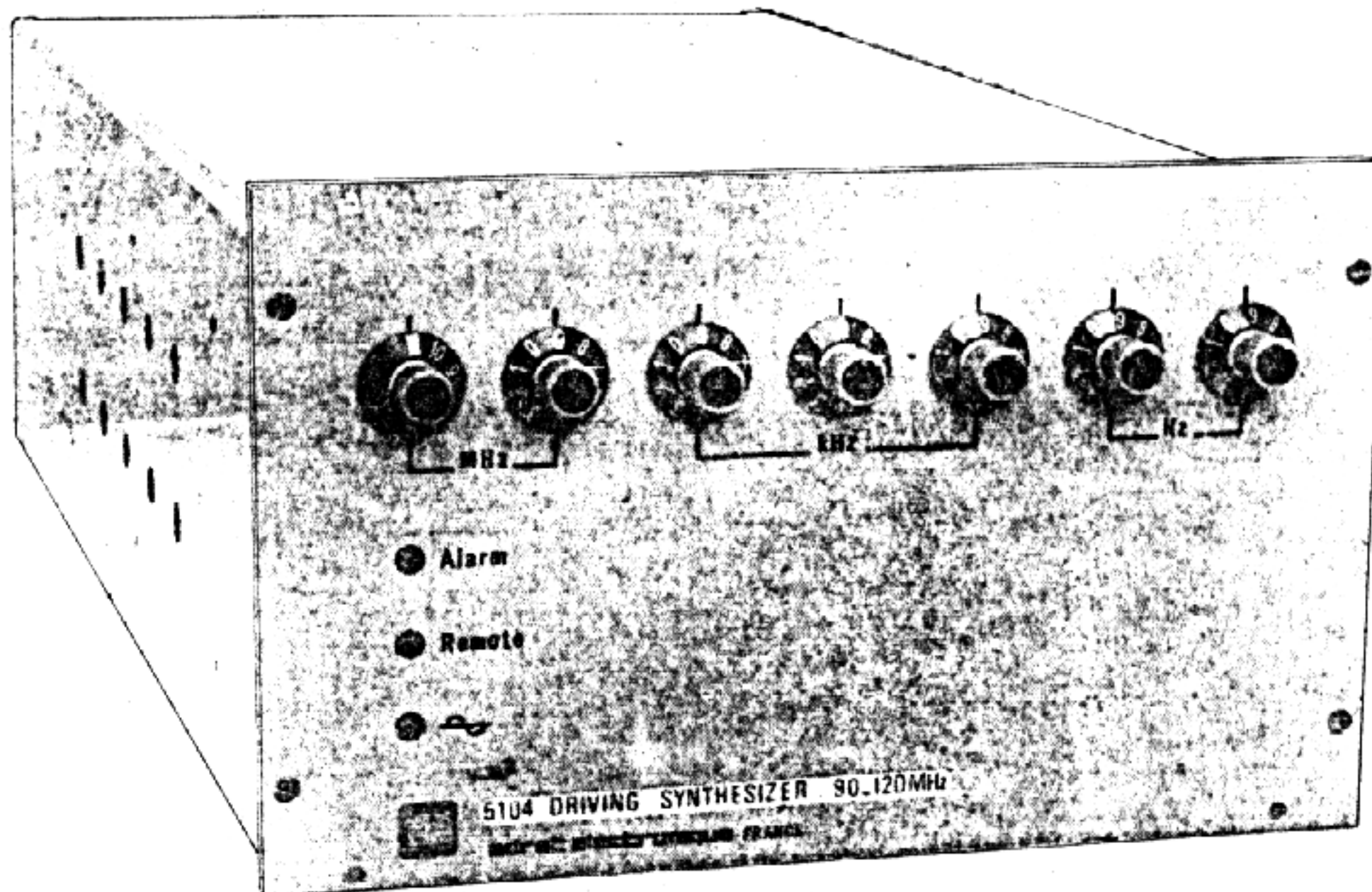
5104

TRAINING MANUAL

adret

ae

electronique®



FREQUENCY SYNTHESIZER
(90 to 120MHz)

5104
TRAINING MANUAL

SUMMARY

GENERAL	2		
CHAPTER I - SPECIFICATION	3		
CHAPTER II - OPERATING INSTRUCTIONS	4		
• Setting up			
• Connections			
• Controls location			
• Preparation for use			
• Use			
CHAPTER III - PRINCIPLE OF OPERATION			
• Principle	8		
• Generation of the variable frequency	8		
• Principle of the phase/frequency comparator	9		
CHAPTER IV - MAINTENANCE	10		
Bloc diagram	11		
1. Power supply	12		
Circuit diagram	13		
Transformer	14		
Rectifier/filter card layout	15		
Regulator card layout	16		
Power transistor mounting	17		
2. Subsystem location	18		
General fault tree	19		
Modules location	20		
Overall diagram	21		
3. First generation card	22		
Circuit diagram	24		
Wiring and component layout diagram	25		
4. Second generation card	26		
Circuit diagram	29		
Wiring and component layout diagram	30		
		5. Increment mixer module	31
		Circuit diagram	33
		Wiring and component layout diagram	34
		6. 1 MHz spectrum module	35
		Circuit diagram	37
		Wiring and component layout diagram	38
		7. 1 MHz divider/lock-on module	39
		Circuit diagram	41
		Wiring and component layout diagram	42
		8. Phase/frequency comparator module	43
		Circuit diagram	46
		Wiring and component layout diagram	47
		Circuit diagram of the output module	48
		Wiring and component layout diagram	49-50-51
		9. Locking of master oscillator	52
		CHAPTER V - FINAL CHECK	
		List of required measuring instruments	53
		CHAPTER VI - ELECTRICAL DIAGRAMS	
		• Display-code filter	59
		Wiring and component layout diagram	60-61
		• 623 Master oscillator	62
		NOMENCLATURE	63
		LIST OF THE PLATES	
		Rear-panel inter connexions	5
		Front-panel references	6
		Rear-panel references	7
		Block diagram	11
		List of required measuring instruments	53

GENERAL

The ADRET 5104 synthesizer is a synthesis-technique programmable master oscillator covering the band from 90 to 120 MHz with 10 Hz resolution and a stability of 2 parts in 10^8 per day.

The output frequency, intended for the control of hyperfrequency sources such as those used in satellite communications facilities, is available on a coaxial connector on the rear of the instrument at a fixed level of + 13 dBm/50 Ω .

The output frequency may be set either manually on seven decimal switches or remotely, by an externally-generated program fed to a rear-panel connector.

MAINTENANCE

The construction of ADRET-ELECTRONIQUE instruments is basically modular. This is inherent in their design. Maintenance of them is therefore easily carried out in two distinct stages :

- This first stage consists of replacing the defective module or sub-assembly with an identical module from the spare-parts stock. Almost all of the modules take the form of plug-in-boards with keyed connectors. They are adjusted at the plant on special test benches in accordance with a precise procedure that does not vary from instrument to instrument, guaranteeing a high degree of interchangeability. Identifying the defective sub-assembly is considerably facilitated by the schematics, charts, and explanations given in the technical manuals ;
- The second stage of maintenance consists of trouble-shooting the defective sub-assembly. During the guarantee period (one year from the date of delivery), this will be done free of charge by ADRET-ELECTRONIQUE in no more than a week or two. ADRET is of course ready to help its customers following this guarantee period, charging a modest sum for each maintenance operation.

Companies or organizations with qualified staff and the necessary basic instrumentation (oscilloscopes in particular) can readily trouble-shoot these instruments themselves. The technical manual supplied with the instrument includes detailed circuit diagram , a parts list, and chapters on adjustment and maintenance.

ADRET is also prepared to organize training sessions covering one or several instruments for its customers ; a good technician will generally need two or three days to become familiar with our products.

Finally, we can supply, on request, such spare parts as transistors, IC's, resistors, capacitors, etc..., if these have to be replaced.

CHAPTER I – SPECIFICATION

FREQUENCY

Frequency range : 90 to 119,999 99 MHz

Resolution : 10 Hz

Number of digits : 7

Stability :

- 2 parts in 10^{-8} per day after 72 hours' operation
- 5 parts in 10^{-9} per day after 3 months' operation

LOCKING

To external standard, by built-in comparator, monitored by a ± 5 V output on the rear panel, with built-in master oscillator tuned by a ten-turn potentiometer.

Frequency : 5 MHz

Level : 200 mVrms to 1 Vrms/50 Ω

OUTPUT LEVEL

The output signal is available on a rear-panel BNC connector.

Fixed output level : + 13 dBm/50 Ω

Output level flatness from 90 MHz to 120 MHz : ± 1 dB

SPECTRAL PURITY

Harmonic signals : - 26 dB

- Non harmonic signals :
- Line frequency spurious : - 70 dB (typical)
- Other spurious : - 80 dB (- 85 dB typical)

Phase noise (in a 1 Hz bandwidth typical)

- 115 dB at 300 Hz from carrier
- 120 dB at 1 kHz from carrier
- 125 dB at 10 kHz from carrier
- 140 dB at 100 kHz from carrier

PROGRAMMING

Manual/Remote switching by logic input to programming connector.

Impedance : 2.2 k Ω

Current source TTL logic :

- «0» logic level : 0 V to 0.7 V/0.2 mA
- «1» logic level : + 2 V to + 5 V/0.1 mA

1-2-4-8 BCD code

- Parallel input

- Acquisition time : See table below

Digit affected by the frequency switching	Settling time at 100 Hz from final frequency	Settling time at 10 Hz from final frequency
$10^7 - 10^8$ Hz	1,8 ms	18 ms
10^6 Hz	9 ms	12 ms
10^5 Hz	4 ms	6 ms
10^4 Hz	18 ms	25 ms
$10^1 - 10^2 - 10^3$ Hz	20 ms	35 ms

The above-mentioned settling times depend only on the weight of the digit affected by the frequency switching.

ALARM

A front-panel indicator monitors the frequency of the output signal.

On : output frequency different from programmed value.

Off : output frequency equal to programmed value.

POWER SUPPLY

Voltage : 115 or 230 Vrms ± 10 %

Frequency : 50 to 400 Hz

Consumption : 22 VA

TEMPERATURE RANGE

Operation : 0 to + 50 °C

Storage : - 20 to + 70 °C

MECHANICAL DATA

Height :

- Front-panel : 126 mm
- Cabinet : 110 mm

Width : 203 mm

Depth : 400 mm

Adaptable to 19" rack : 3 U (two synthesizers can be inserted in the mainframe).

Mass : 6,5 kg.

CHAPTER II OPERATING INSTRUCTIONS

II.1 - SETTING UP

The instrument is plugged into the mains using an FRB DO3 power cord with automatic lock (supplied with the instrument).

Set the mains voltage selector to 115 or 230 V (each setting has a tolerance of $\pm 10\%$). Protection is by two 250-mA fuses, connected in series for 230 V and in parallel for 115 V.

II.2 - CONNECTIONS

See Plate III.1 : Connector Characteristics.

FRONT PANEL

There are no connectors on the front panel of the 5104.

REAR PANEL

Plate III.1 shows all connections to be made to the rear panel of the instrument.

II.3 - CONTROLS LOCATION

3.1 - FRONT PANEL

The seven decimal switches on which the output frequency is set are on the front panel. They provide frequency switching from 10-Hz to 10-MHz steps. Three validation lights are also located on the front panel ; in order :

DSO1 : «ALARM», indicating when off that the output frequency is identical to that set on switches **KO1** or programmed via programming connector **SO1**.

DSO2 : «REMOTE», indicating when lit that the «Remote» mode is enabled (from pin 20 of programming connector **SO3** on the rear panel).

DSO3 : « », indicating that the instrument and master oscillator are on ; goes out when the master oscillator has warmed up.

See Plate II.2 for front panel reference.

3.2 - REAR PANEL

All outside connectors, together with the potentiometer used to tune the master oscillator, are located on the rear panel. They are described in Plate V-2.

II.4 - PREPARATION FOR USE

Before turning the instrument on, check that switch **KO2** is set to a position compatible with the mains voltage (115 or 230 Vrms).

As soon as the instrument is plugged in, indicator light **DSO3** on the front panel lights, indicating that the instrument and master oscillator are on. Wait until **DSO3** goes out again before using the instrument.

II.5 - USE

Refer to descriptive Plates II.2 and II.3 for the locations of front and rear panel controls.

5.1 - DIGITAL MANUAL MODE

The Manual mode is selected via pin 20 of rear-panel connector **SO3**.

The absence of a signal on pin 20 selects the Manual mode.

«REMOTE» lamp **DSO2** on the front panel should be off.

Set the output frequency on the seven decimal switches (**KO1**), which are direct-reading.

5.2 - DIGITAL REMOTE MODE

The Remote mode is also selected via pin 20 of programming connector **SO1**.

Apply a «0» level to this pin (0 to 0.7 V/0.2 mA).

«REMOTE» lamp **DSO2** on the front panel should be lit.

Programming should be in TTL-compatible positive logic, since the input circuits consists of a series L TTL gate preceded by an BC filter (see Plate VI-9 for a circuit diagram of the code filter).

The desired output frequency is programmed by applying a «1» level to the corresponding code inputs and a «0» level to the remaining pins.

Figure 2 shows the pin references of programming connector **SO3**.

Pin 20 is used to program the operating mode : for the Manual mode, no signal is applied to this pin ; for the Remote mode, a «0» level is applied to it.

Pin 18 provides a logice level determined by the operating mode : «0» in the Manual mode and «1» in the Remote mode.

Pin 19 is connected to the instrument ground, and the remaining pins receive the frequency-programming codes in positive logic («1» = + 2 V to + 5 V/100 μ A ; «0» = 0 to + 0.7 V/0.2 mA).

It should be noted that the 8.10^7 Hz bit cannot be programmed from connector **SO3**. Any validation of a step smaller than 1.10^8 Hz validates the 8.10^7 Hz step internally.

Exemples :

1) F = 90 MHz

To obtain this output frequency, code the 1.10^7 Hz and 8.10^7 Hz steps or simply the 1.10^7 Hz step.

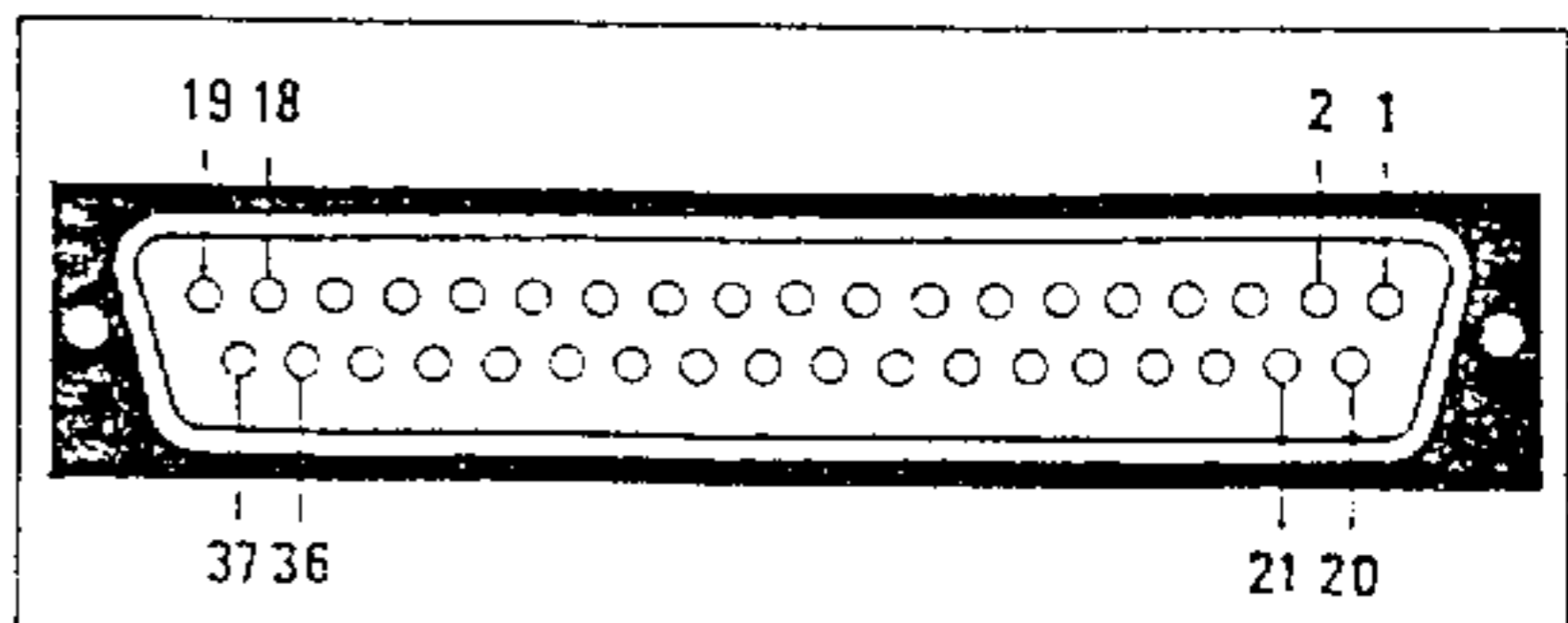
2) F = 96 MHz

Code the 1.10^7 Hz, 4.10^6 Hz and 2.10^6 Hz steps or all three plus the 8.10^7 Hz step.


3) F = 114 MHz

Code the 1.10^8 Hz, 1.10^7 Hz and 4.10^6 Hz steps.

FIGURE 2 : Pin references of programming connector **SO3**.



REMOTE PROGRAMMING

PIN	FUNCTION	PIN	FUNCTION
1	1 10 ¹	20	LOCAL/REMOTE
2	8 10 ¹	21	NC
3	2 10 ¹	22	1 10 ⁵
4	4 10 ¹	23	8 10 ⁵
5	1 10 ²	24	2 10 ⁵
6	8 10 ²	25	4 10 ⁵
7	2 10 ²	26	1 10 ⁶
8	4 10 ²	27	8 10 ⁶
9	1 10 ³	28	2 10 ⁶
10	8 10 ³	29	4 10 ⁶
11	2 10 ³	30	1 10 ⁷
12	4 10 ³	31	8 10 ⁷
13	1 10 ⁴	32	NC
14	8 10 ⁴	33	NC
15	2 10 ⁴	34	1 10 ⁸
16	4 10 ⁴	35	NC
17	— NC	36	NC
18	Lev.«0»/Lev.«1»	37	NC
19			

NC : Not connected.

Logic level : «0» : 0 à +0.7 V/0.2 mA

«1» : +2 à +5 V/+100 µA

5.3 - LOCKING MASTER OSCILLATOR TO EXTERNAL REFERENCE

The frequency of the crystal master oscillator of the synthesizer may be locked to an external reference fed to rear-panel coaxial connector **J2**. This reference should have the following characteristics :

Frequency : 5 MHz ± 3 parts in 10⁷ ;

Level : 200 mV to 1 Vrms/50 Ω.

It should be of good spectral purity.






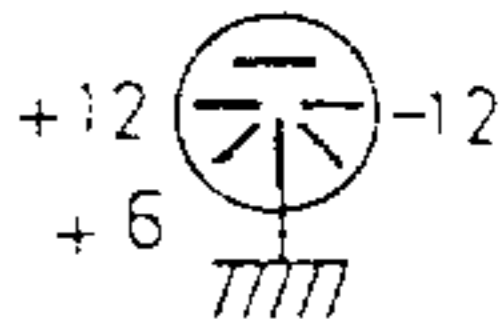


Procedure : (see Plate 3).

Apply the external frequency to **JO2**. The master oscillator is tuned using ten-turn potentiometer **P1** and locking is displayed on a galvanometer (+500 µA) connected across terminals **JO3** and **JO4**, which provide a DC voltage ranging from +5 V to -5 V (Zi= 10 kΩ) as a function of the phase difference.

Maximum locking security is obtained when the DC voltage output is 0 and the frequencies are in phase quadrature.

When the master oscillator is not locked, the voltage delivered by **JO3** is not uniform but triangular, and the galvanometer needle oscillates. At a distance from pull-in, the beat is very fast ; as locking is effected, it decelerates steadily until the galvanometer needle stabilizes.

PLATE II.1 - REAR-PANEL INTERCONNECTIONS

CONNECTOR REFERENCE	MARKING	MATCHING REFERENCE	REMARKS
	Output	RADIALL male BNC	Output of synthesized frequency ; level, +13 dBm ; impedance, 50 Ω
	Input, 5 MHz	RADIALL male BNC	Input of external reference frequency ; 5 MHz, 200 mV to 1 Vrms/50 Ω
	Output, ±5 V	RENAUD female DN4D	Output, ±5 V ; oscillator locking monitoring voltage
	Ground	MFOM female D3203	Ground
	Power supply, 50 mA max.	PERENA P15F - 6855	Power supplies for peripherals ; +12, -12, and +6 V with respect to ground 
	Mains	FRB - D03	AC power supply ; 115 or 230 Vrms, 50 Hz to 400 Hz
	Frequency Programming	SOURIAU DCM, 37 pins	For BCD 1-2-4-8 frequency-programming inputs

Decimal switches for Manual frequency selection
(10^1 Hz to 10^7 Hz steps ; 10-Hz resolution).

K01

Displays validation of output signal available on coaxial connector J01.
When lit, the output frequency does not match the setting. When off, the output frequency is equal to the setting.

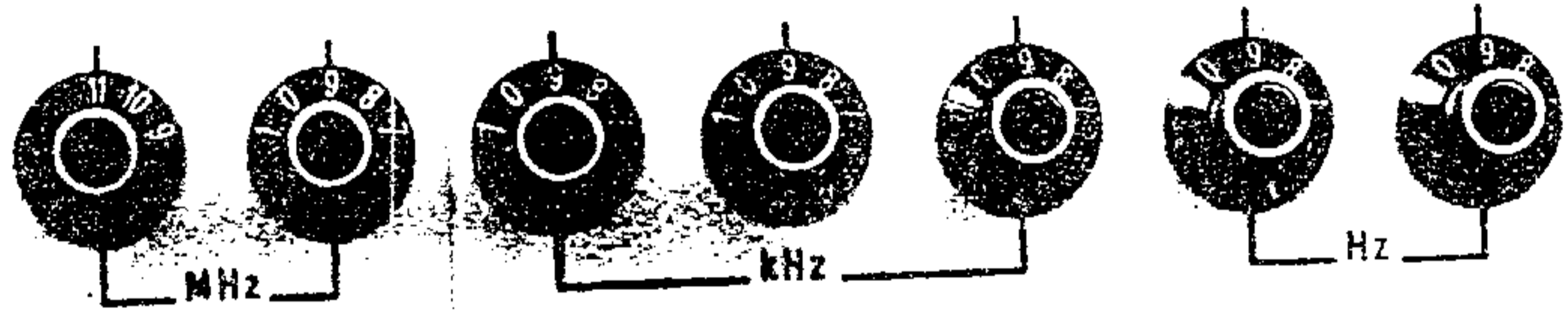
DS01

Displays validation of the Remote mode as selected via programming connector S03. Lit in Remote mode and off in Manual mode

DS02

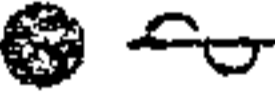
Lit when instrument and local oscillator turned on

DS03



Alarm

Remote



SIG-DRIVING SYNTHESIZER 90-120MHz
SIRAZ ELECTRONIQUE FRANCE

Output of synthesized frequency set K01 or S03.
 - Frequency: 90 to 120 MHz
 - Level: -13 dBm (1 Vrms)
 - Impedance: 50 Ω

37-pin connector
 - «DIGITAL REMOTE PROGRAMMING»: Input of programming signals (BCD 1-2-4-8) for frequency selection
 - «MANUAL/REMOTE SWITCHING»: Mode switching, displayed on DS02.

Connector providing power supplies for peripherals: +12, -12, and -6 V with respect to ground (consumption: 50 mA).

Ten turn potentiometer for oscillator tuning, for locking of local oscillator to external reference fed to coaxial connector J02.

GROUND

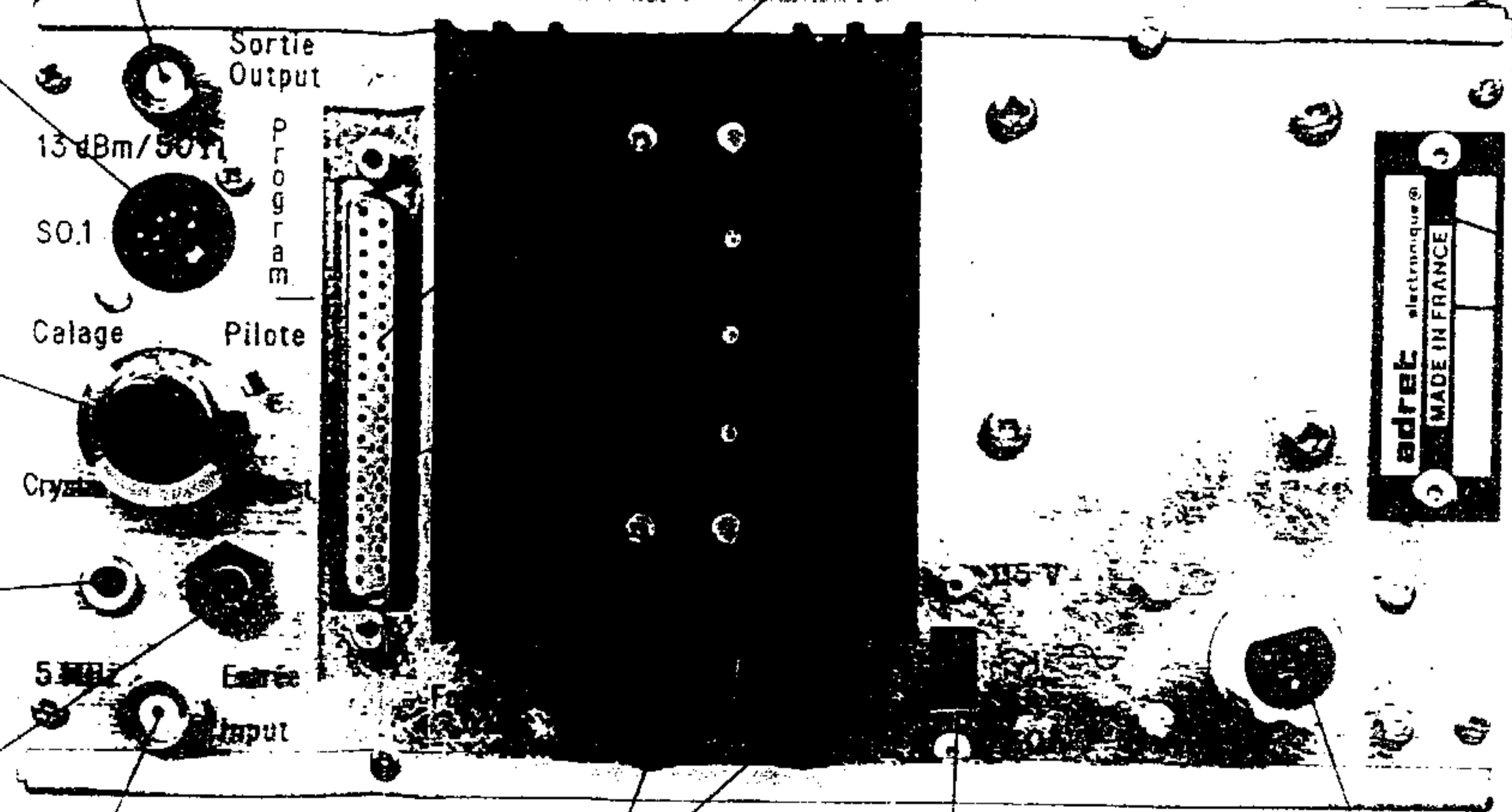
Output: +5 V oscillator locking monitoring voltage

Input of external frequency to which local oscillator is locked
 - 5 MHz
 - 200 mV to 1 Vrms/50 Ω

Main fuses (250 mA)

Voltage selector (115 or 230 Vrms)

Three pin connector for connection to mains (115 or 230 Vrms, 50 to 400 Hz)



CHAPTER III PRINCIPLE OF OPERATION

III.1 - PRINCIPLE

The 5104 generates all discrete frequencies from 90 to 119.999,9 MHz in 10-Hz steps. Each output frequency is synthesized from the 10-MHz reference provided by a quartz-crystal master oscillator.

The instrument is in two parts :

- 1) Generation of 10^1 to 10^5 increments.
- 2) Generation of 1- and 10-MHz increments and output signal.

The general principle of the 5104 is shown in Plate III.1.

1) Generation of 10^1 to 10^5 increments

The 10^1 , 10^2 , 10^3 and 10^4 (1 bit) increments are generated by a decimal insertion unit known as the «First Generation», which feeds frequency F_1 , ranging from 11.6 to 11.999,8 MHz in 200-Hz steps, to the «Increment Mixer» module.

The «Second Generation» generates the 10^4 (2,4 and 8 bits) and 10^5 increments ; this board's output frequency, F_2 , ranging from 4.84 to 6.8 MHz in 40-kHz steps, is also fed to the «Increment Mixer» module.

The «Increment Mixer» module effects the summation of the increments from the «First Generation» and «Second Generation» boards via a phase-lock loop ; its output frequency, F_3 , includes all increments from 10^1 to 10^5 and ranges from 6 to 7.9998 MHz in 20-Hz steps. It is fed to the input of the phase/frequency comparator in the phase-lock loop of the output oscillator (CPF module).

2) Generation of 1- and 10-MHz increments and output signal

The second part generates 1-MHz increments and at the same time improves the noise level of the output signal via the insertion of the «1-MHz Spectrum» module.

In addition, the output oscillator is «coarse-tuned» to the frequency of a first oscillator that provides a signal containing the 1- and 10-MHz increments. This coarse tuning is effected by a digital phase-lock loop. The modules making up this part of the instrument are :

— The «1-MHz Spectrum», which includes a quartz-crystal oscillator locked to 50 MHz by a fixed phase-lock loop. This signal is multiplied by 2 and the frequency of the 87/116-MHz oscillator subtracted from it. The difference gives a new frequency that controls the two oscillators of the «Output Frequency» module via a digital phase-lock loop while at the same time improving the noise level of the output circuit.

— The «1 MHz Divider/Locking» module, which generates the 10^6 and 10^7 (1 bit) increments. This module provides partial locking of the 87/116-MHz oscillator by which the 1-MHz increments and 10-MHz increments are inserted. Final locking, by the phase comparator circuit in the «1-MHz Spectrum» module, is controlled by a digital circuit from the «Divider» module. The «Divider» also includes the

circuit used to lock the built-in oscillator to an external standard.

— The «Output Frequency» and «CPF» modules, which provide the output frequency ranging from 90 to 120 MHz in 10-Hz steps. The output oscillator is first coarse-tuned, then locked, to permit the insertion in the output frequency of all increments from 10^1 to 10^7 Hz (1 bit).

It should be noted that all of the phase/frequency comparators have alarm circuits controlling an LED on the front panel of the instrument to confirm that the output frequency is correct. When it is unlit, the output frequency is that set on the switches or programmed and may be used.

III.2 - GENERATION OF THE VARIABLE FREQUENCY

BASIC CIRCUIT (Phase lock loop)

The basic circuit of each decimal insertion unit is a phase lock oscillator (see figure III.1).

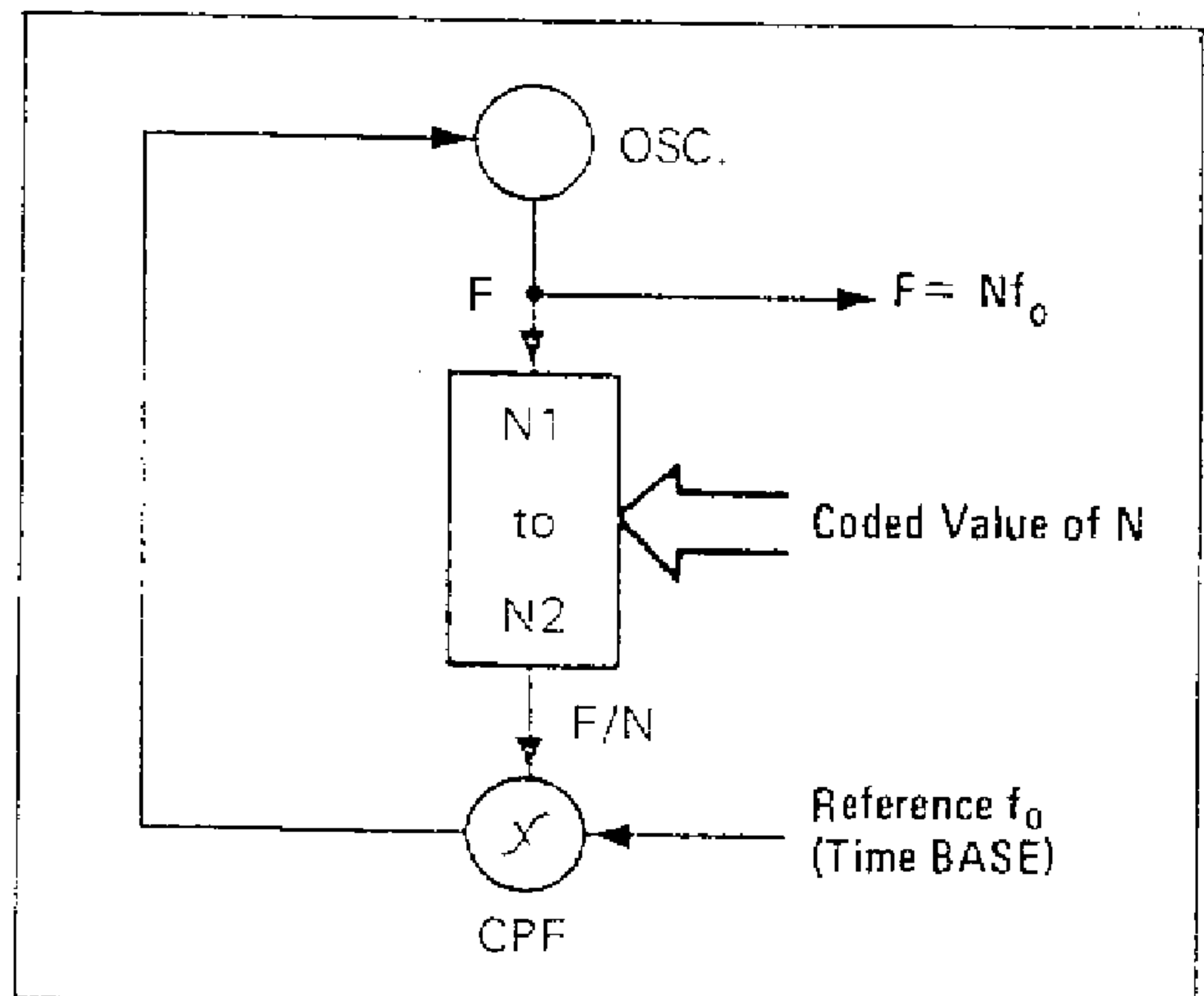


FIGURE III.1 : Frequency synthesis

An oscillator, OSC, provides a variable frequency, F , which is divided by a counter of which the divisor (programmable from N_1 to N_2) varies according to input value N corresponding to the digit to be synthesized (desired offset step in the case of the 5104).

The states of this counter are fed to a coincidence circuit that also receives the digit to be generated in BCD form ; when the count reaches the programmed value, N , the coincidence circuit resets the counter ; the resulting output frequency is F/N .

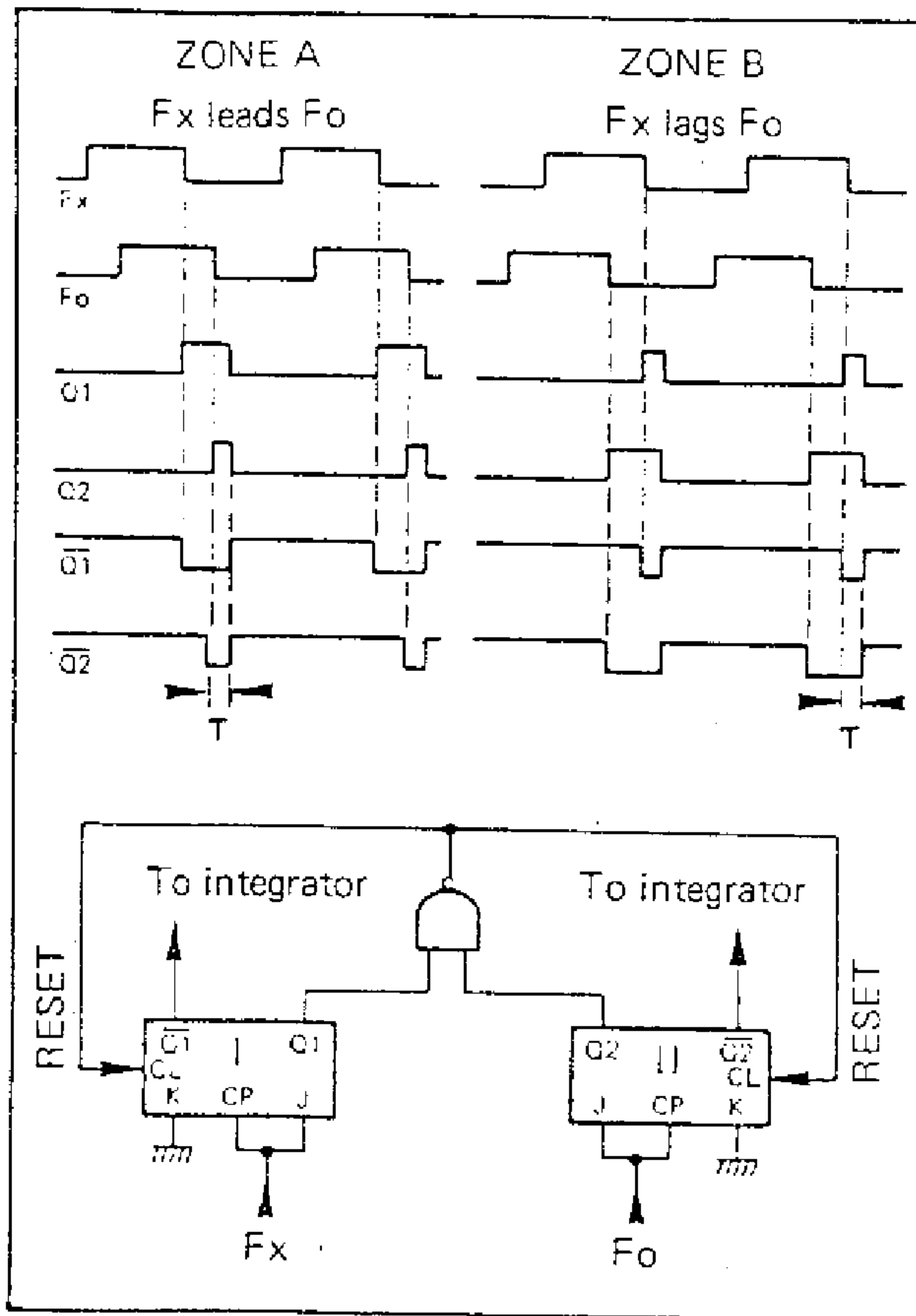
Frequency F/N so generated is compared to a reference frequency, f_0 , derived from that of the master oscillator.

The comparator output is a control voltage, U , that modifies the frequency of the oscillator to satisfy the equation $F = N f_0$; F thus has the accuracy and stability of reference frequency f_0 .

III.3 - PRINCIPLE OF THE PHASE/ FREQUENCY COMPARATOR (CPF)

Comparison is in two stages : first, a gate pulse proportional to the phase difference is generated ; then an analog voltage proportional to the original phase difference is derived from it. This comparator acts first as a frequency comparator, then as a phase comparator, whence the name «phase/frequency comparator».

The principle of operation and chronogram of the comparator are shown in figure III.2.



Let F_x be the output frequency of programmable divider DP1 and F_o the reference frequency.

In zone A of the chronogram, frequencies F_x and F_o are identical but out of phase. Since frequency F_x leads frequency F_o , flip-flop I changes states before flip-flop II.

It follows that the duration of output signal Q_1 is greater than that of output signal Q_2 , since both bistables are reset by the NAND gate when outputs Q_1 and Q_2 have both reached state «1»; the duration of Q_2 is thus equal to the delay introduced by the NAND gate.

In zone B of the chronogram, frequency F_x lags F_o ; the duration of output signal Q_1 is thus less than that of output signal Q_2 .

In both of the cases mentioned above, the durations of Q_1 and Q_2 tend toward equality at value as locking is effected.

In short :

F_x leads F_o	$Q_1 > Q_2 = \tau$
F_o leads F_x	$Q_2 > Q_1 = \tau$
F_x in phase with F_o	$Q_1 = Q_2 = \tau$

If frequencies F_o and F_x are different, the phase difference is no longer constant and the durations of signals Q_1 and Q_2 also vary. However, it is always the flip-flop that receives the higher frequency that provides the longer pulses ; the system then acts as a frequency comparator.

FIGURE III.2 : Principle and chronogram of the CPF.

CHAPTER IV MAINTENANCE

GENERAL

Troubleshooting the instrument is effected in two stages :

- a) locate the malfunctioning subsystem.
- b) repair or replace it.

The operating principles of the various modules are described in the preceding chapter. The following pages provide all necessary additional information for troubleshooting the various modules.

- block schematic ;
- fault diagnosis flowchart («fault tree») ;
- wiring diagram ;
- component layout diagram.

When a fault has been repaired, the instrument specifications are checked out as described in the next chapter.

Full parts lists are reproduced at the end of the manual.

TROUBLESHOOTING PROCEDURE

When troubleshooting the instrument, always proceed as follows :

- 1 - Check the power supply circuit.
- 2 - Determine the type of malfunction :
 - output steps less than 1 MHz unobtainable ;
 - 10 MHz and 100 MHz output steps unobtainable ;

- no output signal ;
- lock-on impossible ;
- programming ineffective.

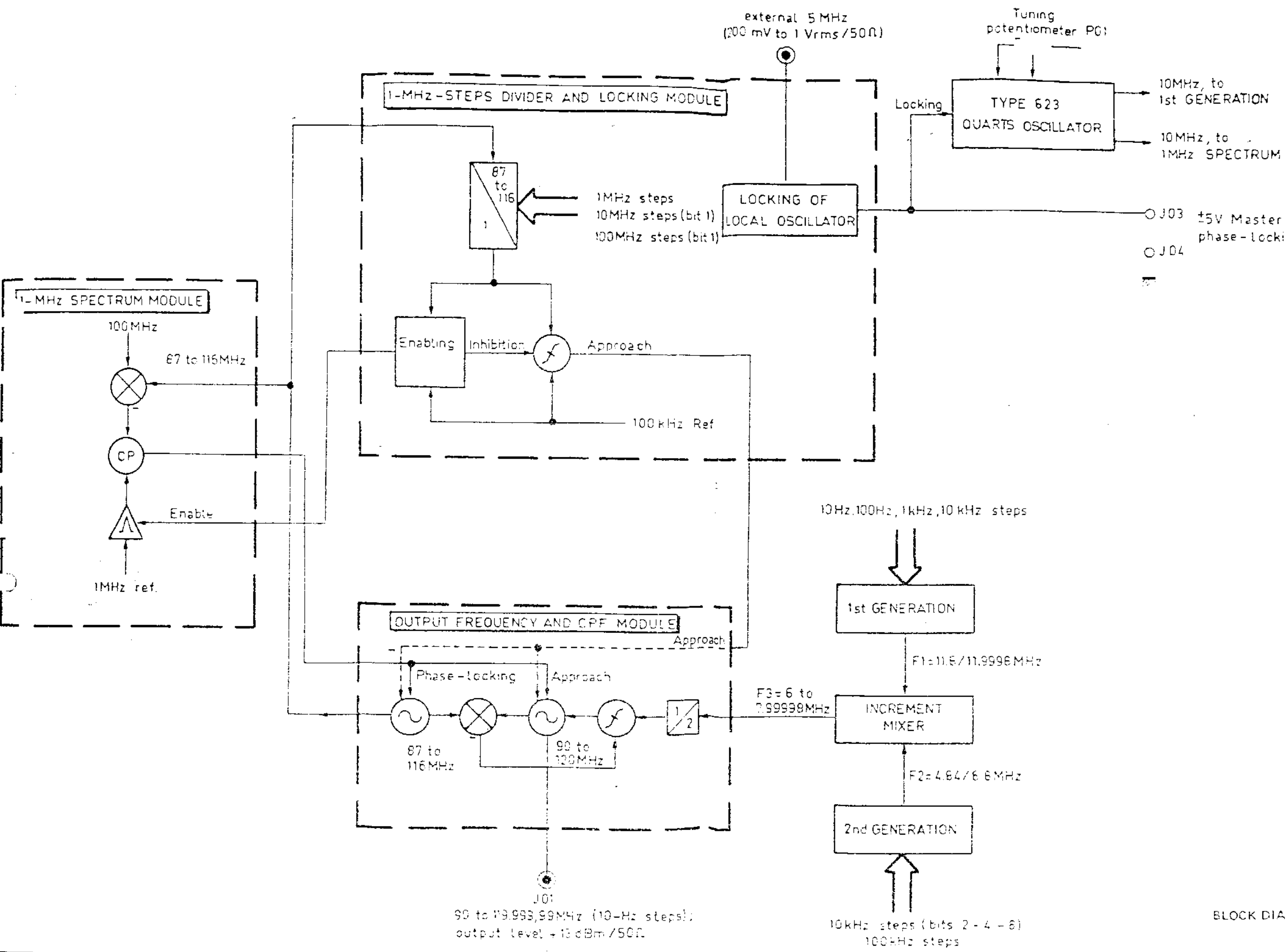
3 - Refer to fault tree to identify subsystem responsible for malfunction. Refer to block schematic and full description of 5104 cards and modules for further information.

4 - Consult that part of this chapter indicated on the fault tree and referring specifically to the suspect subsystem. Troubleshoot the individual card or module according to the appropriate document (operating principles, wiring diagram, component layout diagram).

5 - Check that the malfunction has been eliminated and then proceed to the final check on instrument specifications (see chapter VI).

The remainder of this chapter is divided into nine sections, as follows :

- 1 - POWER SUPPLY
- 2 - SYBSYSTEM LOCATION
- 3 - FIRST GENERATION CARD
- 4 - SECOND GENERATION CARD
- 5 - INCREMENT MIXER MODULE
- 6 - 1 MHz SPECTRUM MODULE
- 7 - 1 MHz DIVIDER/LOCK-ON MODULE
- 8 - PHASE-FREQUENCY COMPARATOR MODULE
- 9 - OUTPUT MODULE



BLOCK DIA

1 - POWER SUPPLY

Documentation

Fault tree

Circuit diagram N° 973016

Wiring and component layout diagrams :

- transformer N° 931392 C
- rectifier/filter card N° 932142
- regulator card N° 931502
- power transistor mounting N° 931504.

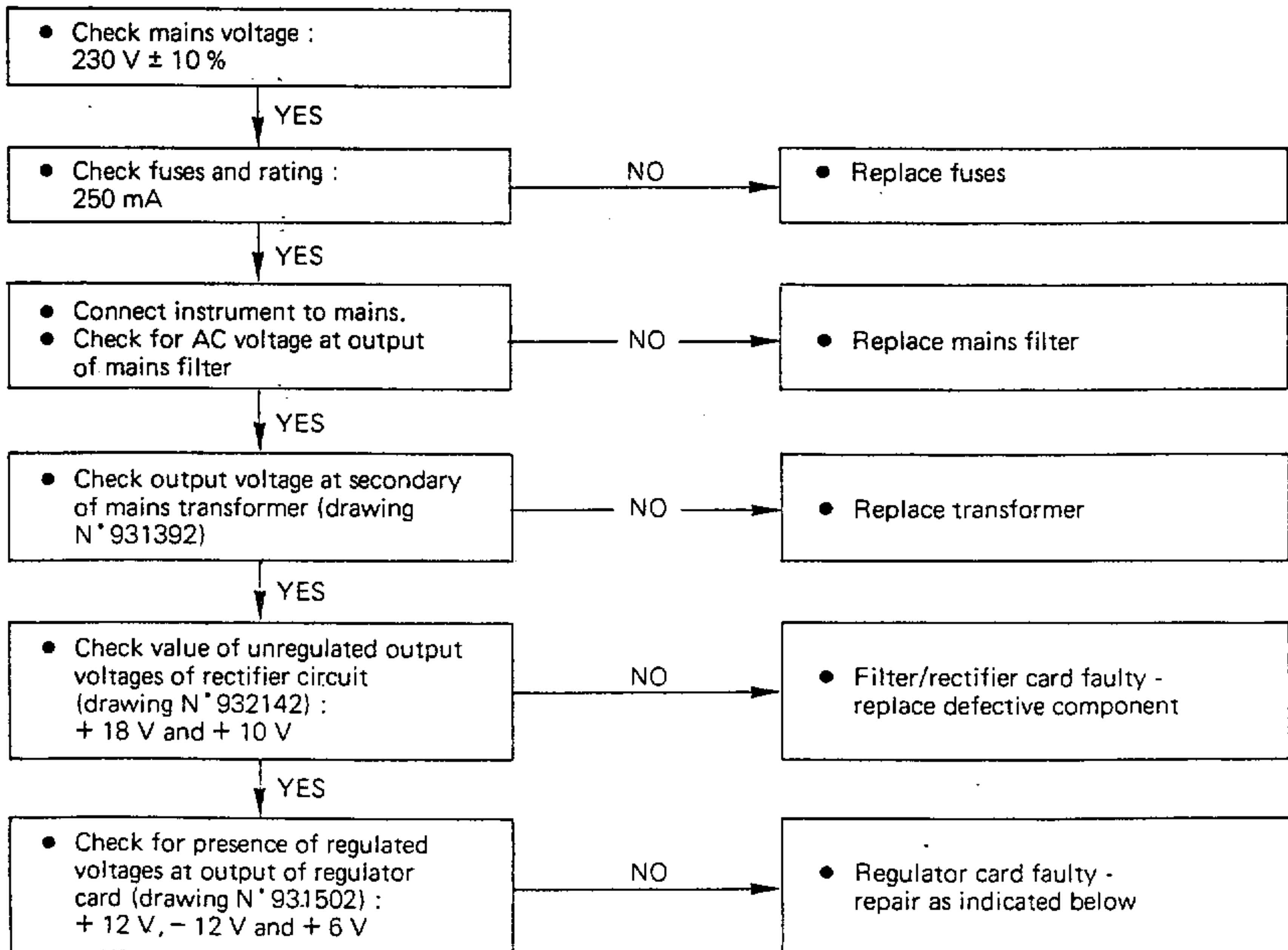
Instruments and equipment required

Multimeter.

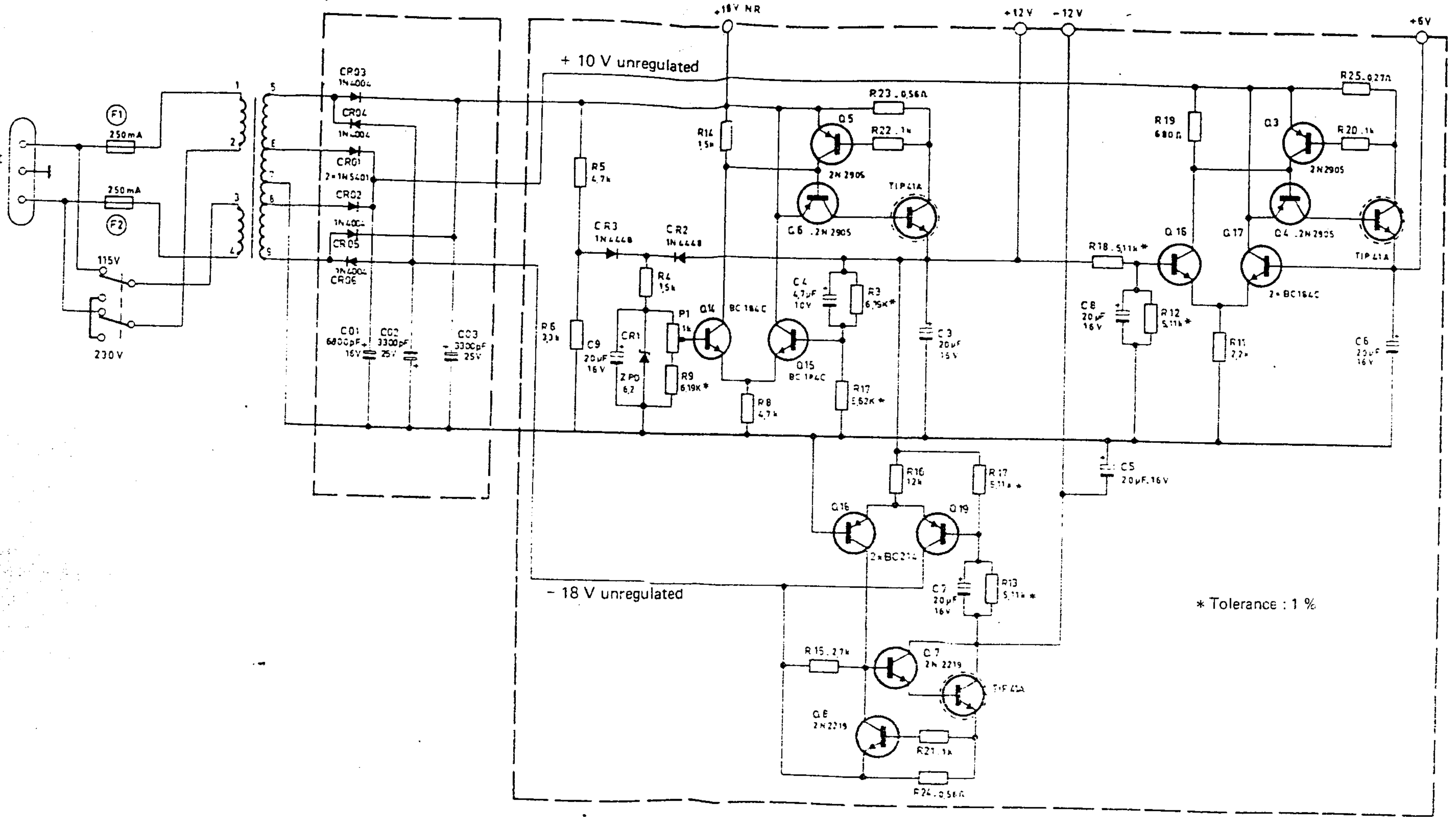
Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

FAULT TREE

Key to Drawing 1 (Planche 1)



Mains input
230 V ± 10 %



* Tolerance : 1 %

<p>STUDIE, DESSIN, VERIFICATION</p>	<p>DATE: JULI 1975</p>
<p>POWER SUPPLY</p>	<p>PAGE: 1/1</p>
<p>973016</p>	

CIRCUIT MAGNETIQUE

Toles FA35 T32 Qualité

Épaisseur 32 Imbriqué
Entrefer
(épaisseur de la cale)

BOBINAGE

Carcasse Isolectra 2696

Finition Presspahn

NOTA Les fils de diamètre ≤ 50 100 doivent
être raccordés en fils souple 7x0,2

ASSEMBLAGE

	Type	Nbre
vis tiges filetées		
barrettes équerres étriers		
divers	Cadre à fixation latérale sans colonnettes (type T) Isolectra	2

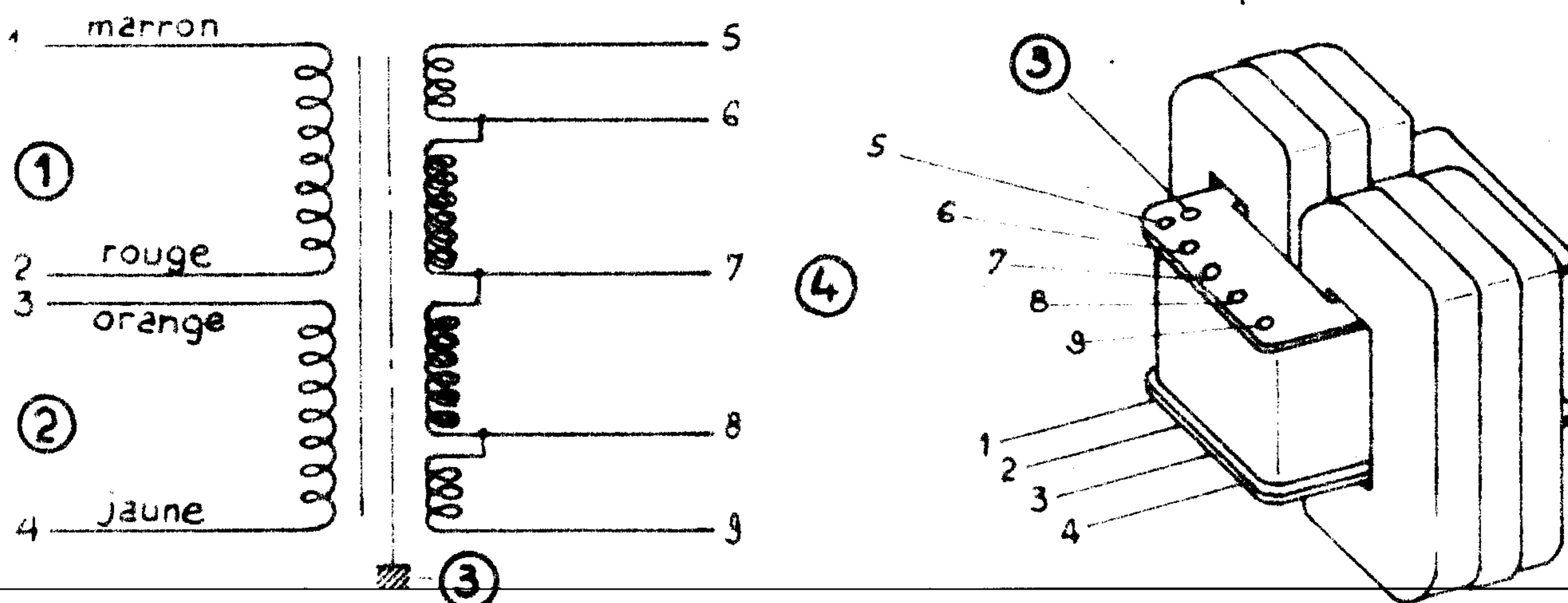
TRAITEMENT

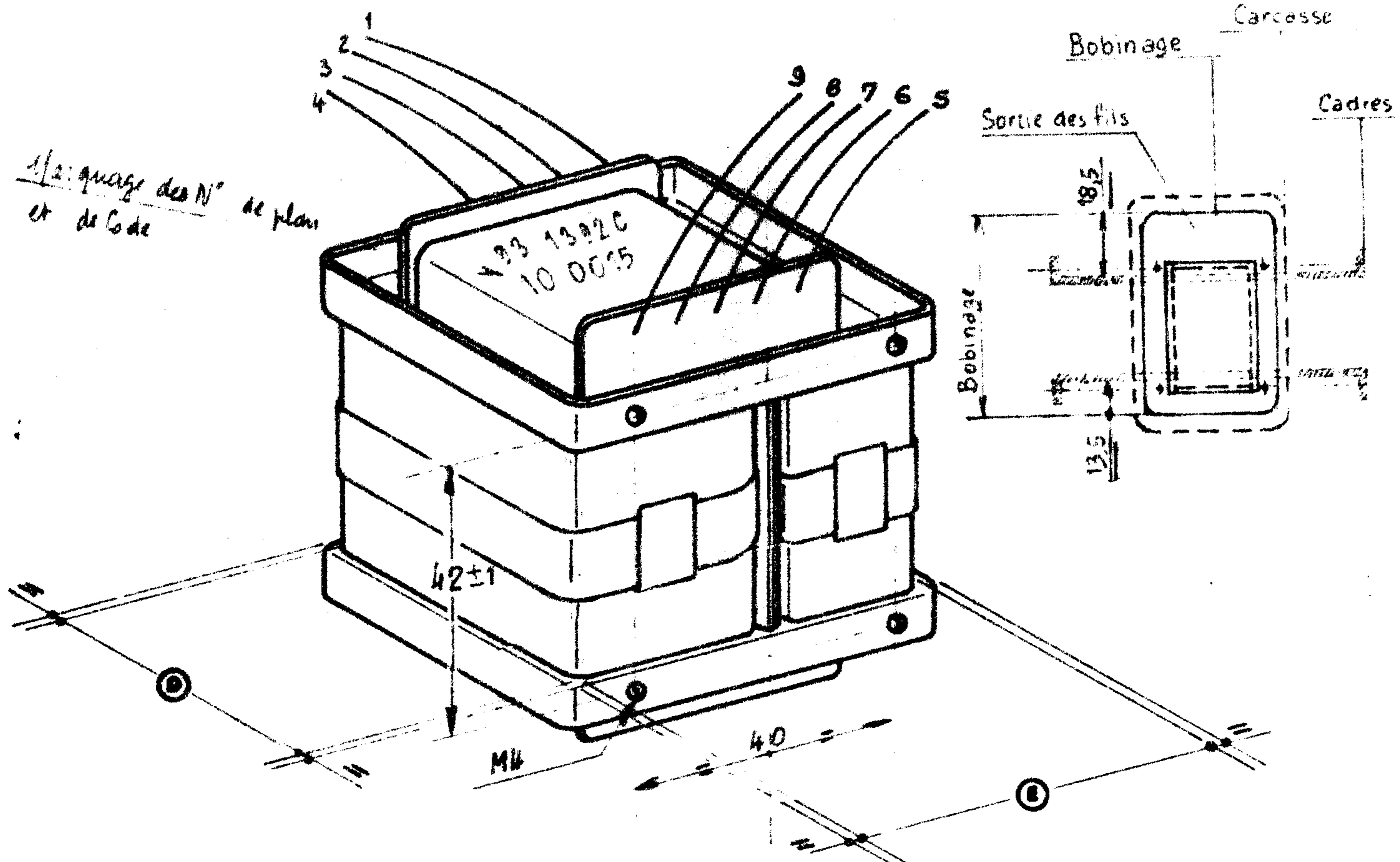
Circuit Vernis vide - pression } avant
Bobine } après
assemblage

ENROUL. n°	Nbre de sp.	DIAMETRE	QUALITE	V. eff.	I. eff.	V.A.	SORTIES
①	650	32/100	Email	115			Fils 20 cm Code couleur
②	650	32/100	Email	115			Fils 20 cm Code couleur
③	ECRAN A LA MASSE						
④	35 + 57 + 57 + 35	65/100 120/100 120/100 65/100	Email " " "	6 10 10 6			Fils de 10 cm au code couleur

ISOLEMENT	①-② 1000 V	③-④ 500 V	⑤-⑥	④-⑦ 500 V
① 1500 V	②-③ 1500 V	④-⑤	⑥-⑦	

SCHEMA - PRESENTATION

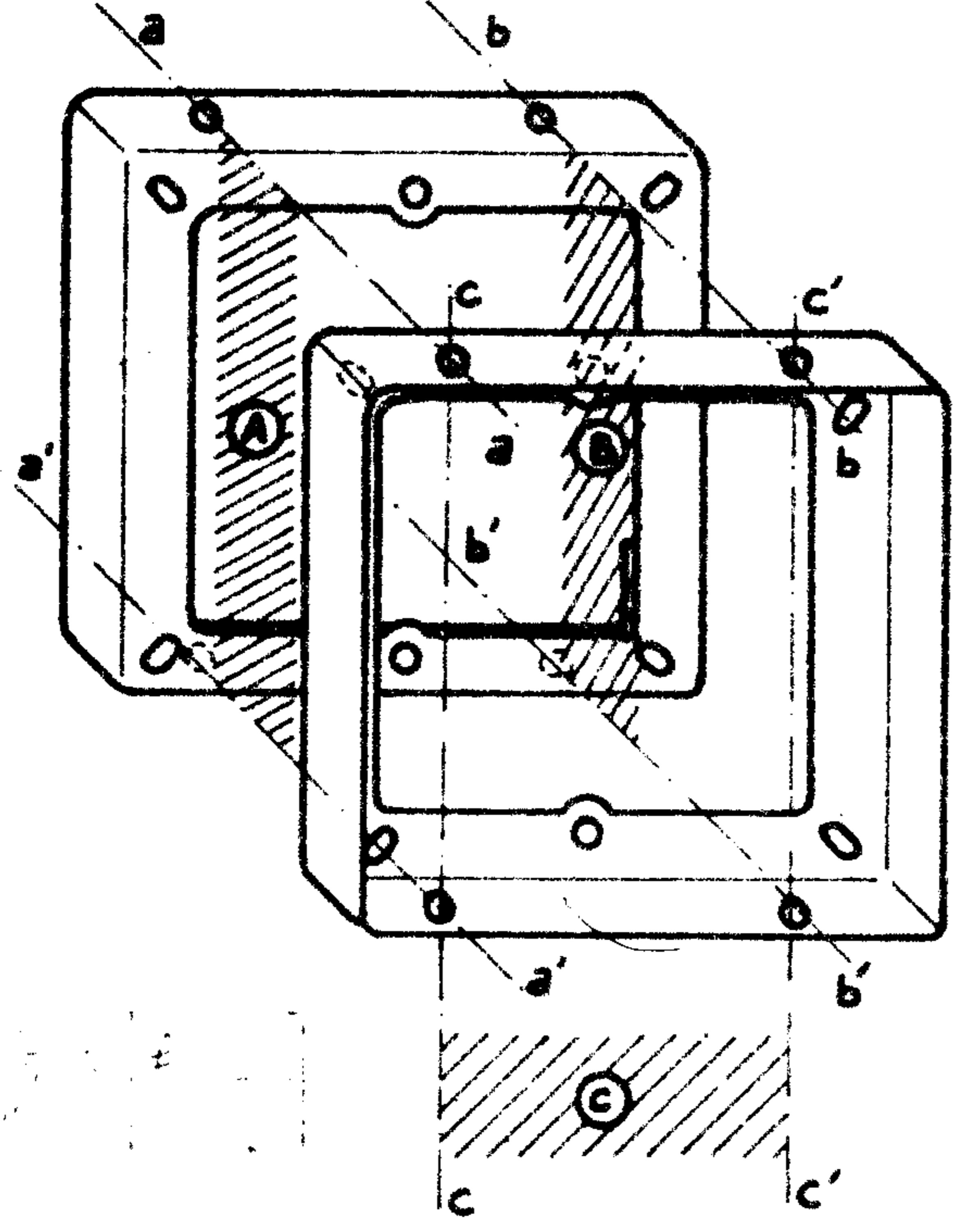




1/2: marquage des N° de plans et de Code

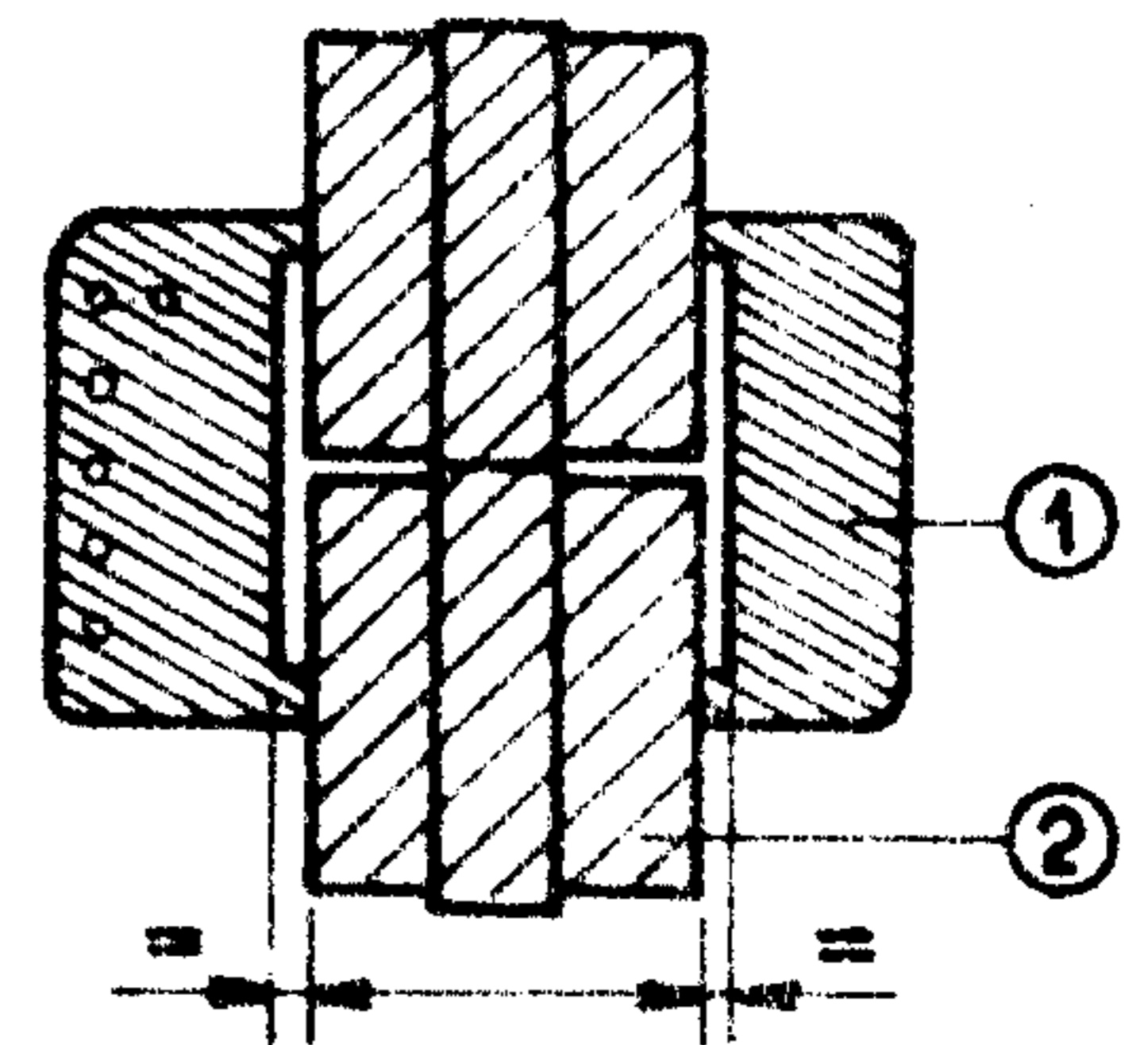
NOTA 1: Au montage, les axes *a-a'* et *b-b'* devront être dans un même plan (A). Les plans (A) et (B) devront être parallèles entre eux et perpendiculaires au plan (C).

Les circuits (D), (E) seront centrés par rapport aux cadres.



Très important: l'épaisseur de la boucle de cerclage ne devra pas excéder 3,5 mm soudure comprise.

La boucle de cerclage sera sur la face du côté sortie des fils numérotés de 5 à 9 (Impératif).



NOTA 2: Les circuits (2) seront centrés dans l'ouverture de la carcasse (1)

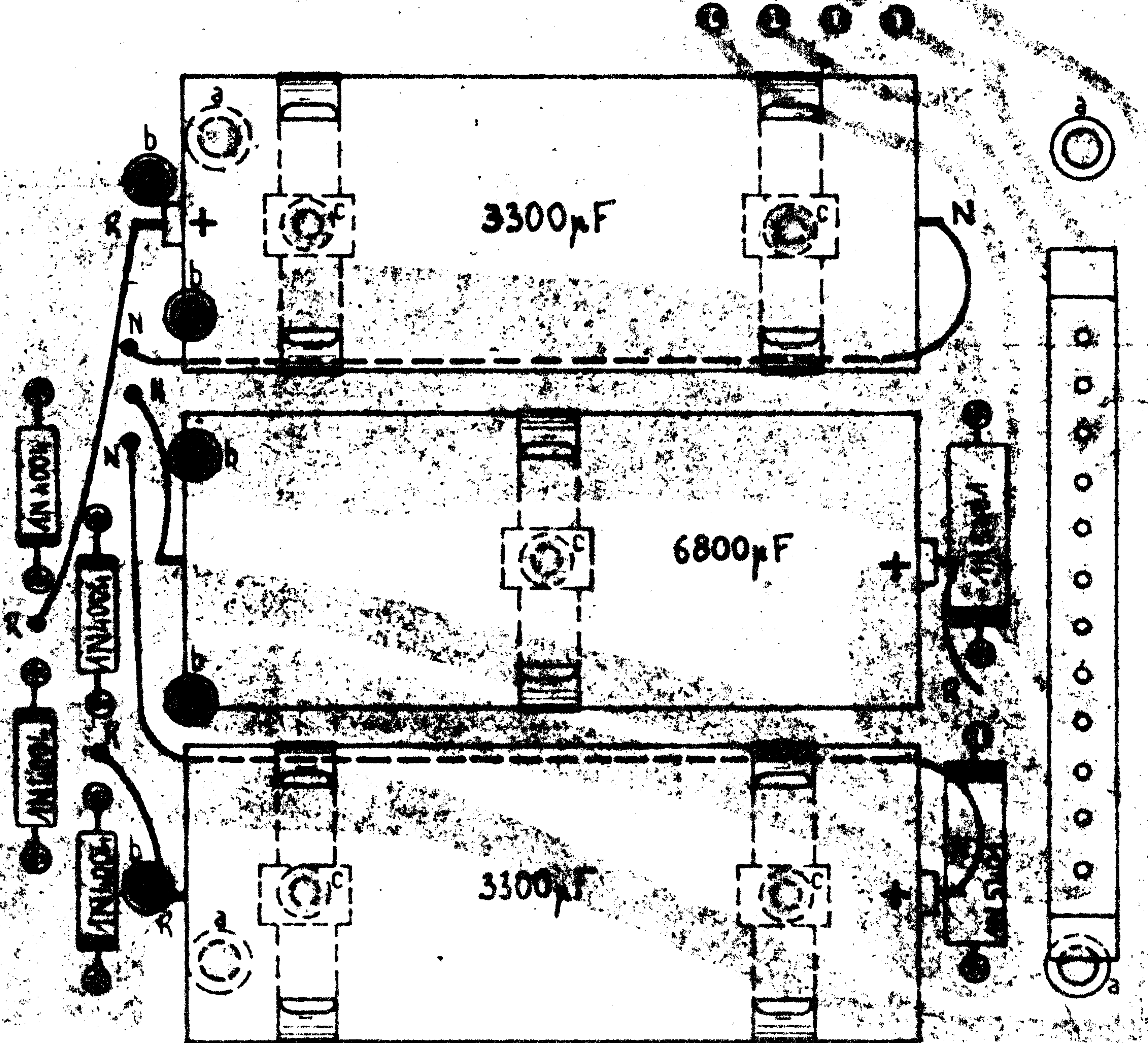
Ex: 4248 P2

Traitement /	Matière /		
Protection /	Tol. gr. /	Echelle /	
Etude /	Dessiné AR	Vendu CH	Date 29.10.74

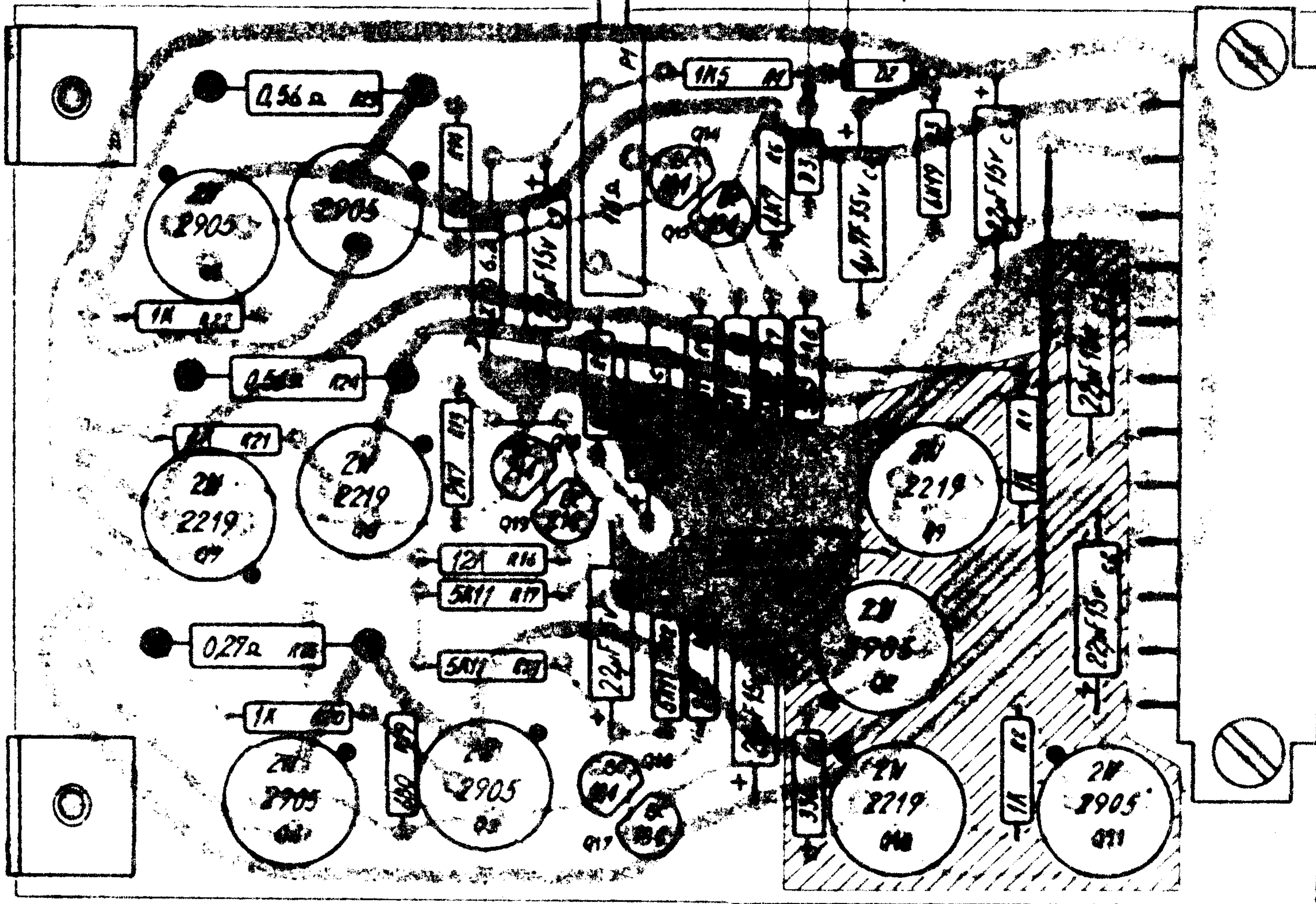
adrot
ae
electronique

A. VIGNON - R. MARTEL
10, TRAPPIERES
30 402 81 50

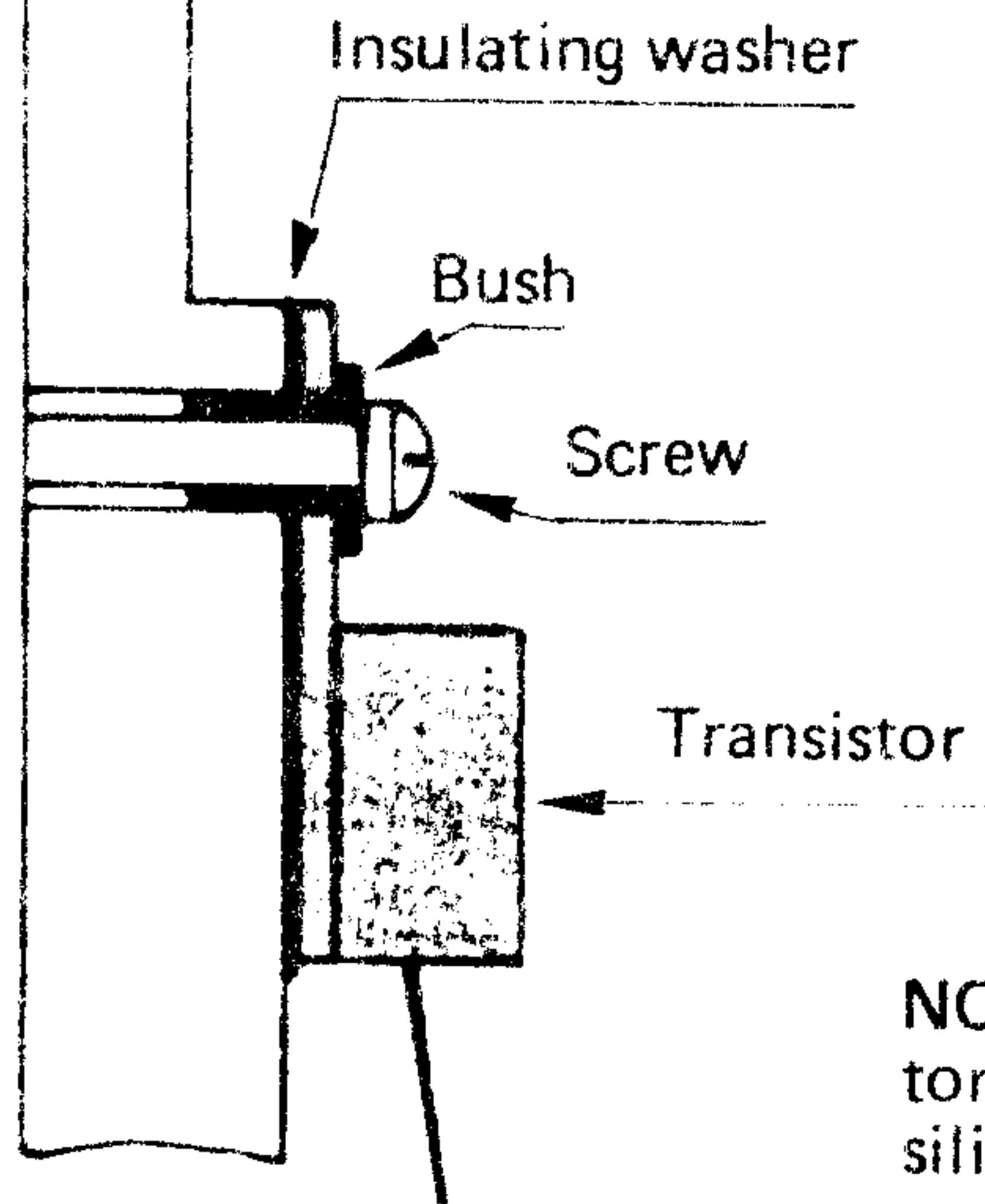
Ensemble Alim. 20



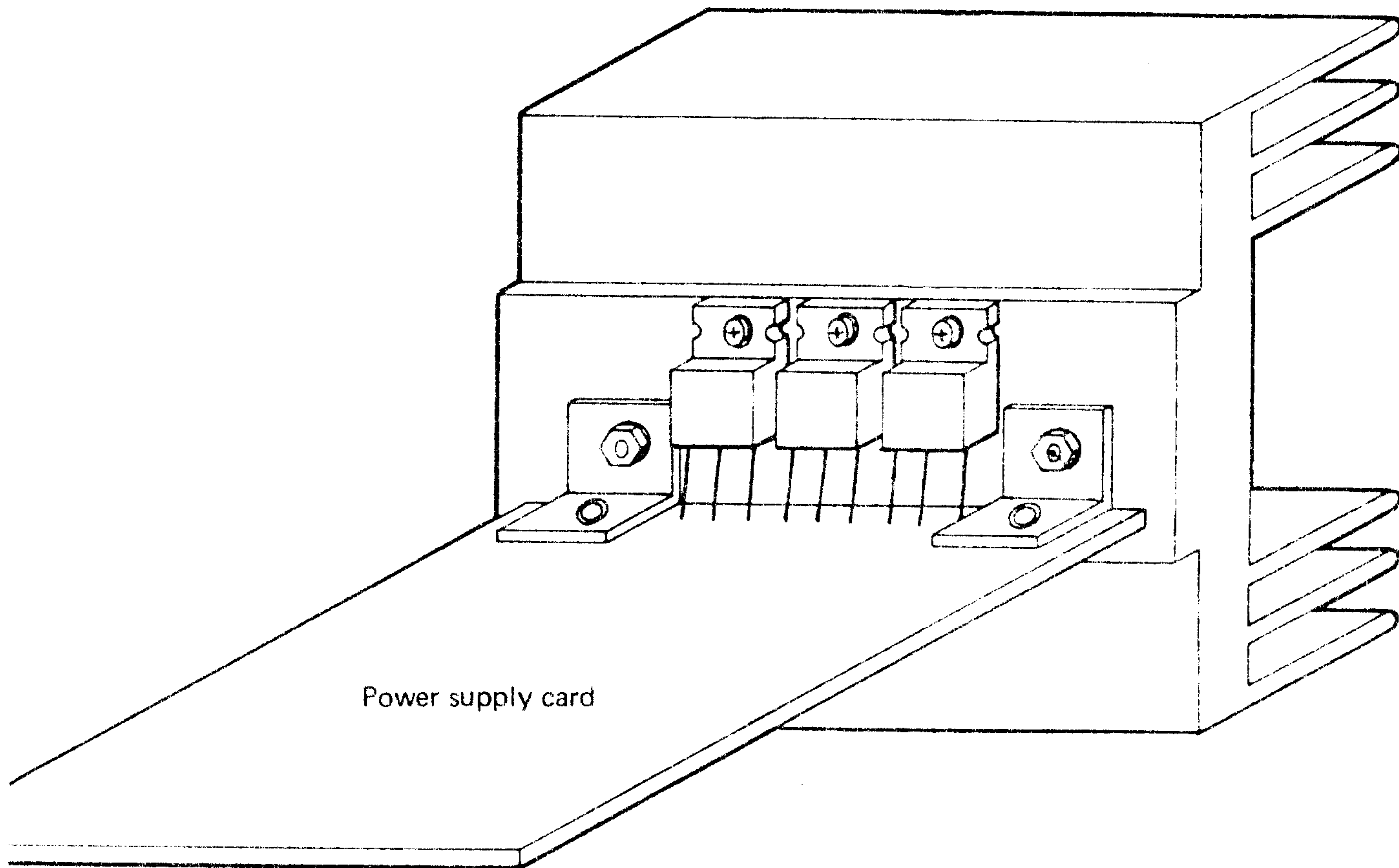
RECTIFIER/FILTER CARD N° 932142



POWER TRANSFORMER MOUNTING DETAILS



NOTE : Before fitting transistors coat insulating washer with silicone grease (690027).



2 - SUBSYSTEM LOCATION

Documentation

Fault tree

Block schematic

Subsystem layout and coaxial links

Instruments and equipment required

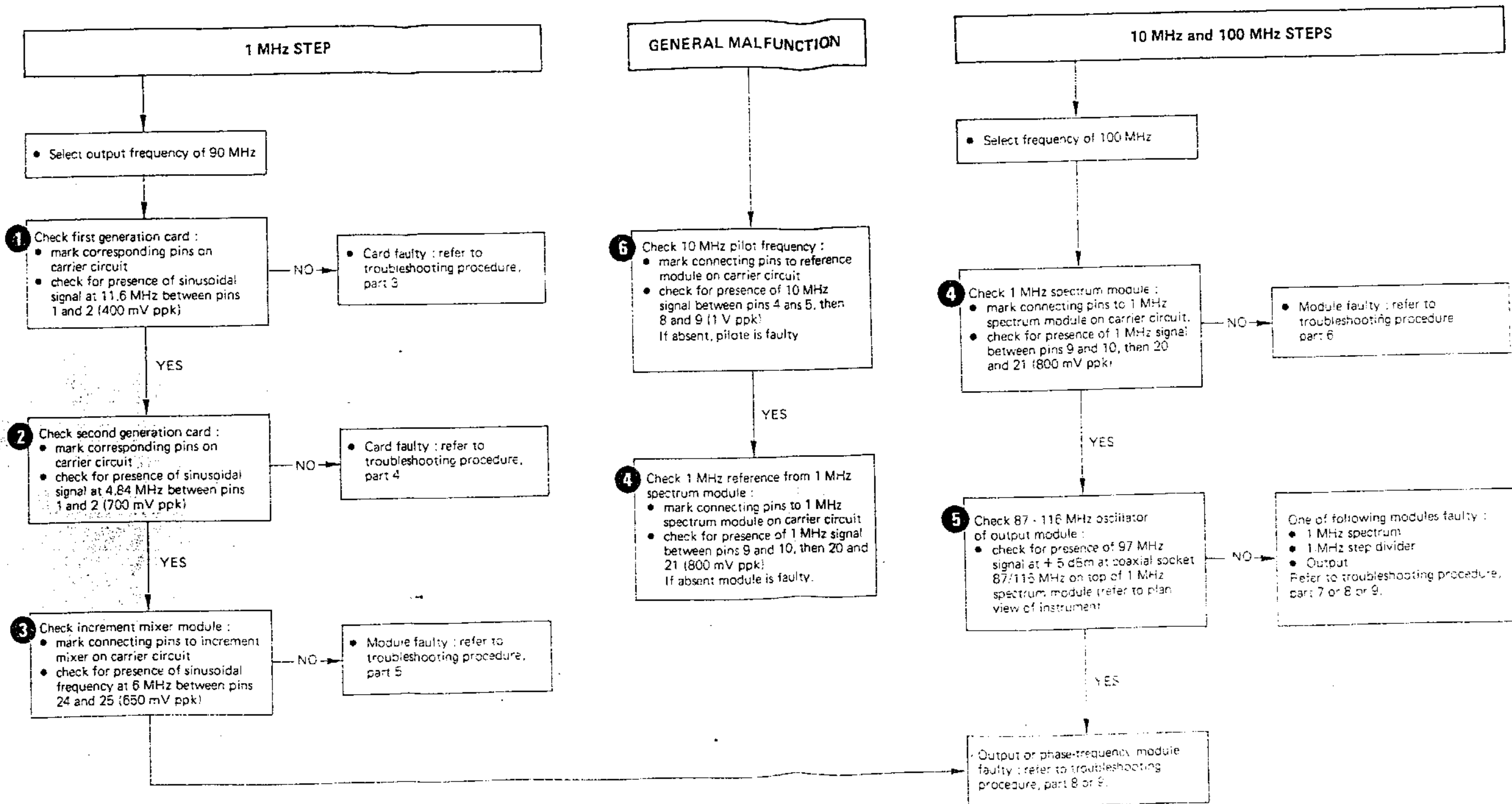
Oscilloscope

Frequency meter

Spectrum analyser

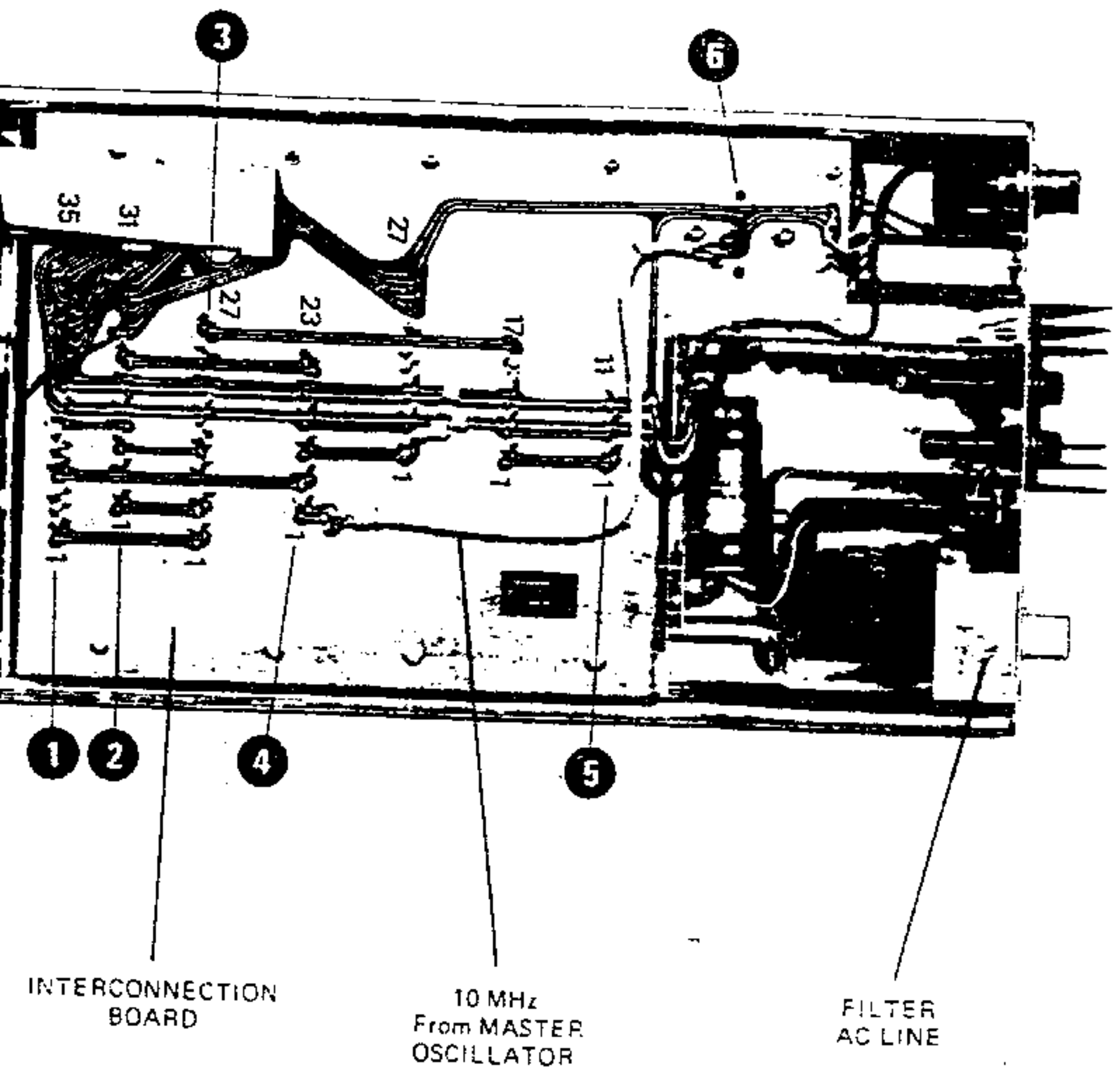
Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

5104 : OUTPUT FREQUENCY MALFUNCTION

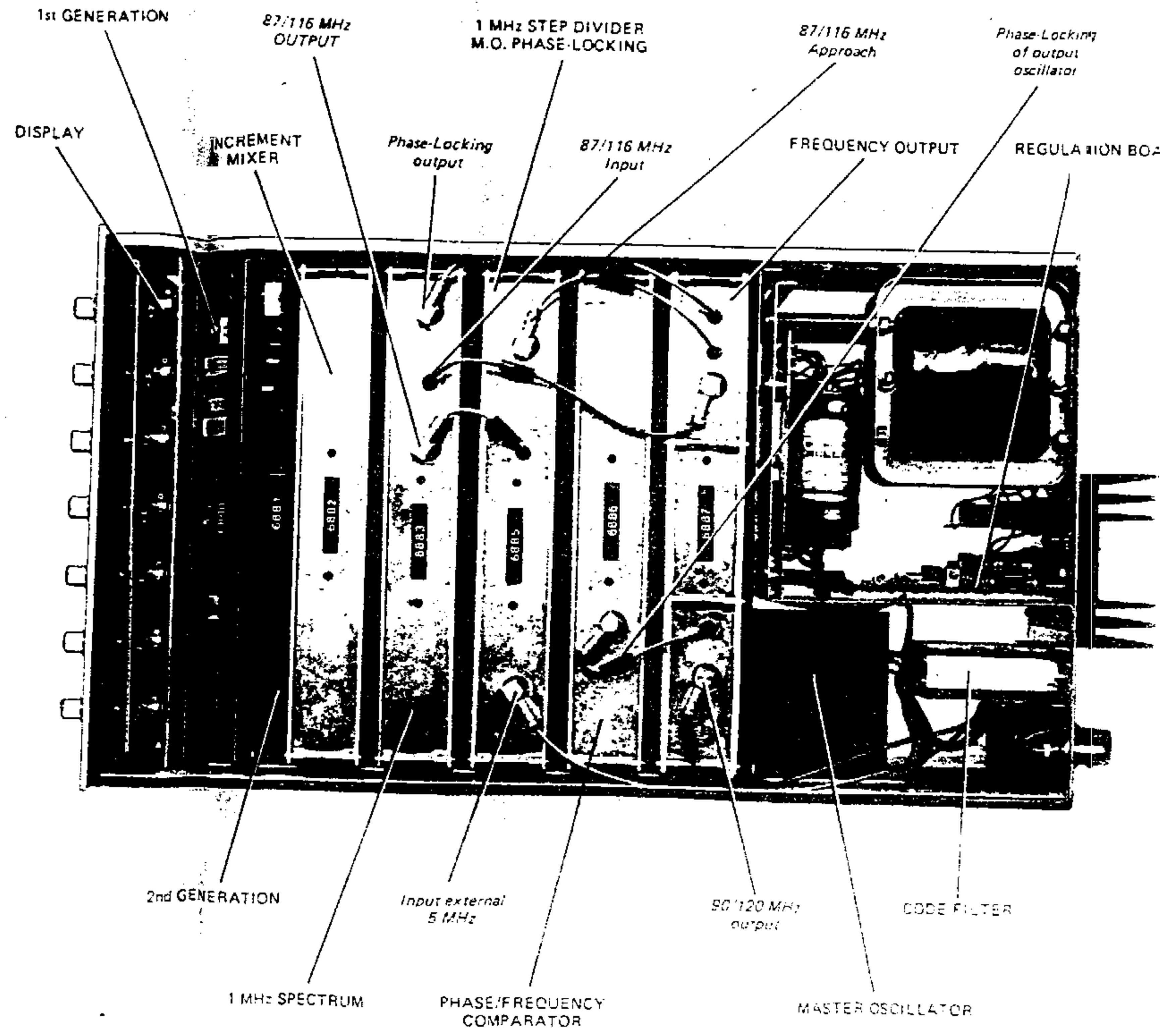


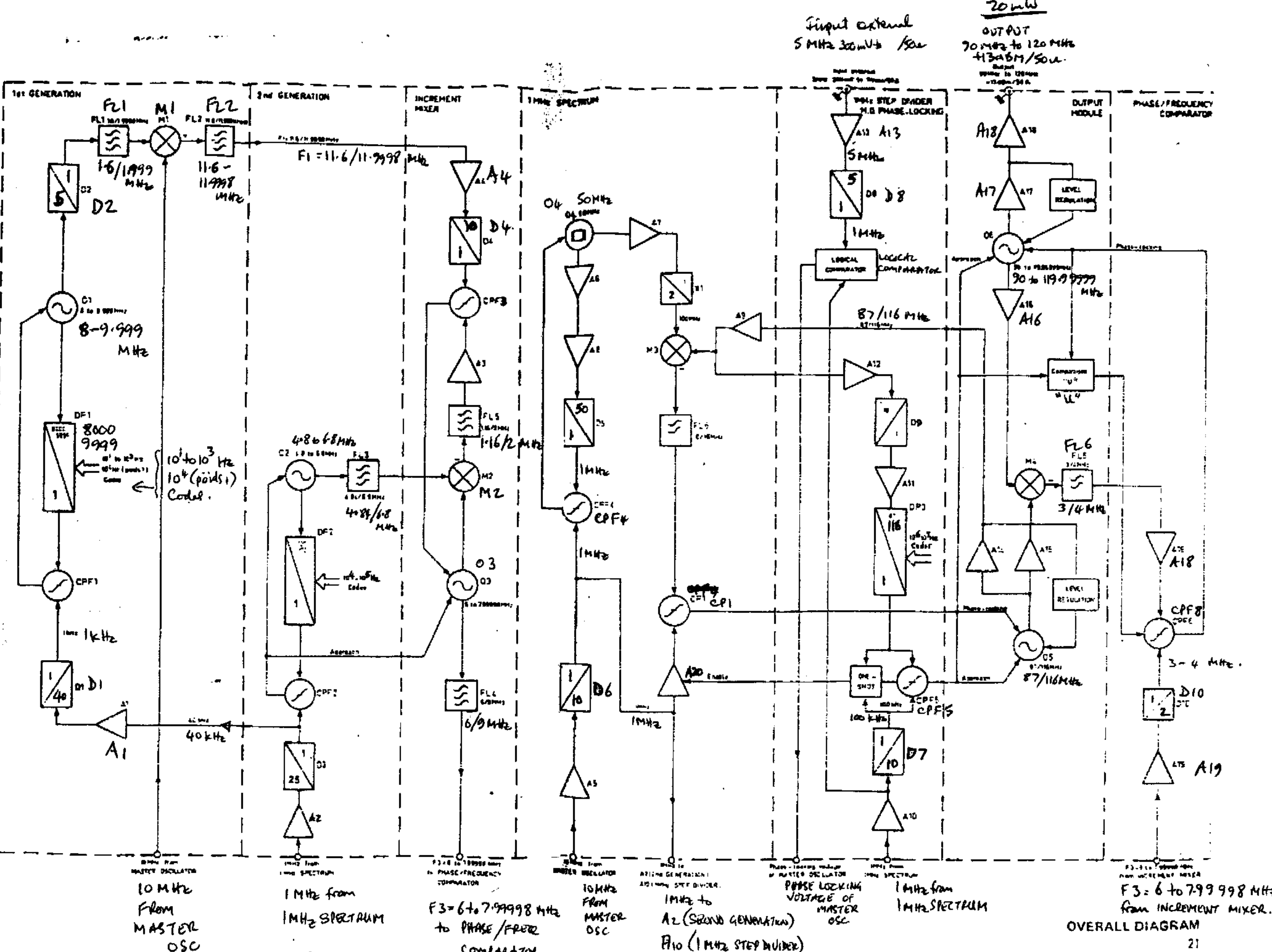
FAULT TREE

BOTTOM VIEW



0 - 6 : see Fault tree





Input external
5 MHz 300 mV / sec

20 mW
OUTPUT
70 MHz to 120 MHz
+13 dBm/50Ω

1st GENERATION

2nd GENERATION

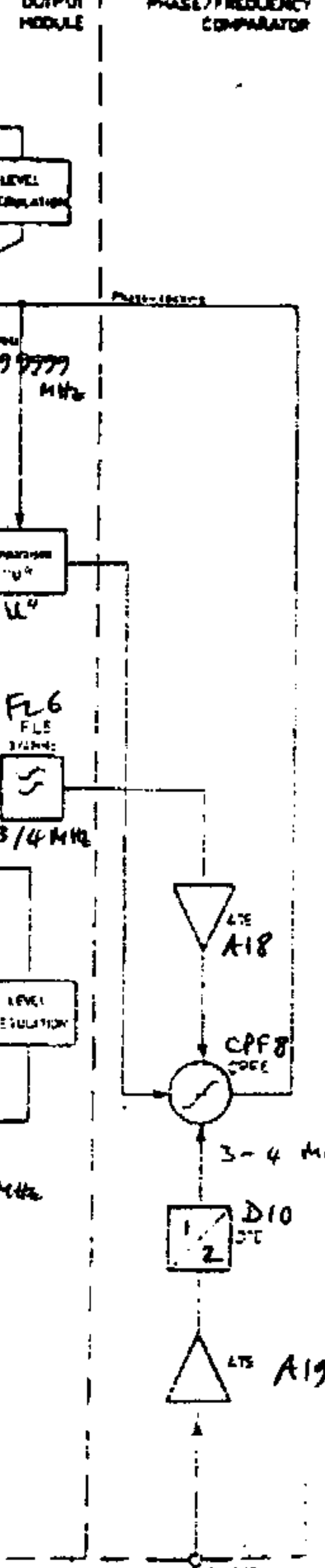
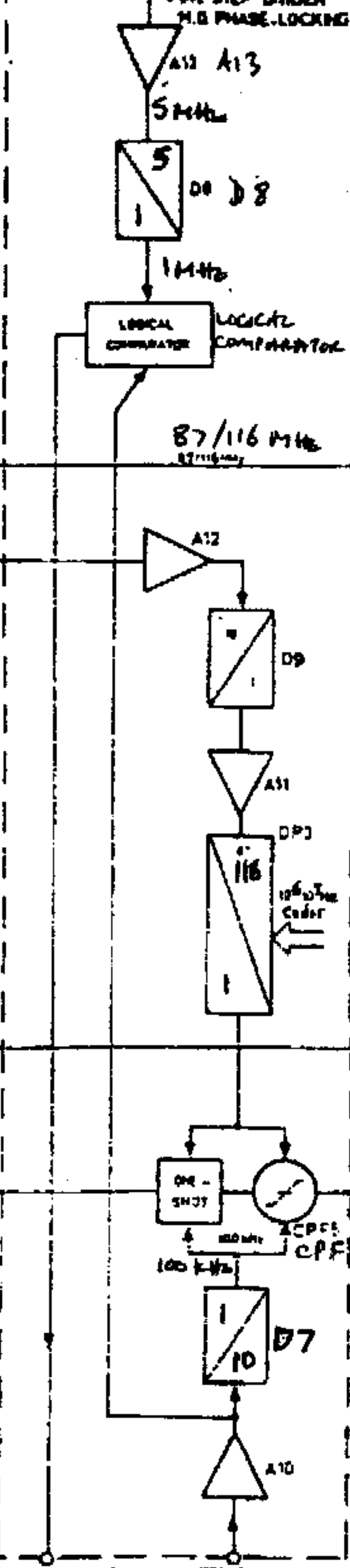
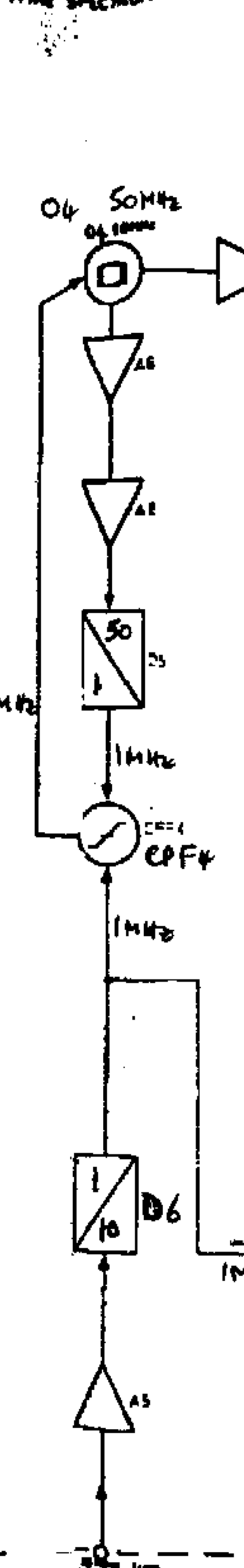
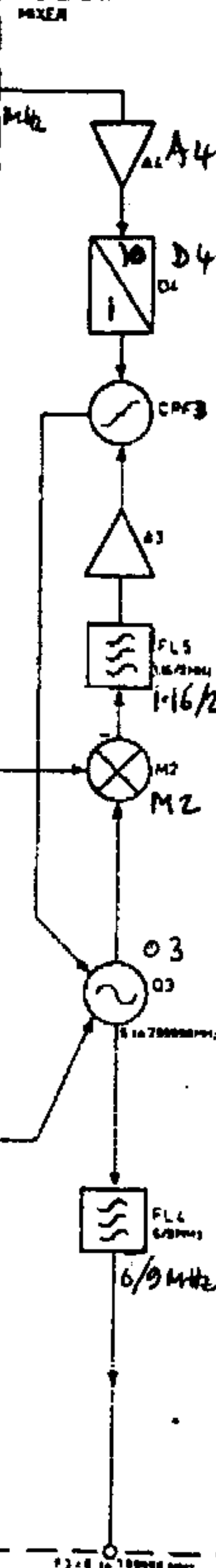
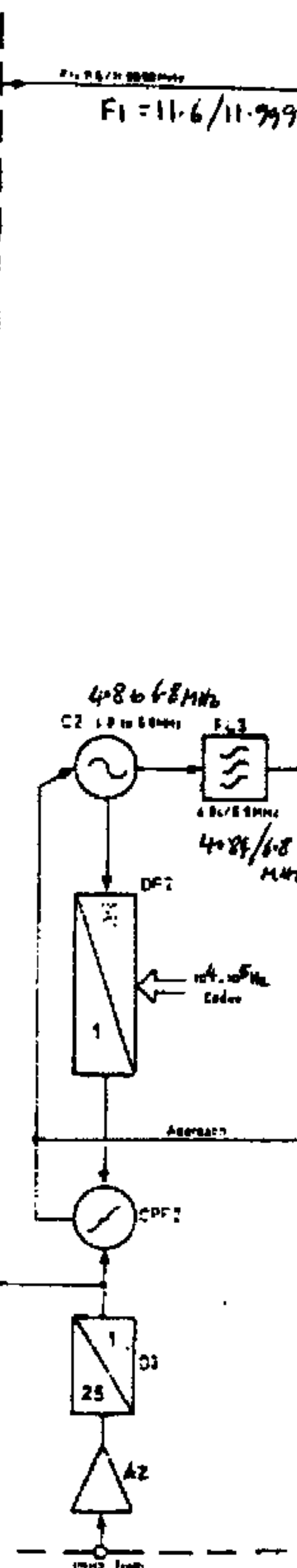
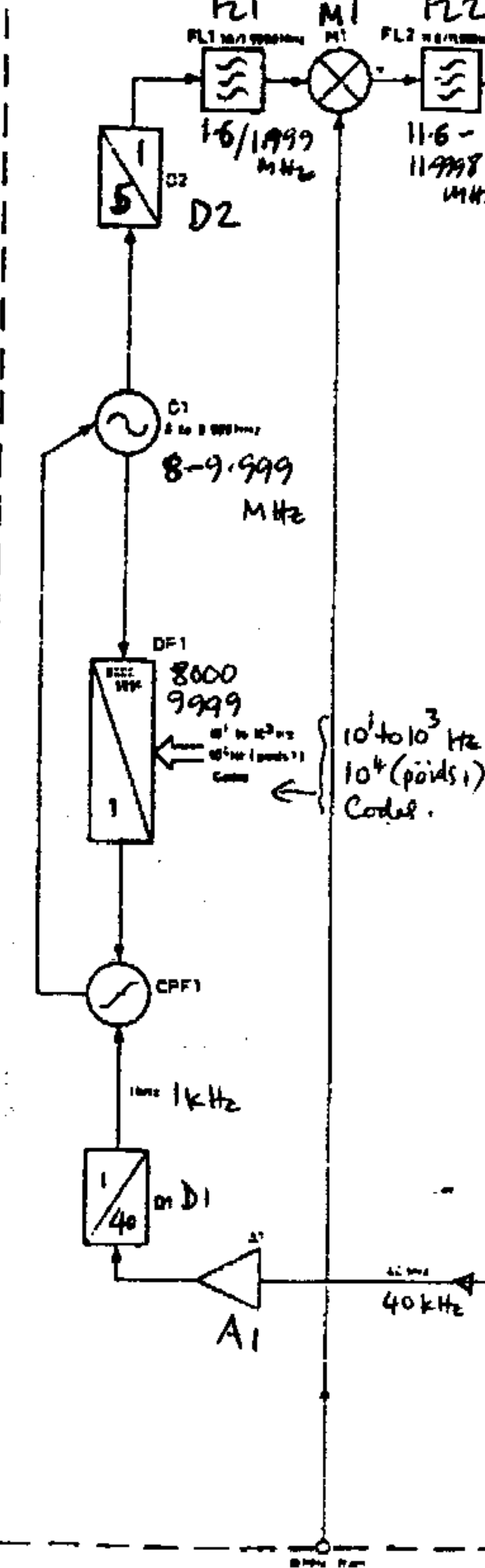
INCREMENT MIXER

1 MHz SPECTRUM

PHASE-LOCKING VOLTAGE OF MASTER OSCILLATOR

OUTPUT MODULE

PHASE/FREQUENCY COMPARATOR



10 MHz from MASTER OSC

1 MHz from 1 MHz SPECTRUM

$F3 = 6$ to 7.99998 MHz to PHASE/FREQ COMP

10 MHz from MASTER OSC

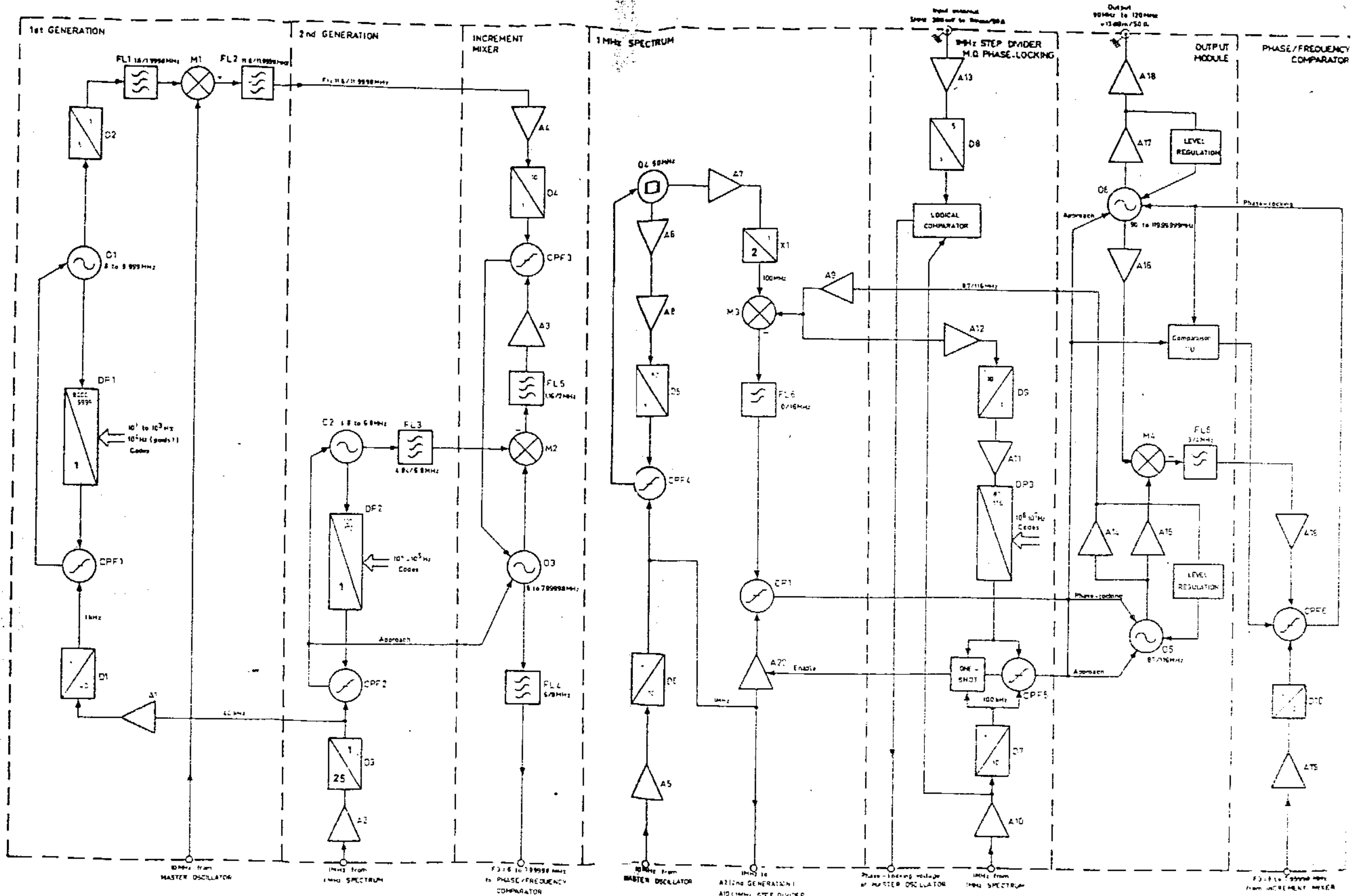
1 MHz to A2 (SECOND GENERATION) F10 (1 MHz STEP DIVIDER)

PHASE-LOCKING VOLTAGE OF MASTER OSC

1 MHz from 1 MHz SPECTRUM

$F3 = 6$ to 7.99998 MHz from INCREMENT MIXER.

OVERALL DIAGRAM



OVERALL DIAGRAM

3 - FIRST GENERATION CARD

Documentation

General description and operating principles.

Fault tree.

Circuit diagram N° 976880.

Wiring and component layout diagram N° 932129 2/2.

Instruments and equipment required

25 MHz oscilloscope.

Card extender.

Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

PRINCIPLE OF FIRST GENERATION

The First Generation generates the increments corresponding to the 10^1 Hz, 10^2 Hz, 10^3 Hz and 10^4 Hz (1 bit) steps. It is controlled either by four of the seven decimal switches or by an external program.

Figure IV.1 shows the principle of the FIRST GENERATION board and Plate N° 976880 is its circuit diagram.

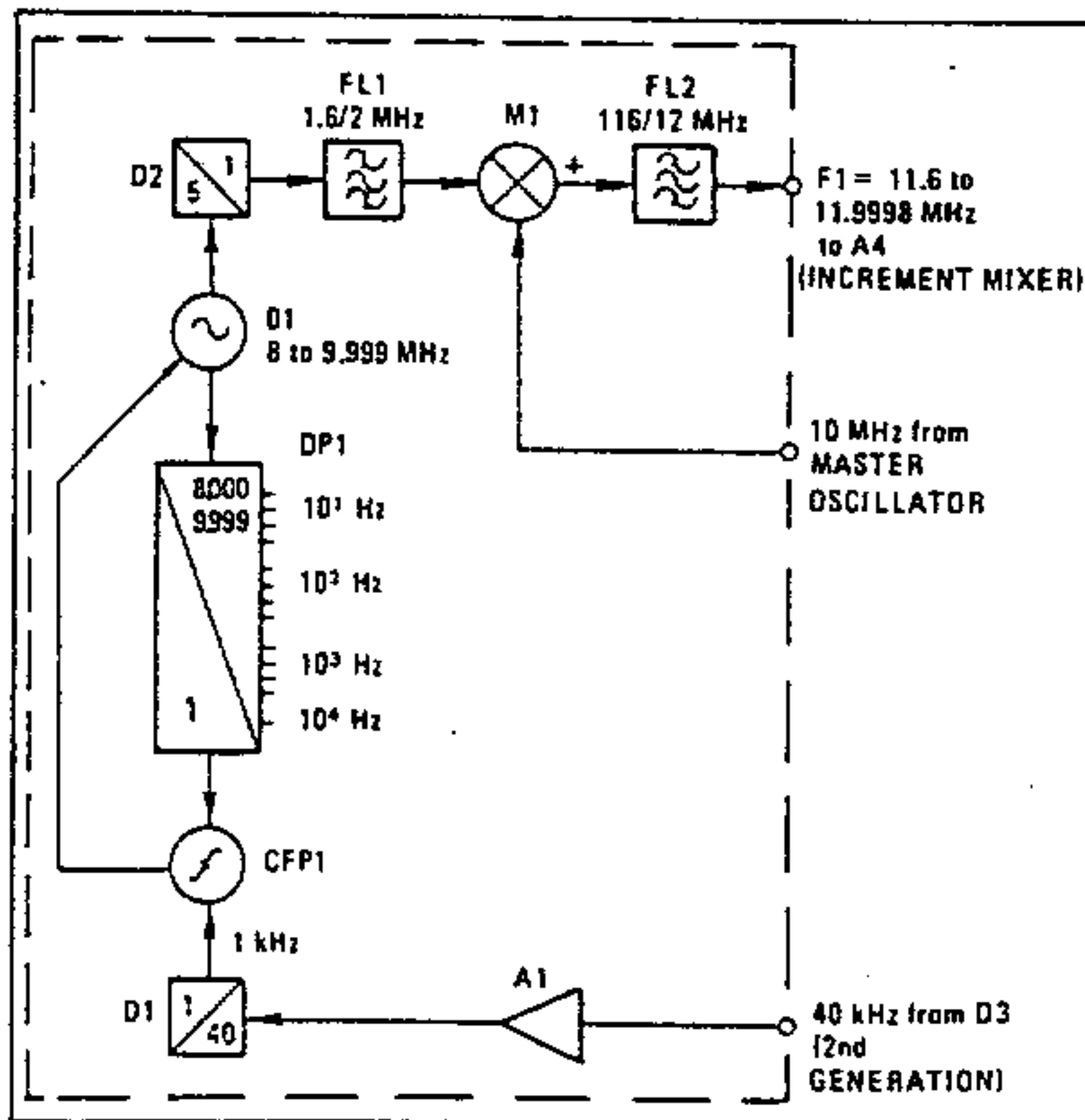


FIGURE IV.1 : Principle of the first generation

The first generation includes a phase lock loop with an oscillator, O1, providing a frequency ranging from 8 to 9.999 MHz in 1-kHz steps. This frequency is fed to the input of programmable divider DP1, the divisor of which ranges from 8000 to 9999 as a function of the switch settings or external program.

The output frequency of divider DP1 is fed to the input of phase/frequency comparator CPF1, which also receives a 1-kHz reference frequency derived from the frequency of the 1-MHz spectrum by division by 1000. The DC output of CPF1 controls

oscillator O1 so as to satisfy the following equation :

$$F = NF_0$$

in which F is the frequency of O1, N the divisor of DP1, and F_0 the reference frequency.

NOTE : The phase/frequency comparator has an «alarm» circuit that is validated whenever the oscillator is not locked. The alarm signal acts on a logic circuit in the SECOND GENERATION board that actuates on LED on the instrument's front panel.

Oscillator O1 also feeds the frequency ranging from 8 to 9.999 MHz to the input of divider D2. D2 is a fixed counter dividing by 5, and its output frequency ranges from 1.6 to 1.999,8 MHz. This is filtered and fed to mixer M1, which receives a fixed 10-MHz frequency directly from the MASTER OSCILLATOR on its switching input.

The additive beat of these two frequencies produces, at the output of M1, frequency F1, which ranges from 11.6 to 11.999,8 MHz in 200-Hz steps. This signal is fed to the INCREMENT MIXER.

PRINCIPLE OF THE PROGRAMMABLE DIVIDER

Figure IV.2 shows the principle and chronogram of the 8000/9999 divider.

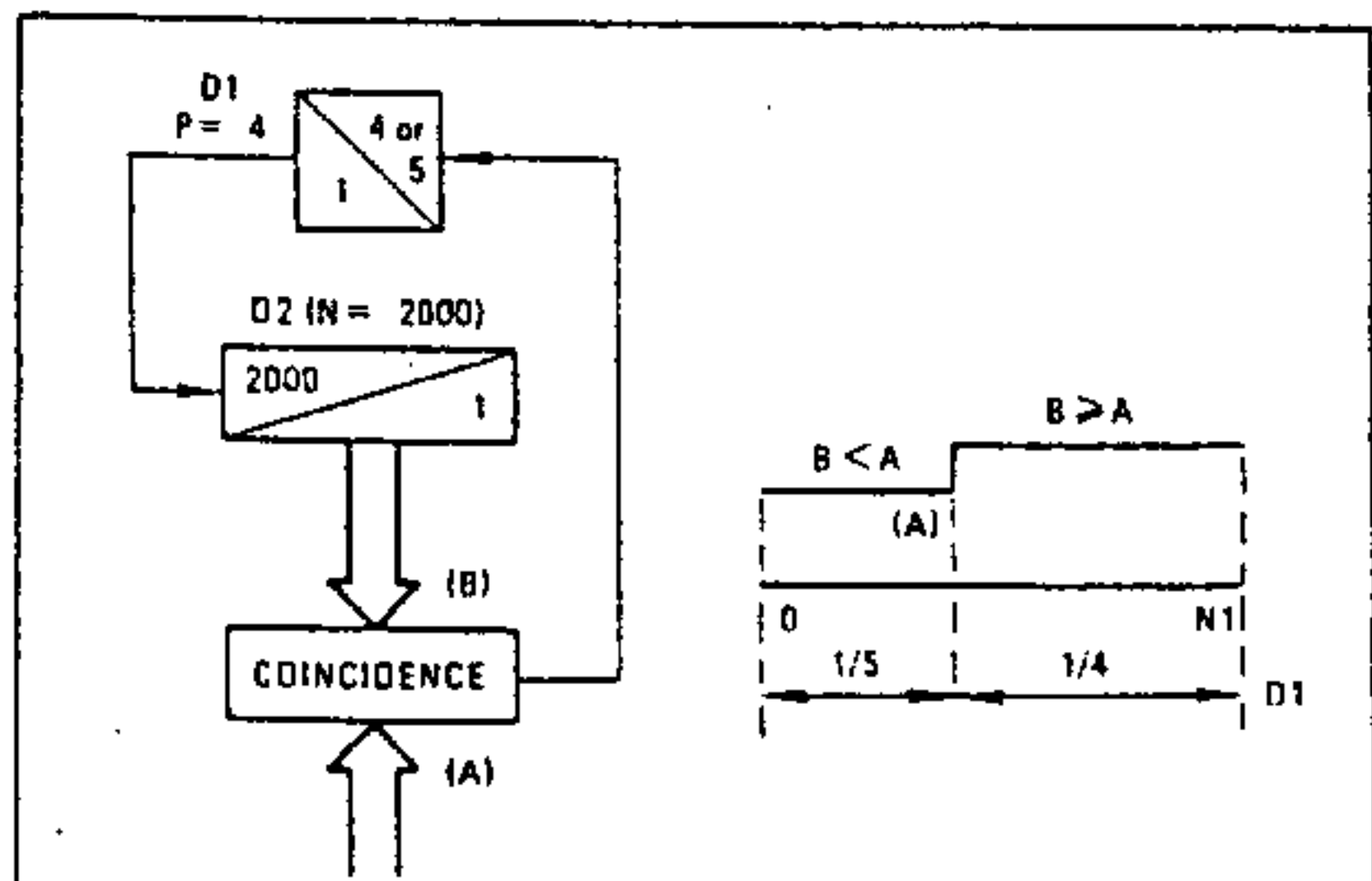


FIGURE IV.2 : Principle of the 8000/9999 Counter.

D1 : divides by 5 (P + 1) with a «0» level applied to input (2) and by 4 (P) with a «1» level applied to input (2).

The 8000/9999 divider has a first-stage divider, D1, that divides by 4 or 5 depending on the logic level («1» or «0») fed to input (2).

D1 is connected to a second divider, D2, having a fixed divisor of 2000, which feeds a signal (B) to the amplitude comparator, which also receives a signal (A) ranging from 0 to 2000 derived from the programming codes generated either by the front-panel decimal switches or by an external program.

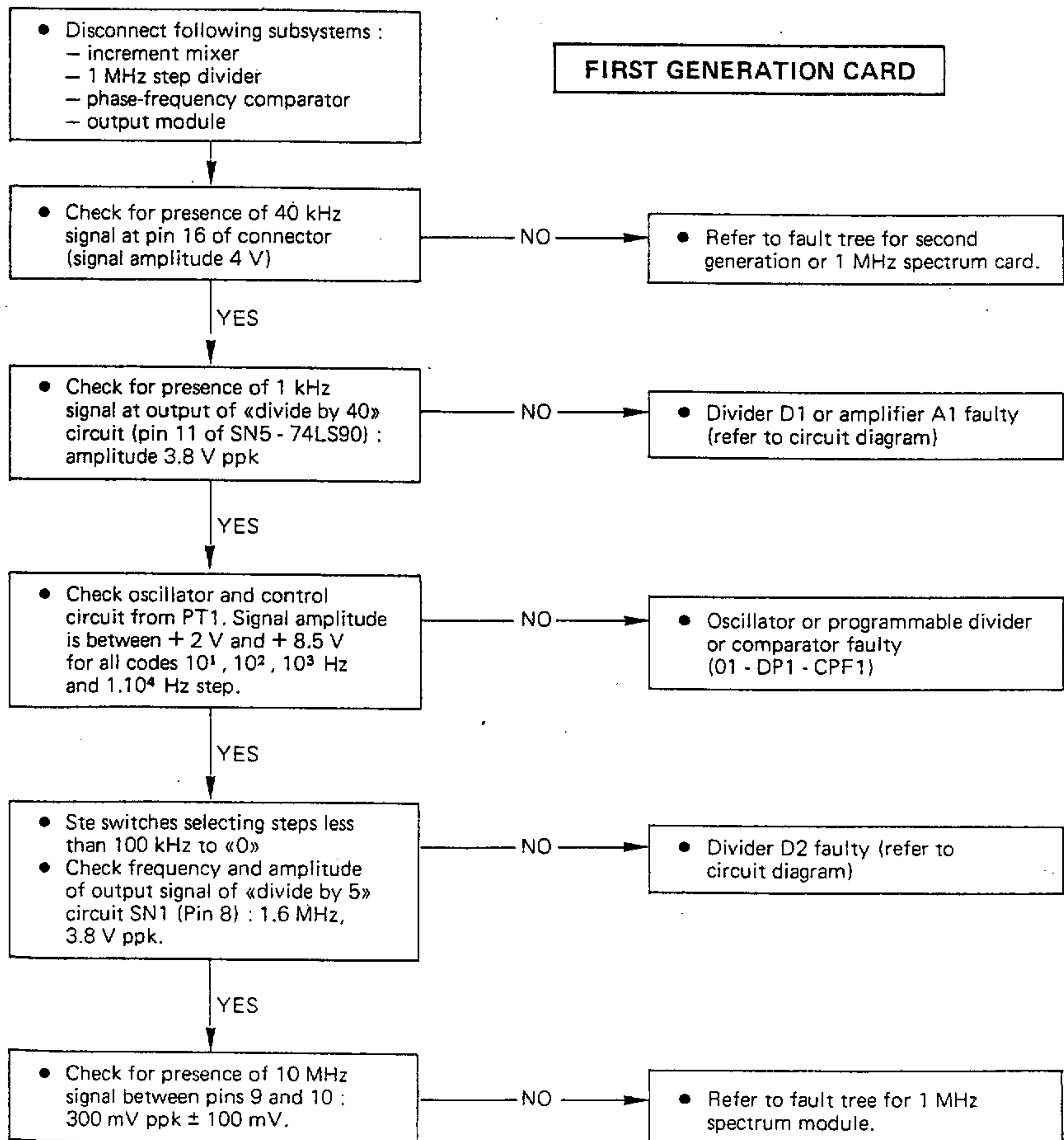
The comparator applies a «0» level to input (2) of D1 while B is less than A, thus causing D1 to divide by 5. When B is equal to or greater than A, the logic level applied is «1» and the divisor 4.

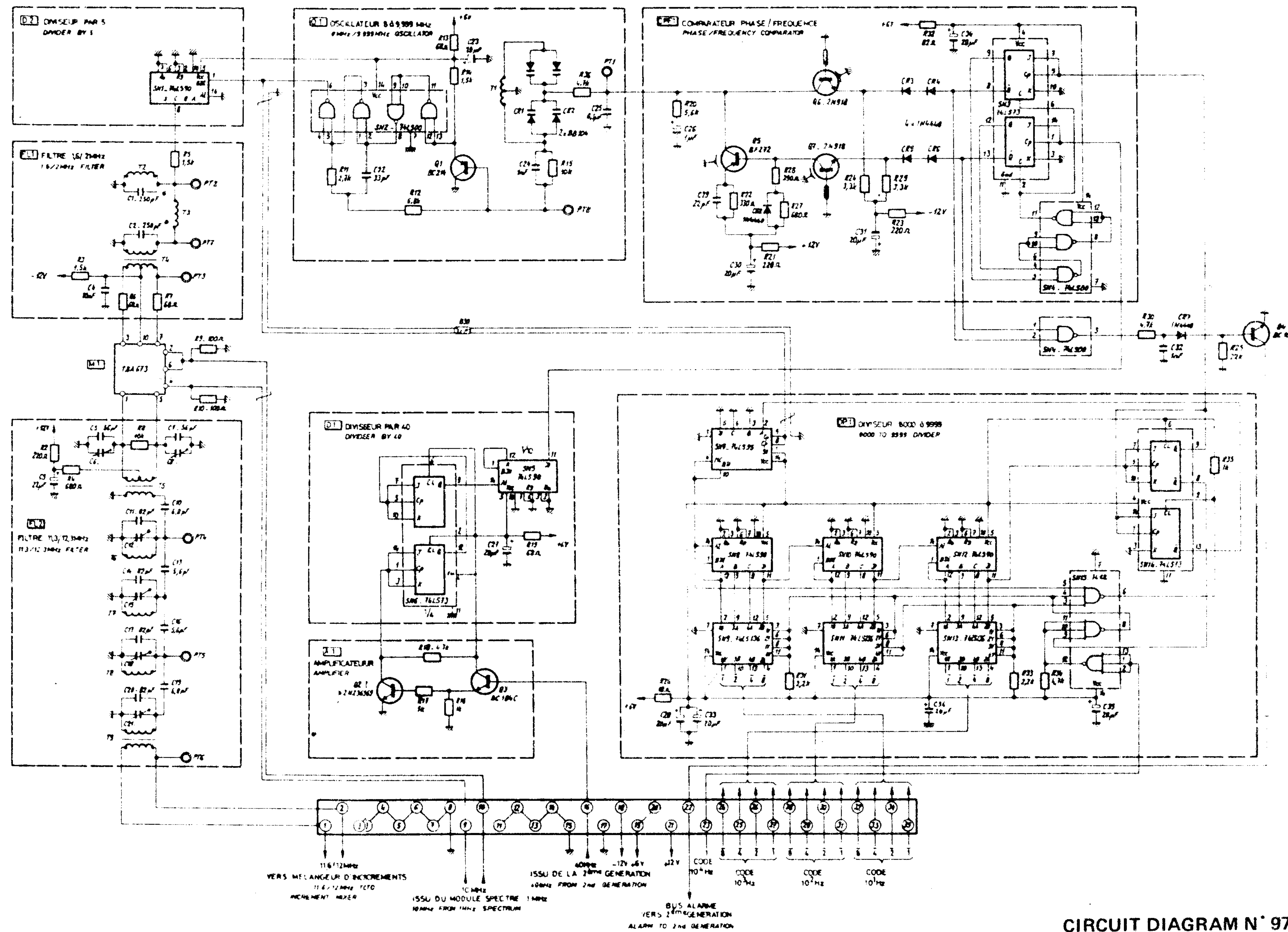
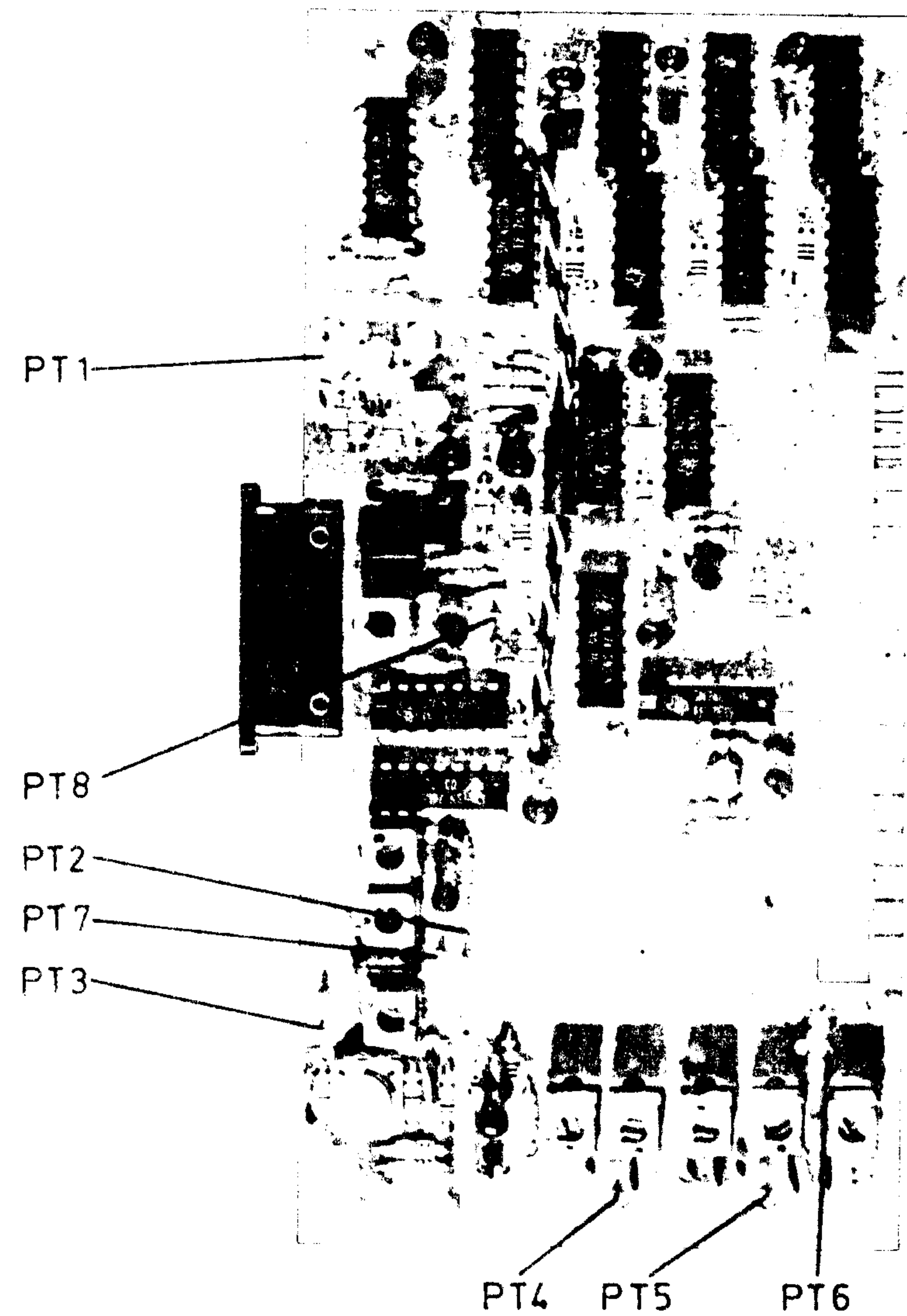
The resulting divisor can be expressed as follows :

$$(P + 1) A + (N - A) P$$

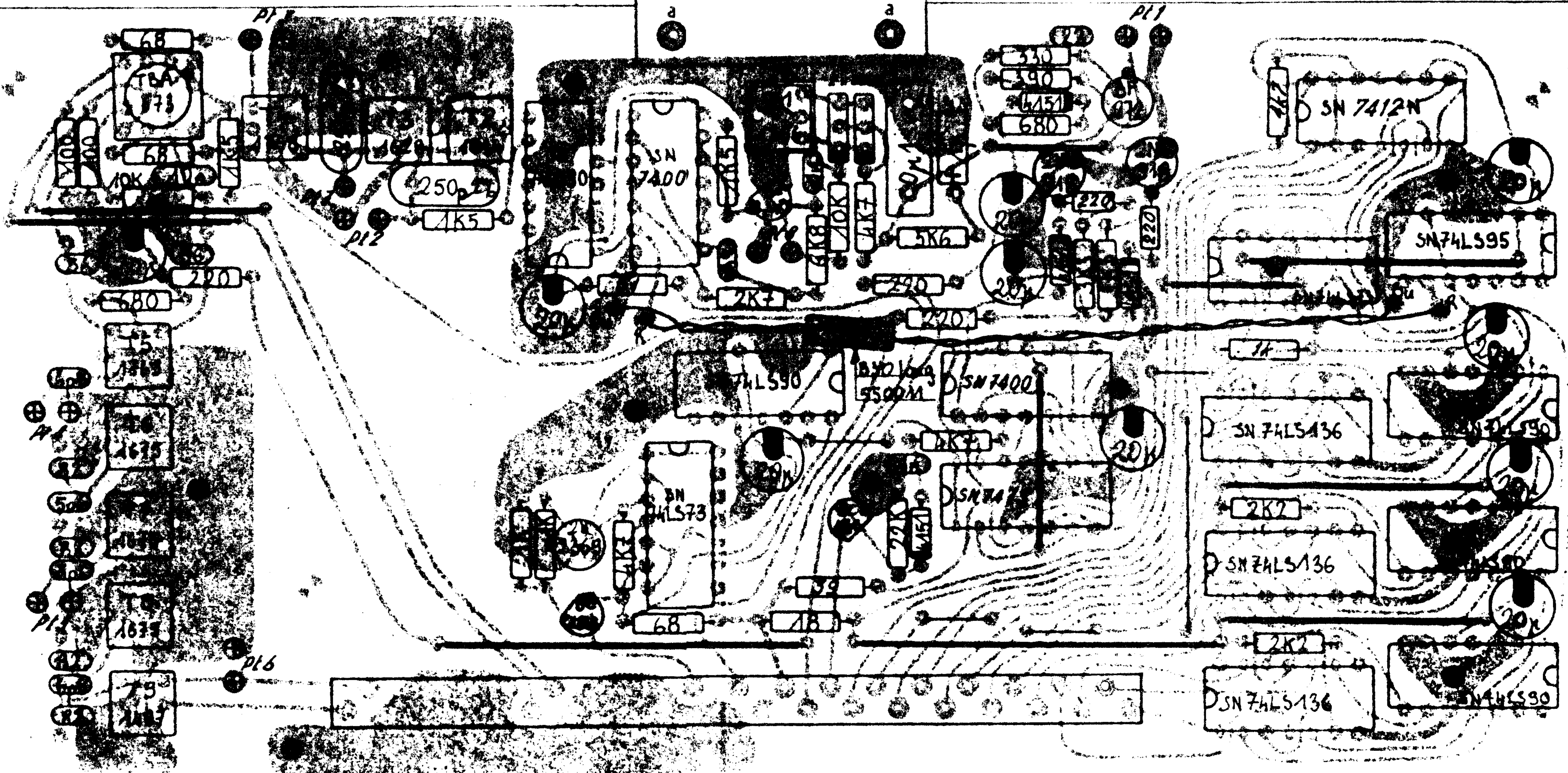
If, for example, A = 800, the divisor is $(5 \times 800) + 4 (2000 - 800) = 8800$, and the counter divides by 8800.

FAULT TREE





CIRCUIT DIAGRAM N° 976880



WIRING AND COMPONENT LAYOUT
 DIAGRAM N° 932129 2/2

4 - SECOND GENERATION CARD

Documentation

General description and operating principles.

Fault tree.

Circuit diagram N° 976881.

Wiring and component layout diagram N° 932180 2/2.

Instruments and equipment required

Oscilloscope.

Card extender.

Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

PRINCIPLE OF THE SECOND GENERATION

The second generation generates the increments corresponding to the 10^4 Hz (2, 4 and 8 bits) and 10^5 Hz codes, controlled either by two decimal switches or by an external program.

Figure IV.3 shows the principle of the second generation and Plate N° 976881 is its circuit diagram.

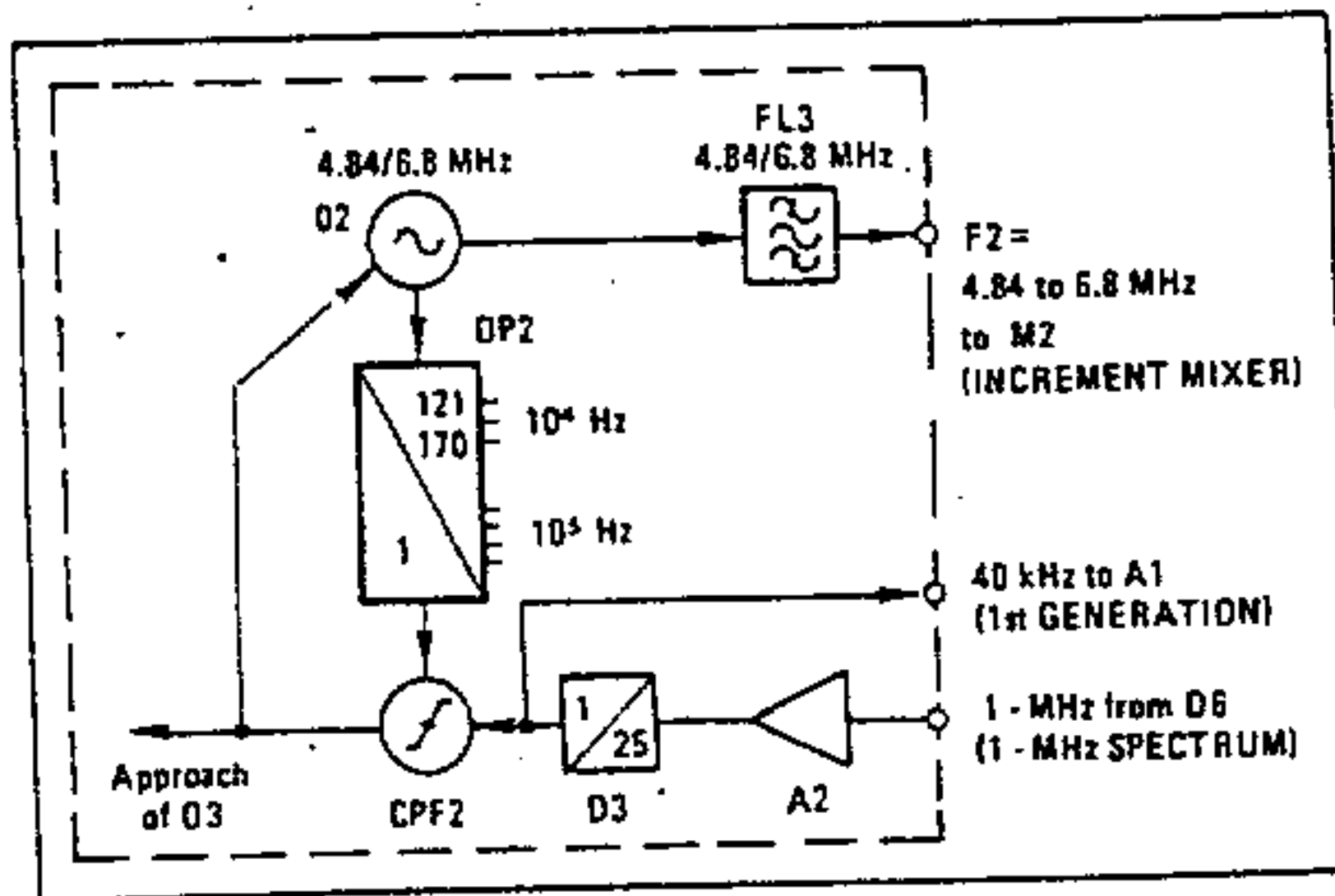


FIGURE IV.3 - Principle of the second generation.

Much simpler than the first generation, this board has only a divider and an output filter in addition to its phase lock loop.

The phase lock loop includes an oscillator, O2, providing a frequency ranging from 4.84 to 6.8 MHz in 40-kHz steps. This is fed to the input of programmable divider DP2, the divisor of which ranges from 121 to 170 as a function of the Manual or Remote frequency programming codes.

The divided output frequency of DP2 is fed to the input of phase/frequency comparator CPF2, which also receives a 40-kHz reference frequency derived from the 1-MHz SPECTRUM by division by 25.

The DC output signal of CPF2 acts on oscillator O2 to maintain the equilibrium of the loop and satisfy the equation :

$$F = NF_0$$

in which F is the frequency of O2, N the divisor of DP2, and F_0 the reference frequency.

The DC output voltage of CPF2 is also used to coarse-tune oscillator O3 in the Increment Mixer.

The output frequency of O2, F2, which ranges from 4.84 to 6.8 MHz in 40-kHz steps, is filtered and fed directly to the increment mixer module.

NOTE : The phase/frequency comparator has an «alarm» circuit that is validated whenever the oscillator is not locked. The alarm signal acts on a logic circuit in the SECOND GENERATION that controls an LED on the instrument's front panel.

PRINCIPLE OF THE 121/170 DIVIDER

Figures IV.4 to IV.6 show the principle and chronogram of this divider.

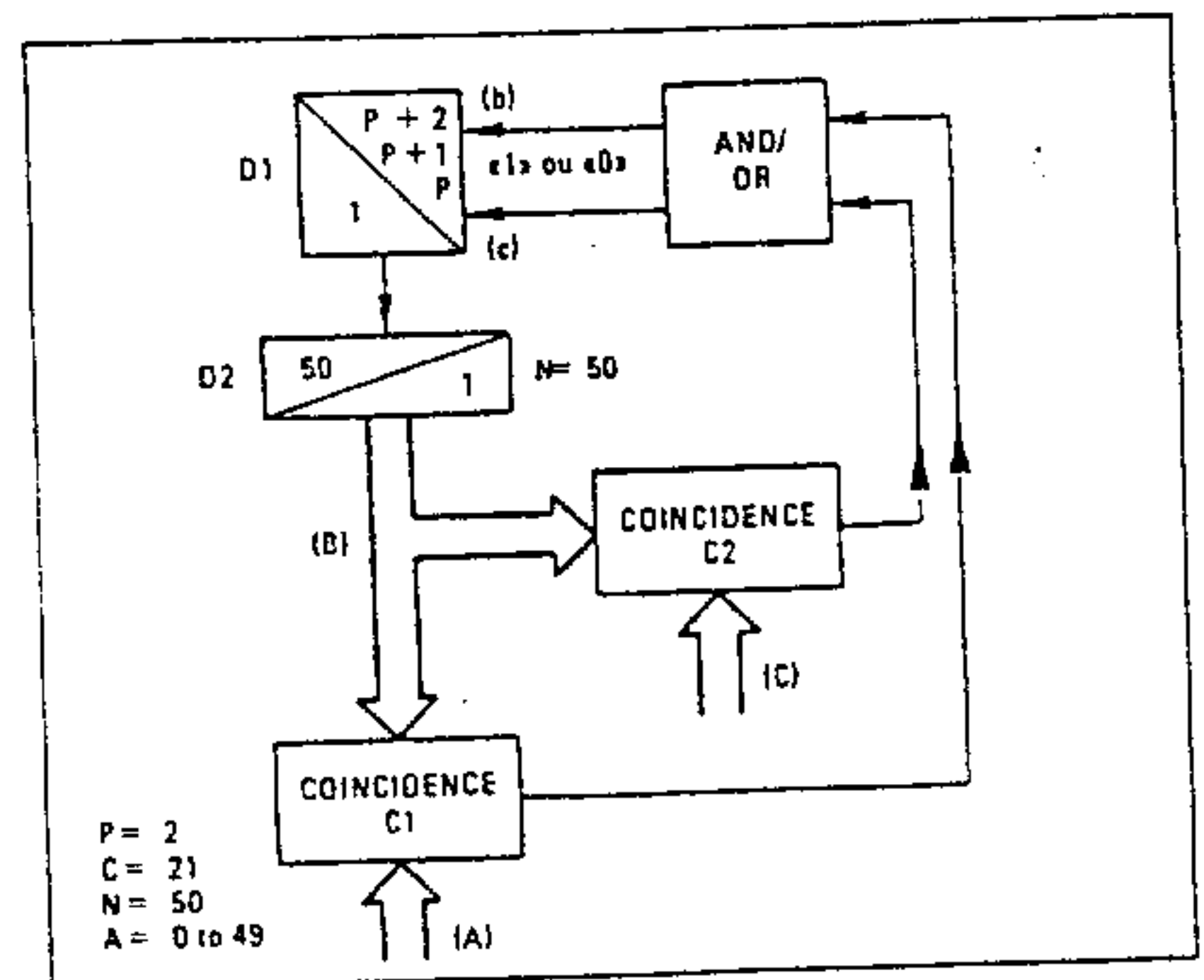


FIGURE IV.4 : Principle of the 121/170 Counter

The 121/170 programmable divider consists of a first-stage divider, D1, the divisor of which is controlled by the logic levels applied to its inputs (b) and (c), connected to a second-stage divider, D2, having a fixed divisor ($N = 50$).

D2 feeds a signal (B) to two comparators, one of which receives signal (C), constant and equal to 21, and the other, signal (A), ranging from 0 to 49, derived from the programming codes generated either by the front-panel decimal switches or by an external program.

These two comparators feed logic levels to a circuit that controls the divisor of divider D1 accordingly.

Two cases must be considered :

- a) A is less than C.
- b) A is greater than C.

First case (A less than C) : see chronogram below :

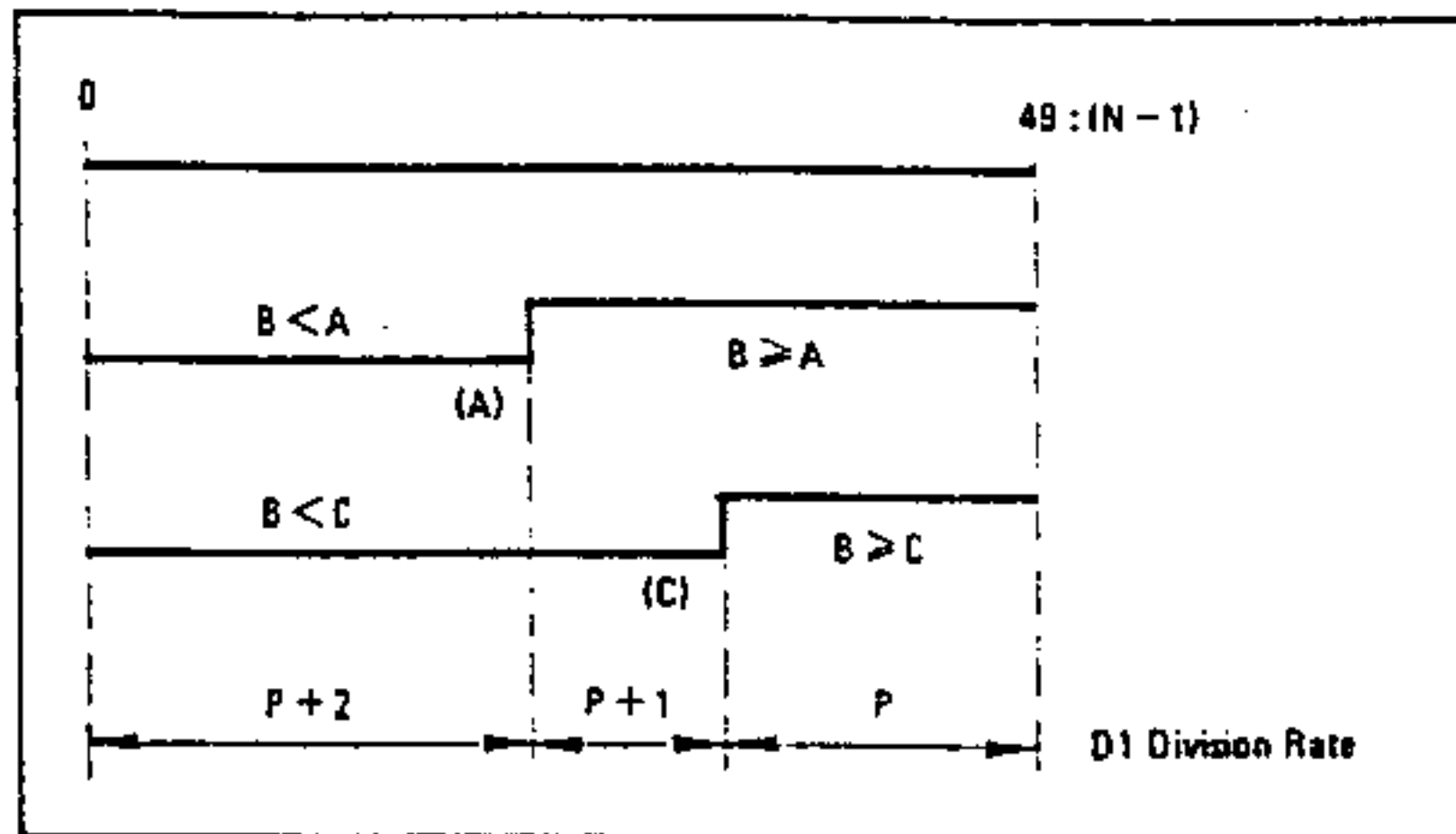


FIGURE IV.5 : Chronogram of the 121/170 counter.

The divisor of divider D1 assumes three different values in three distinct zones, the resulting divisor of the 120/170 programmable counter can be deduced from them.

- $B < A$ in which D1 divides by $P + 2$
- $A \leq B < C$ in which D1 divides by $P + 1$
- $B \geq C$ in which D1 divides by P .

This gives the following expression for the counter's divisor :

$$A (P + 2) + (C - A) (P + 1) + (N - C) P$$

A summary table is given below :

$A < C$	Signal provided by comparator C1	Signal provided by comparator C2	Signals fed to inputs (b) and (c) of D1		Divisor of D1
			(b)	(c)	
$B < A$	0	0	1	1	$P + 2$
$A \leq B < C$	1	0	1	0	$P + 1$
$B \geq C$	1	1	0	0	P

If, for example, $A = 18 (< C)$, since the expression for the divisor of the programmable counter is $A (P + 2) + (C - A) (P + 1) + (N - C) P$.

The divisor is equal to $(18 \times 4) + (3 \times 3) + (29 \times 2) = 72 + 9 + 58 = 139$.

Second case (A greater than C) : see chronogram below :

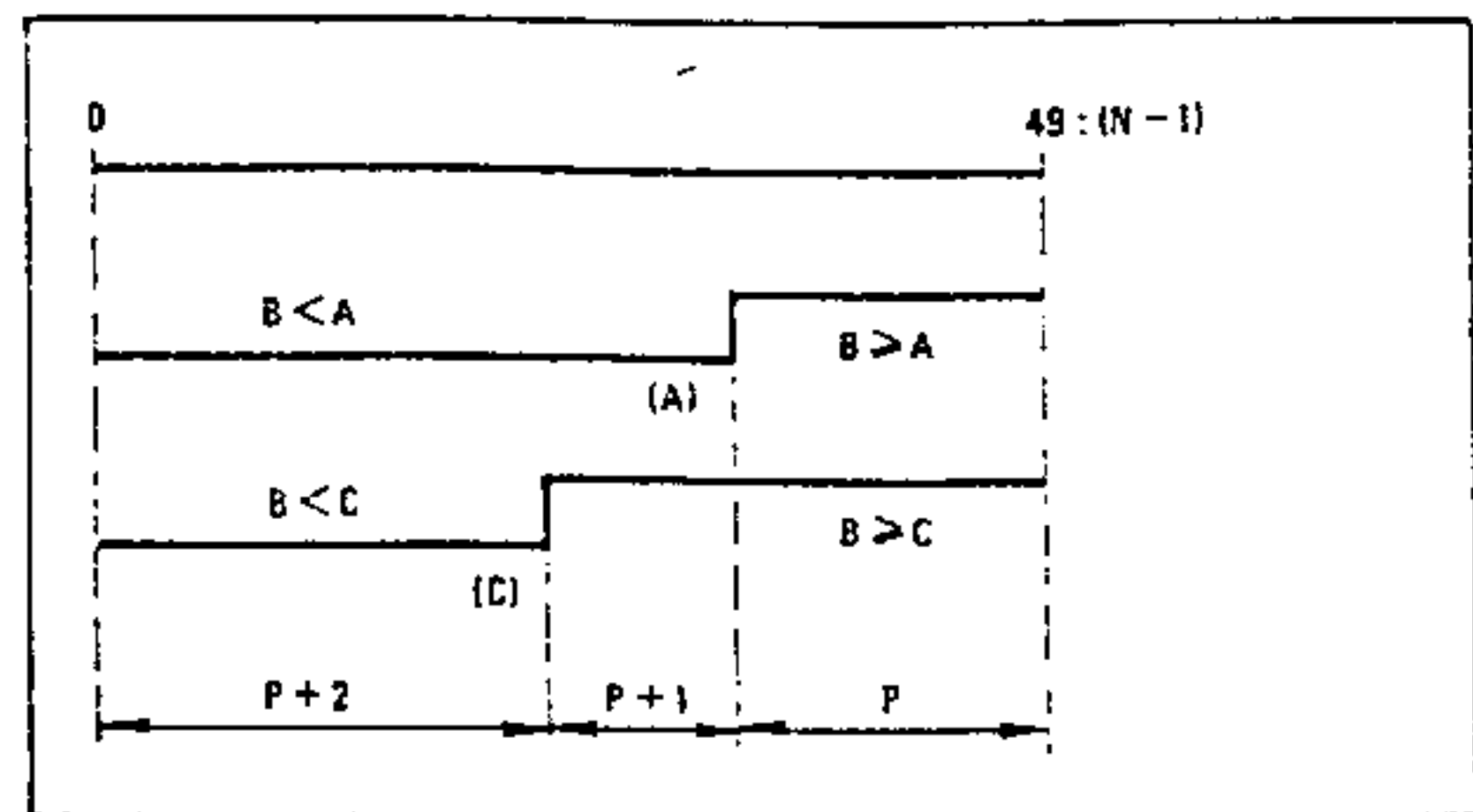


FIGURE IV.6 : Chronogram of the 121/170 counter.

In this case, the divisor of D1 is determined as follows :

- $B < C$ in which D1 divides by $P + 2$
- $C \leq B < A$ in which D1 divides by $P + 1$
- $B \geq A$ in which D1 divides by P .

In consequence, the expression of the divisor of the programmable counter is as follows :

$$C (P + 2) + (A - C) (P + 1) + (N - A) P$$

A summary table is given below :

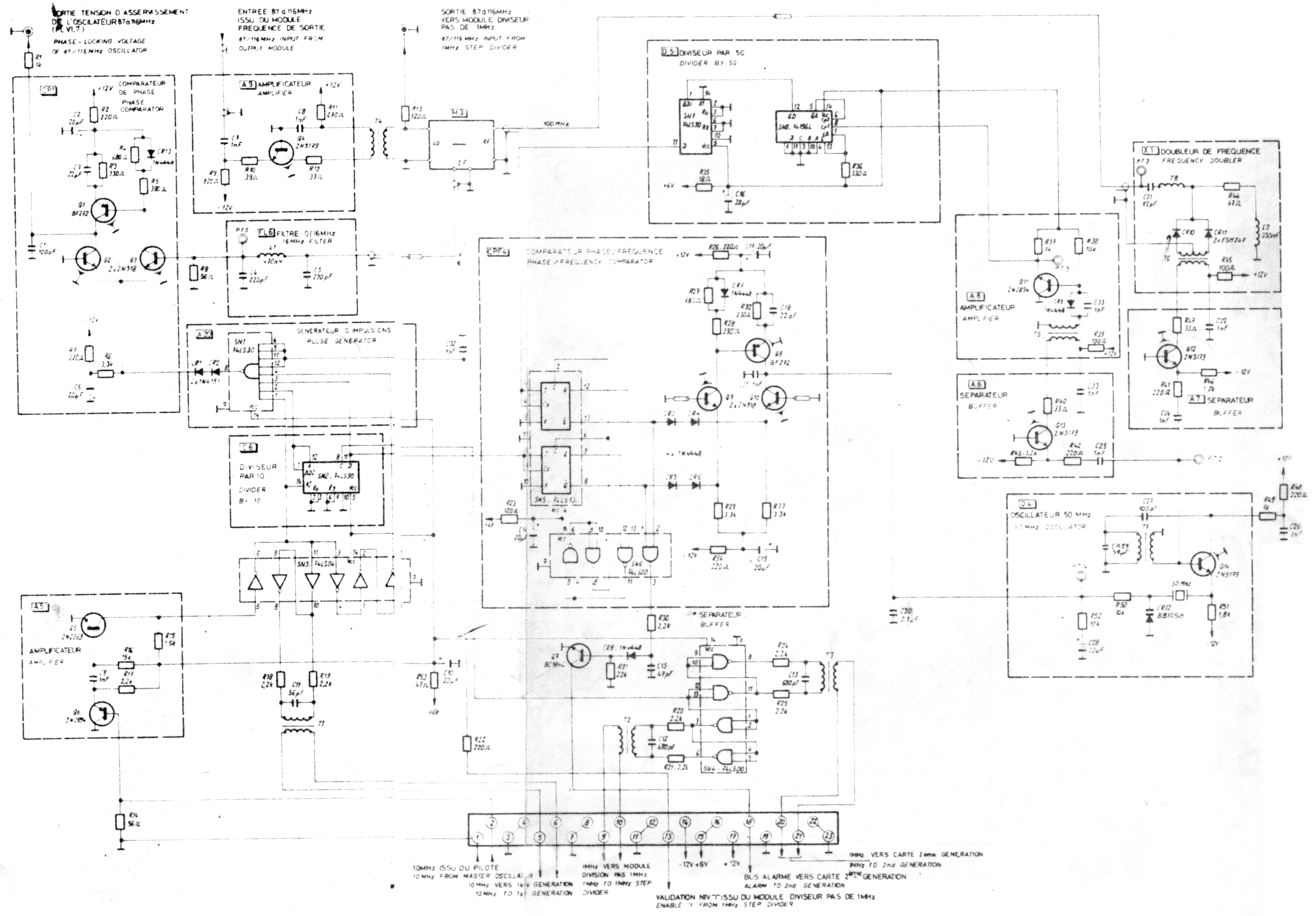
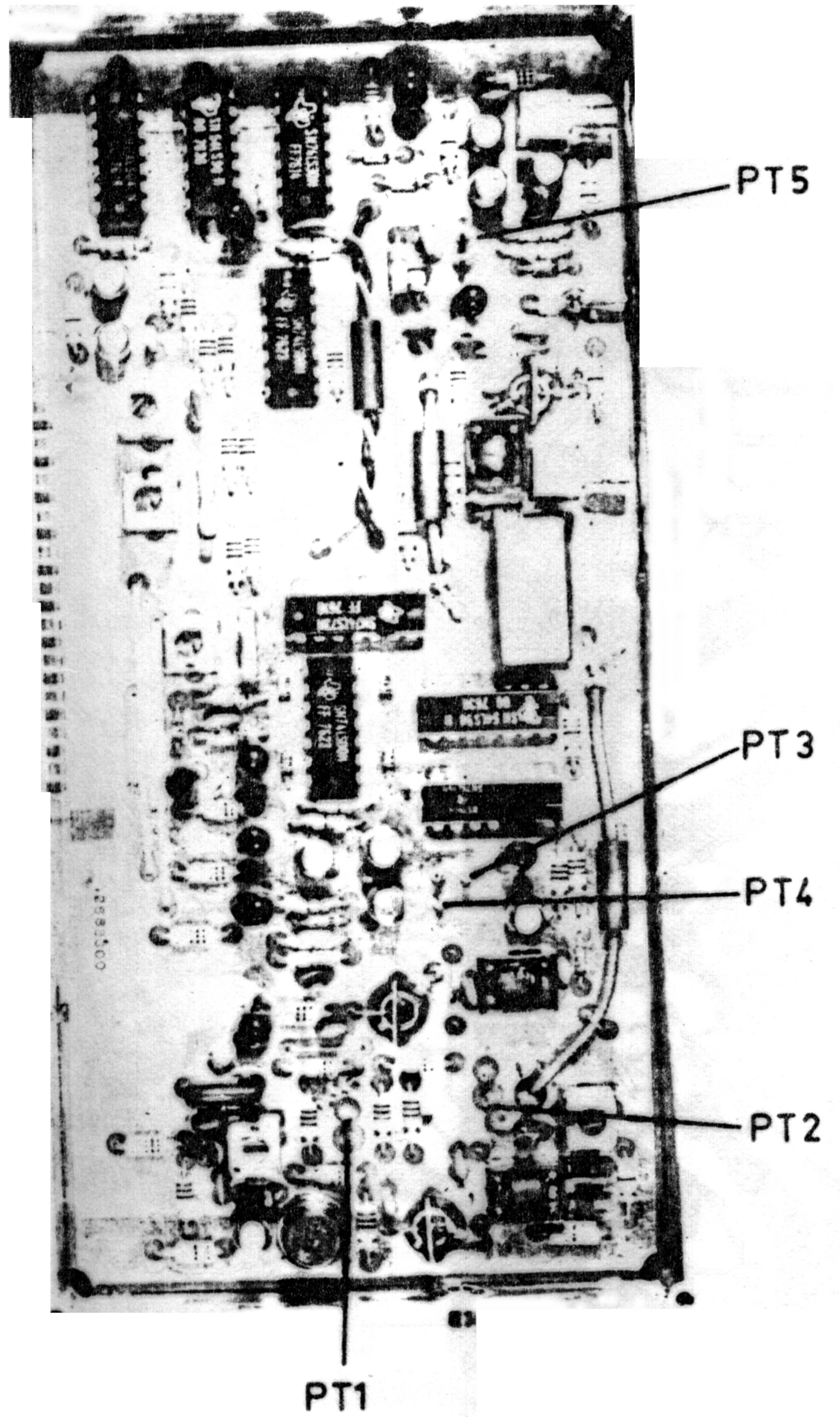
$A > C$	Signal provided by comparator C1	Signal provided by comparator C2	Signals fed to inputs (b) and (c) of D1		Divisor of D1
			(b)	(c)	
$B < C$	0	0	1	1	$P + 2$
$C < B < A$	0	1	1	0	$P + 1$
$B \geq A$	1	1	0	0	P

If, for example, $A = 35 (> C)$, since the expression for the divisor of the programmable counter is $C (P + 2) + (A - C) (P + 1) + (N - A) P$, the divisor is equal to $(21 \times 4) + (14 \times 3) + (15 \times 2) = 84 + 42 + 30 = 156$.

When A is equal to C, the expression for the divisor becomes :

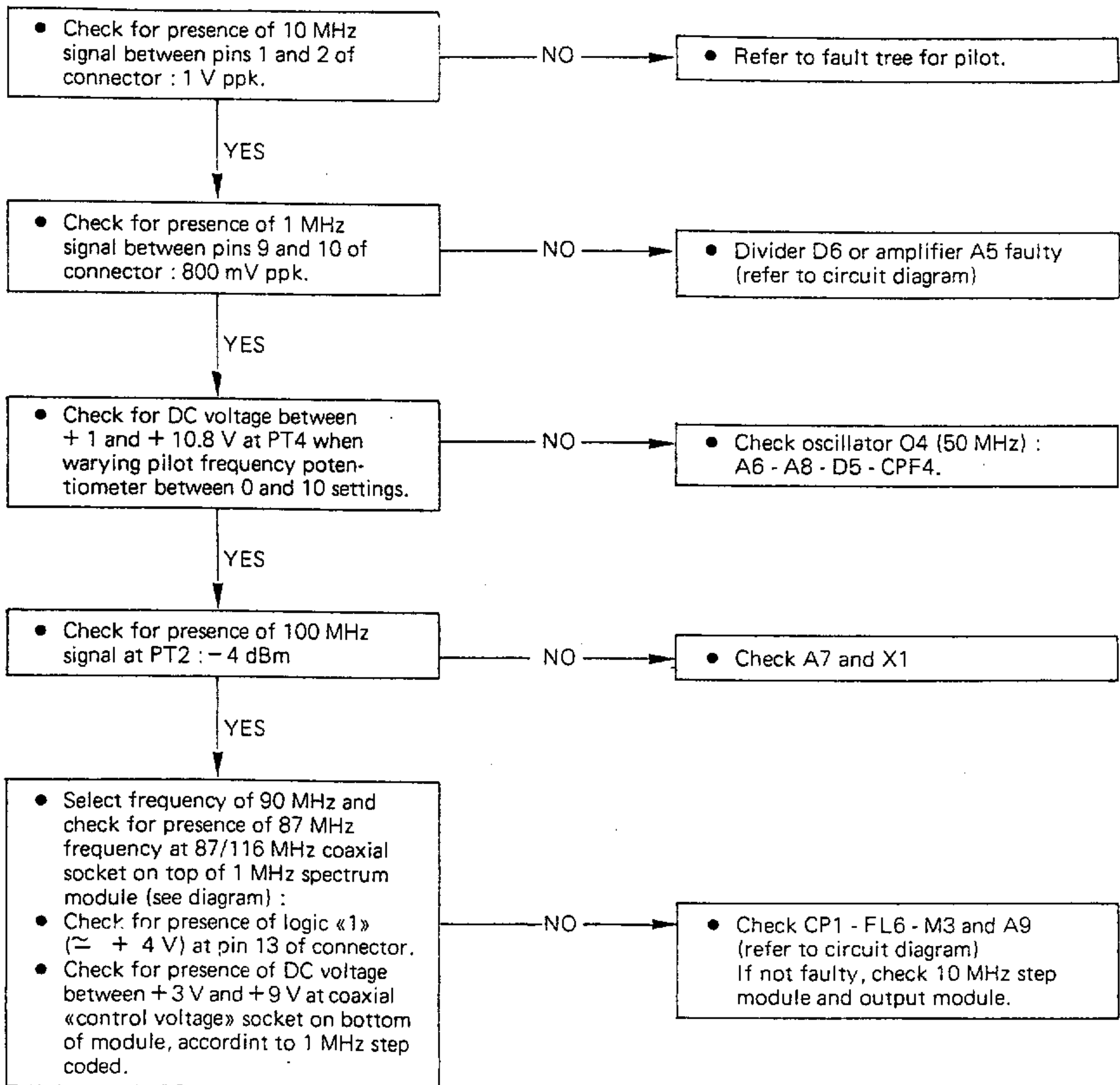
$$(P + 2) A + (N - A) P \text{ or } (P + 2) C + (N - C) P$$

If, for example, $A = 21 (= C)$, $(P + 2) 21 + (29) 2 = (4 \times 21) + (29 \times 2) = 142$.



FAULT TREE

1 MHz SPECTRUM MODULE



6 - 1 MHz SPECTRUM MODULE

Documentation

General description and operating principles.

Fault tree.

Circuit diagram N° 976883.

Wiring and component layout diagram N° 932127
2/2.

Instrument and equipment required

Spectrum analyser.

Frequency meter.

Oscilloscope.

Card extender.

Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

PRINCIPLE OF THE 1-MHz SPECTRUM MODULE

Figure IV.8 shows the principle of the 1-MHz SPECTRUM MODULE and Plate N° 976883 is its circuit diagram.

to the «RF» input of mixer M3, which also receives the frequency ranging from 87 to 116 MHz generated by oscillator O5 (in the Output Frequency module). The subtractive beat, ranging from 0 to 16 MHz, is filtered and fed to phase comparator CP1, which also receives the 1-MHz frequency from comb generator

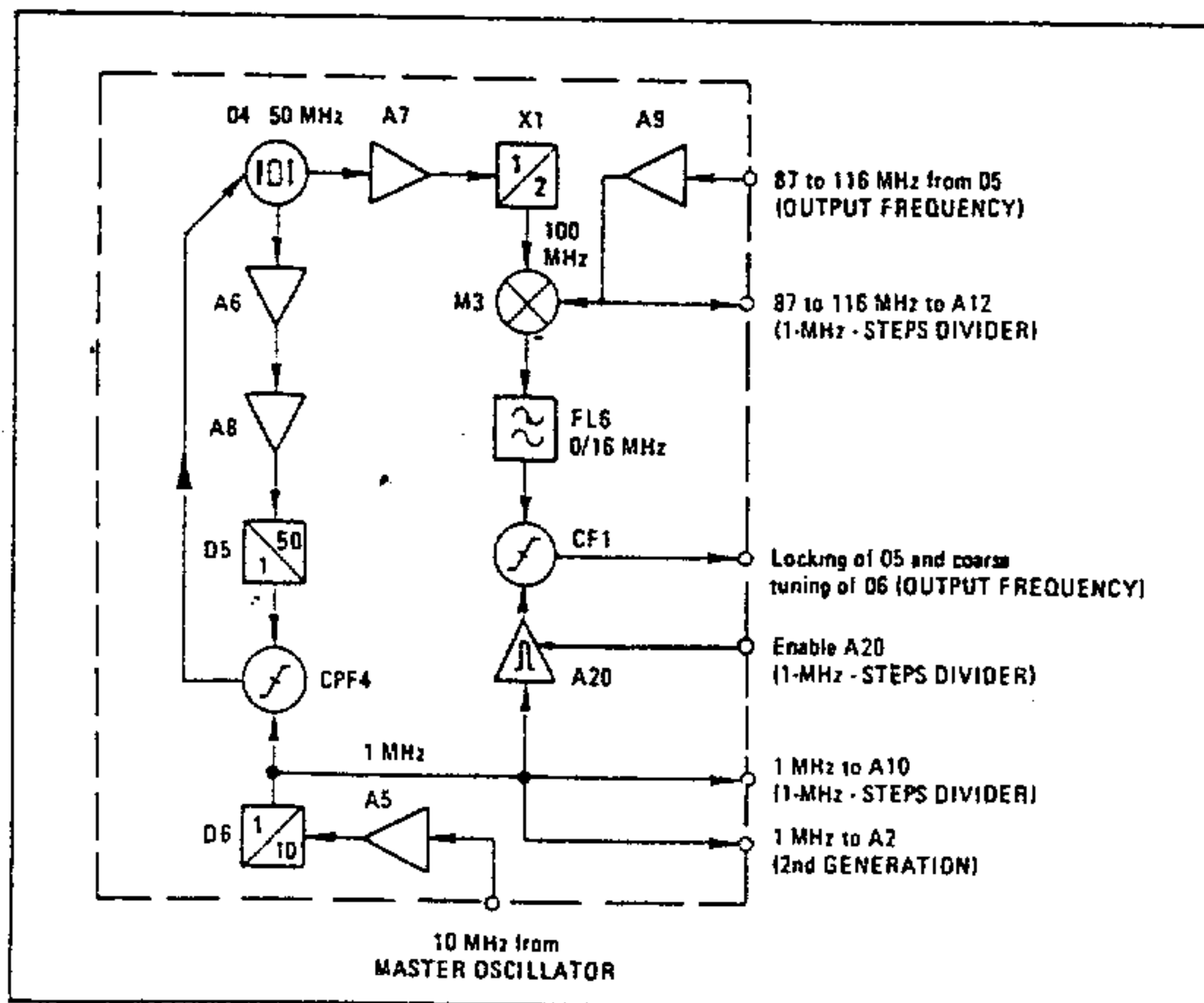


FIGURE IV.8 :
Principle of the 1-MHz Spectrum.

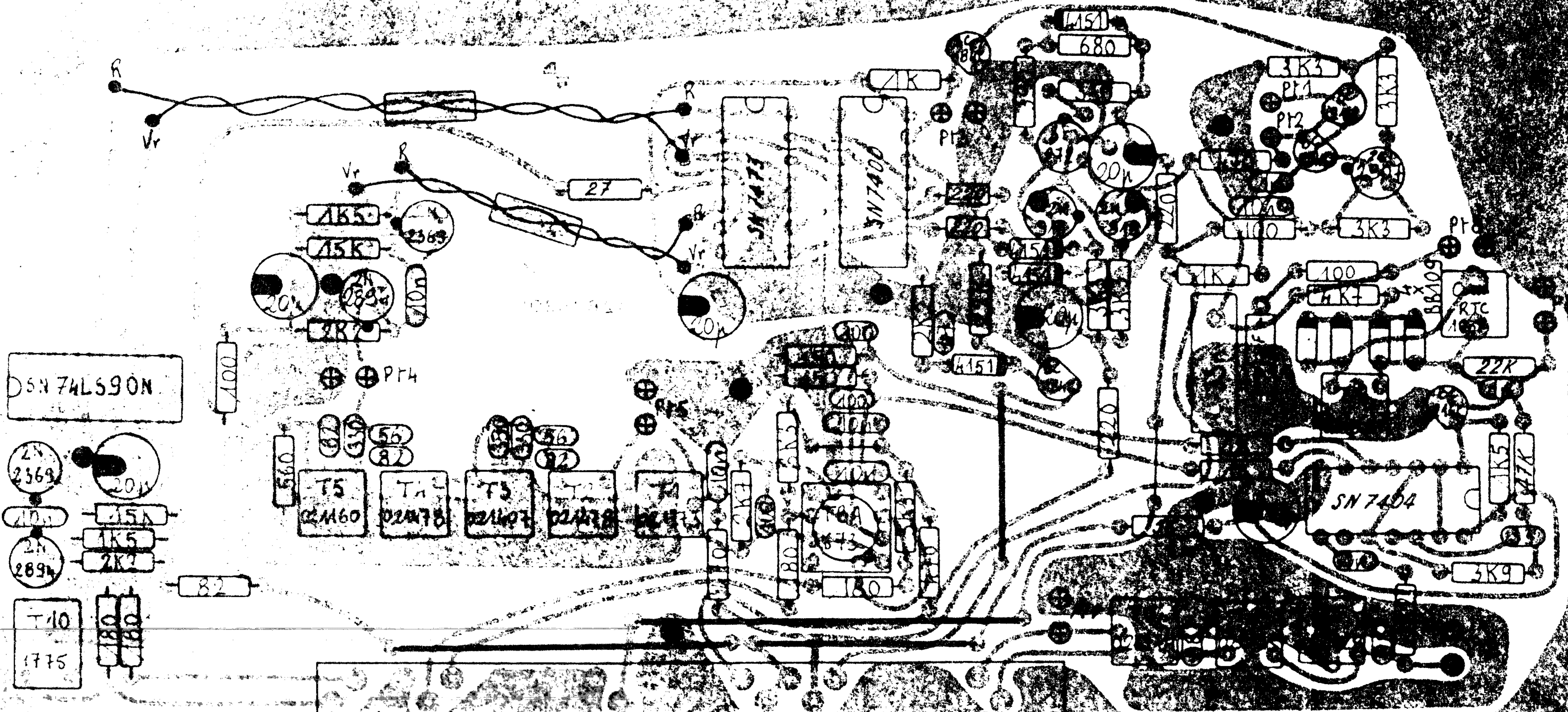
The 1-MHz SPECTRUM MODULE serves to improve the noise level of the output signal. It consists of a 50-MHz quartz-crystal oscillator, O4, a fixed counter, and a phase/frequency counter, CPF4, forming a fixed loop.

The comparator receives a 1-MHz reference derived from the 10-MHz frequency of the master oscillator by division by 10 (D6).

The 50-MHz frequency is amplified and fed to doubler circuit X1, which feeds a frequency of 100 MHz

A2. A20 is validated by a logic circuit, L, in the 1-MHz STEPS DIVIDER MODULE.

The DC output signal from CP1 controls oscillator O5 and coarse-tunes oscillator O6; both of these oscillators are part of the OUTPUT FREQUENCY MODULE.



SN 74LS90N

2N
2369

20n

10n

2N
289n

15n

1K5

2K2

T10

1775

560

56

82

T5 02A160

T1 02A178

T3 02A197

T2 02A178

T4 02A178

100

470p

100

100

100

100

100

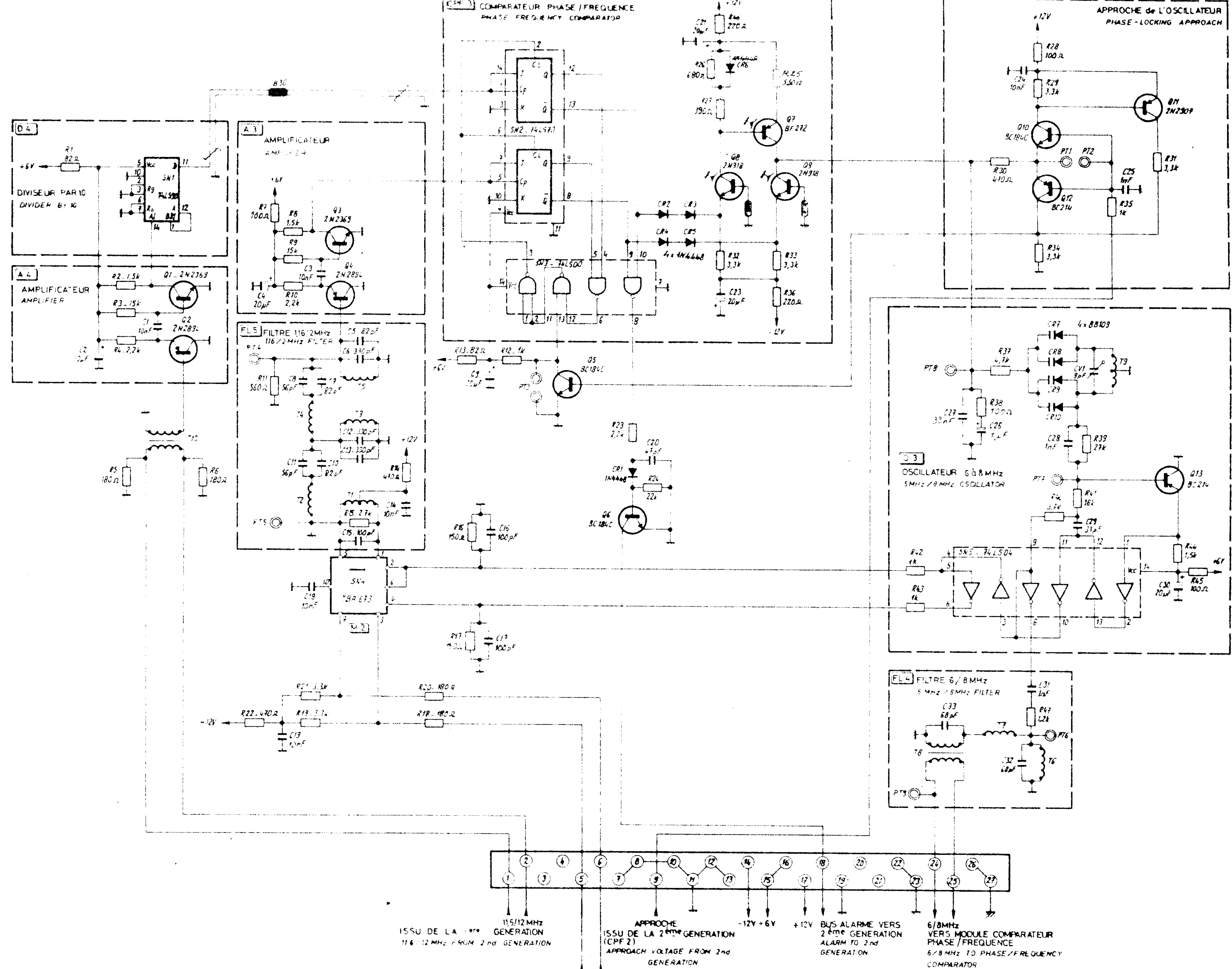
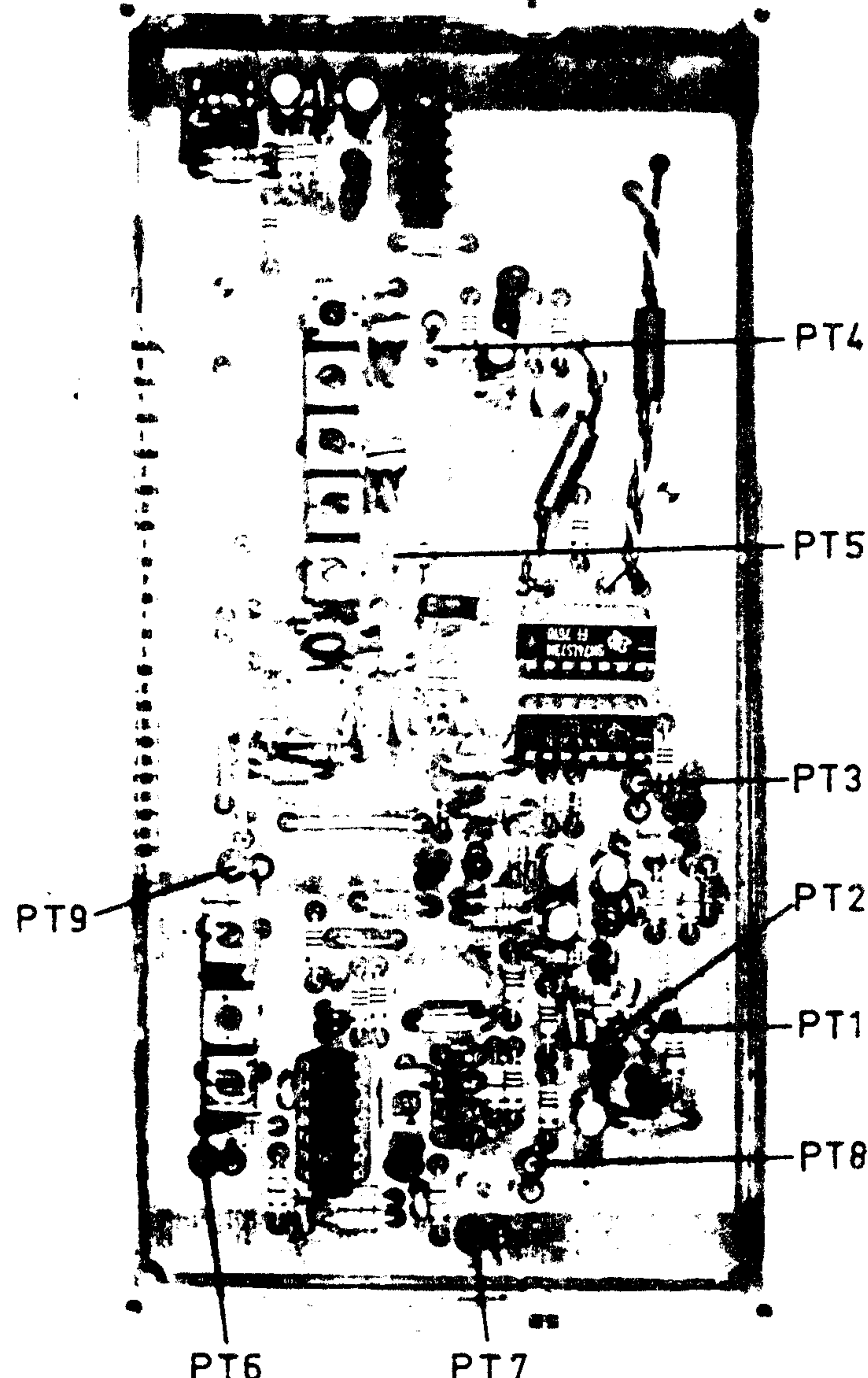
100

100

100

100

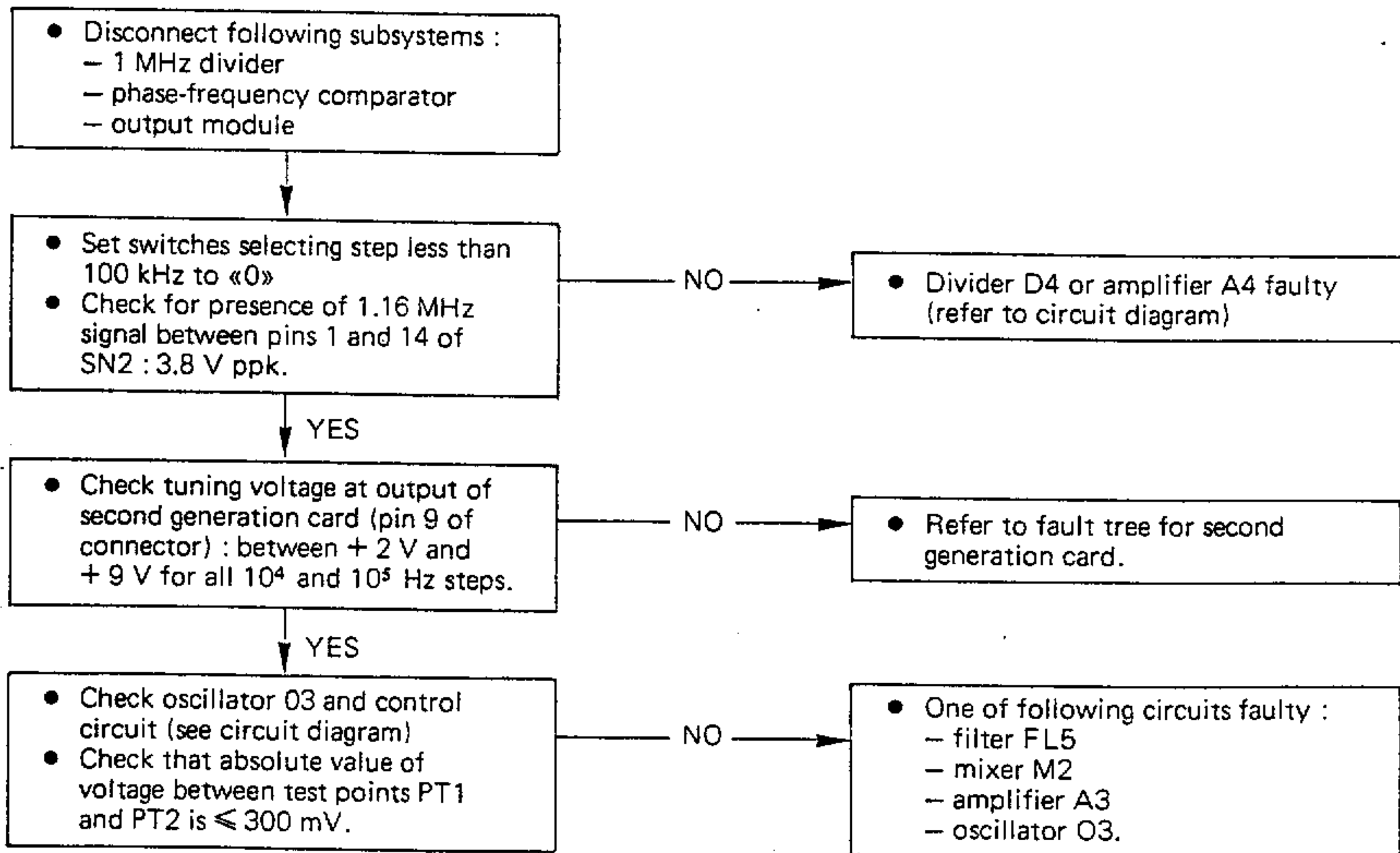
WIRING AND COMPONENT LAYOUT
DIAGRAM N° 932131 2/2



CIRCUIT DIAGRAM N° 976882

FAULT TREE

INCREMENT MIXER MODULE



5 - INCREMENT MIXER MODULE

Documentation

General description and operating principles.

Fault tree.

Circuit diagram N°976882.

Wiring and component layout diagram N°932131
2/2.

Instrument and equipment required

Oscilloscope.

Module extender.

Frequency meter.

Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

PRINCIPLE OF THE INCREMENT MIXER

The Mixer module combines the increments from the two-GENERATIONS and controls oscillator O3, which provides a frequency ranging from 6 to 7.999,98 MHz.

Figure IV.7 shows the principle of the INCREMENT MIXER and Plate N°976882 is its circuit diagram.

The DC output voltage of CPF3 controls oscillator O3 so as to maintain the loop is equilibrium and satisfy the equation $F = F1 + F2$, in which F represents the frequency of oscillator and F1 and F2 the output frequencies of the FIRST AND SECOND GENERATIONS.

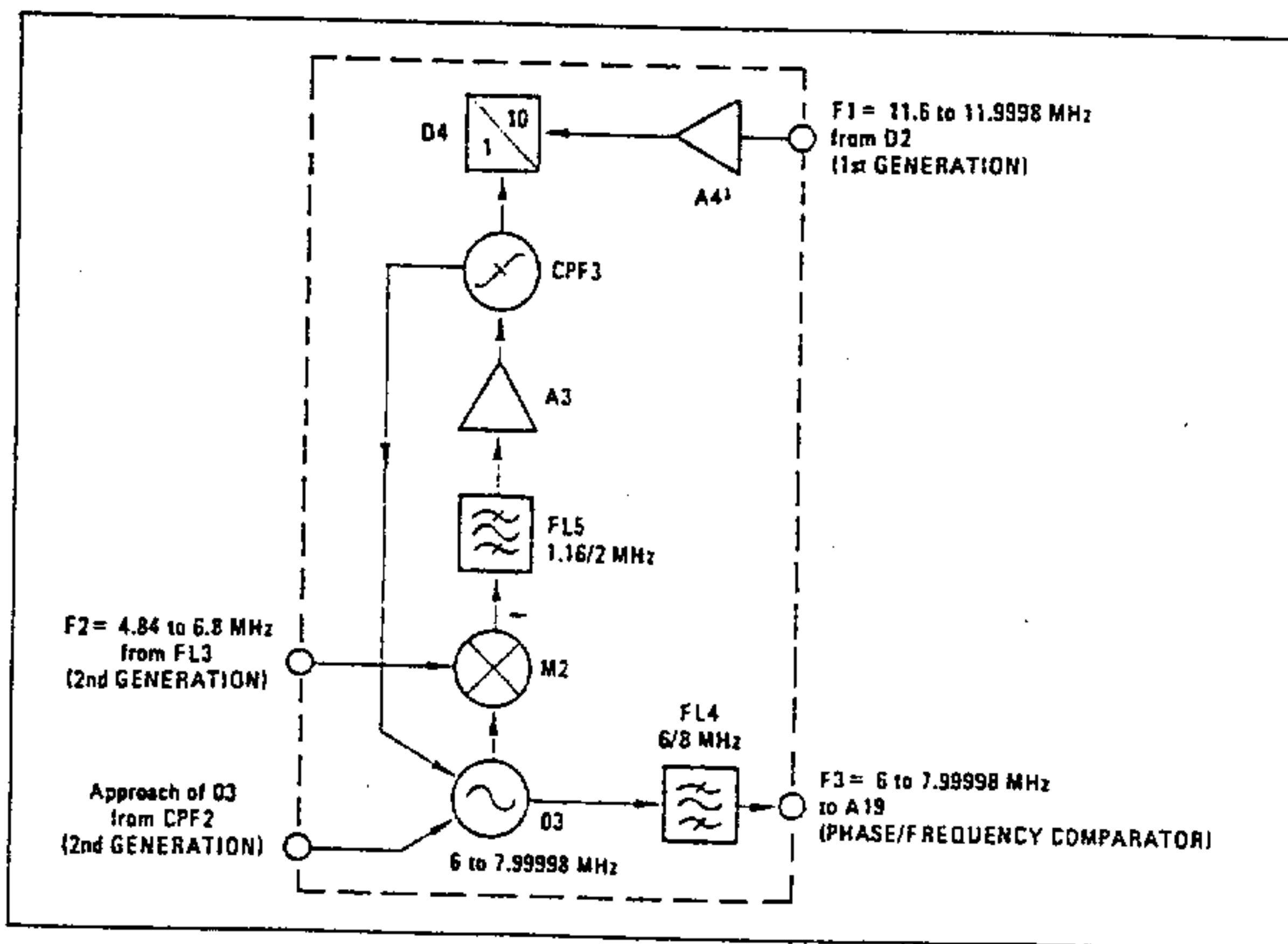


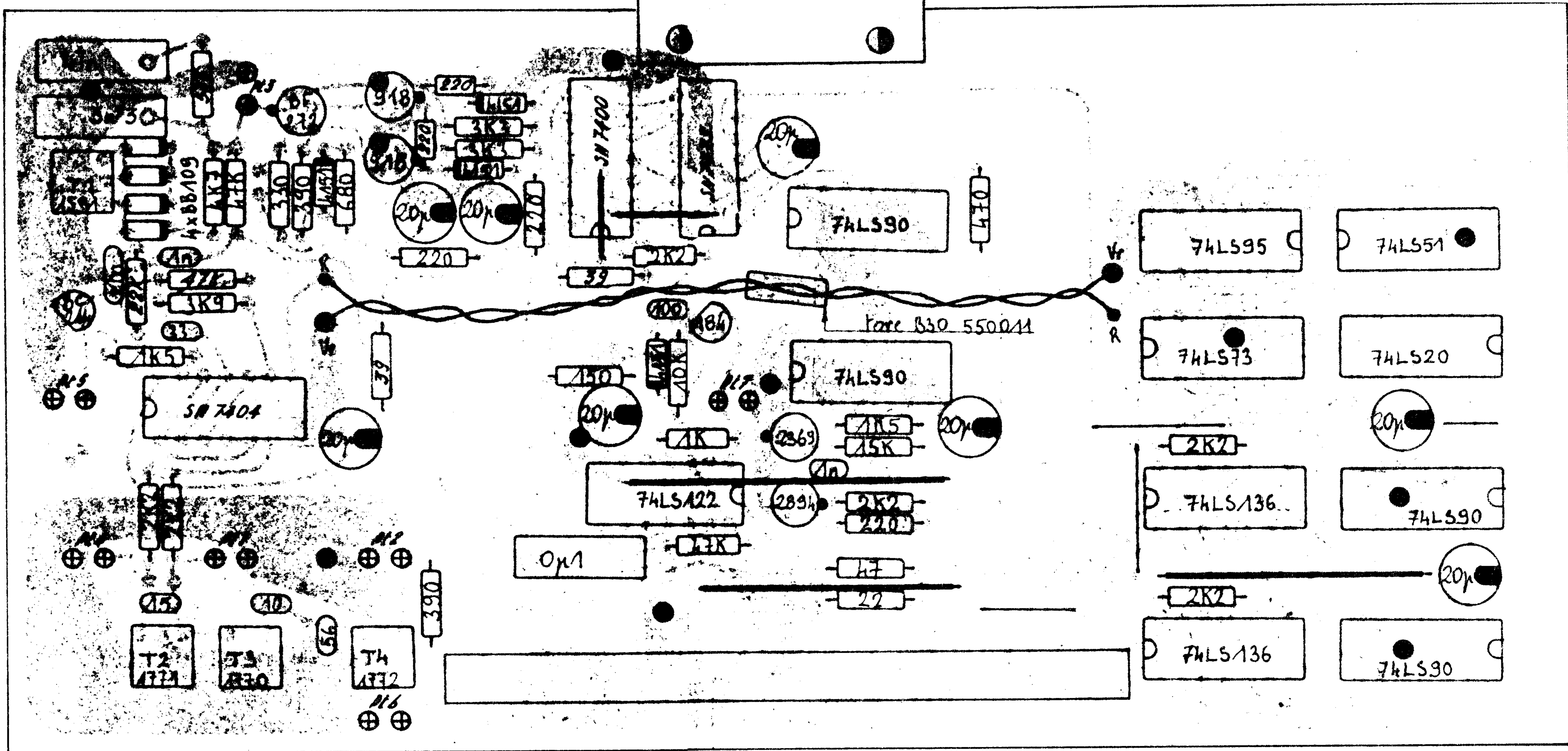
FIGURE IV.7 :
Principle of the Increment Mixer.

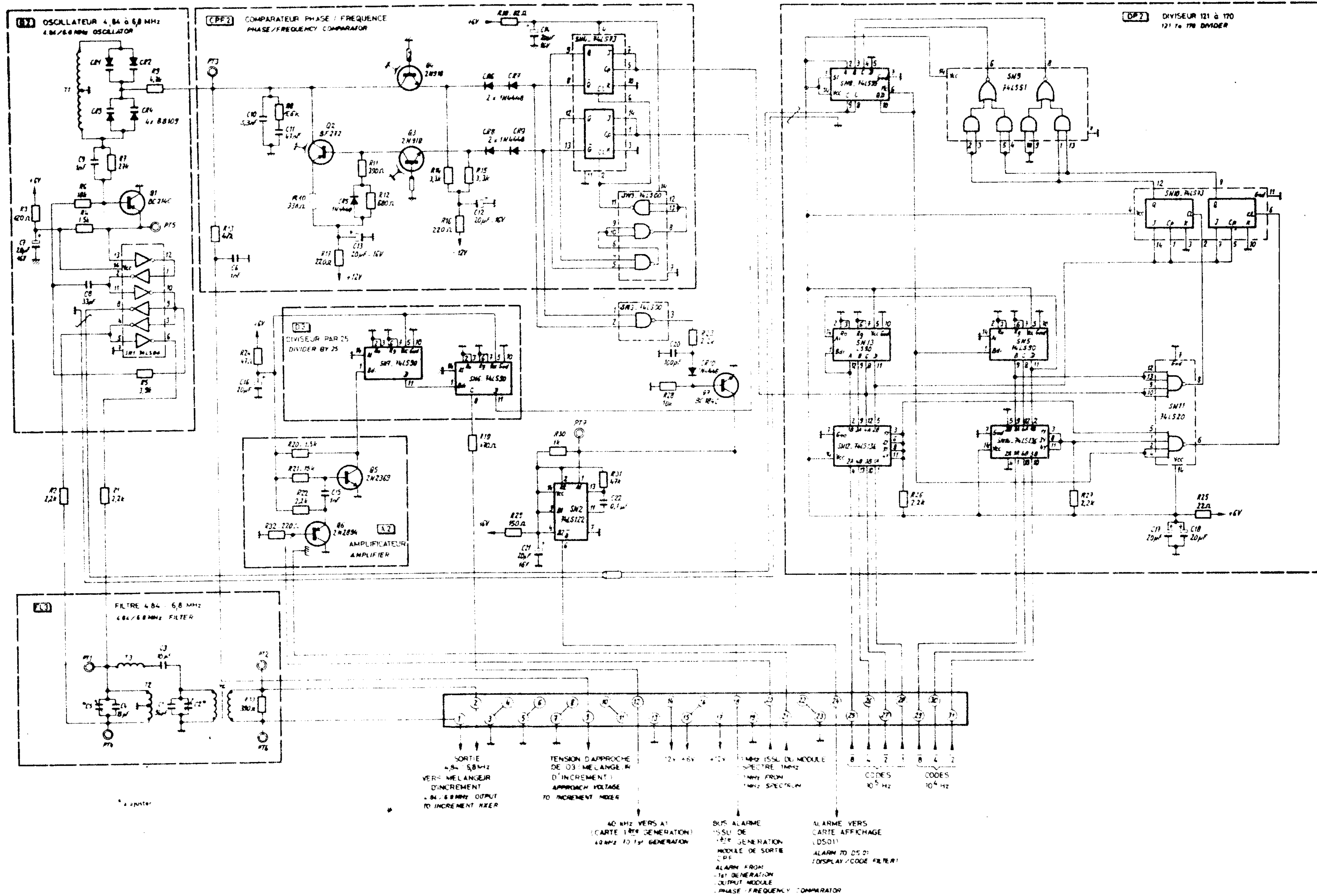
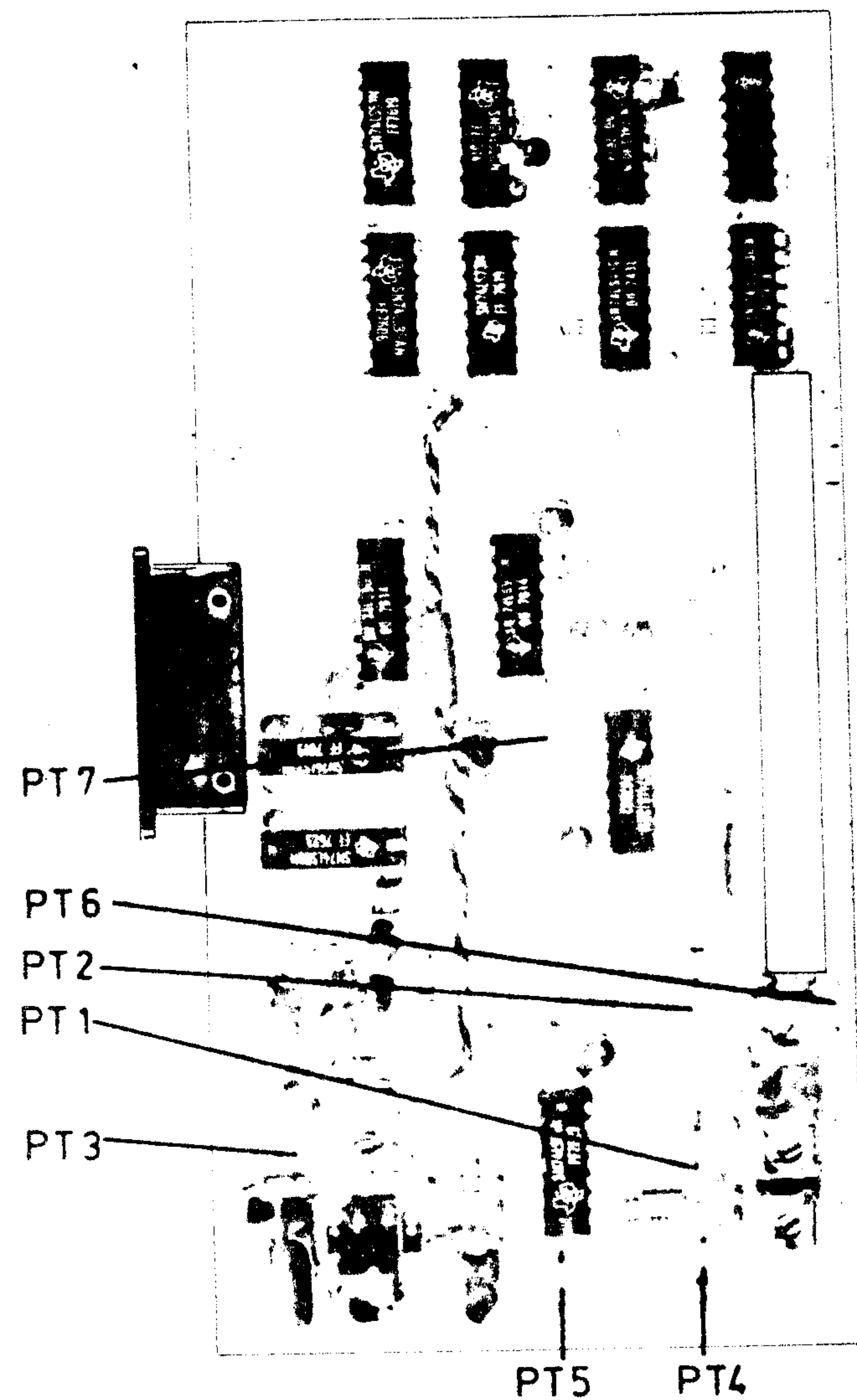
After coarse-tuning by phase/frequency comparator CPF2 (SECOND GENERATION board), the signal provided by oscillator O3 is fed to the linear input of mixer M2, which receives the 4.84/6.8-MHz signal on its switching input.

The subtractive beat is filtered, amplified, and fed to phase/frequency comparator CPF3, which also receives a frequency ranging from 1.16 to 1.199,98 MHz derived from F1 (11.6 to 11.999,8 MHz - FIRST GENERATION) by division by 10.

NOTE : The phase/frequency comparator has an «alarm» circuit that is validated when the oscillator is not locked. The alarm signal acts on a logic circuit in the SECOND GENERATION that controls an LED on the instrument's front panel.

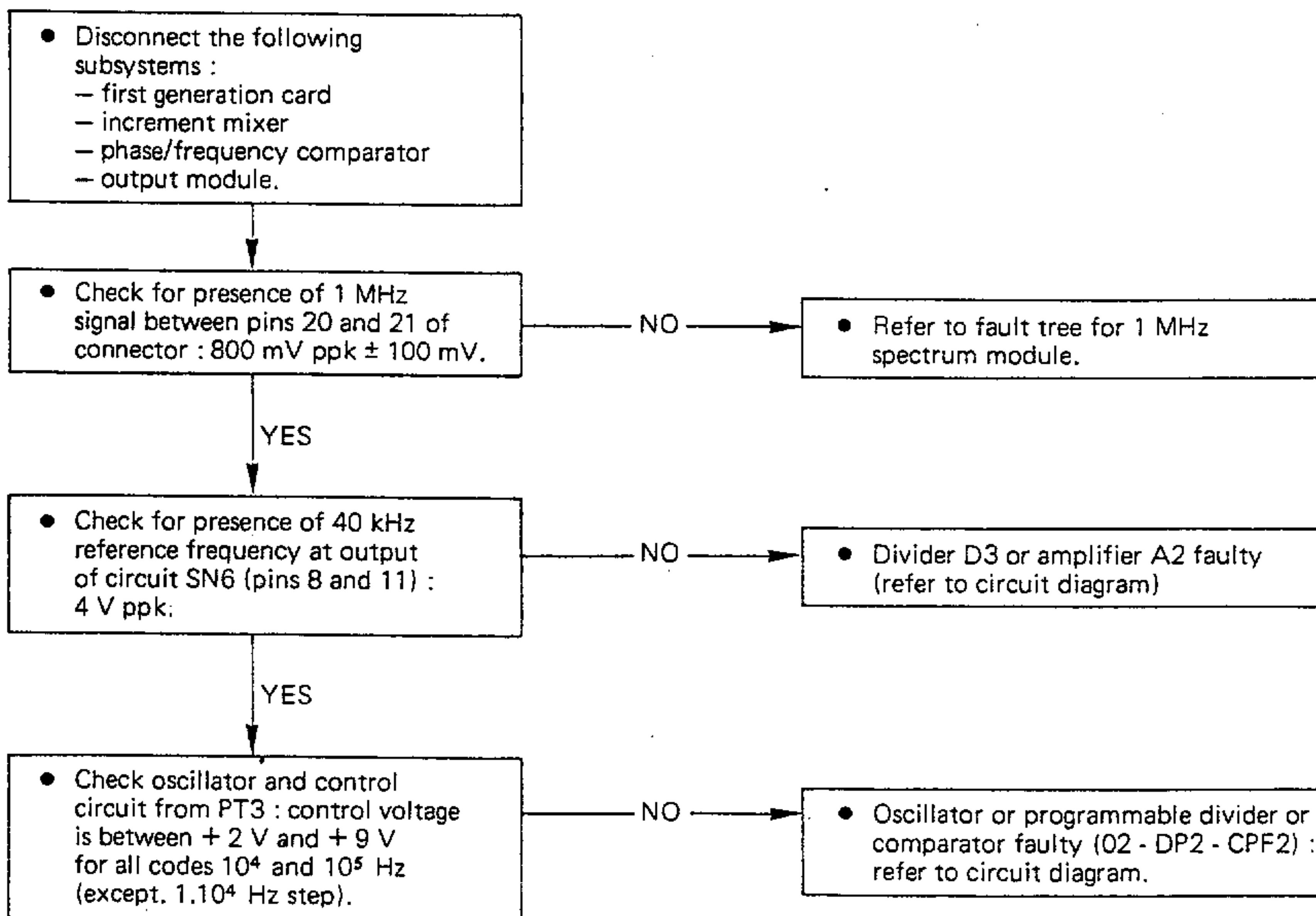
The output signal of the Mixer module, which comes directly from oscillator O3 and includes all the increments of the 10^1 to 10^5 Hz steps, is divided by 2 and fed to CPF6 of the PHASE/FREQUENCY COMPARATOR MODULE.

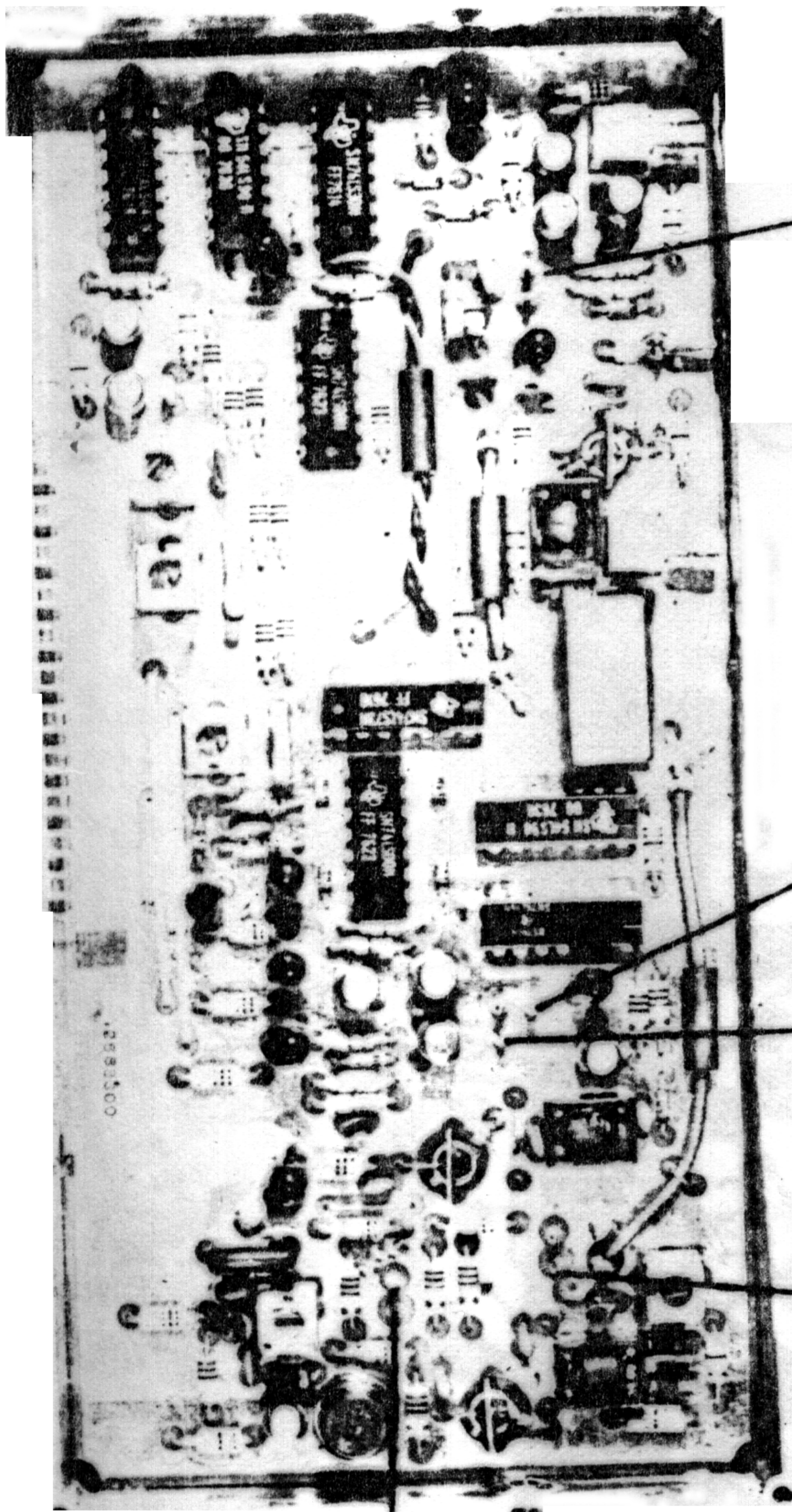




FAULT TREE

SECOND GENERATION CARD





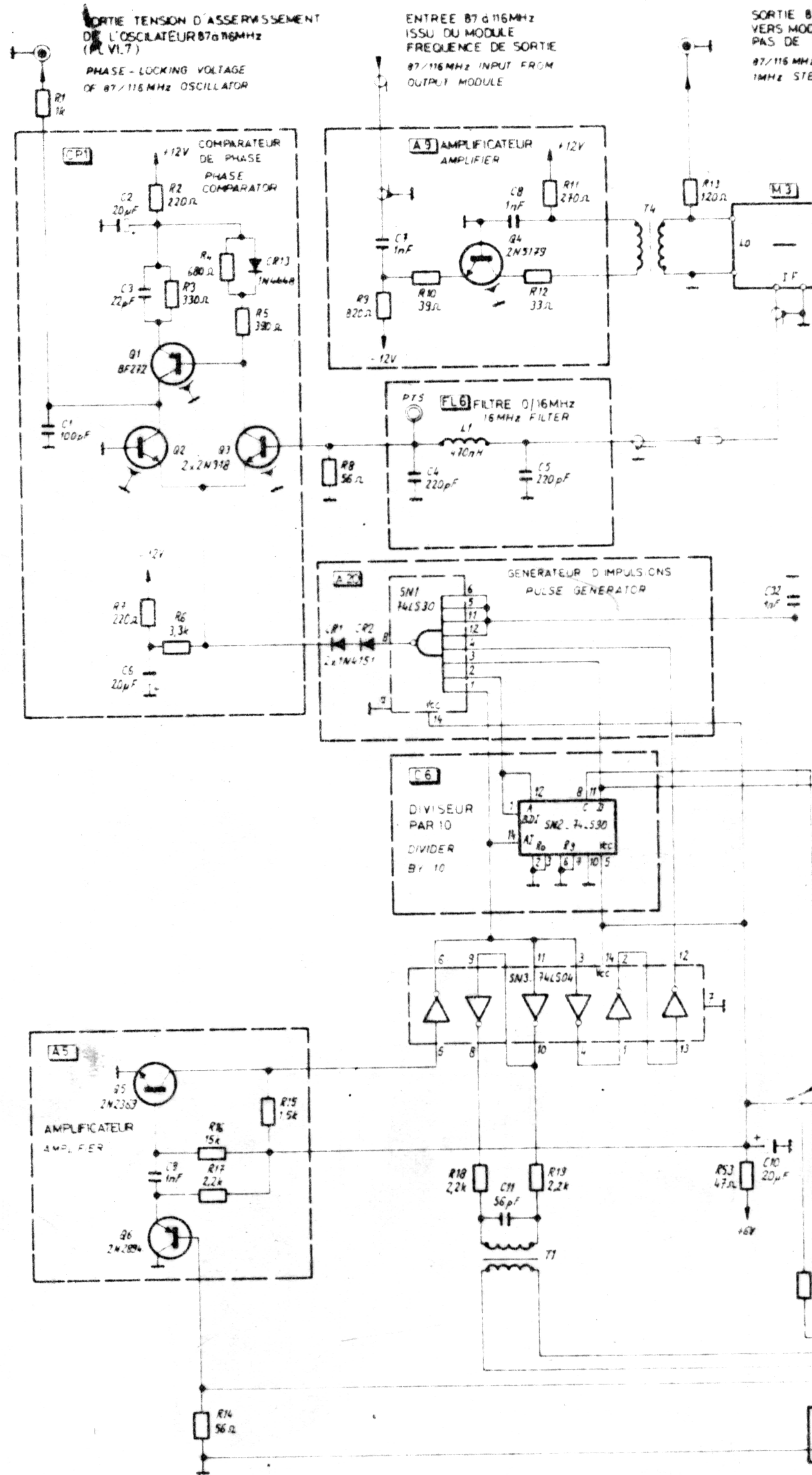
PT5

PT3

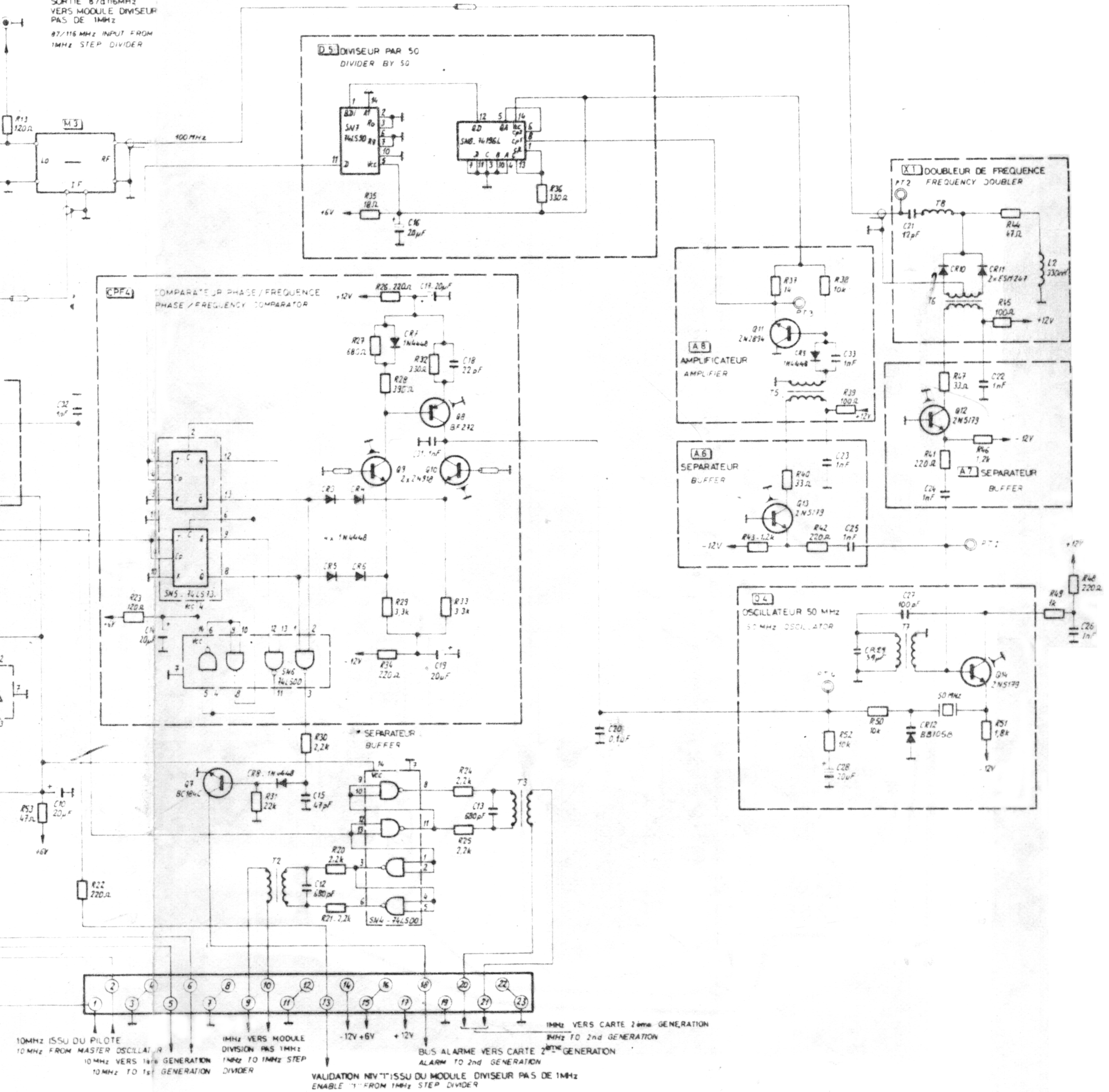
PT4

PT2

PT1



SORTIE 87d116MHz
VERS MODULE DIVISEUR
PAS DE 1MHz
87/116 MHz INPUT FROM
1MHz STEP DIVIDER



CIRCUIT DIAGRAM N° 976883

7 - 1 MHz DIVIDER/LOCK-ON MODULE

Documentation

General description and operating principles.

Fault tree.

Circuit diagram N° 976885.

Wiring and component layout diagram N° 932135
2/2.

Instrument and equipment required

Spectrum analyser.

Frequency meter.

Oscilloscope.

Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

PRINCIPLE OF THE 1-MHz-STEPS DIVIDER/LOCKING MODULE

The 1-MHz STEPS DIVIDER MODULE generates the increments corresponding to the 10^6 Hz and 10^7 Hz steps. These are selected either by two decimal switches or by an external program.

Figure IV.9 shows the principle of the 1-MHz STEPS DIVIDER/MASTER OSCILLATOR LOCKING MODULE and Plate N° 976885 is its circuit diagram.

116 as a function of the decimal-switch settings or external program. The signal is fed after this division to phase/frequency comparator CPF5 and to logic circuit L, both of which also receive a 100-kHz reference derived from the 10 MHz of the master oscillator by division by 100.

Unlike the phase/frequency comparators of other

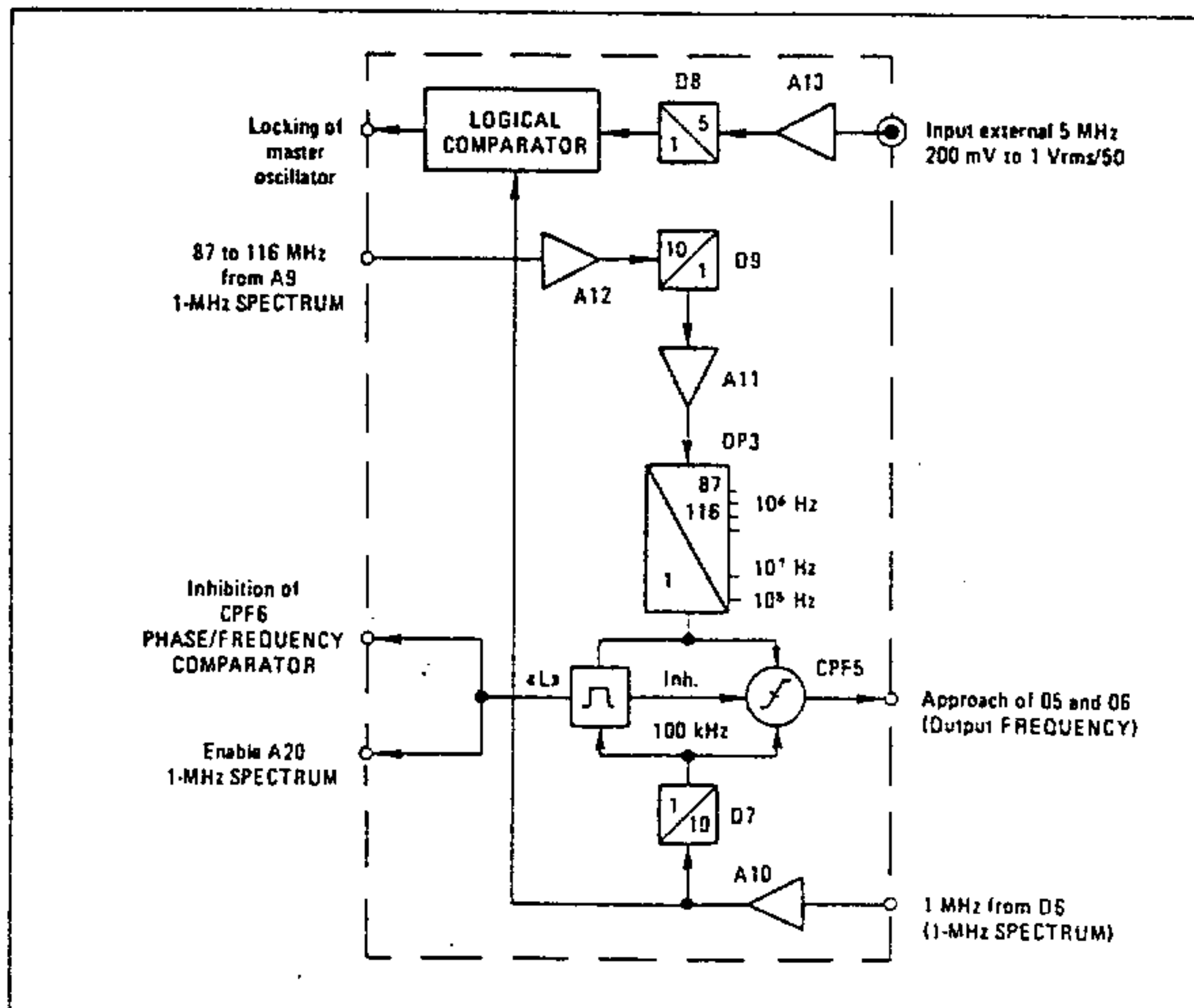
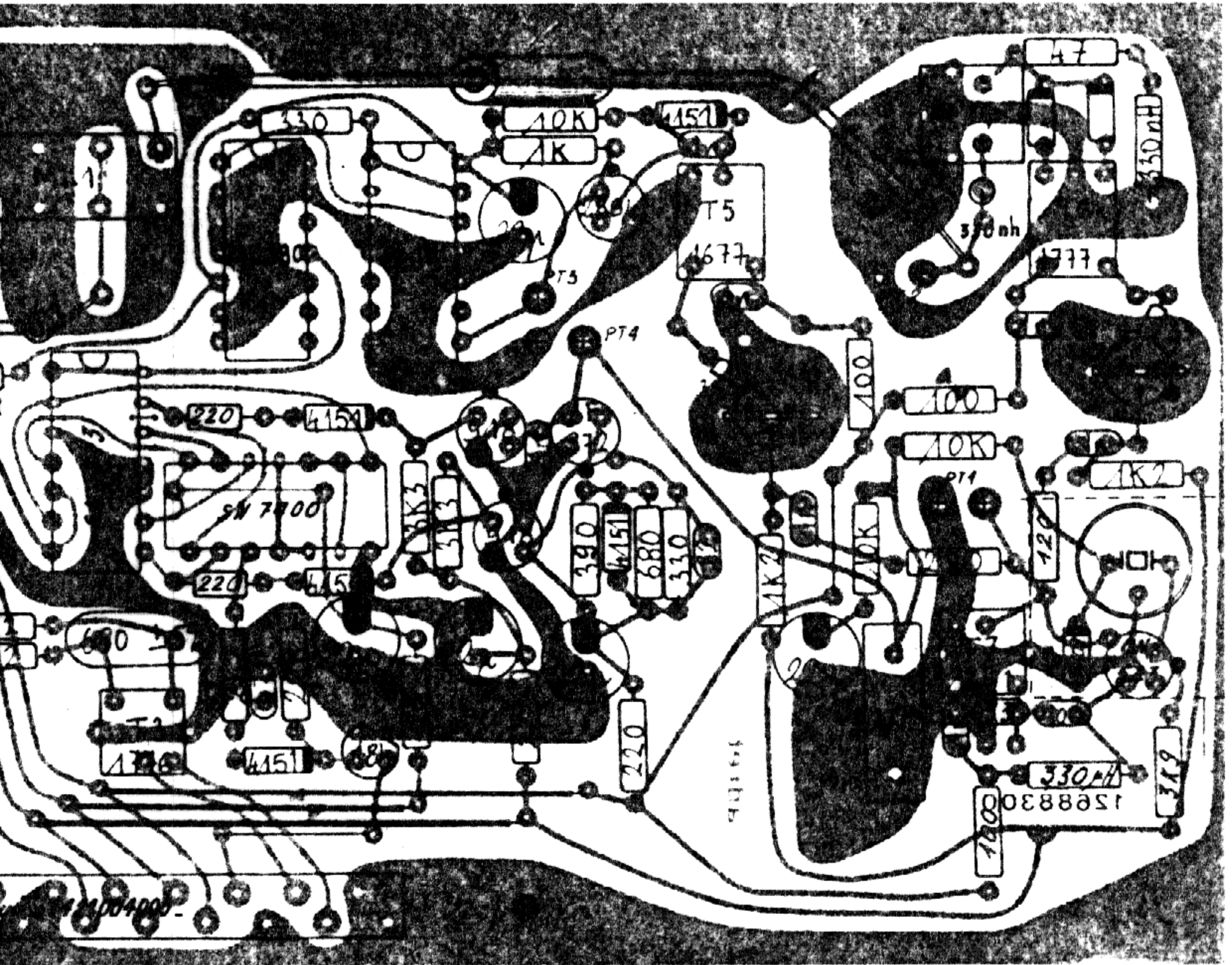


FIGURE IV.9 :
Principle of the 1-MHz-Steps Divider/
Locking module.

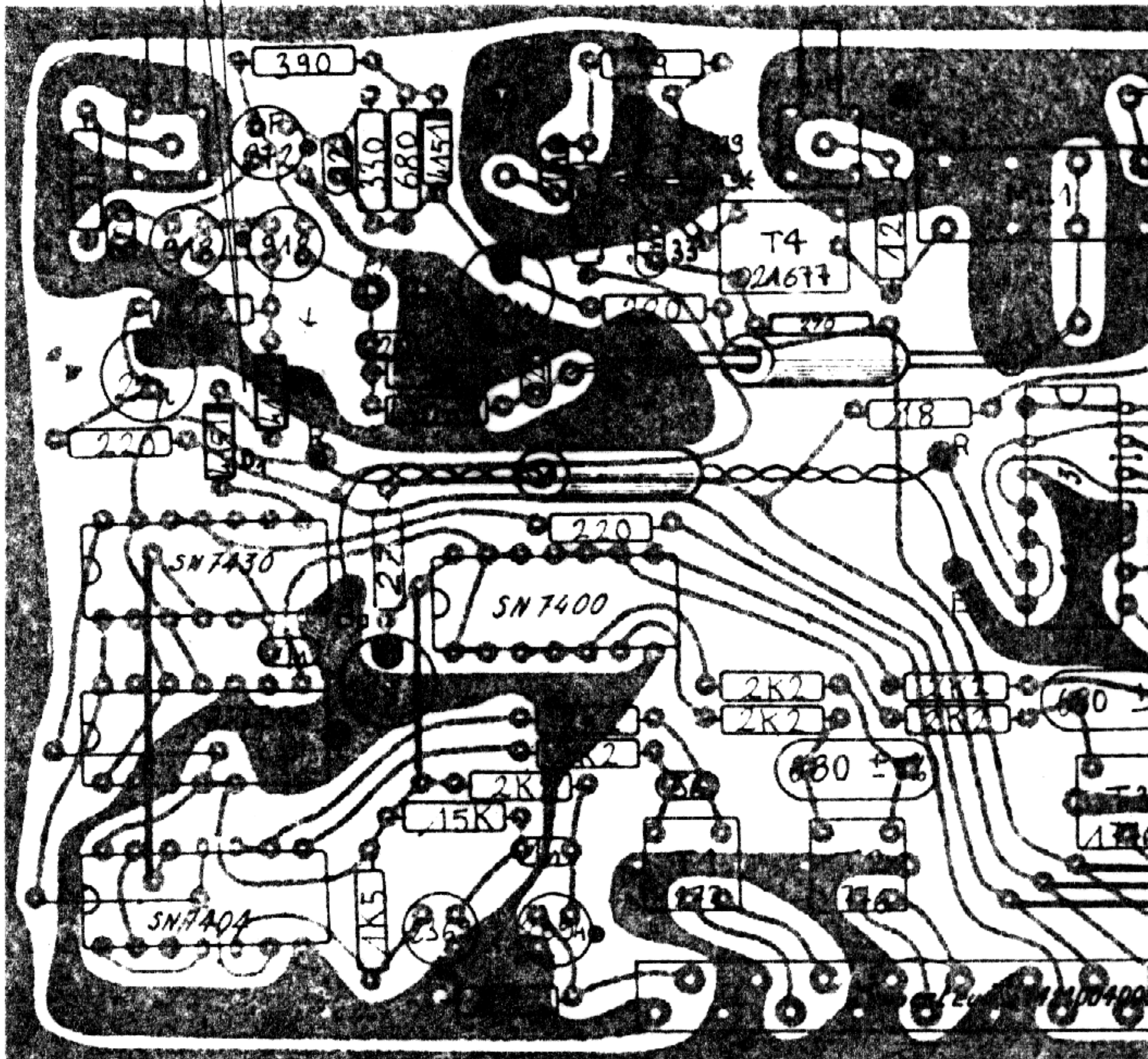
1-MHz STEPS DIVIDER

The 1-MHz steps are generated by oscillator 05, which provides a frequency ranging from 87 to 116 MHz (Output Frequency Module). This frequency is amplified by A9 and A12 and divided by 10 in D9. The output signal of D9 is fed to programmable divider DP3, the divisor of which ranges from 87 to

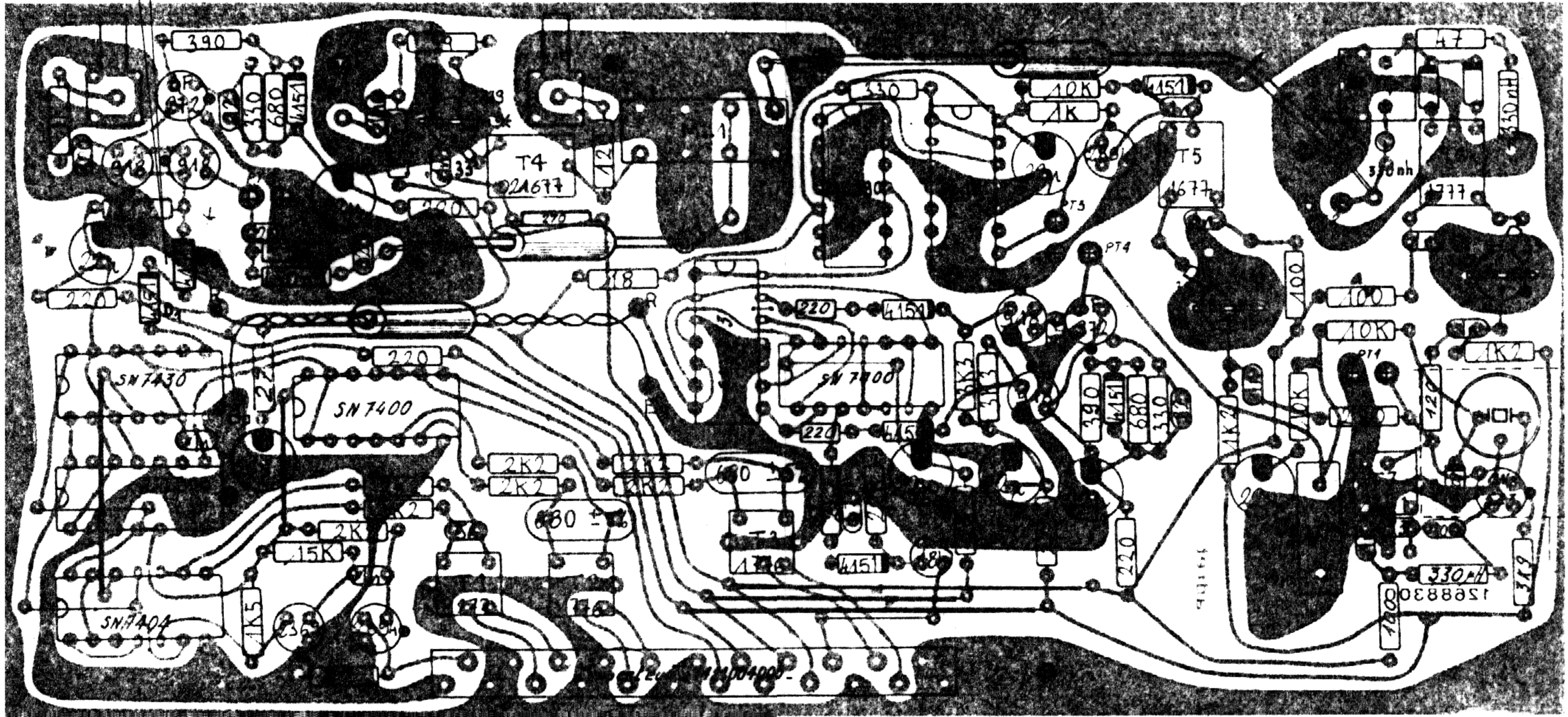
control loops, CPF5 is not used to maintain oscillator 05. When the output frequency of the 87/116 divider is equal to the 100-kHz reference, monostable L inhibits CPF5 and enables phase comparator CP1, which controls oscillator 05 and constitutes together with CPF5 the coarse-tuning control of the 90/119.99,99-MHz output oscillator.



D1 and D2 must be type 1N4151

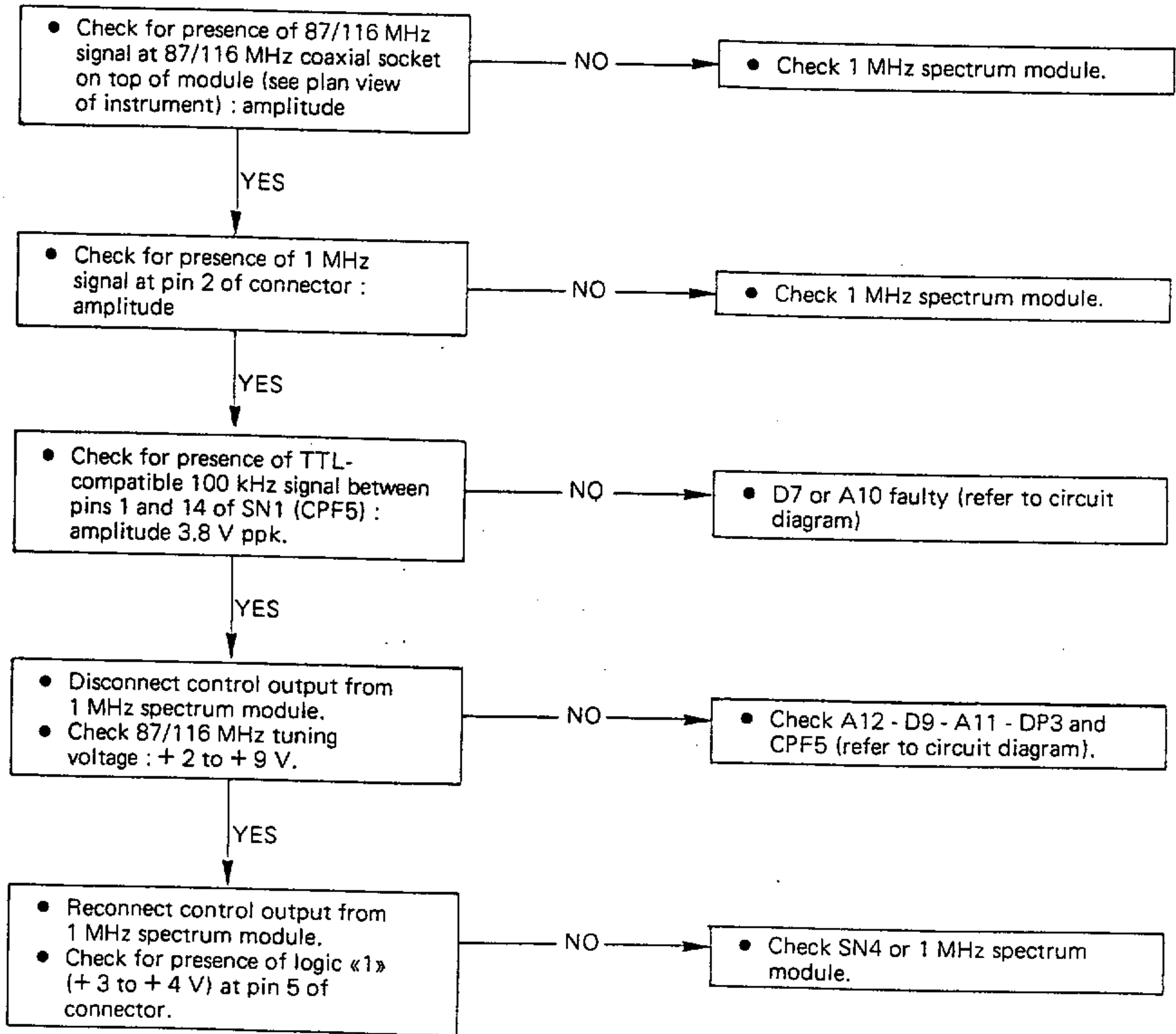


D1 and D2 must be type 1N4151



FAULT TREE

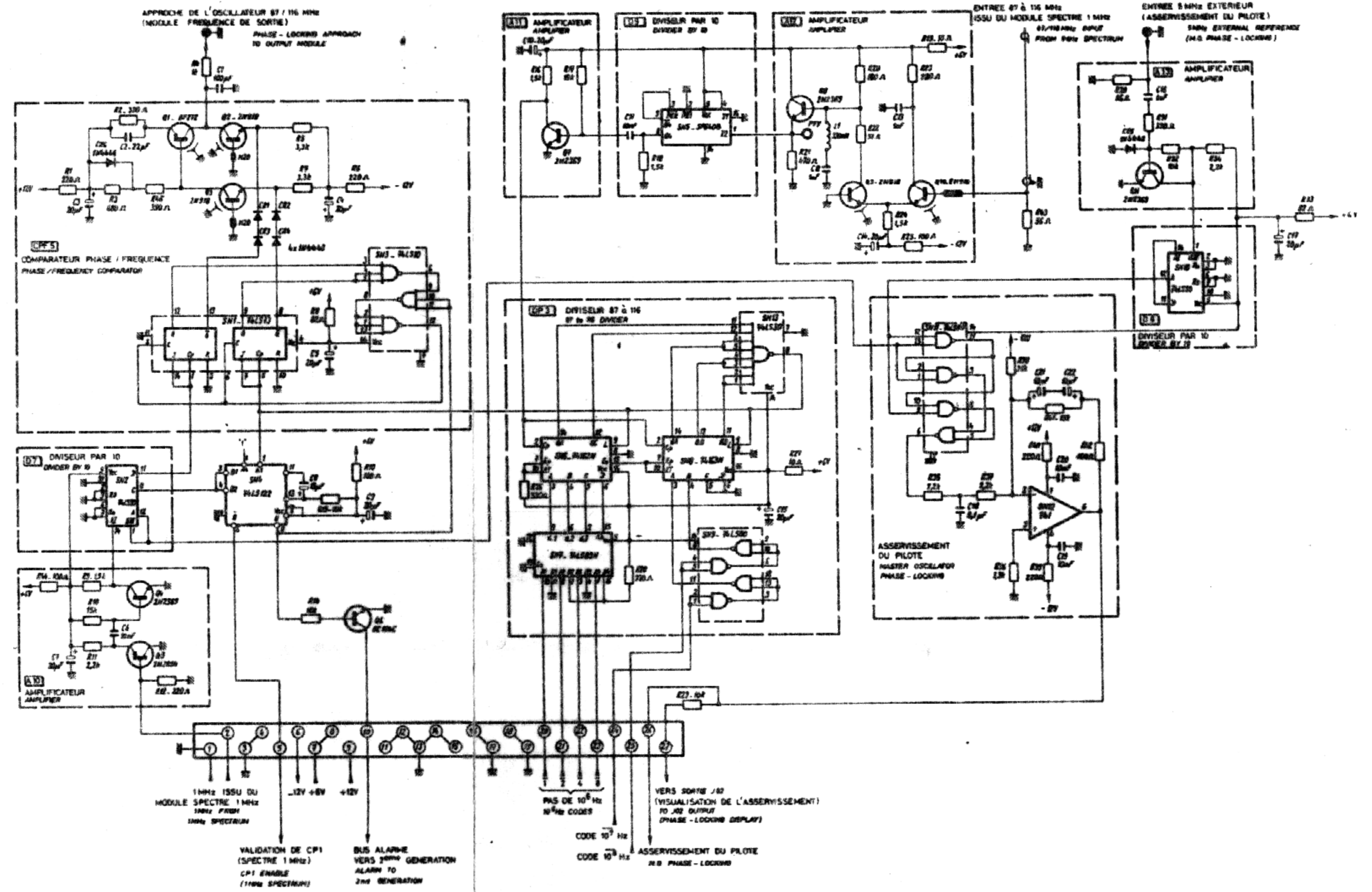
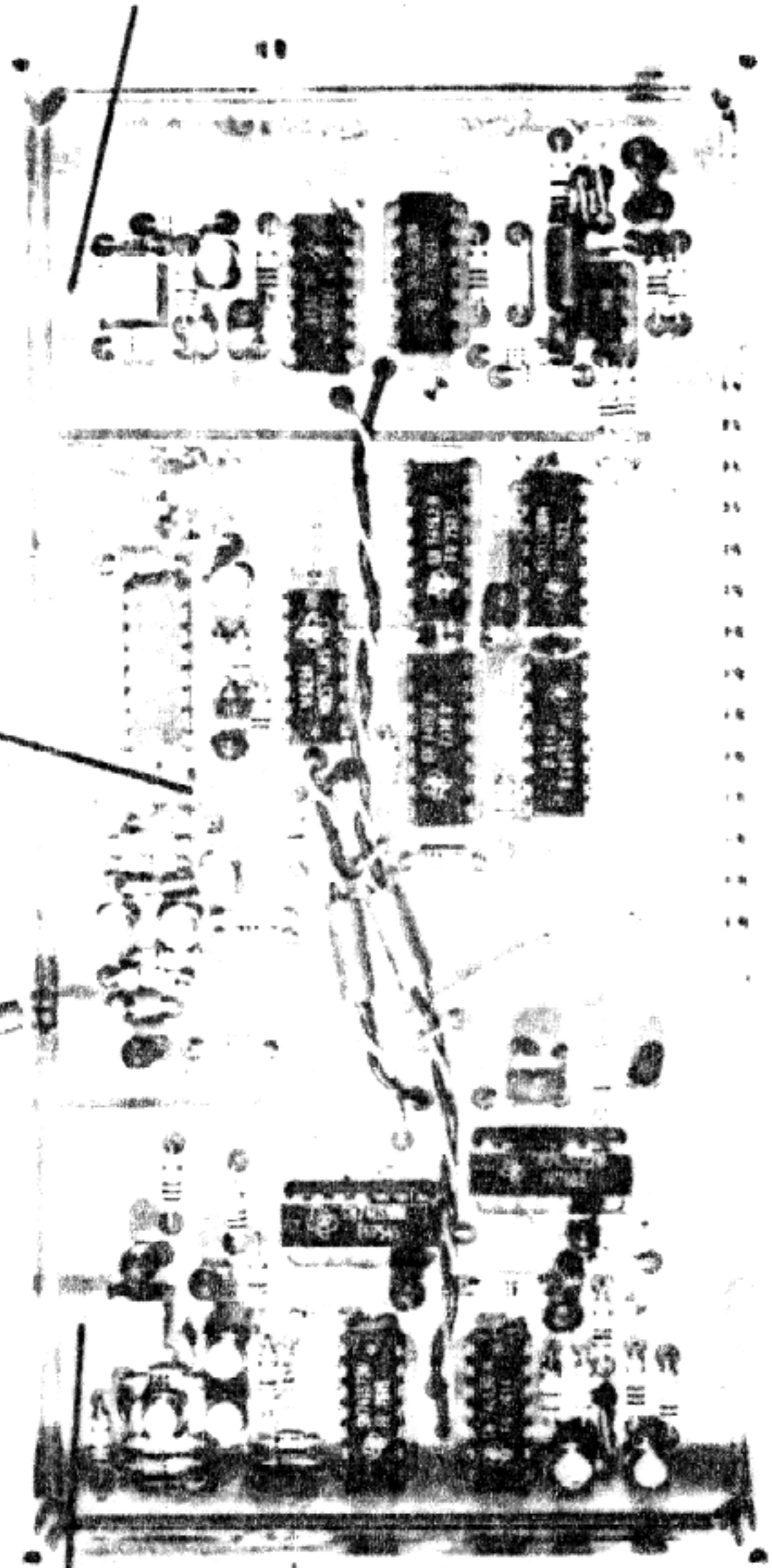
1 MHz STEP DIVIDER



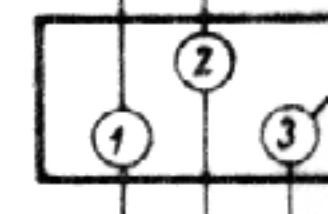
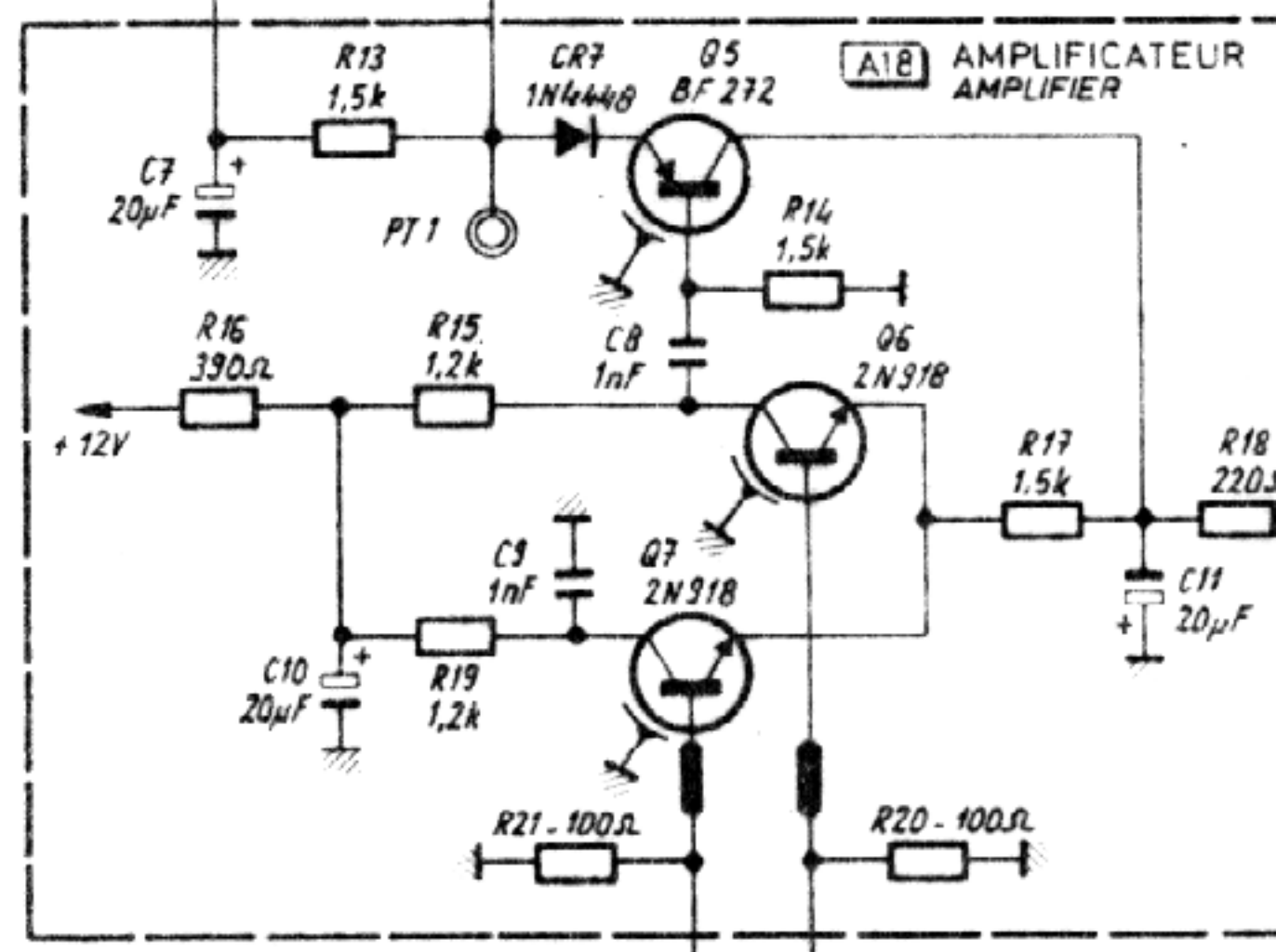
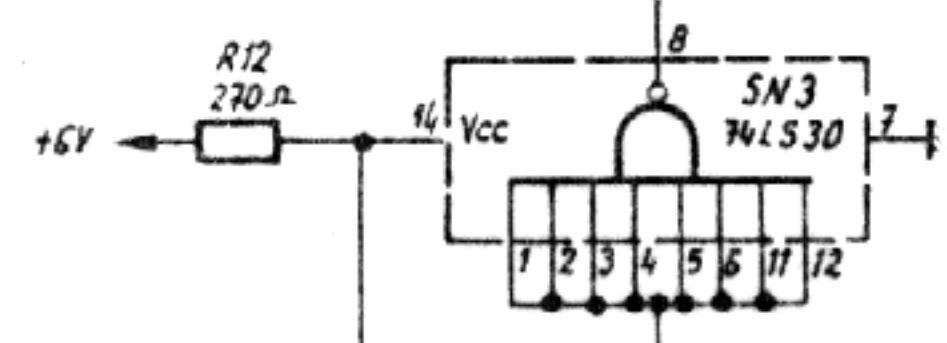
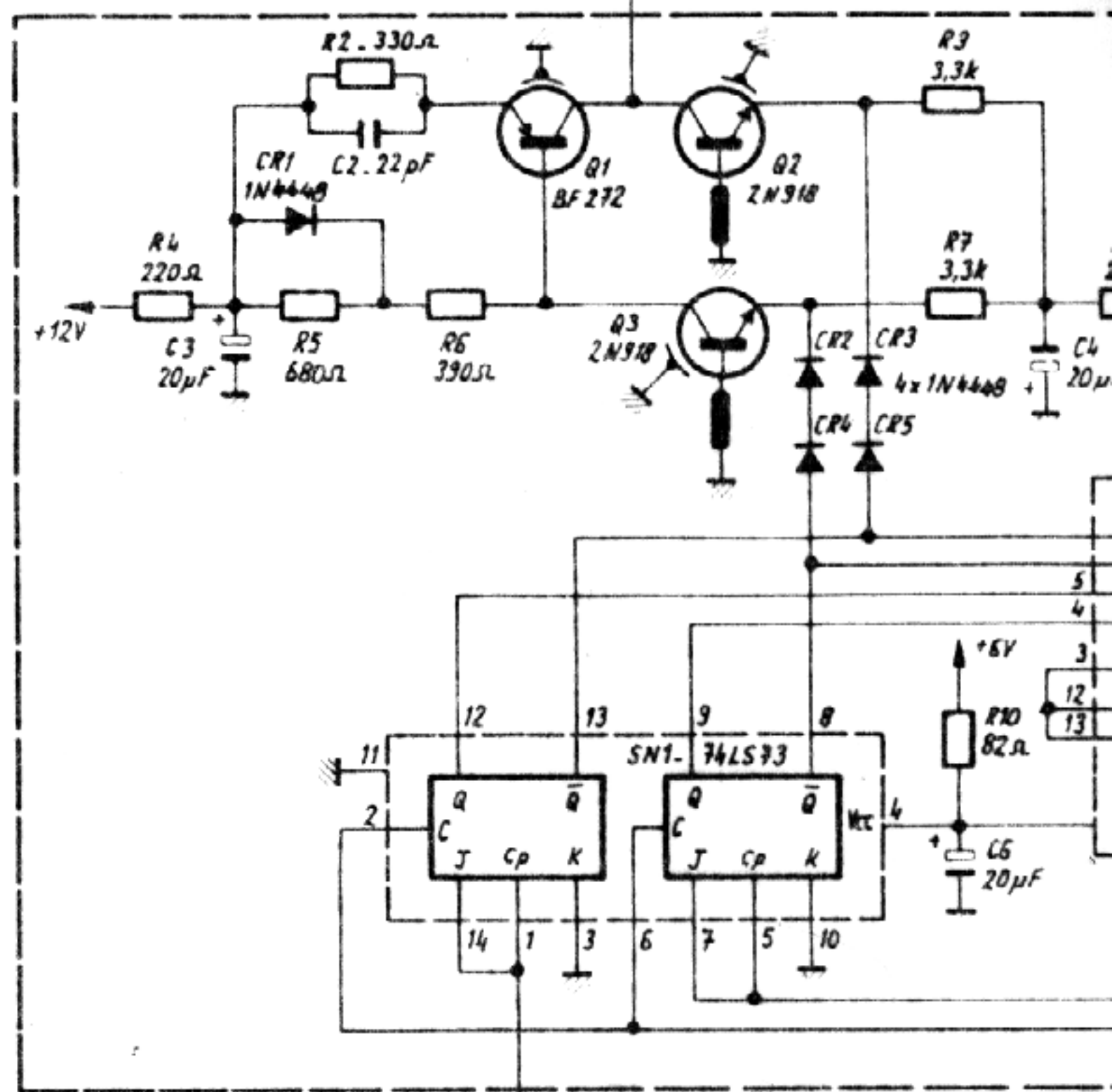
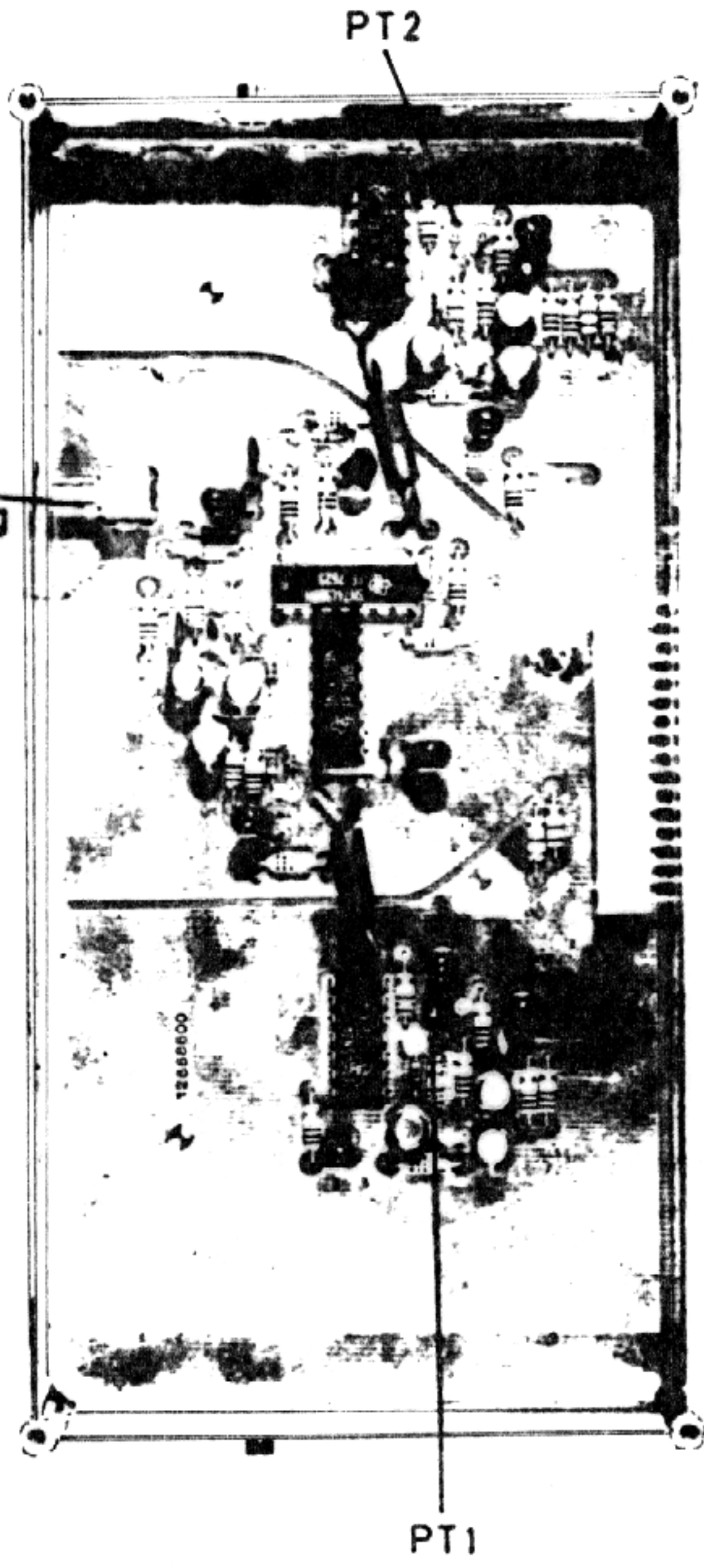
5 MHz external reference

PT1

Phase locking approach to output module

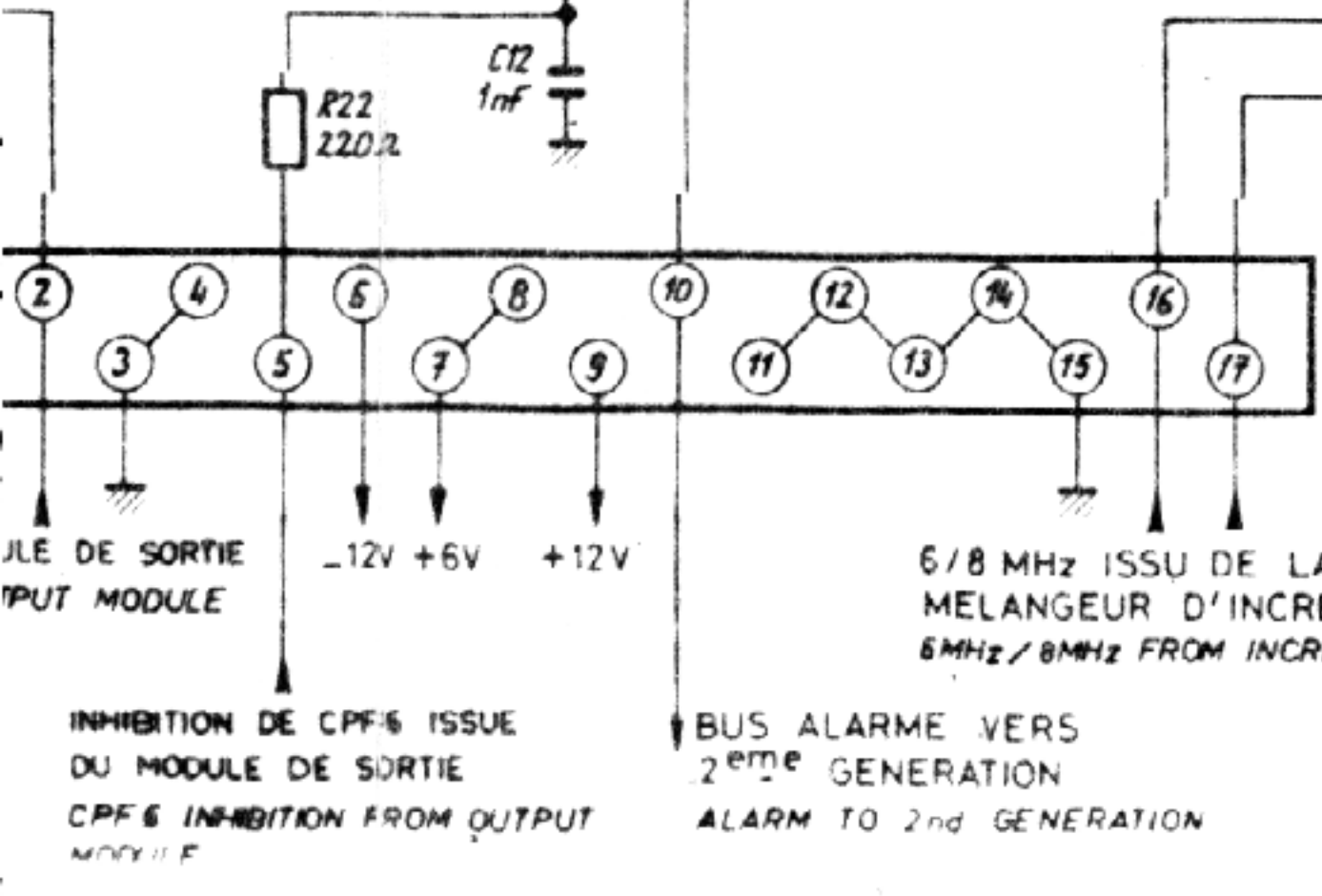
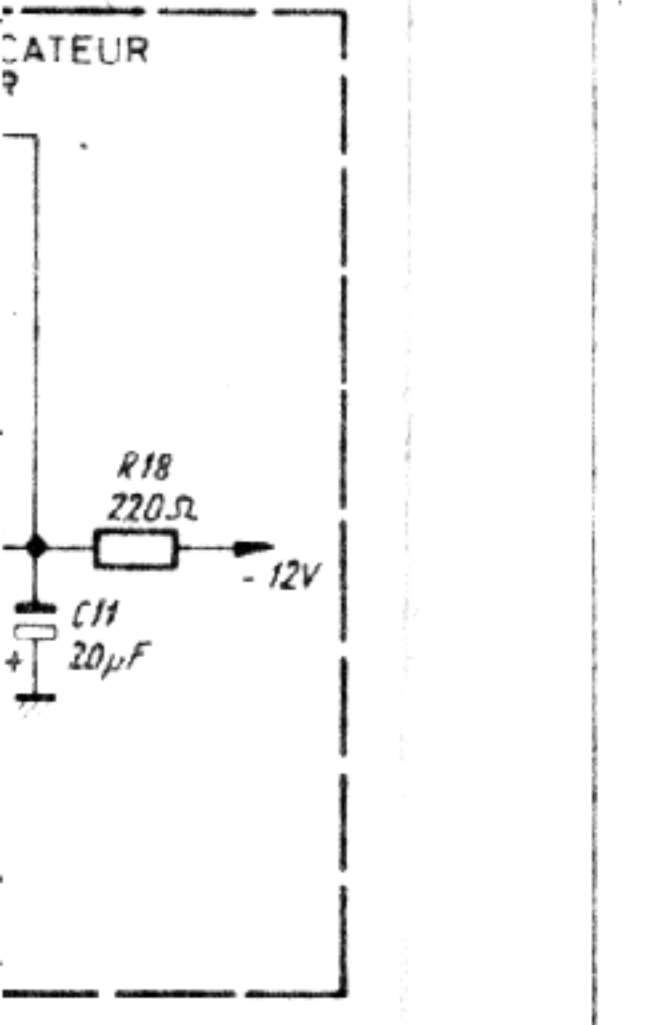
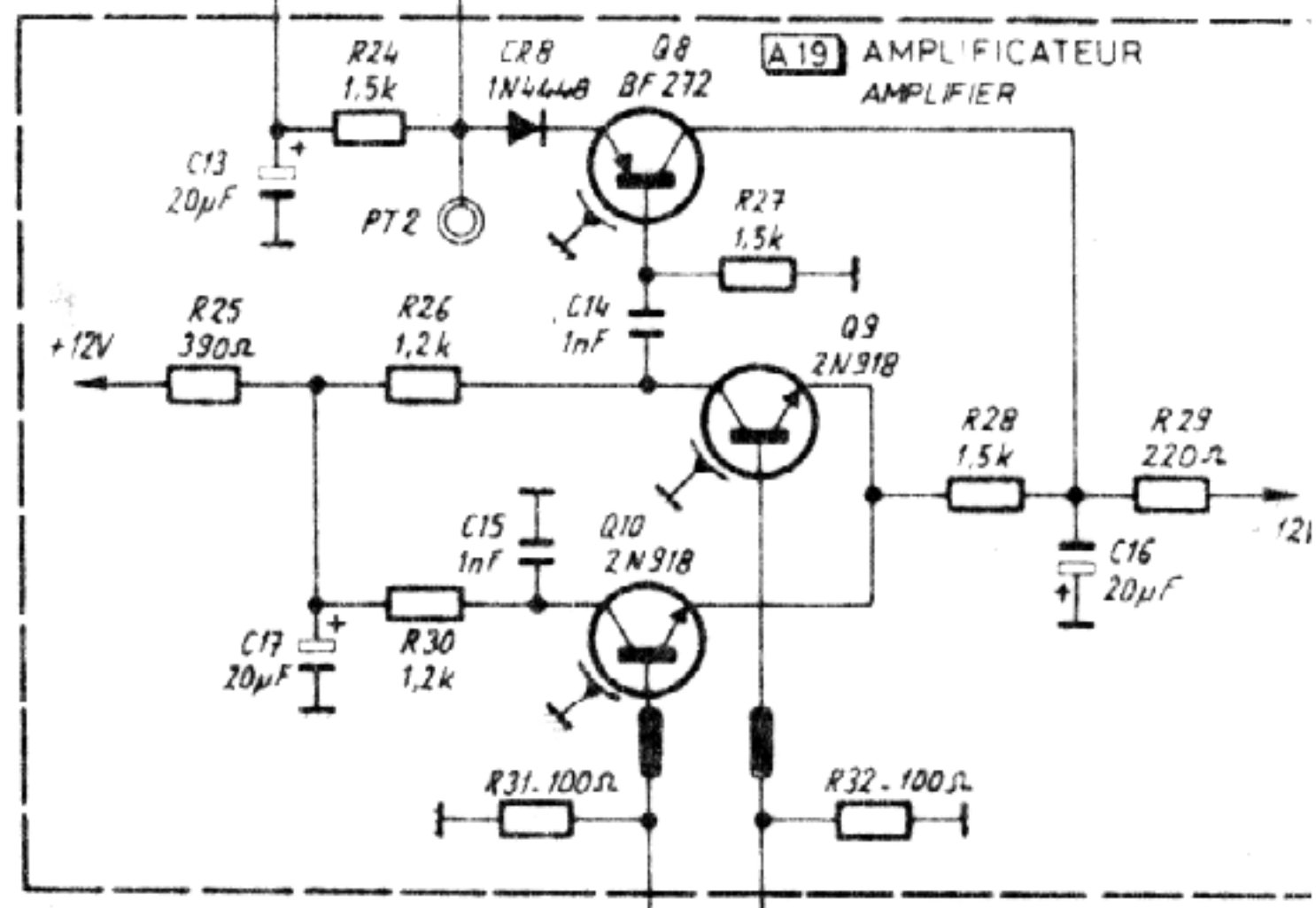
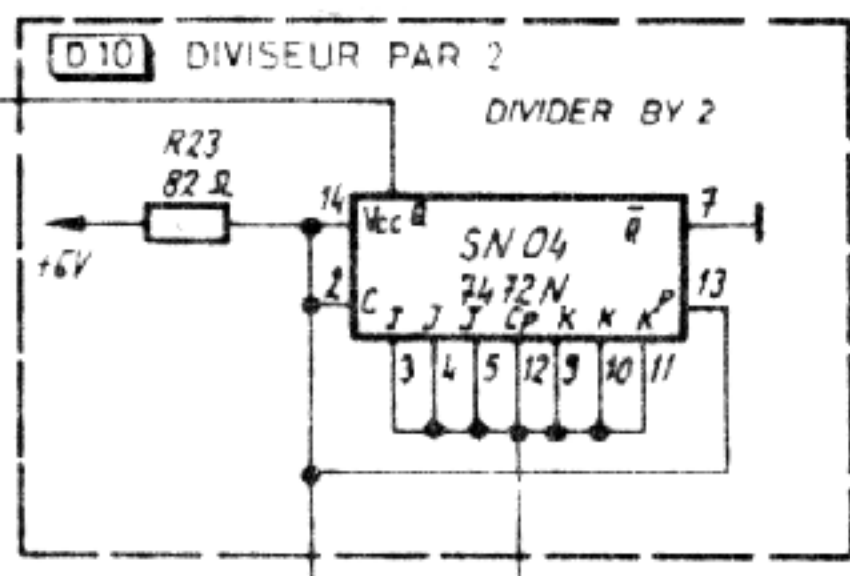
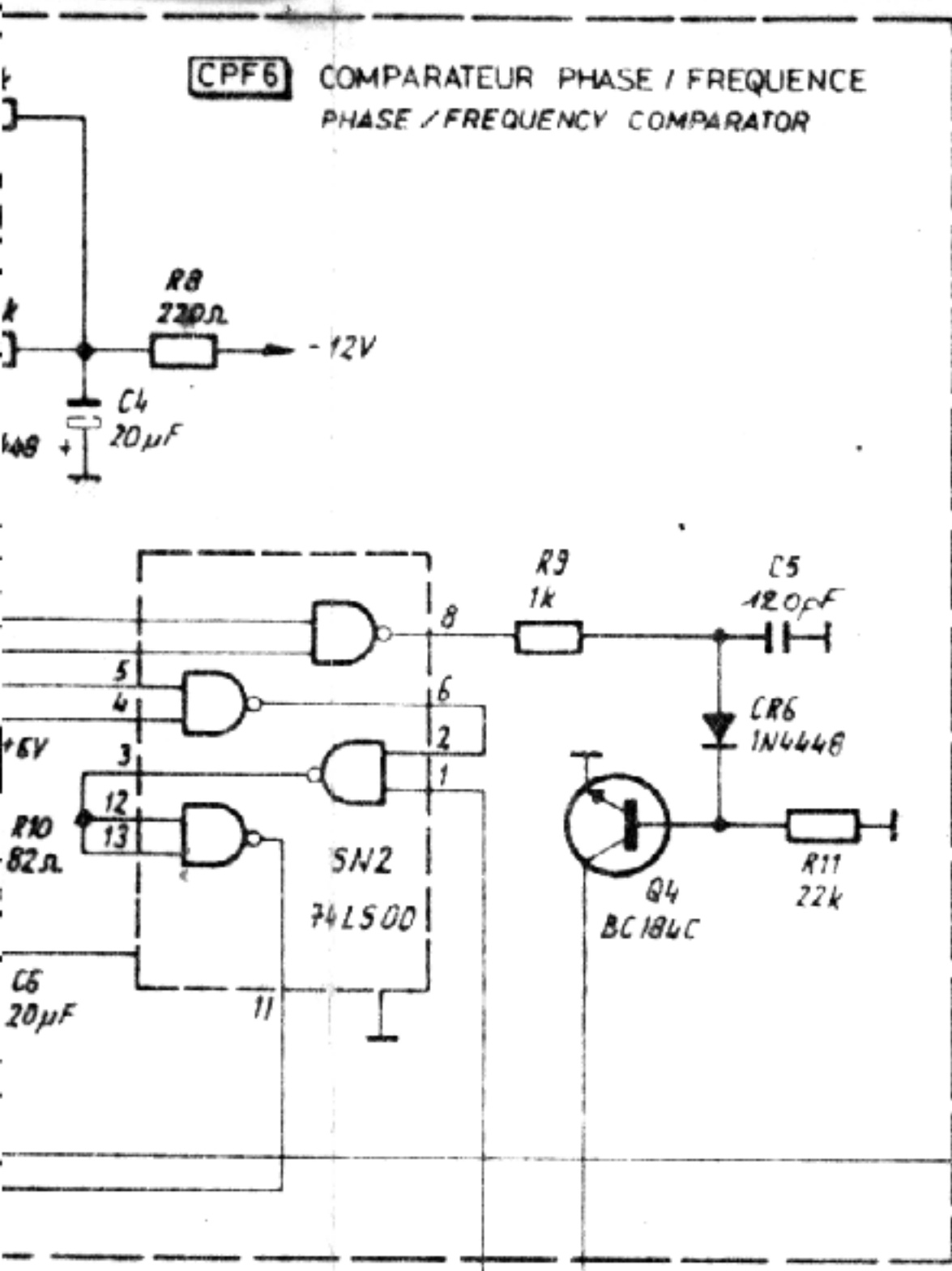


06
Phase-Locking



3/4 MHz ISSU DU MODULE DE S
3MHz/4MHz FROM OUTPUT MOD

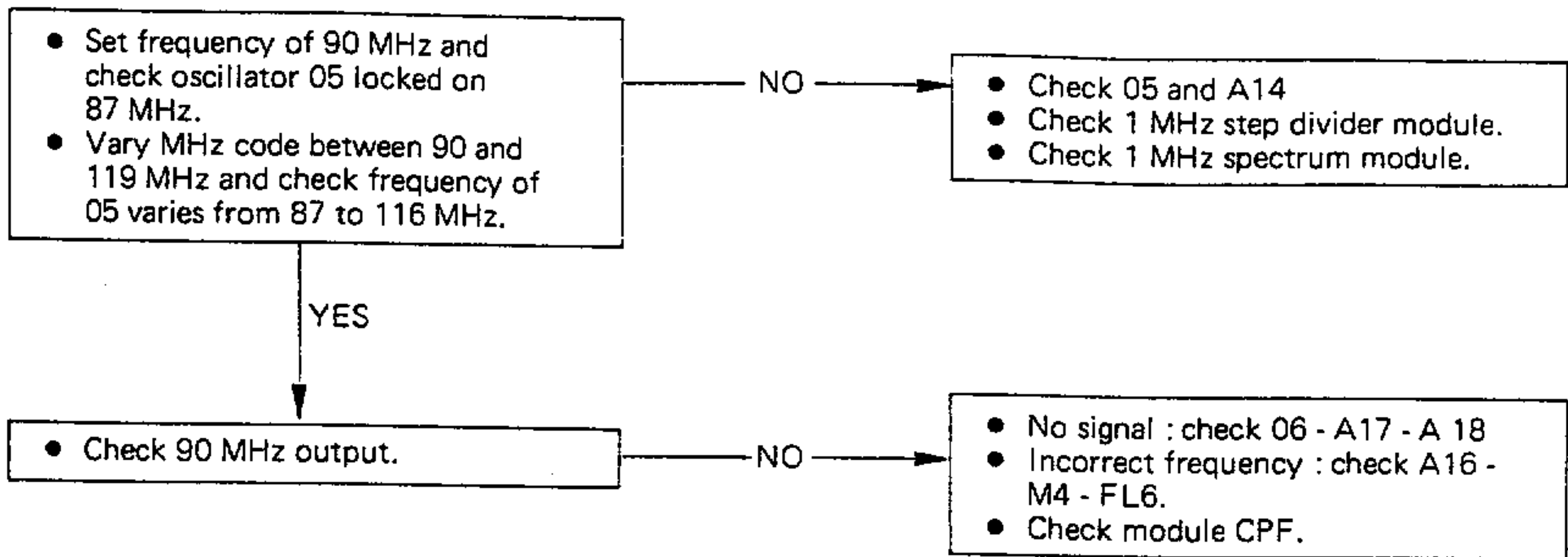
INHIB
DU M
CPF 6
MOD



6/8 MHz ISSU DE LA CARTE
MELANGEUR D'INCREMENTS
6MHz / 8MHz FROM INCREMENT MIXER

**PHASE-FREQUENCY COMPARATOR MODULE
CIRCUIT DIAGRAM N° 976886**

OUTPUT MODULE



control oscillator 06 and at the same time incorporate the 10^1 Hz to 10^5 Hz increments into the output signal.

The DC output voltage of CPF6 controls oscillator 06 so as to maintain the equilibrium of the loop at a frequency that is the sum of the frequency of oscillator 05 and the frequency from the INCREMENT

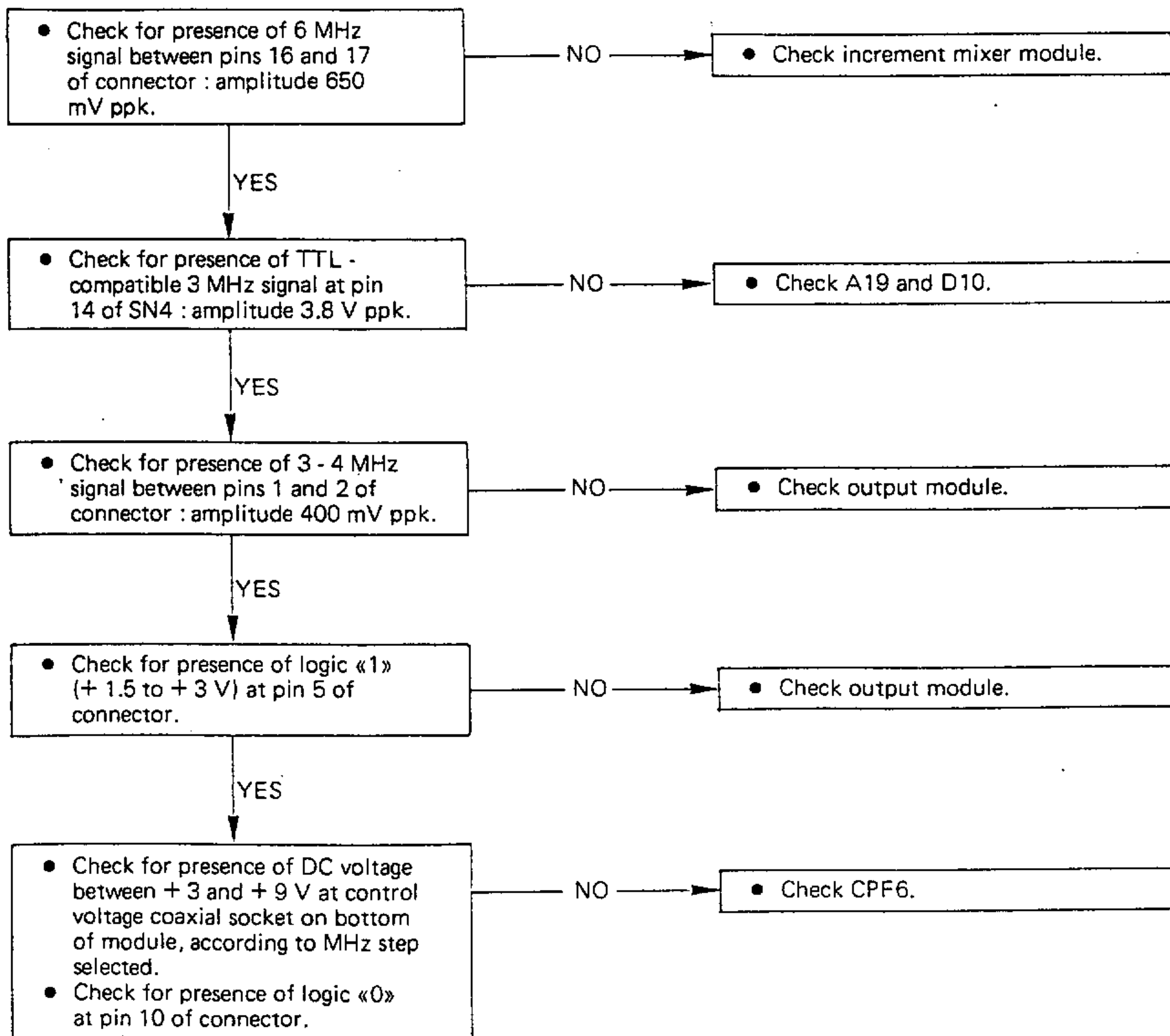
MIXER MODULE (which includes the 10^1 Hz to 10^5 Hz) increments :

$$F(06) = 87/116 \text{ MHz} + 3/3.999,99 \text{ MHz} = 90/119,999,99 \text{ MHz}$$

NOTE : The phase/frequency comparator has an «alarm» circuit that is validated when the oscillator is not locked. The alarm acts on a logic circuit in the SECOND GENERATION that controls an LED on the instrument's front panel.

FAULT TREE

PHASE-FREQUENCY COMPARATOR MODULE



8 - PHASE-FREQUENCY COMPARATOR MODULE

Documentation

General description and operating principles.

Fault tree.

Circuit diagram N° 976886 - 976887.

Wiring and component layout diagram N° 932136
2/2, 932137 C 2/2, 932138 C 2/2, 932139 B.

Instruments and equipment required

Oscilloscope.

Frequency meter.

Spectrum analyser.

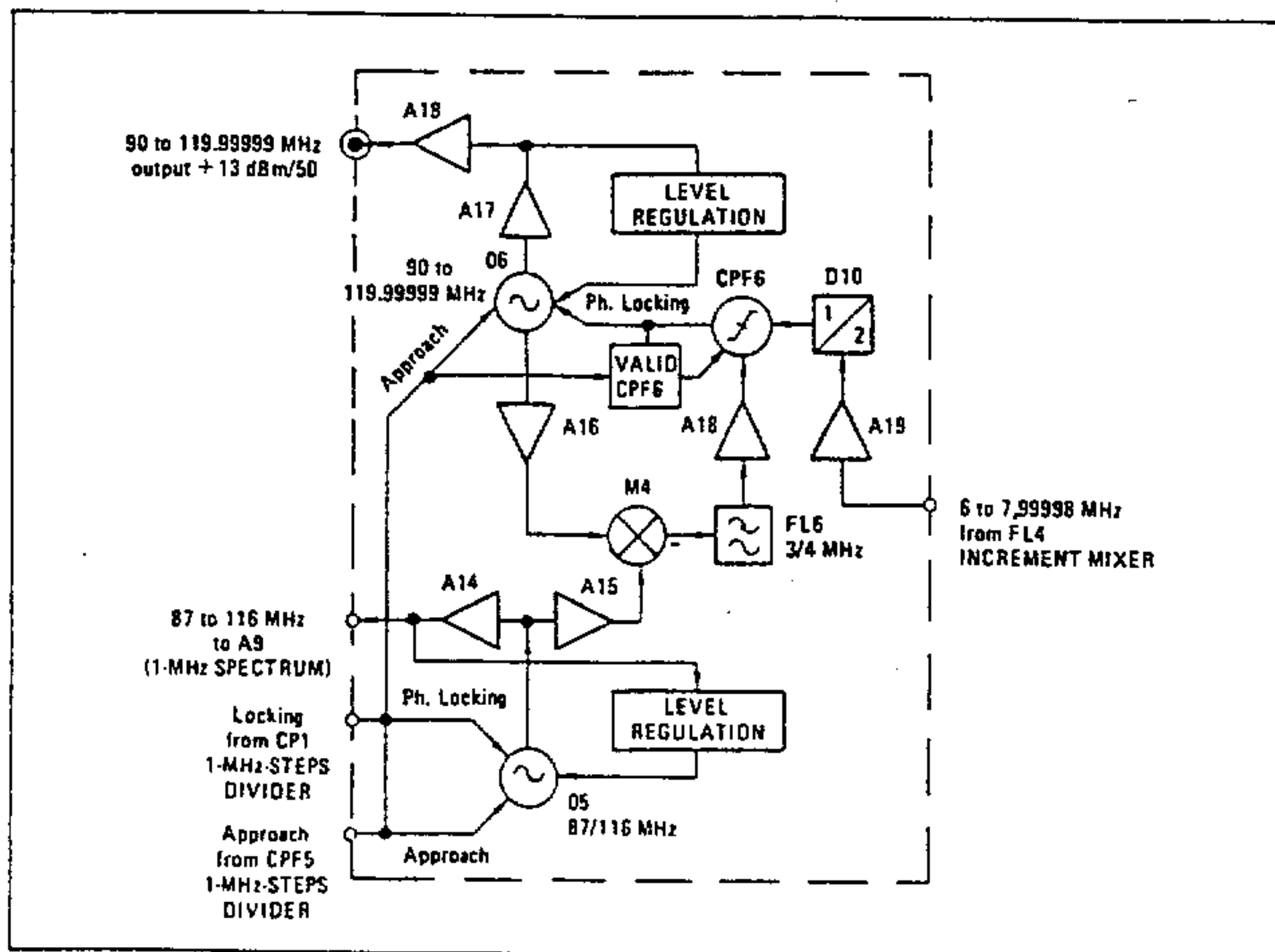
Carry out the checks indicated on the fault tree referring to the circuit diagram and wiring and component layout diagrams where necessary.

PRINCIPLE OF THE OUTPUT FREQUENCY AND PHASE/FREQUENCY COMPARATOR MODULES

These two modules constitute the control loop of output oscillator 06.

Figure IV.14 shows their principle of operation and Plates VI.7 and VI.8 are circuit diagrams of them.

FIGURE IV.14 : Principle of the Output Frequency and CPF modules.



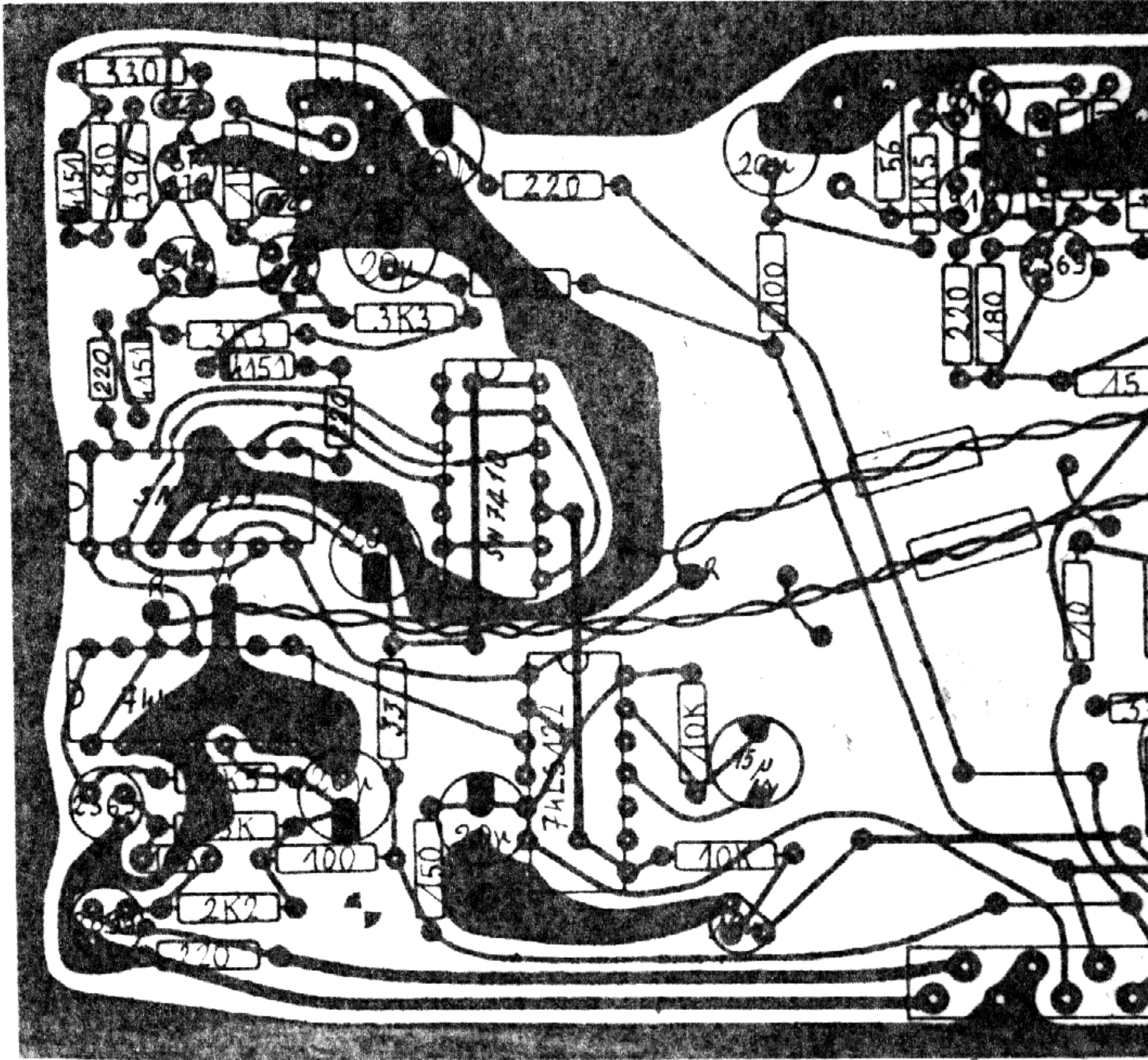
Since the control of oscillator 05 has been described earlier, in sections VI.5 and VI.6, this section is limited to control of output oscillator 06.

This oscillator, coarse-tuned by phase comparator CP1 in the 1-MHz SPECTRUM MODULE, provides a frequency that varies roughly about that of oscillator 05.

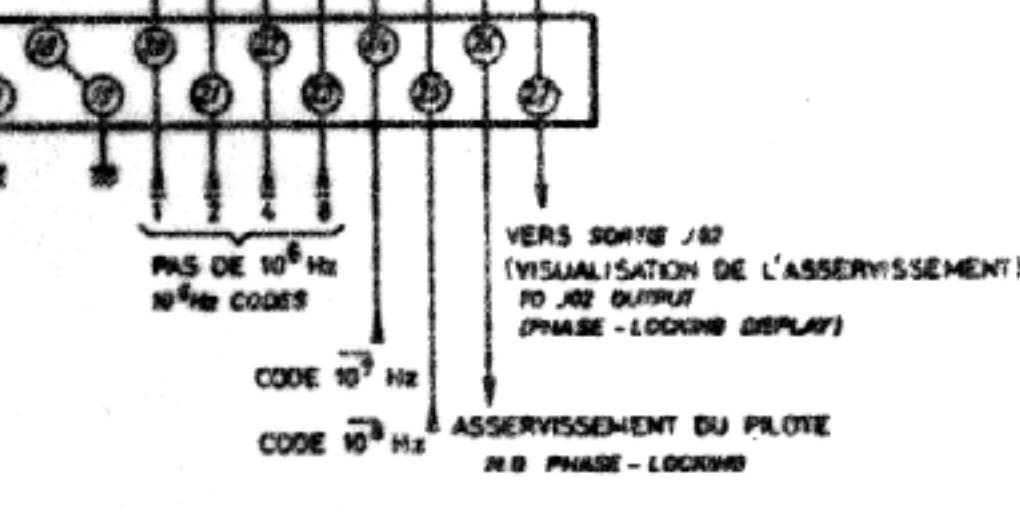
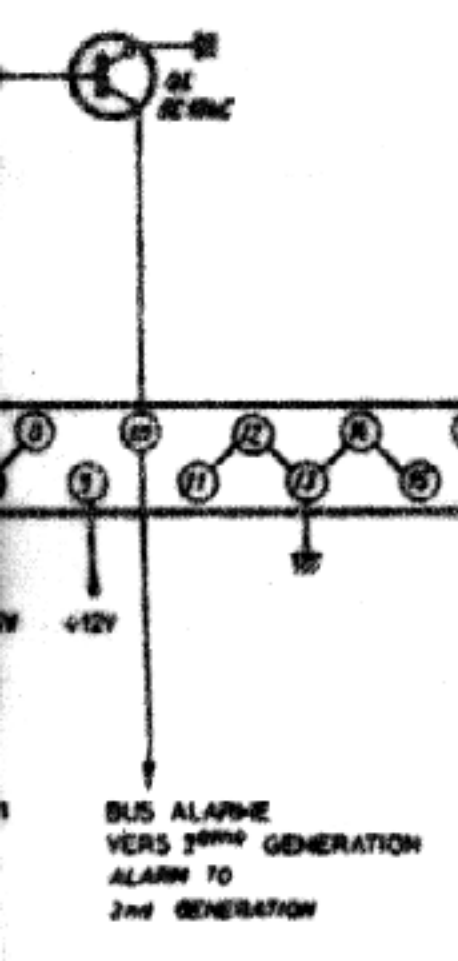
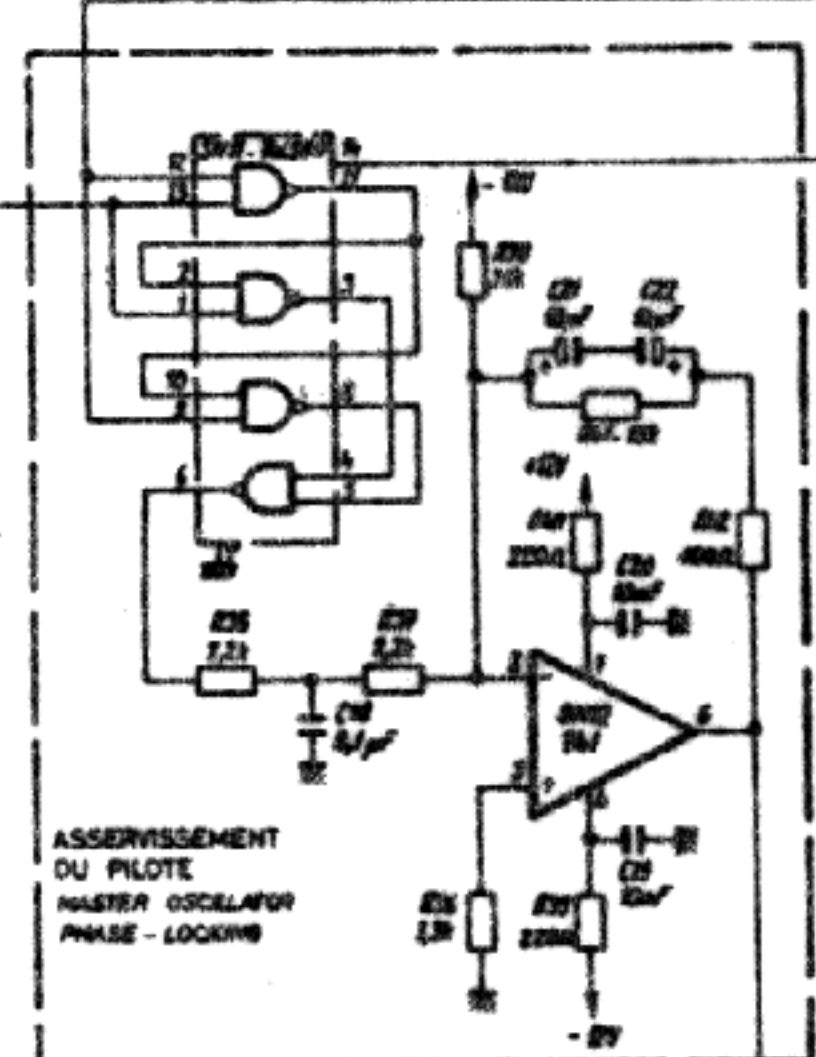
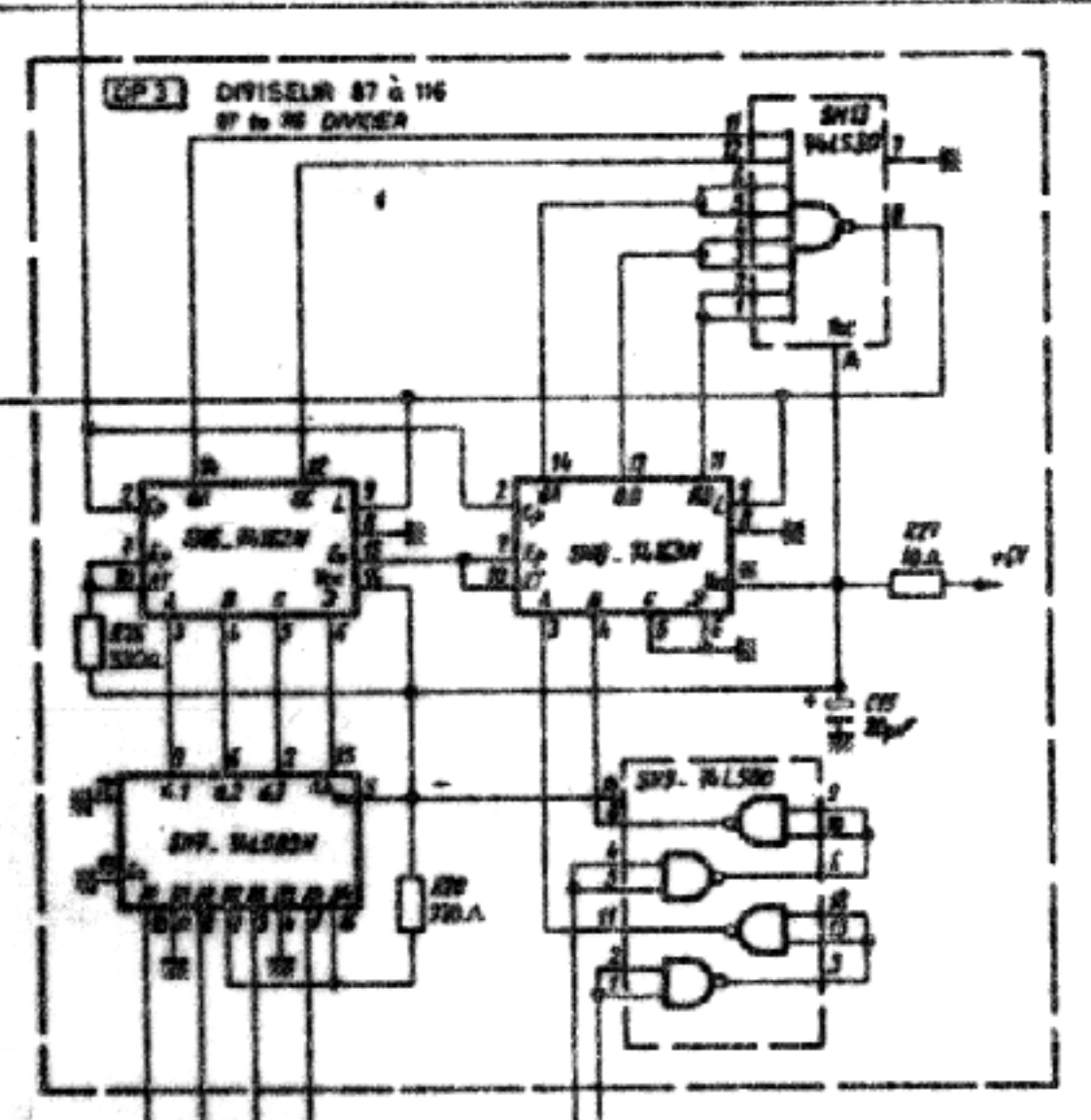
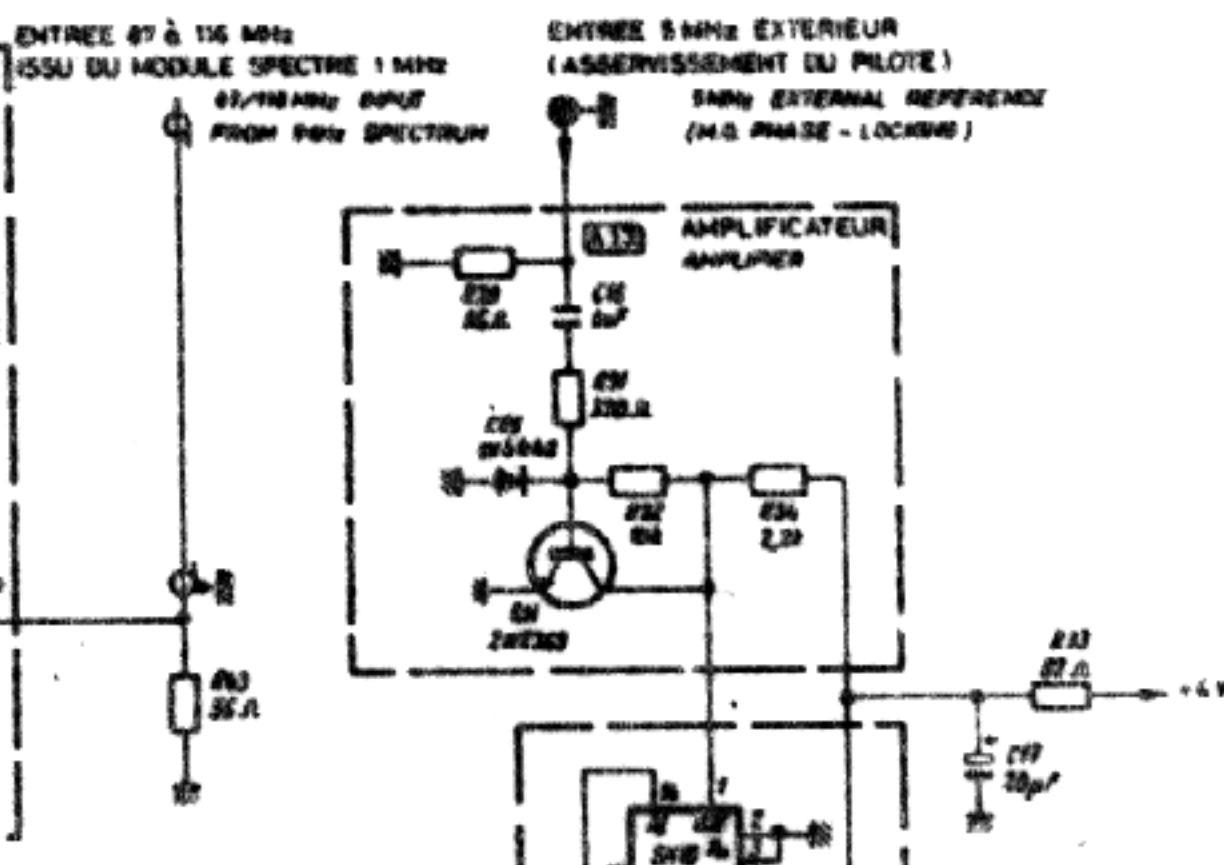
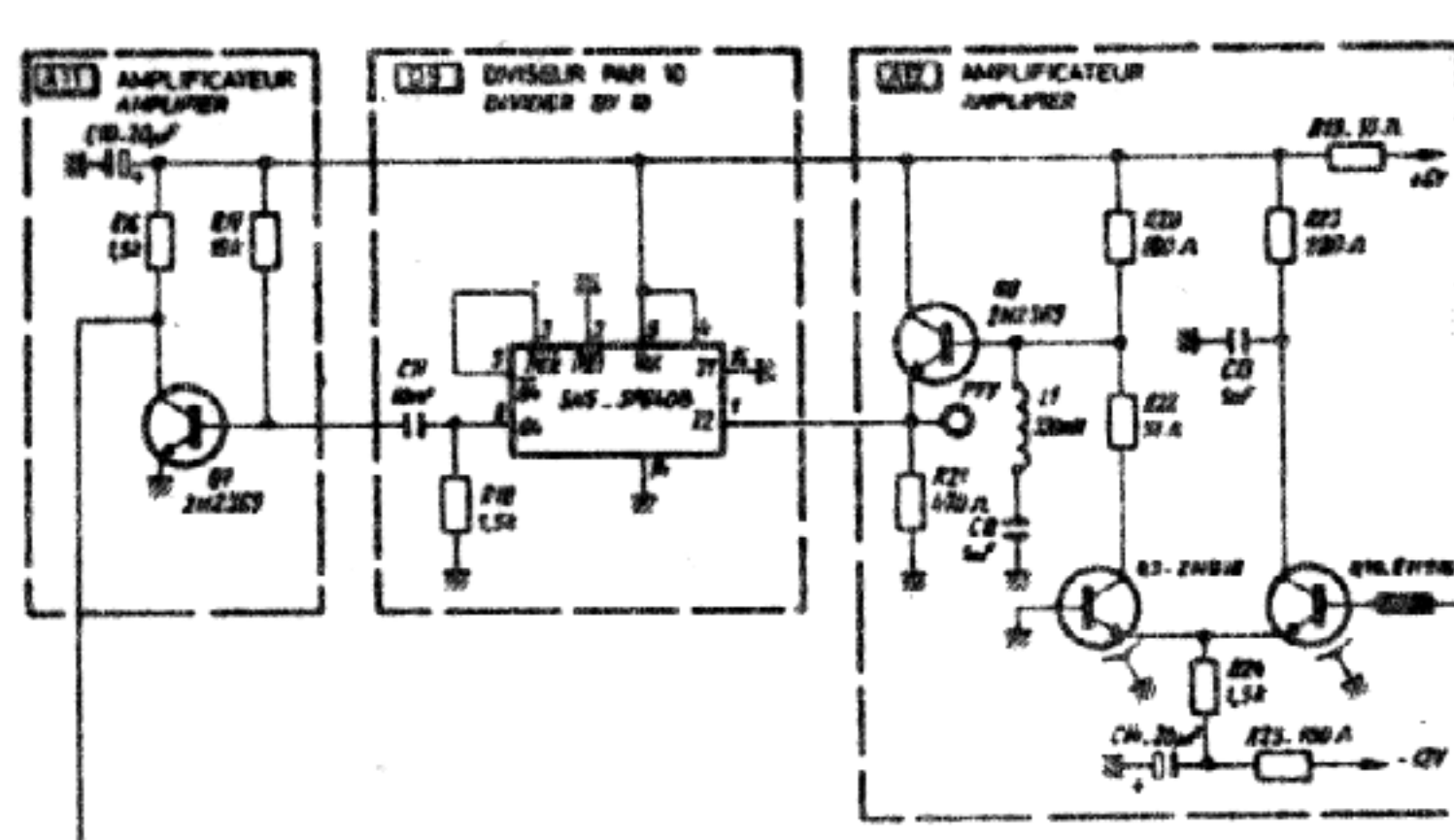
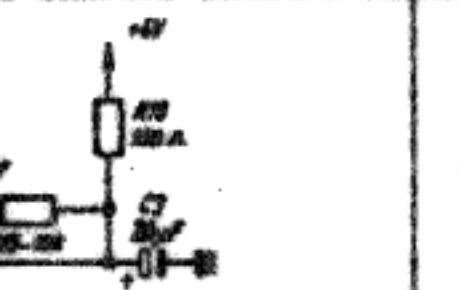
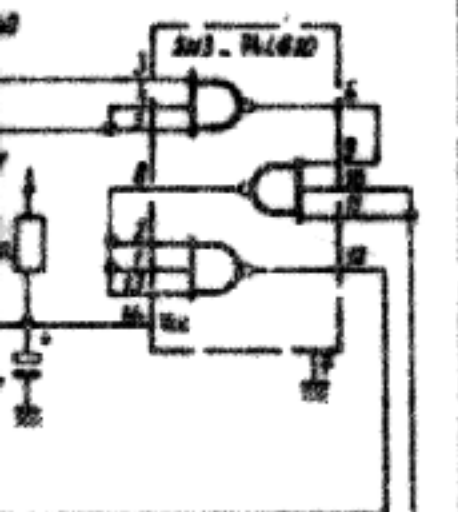
Voltage V from CP1 is applied to oscillator 06 via two complementary followers. When this voltage has

attained its final value, the control voltage of 06 is $V \pm 0.7$ V, thanks to the «follower oscillator» mounting, this limits the frequency error to a maximum of 5 to 6 MHz.

During the time required to reach the value of $V \pm 0.7$ V, comparator CPF6 is inhibited by a signal from monostable L (1-MHz STEPS DIVIDER MODULE). Once the value has been reached, the inhibition of CPF6 is suppressed, enabling this comparator to



APPROACH



BUS ALARME
VERS 3ème GENERATION
ALARM TO
2nd GENERATION

PAS DE 10^6 Hz
 N^2 Hz CODES

CODE 10^7 Hz

CODE 10^8 Hz

VERS SORTIE /02
(VISUALISATION DE L'ASSERVISSEMENT)
TO J02 OUTPUT
(PIASE - LOCKING DISPLAY)

ASSERVISSEMENT DU PILOTE
N.B PHASE - LOCKING

ENTREE 1 MHz
(ISSU DU MODULE SPECTRE 1 MHz)

ENTREE 5 MHz EXTERIEUR
(ASSERVISSEMENT DU PILOTE)

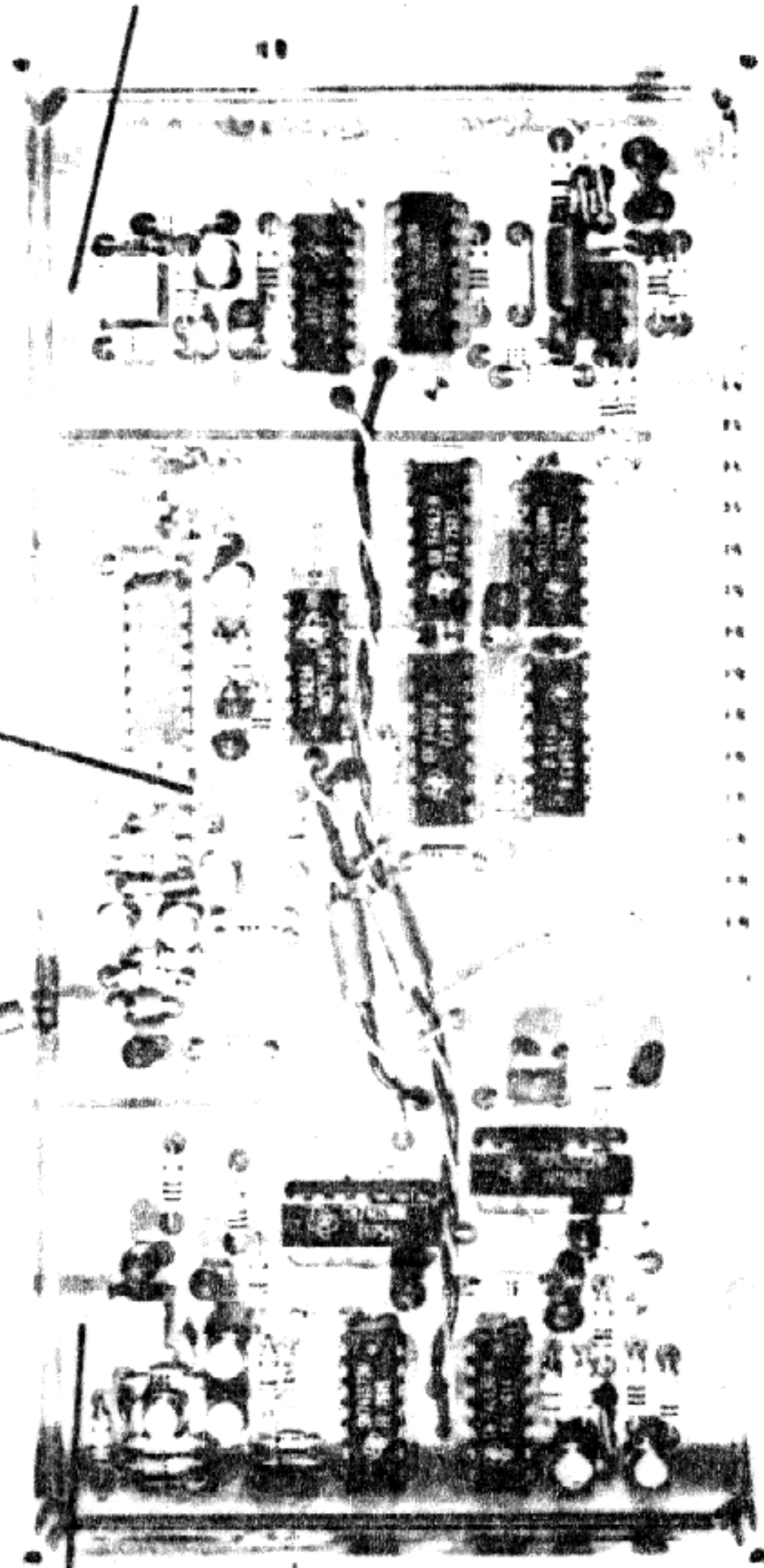
5MHz EXTERNAL REFERENCE
(N.B PHASE - LOCKING)

ASSERVISSEMENT
DU PILOTE
MASTER OSCILATOR
PHASE - LOCKING

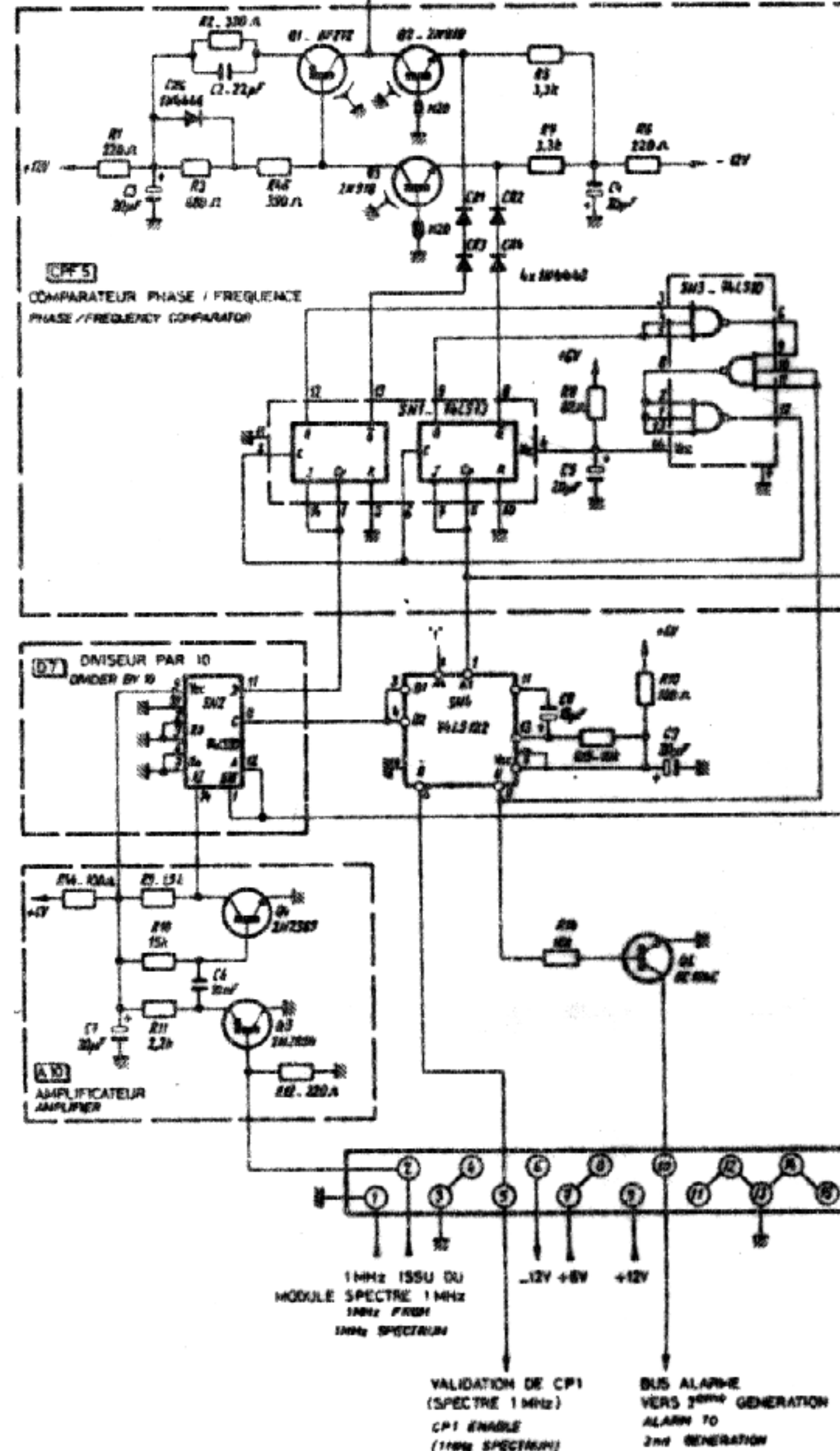
5 MHz external reference

PT1

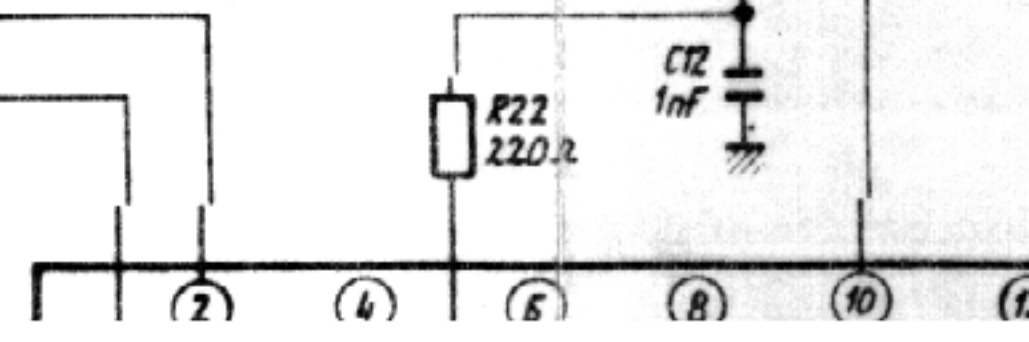
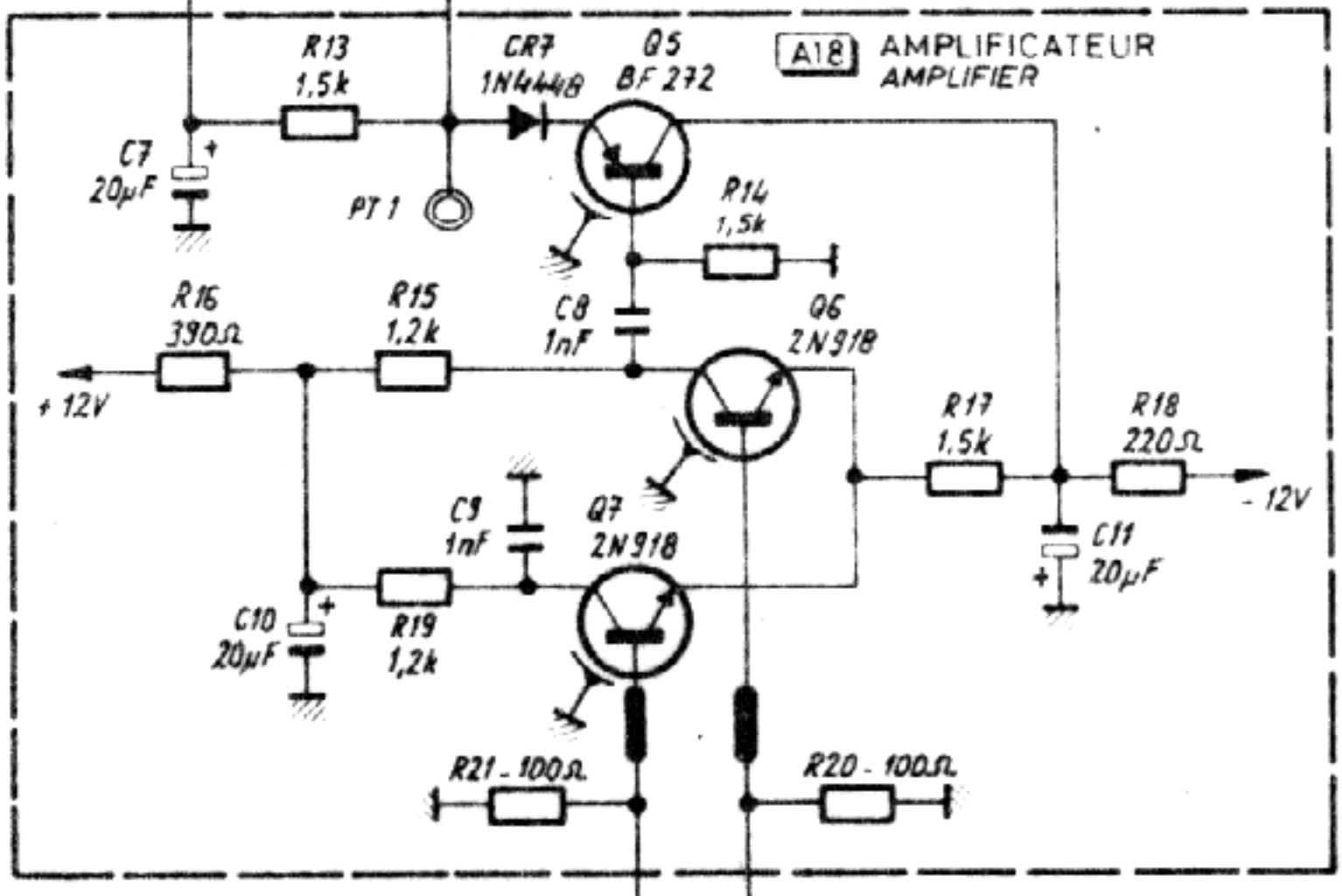
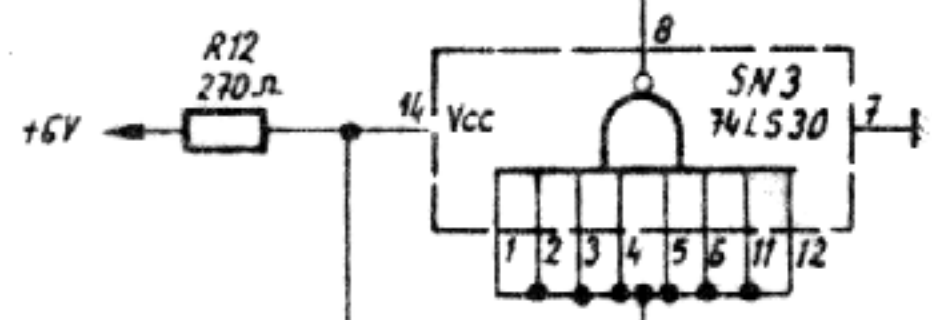
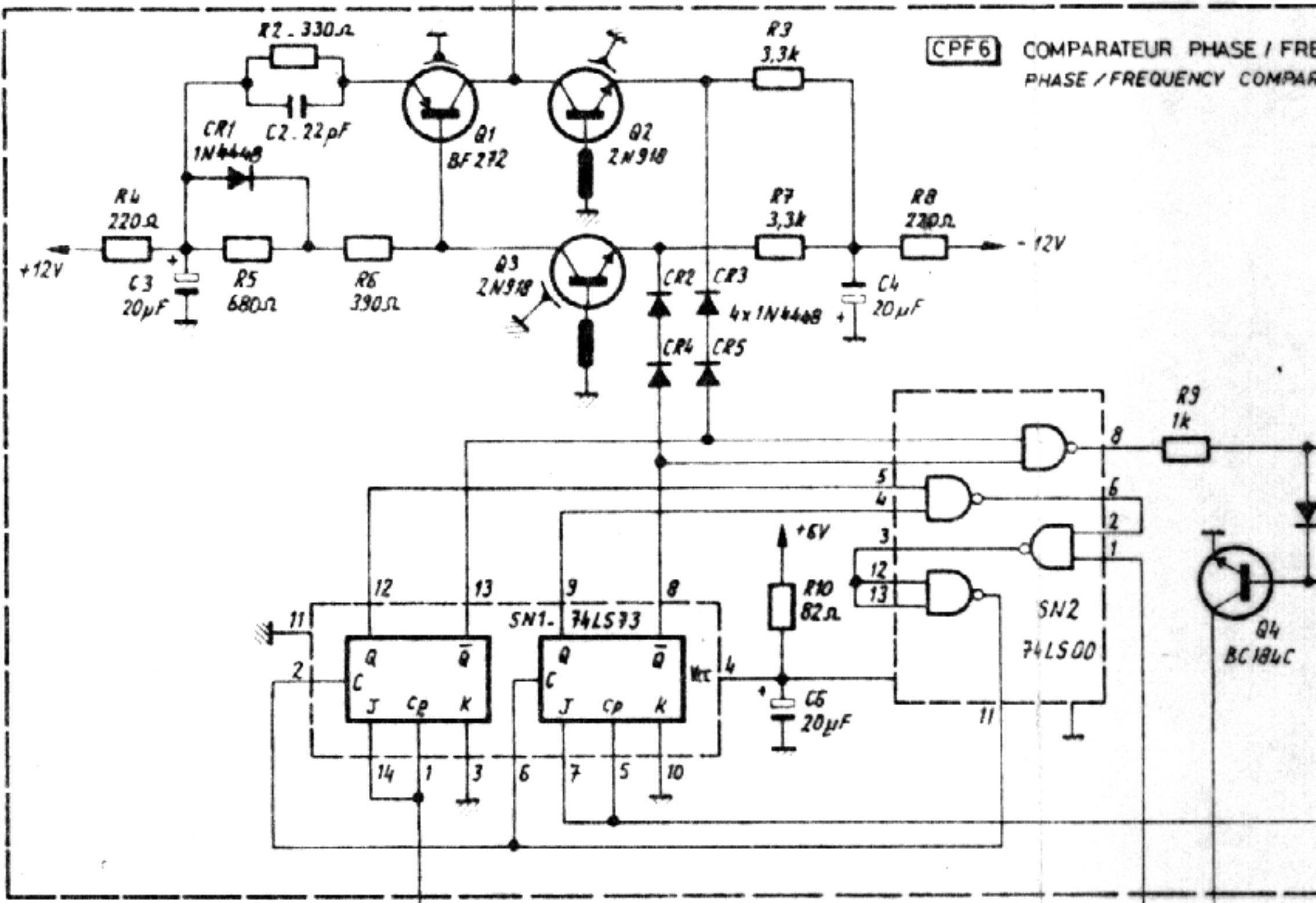
Phase locking approach to output module



APPROCHE DE L'OSCILLATEUR 87 / 116 MHz
(MODULE FREQUENCE DE SORTIE)
PHASE-LOCKING APPROACH
TO OUTPUT MODULE

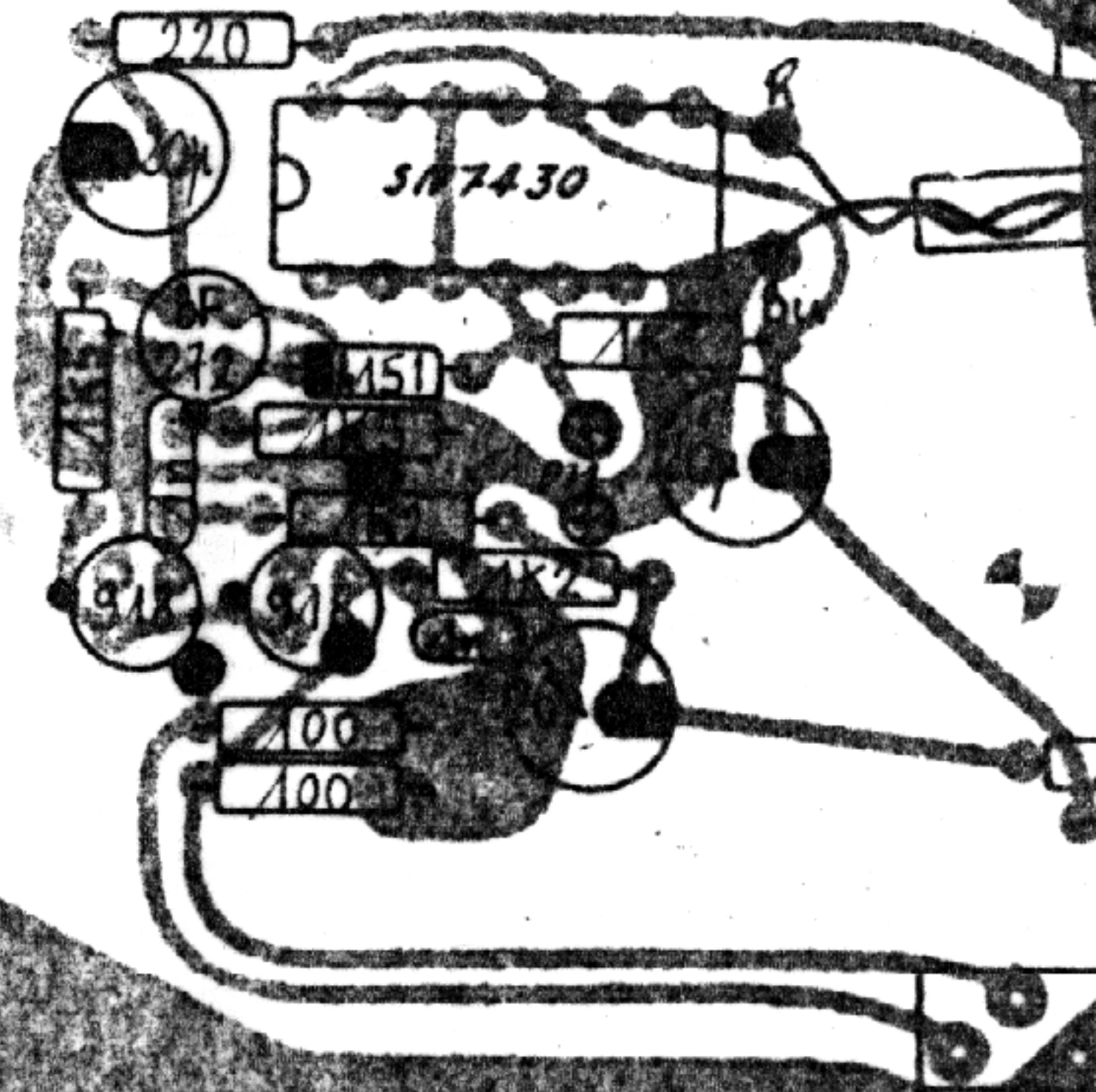


TENSION D'ASSERVISSEMENT DE L'OSCILLATEUR DE SORTIE
(MODULE DE SORTIE)
PHASE LOCKING VOLTAGE TO OUTPUT MODULE



00888851

31106



CHAPTER V – FINAL CHECK

The purpose of this chapter is to provide the user which all necessary information about performance control.

This chapter is divided into three sections :

V.1 - ACCESS TO INTERNAL CIRCUITS

Screw off the two fixing screws on the rear panel of the instrument, then pull out the two upper and lower sliding panels.

V.2 - PRE-CONTROL

When the instrument does not operate properly, it

is necessary to check that it is being used correctly (controls setting according to the operation mode). Check the mains voltage value : it should not vary $\pm 10\%$ its nominal value.

V.3 - PERIODICAL CONTROLS

The periodical controls consist mainly in checking the performance as they have been defined in chapter I : SPECIFICATIONS.

They are necessary whenever a fault is detected in the instrument operation, or after quite a long storage time.

LIST OF REQUIRED MEASURING INSTRUMENTS

FUNCTION	SPECIFICATIONS	INSTRUMENTS USED
VHV DC supply	0 to 1500 V	H. BOUCHET Model A 209
AC power supply	45 Hz to 400 Hz Power : 200 VA	BOONTON Model 250
Ammeter	Caliber : 500 mA	METRIX Model 340
Oscilloscope	75 MHz bandwidth	HEWLETT PACKARD 180 C
DC Voltmeter	200 mV to 1200 V	J. FLUKE Model 8000 A
Frequency standard receiver	Tuning frequency : 15/200 kHz Resolution : 20 Hz Outputs : 1,5 and 10 MHz	ADRET ELECTRONIQUE Model 4101
Frequency meter	0 to 500 MHz - 9 digits Display time : 0.2 s to 5 s	SCHLUMBERGER PH 2523
Frequency programmer	Positive TTL Logic 1-2-4-8 BCD Code	ADRET ELECTRONIQUE ECF 134 + Head 5104
Spectrum analyzer	0 to 1.5 GHz	HEWLETT PACKARD 8558 B
Spectrum analyzer + XY graphic recorder	Dynamic range : 120 dB Frequency range : 0 to 1 MHz	ADRET ELECTRONIQUE Series 6000 : 6100 mainframe 6303 and 6503 plug-ins
Subtractive mixer	0.2 to 500 MHz	ADRET ELECTRONIQUE ECF 59

In order to facilitate maintenance and adjustments, all the measurements to be made are listed below, in the order of checking.

- I APPEARANCE
- II MAINS INSULATION
- III POWER SUPPLY
- IV PHASE-LOCKING

- V OUTPUT/ALARM FREQUENCY
 - a) Local Mode
 - b) Remote Mode
- VI OUTPUT LEVEL
- VII SPECTRAL PURITY
 - a) Harmonic signals
 - b) Non-harmonic signals
 - c) Phase noise
 - d) Mains signals

9 - LOCKING OF MASTER OSCILLATOR

Locking of the master oscillator is effected in the same module by comparing the phase of the internal 5-MHz reference to that of the external 5-MHz reference in a logical phase comparator consisting of an «EXCLUSIVE OR», shown by figure IV.12 ; the comparison is effected at 500 kHz.

The output of the «EXCLUSIVE OR» provides rectangular waves proportional in duration to the phase difference between the two 500-kHz reference (internal and external) ; these rectangular waves are integrated to provide the locking voltage.

The frequency of the master oscillator is divided by 10 by divider D6 (1-MHz Spectrum module), then by 2 (1-MHz Steps Divider), to produce the internal 500-kHz reference. This is fed to one input of the phase comparator ; the other receives a 500-kHz reference derived by division by 10 from the external 5-MHz signal fed to rear-panel connector J02.

Gate C receives F_c and $\overline{F_a F_c}$ and applies $F_c \cdot \overline{F_a F_c}$, equal to $\overline{F_c} + F_a F_c$, to the other input of gate D.

Gate D therefore provides $(\overline{F_a} + F_a F_c) (F_c + F_a F_c)$, equal to :

$$\begin{aligned} &= (\overline{F_a} + F_a F_c) + (\overline{F_c} + F_a F_c) \\ &= (F_a + \overline{F_a F_c}) + (F_c + \overline{F_a F_c}) \\ &= F_a (\overline{F_a} + \overline{F_c}) + F_c (\overline{F_a} + \overline{F_c}) \\ &= (F_a + F_c) (\overline{F_a} + \overline{F_c}) \\ &= (F_a \overline{F_c}) + (\overline{F_a} F_c) \end{aligned}$$

The expression $F_a \overline{F_c} + \overline{F_a} F_c$ is the function provided by an «EXCLUSIVE OR» ($F_a \oplus F_c$).

When the two phases are exactly in quadrature, the output of gate D is balanced, but if the phase of one varies with respect to the other, the duty cycle changes in proportion to the phase difference.

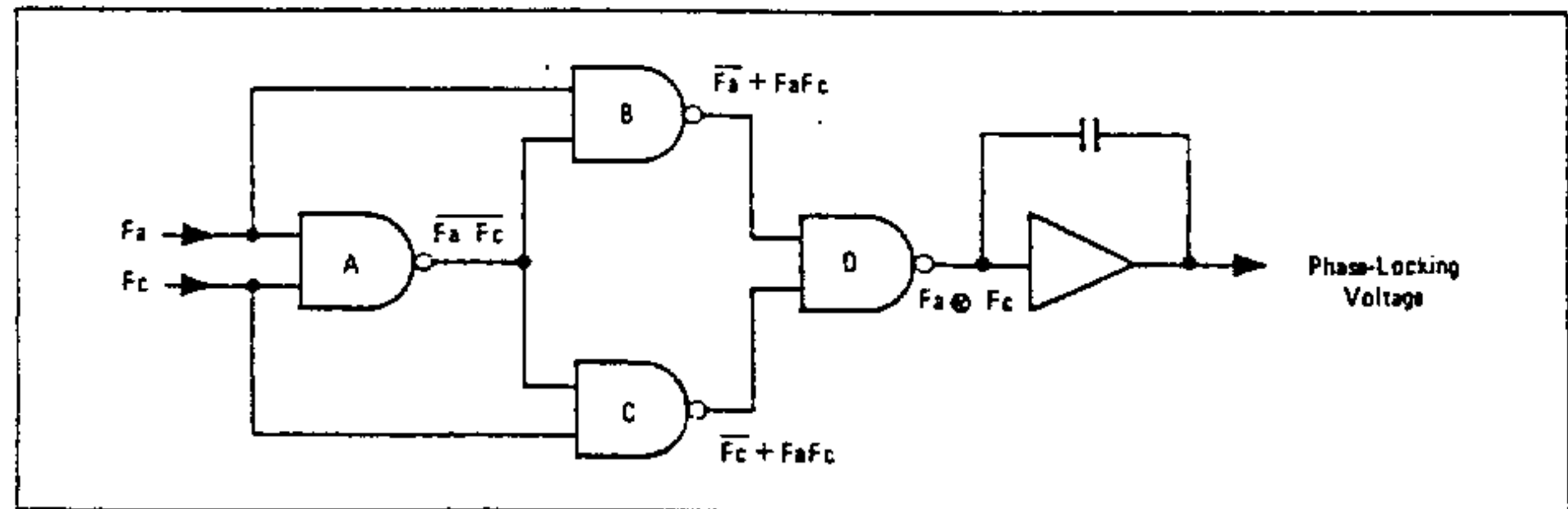


FIGURE IV.12 : Locking principle

Gate A receives F_a and F_c on its inputs and feeds $F_a F_c$ to one input of gates B and C ; F_a and F_c , respectively, are applied to the other input of these gates.

Gate B therefore receives F_a and $\overline{F_a F_c}$ and applies $F_a \cdot \overline{F_a F_c}$, equal to $\overline{F_a} + F_a F_c$, to one input of gate D.

The output of gate D is integrated by an A741 amplifier mounted as a mean-value detector (123), which drives the locking input of the master oscillator and also provides a voltage ranging from -5 to $+5$ V as a function of the phase difference. This voltage is available on rear-panel connector J03 and may be used to monitor locking.

This voltage is negative when the signals are in phase, 0 for a phase difference of 90° , and positive for a phase difference of 180° , as shown in figure VI.13.

It should be noted that the output voltage of this type of phase comparator is 0 if one of the input signals is absent ; in consequence, if the synchronization frequency disappears, the master oscillator frequency will remain unchanged if the operator has taken the precaution of adjusting the galvanometer to 0 using the tuning potentiometer.

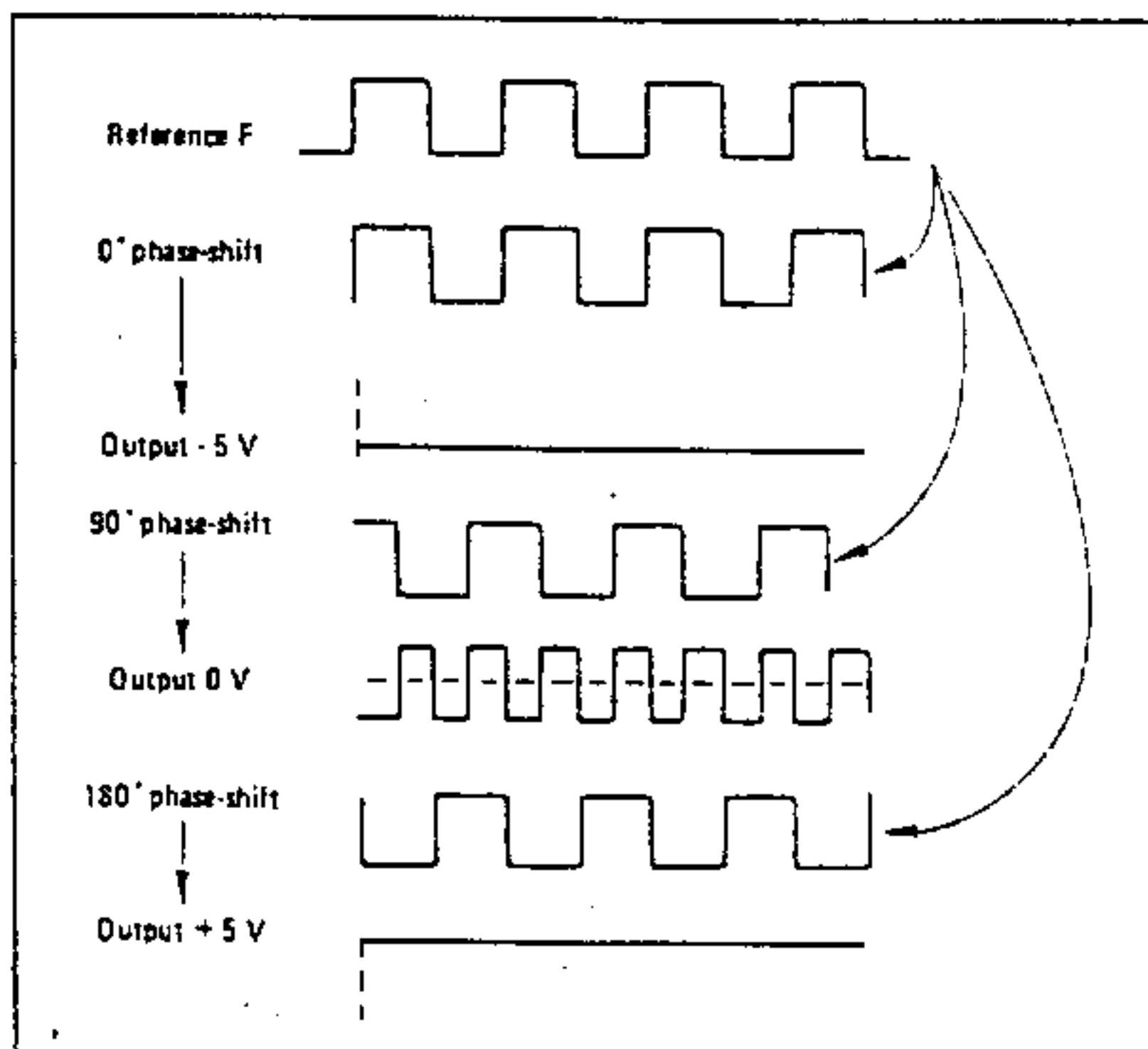
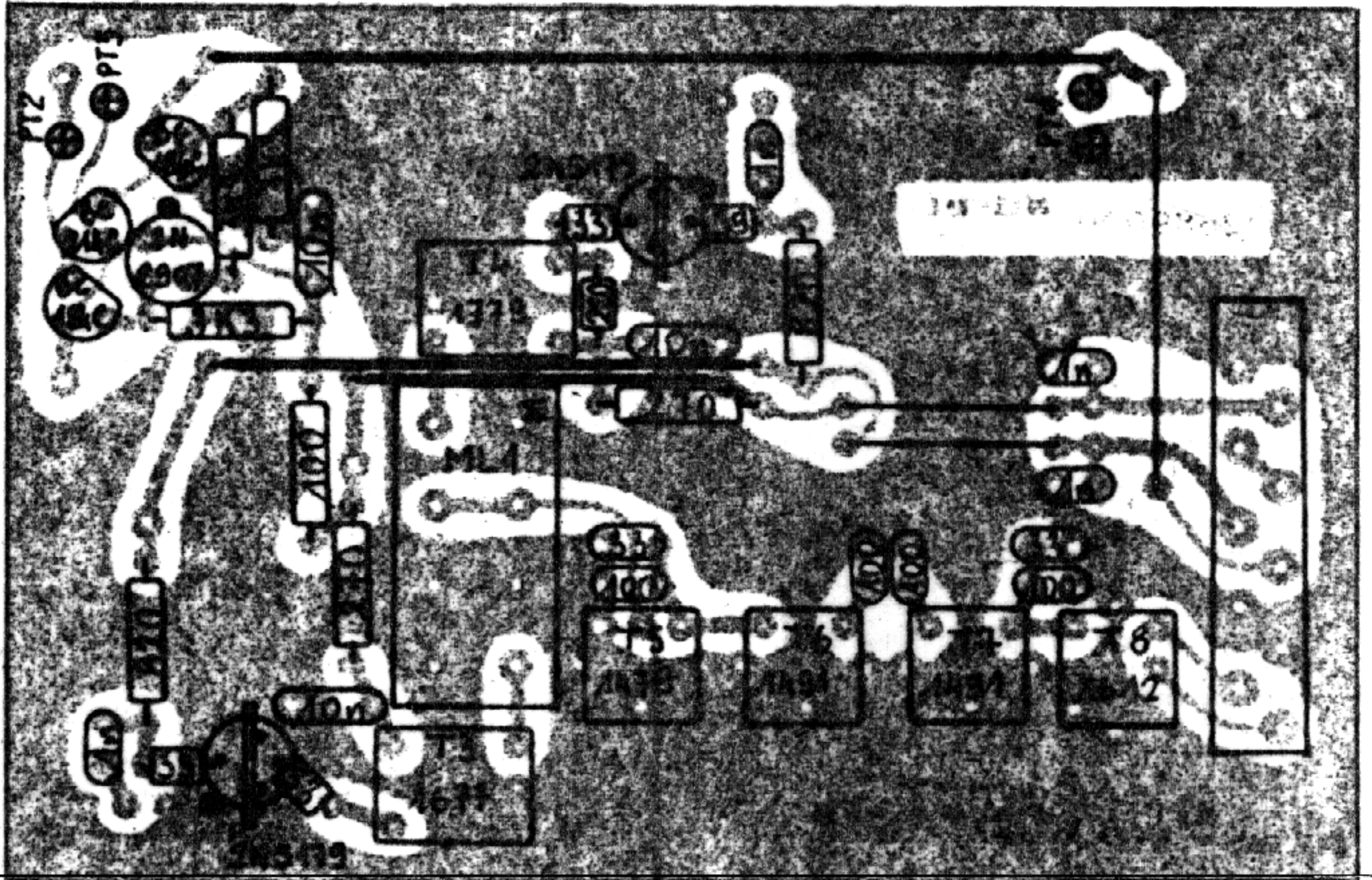
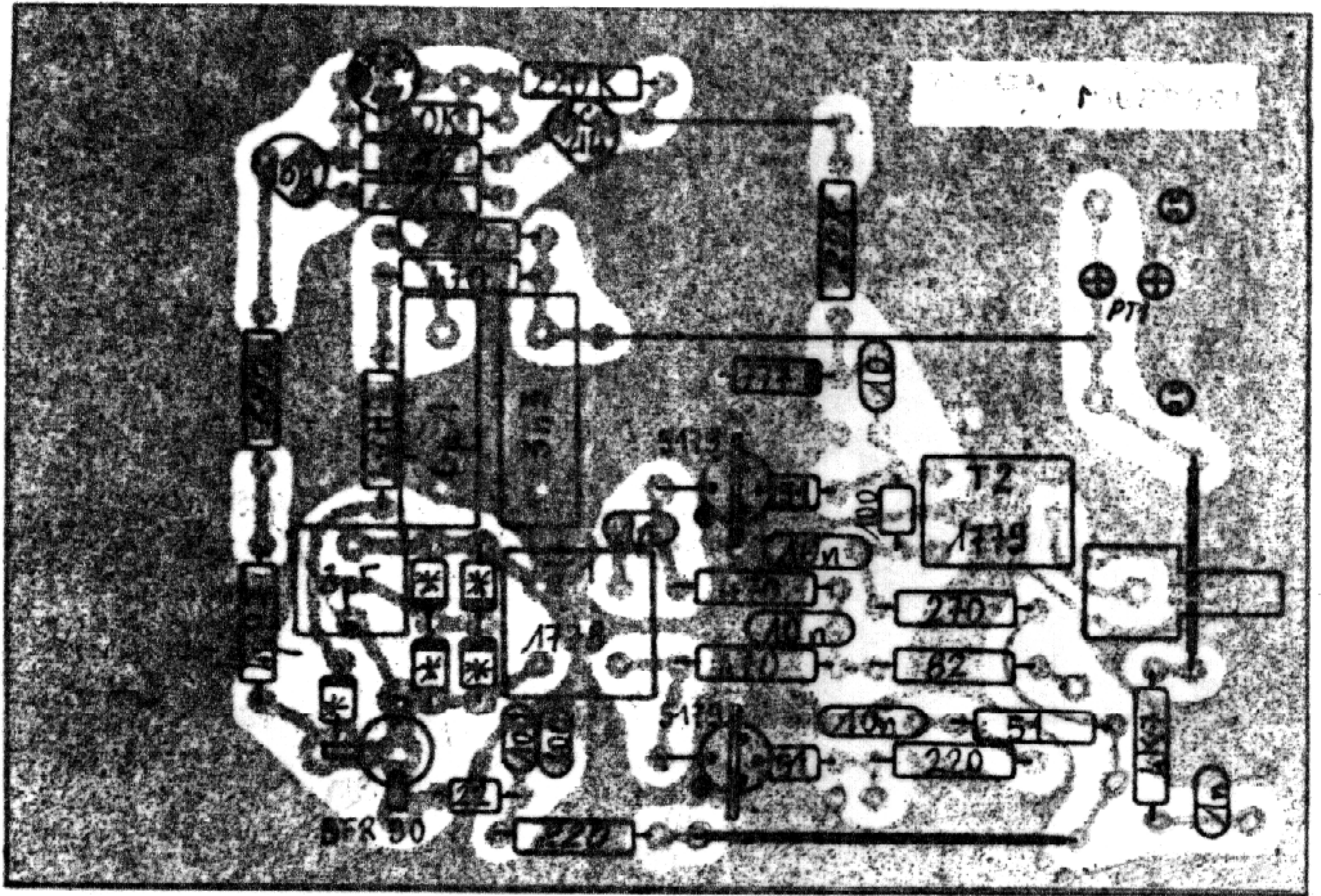


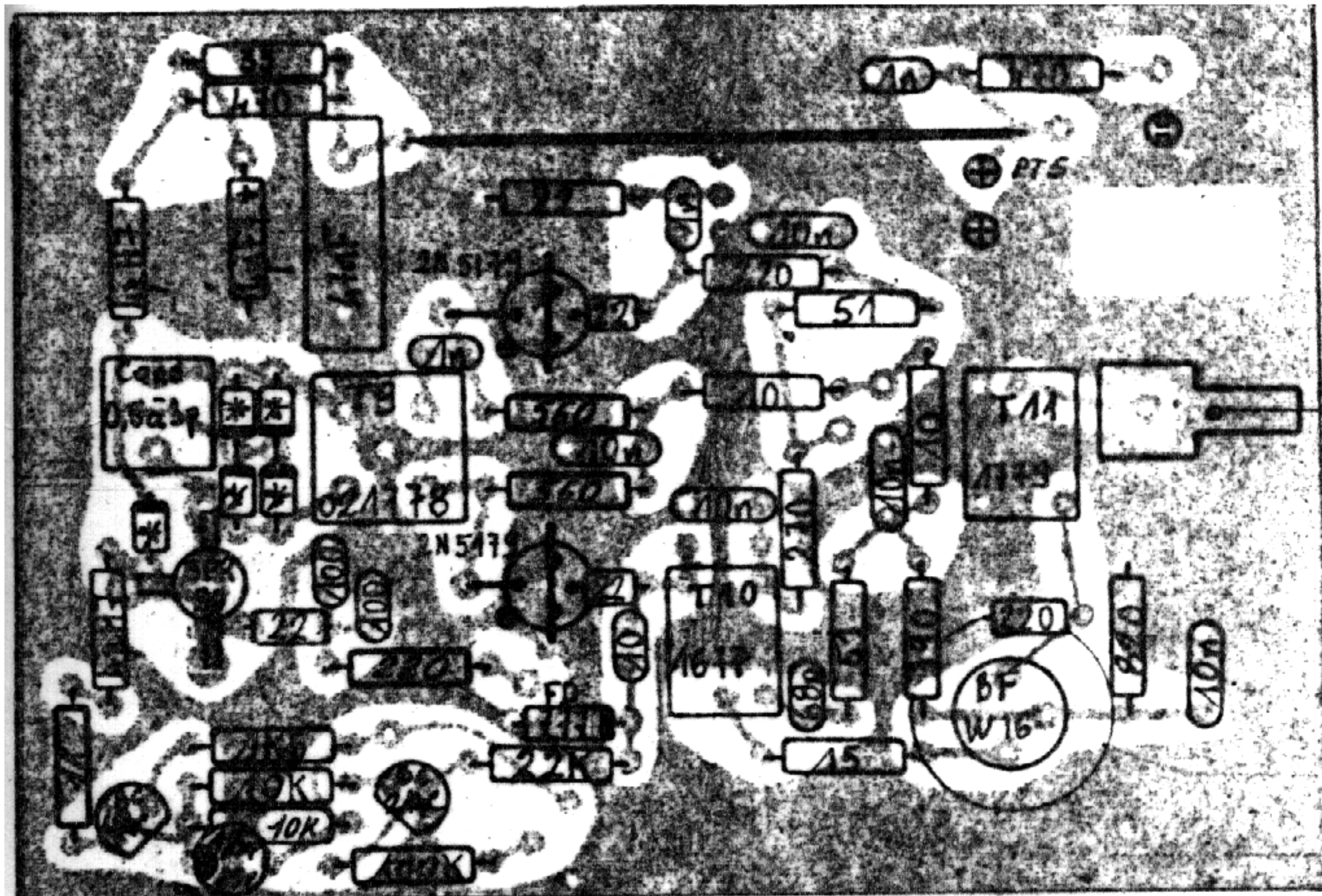
FIGURE IV.13 : Output signal phase shift.



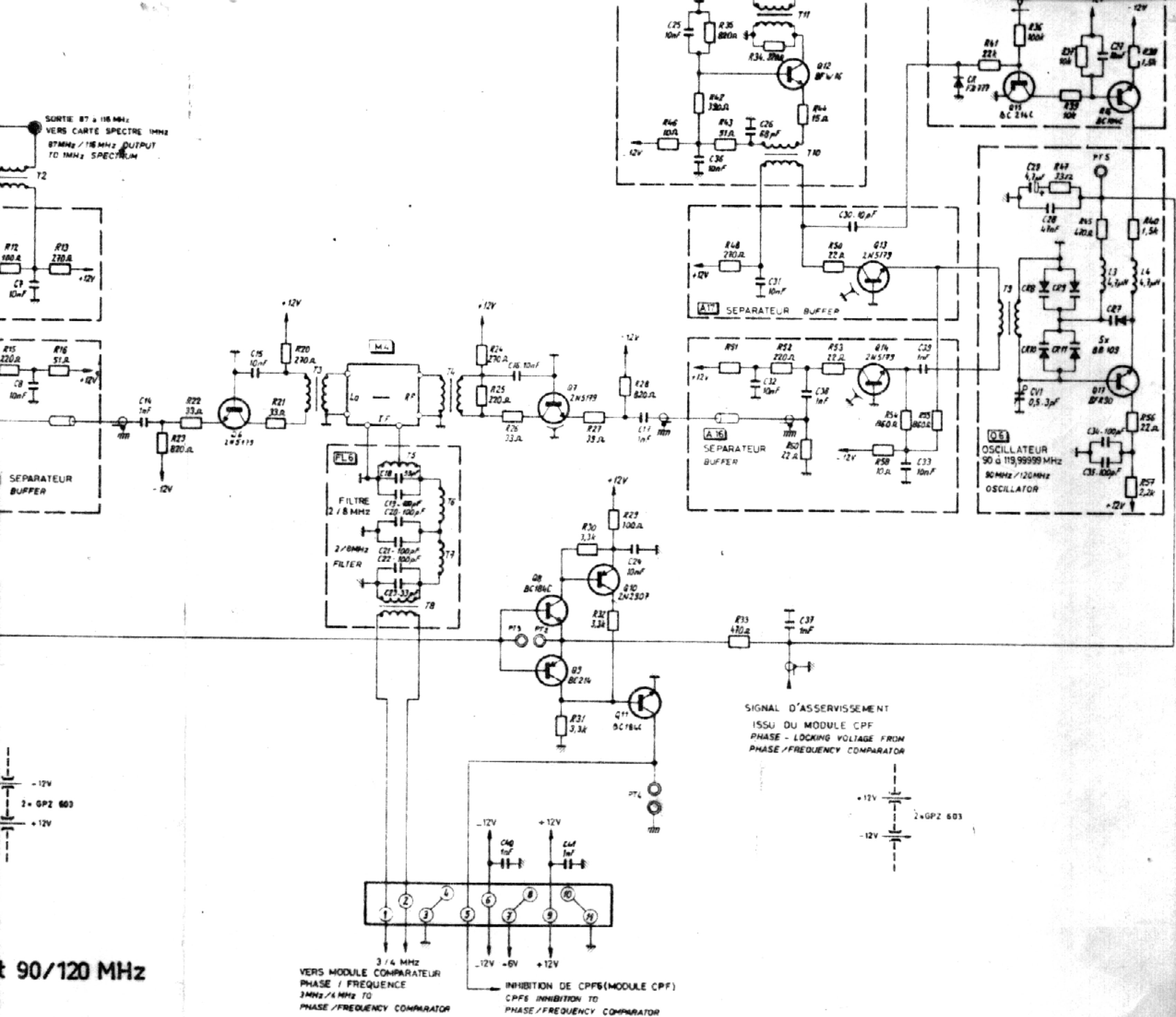
WIRING AND COMPONENT LAYOUT
 DIAGRAM N° 932139 B



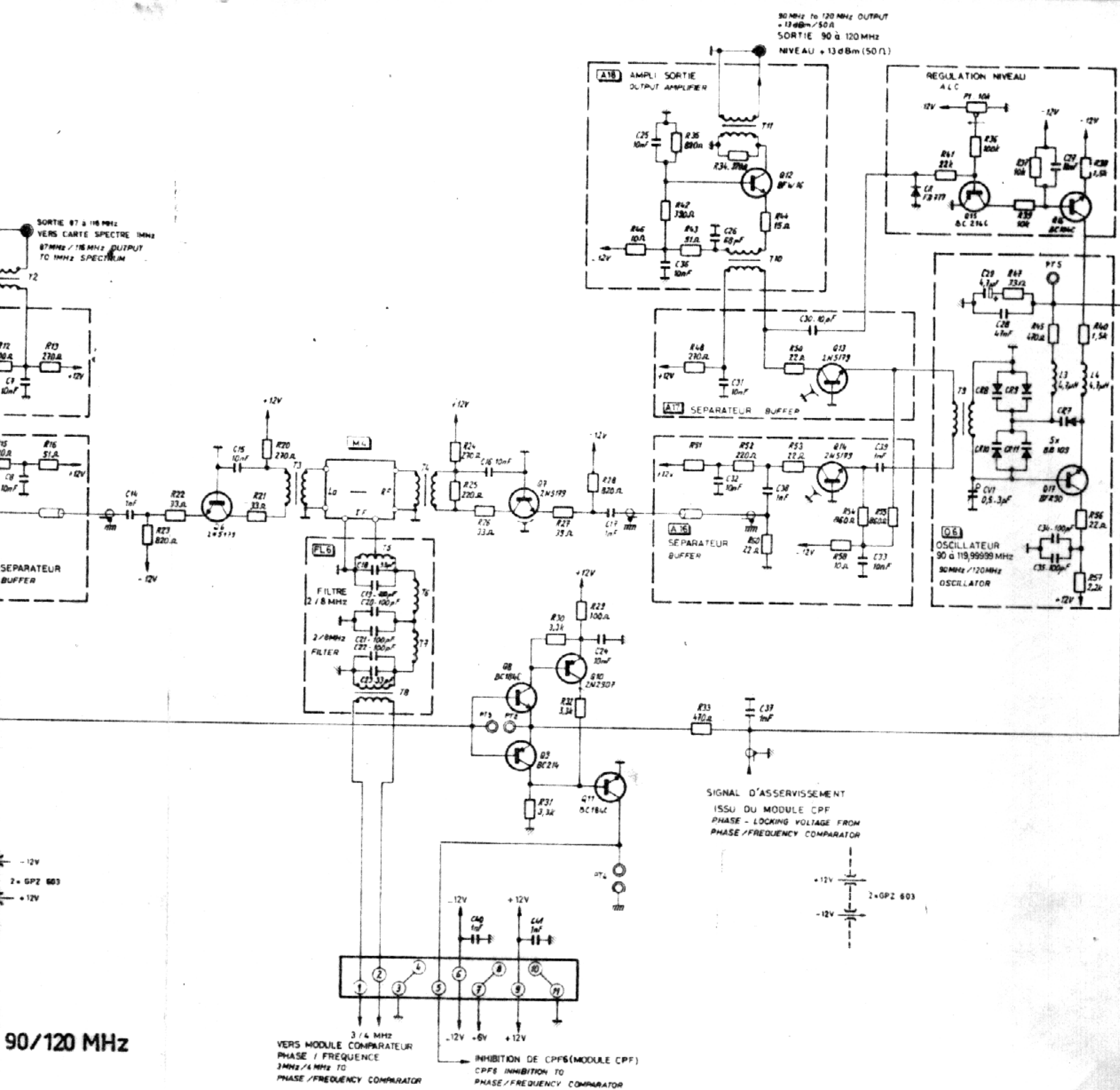
WIRING AND COMPONENT LAYOUT
 DIAGRAM N° 932138 C 2/2

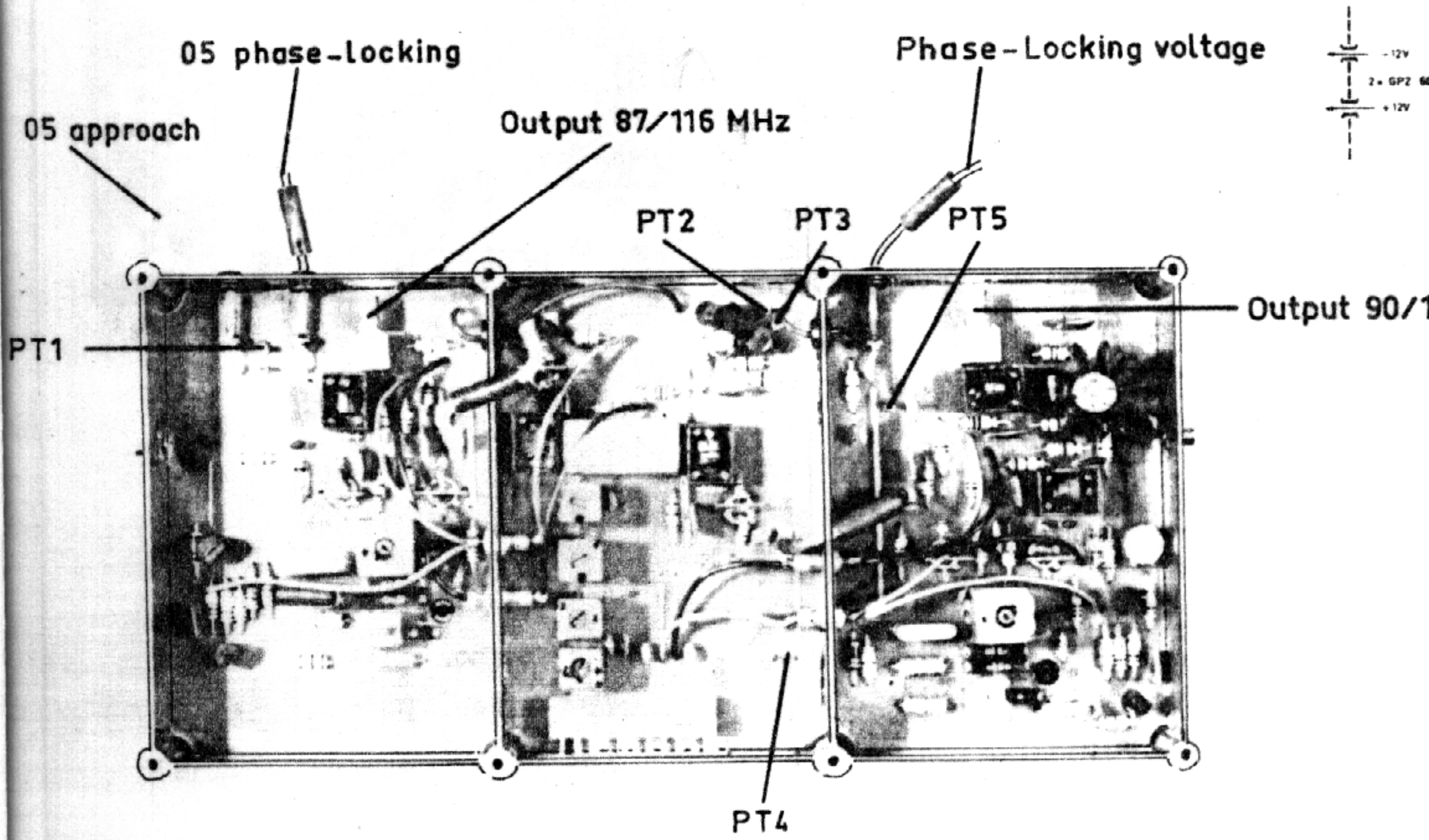
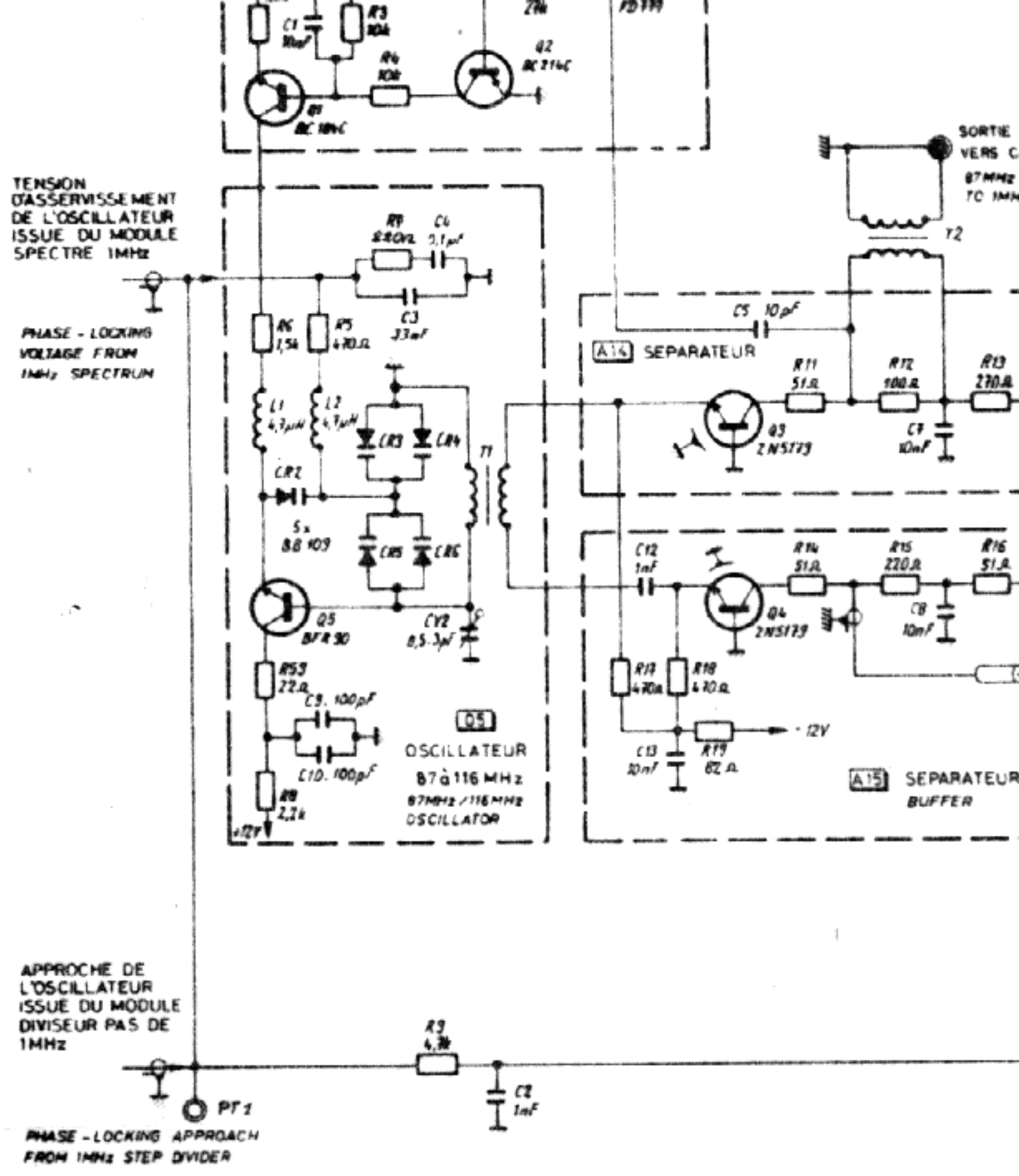


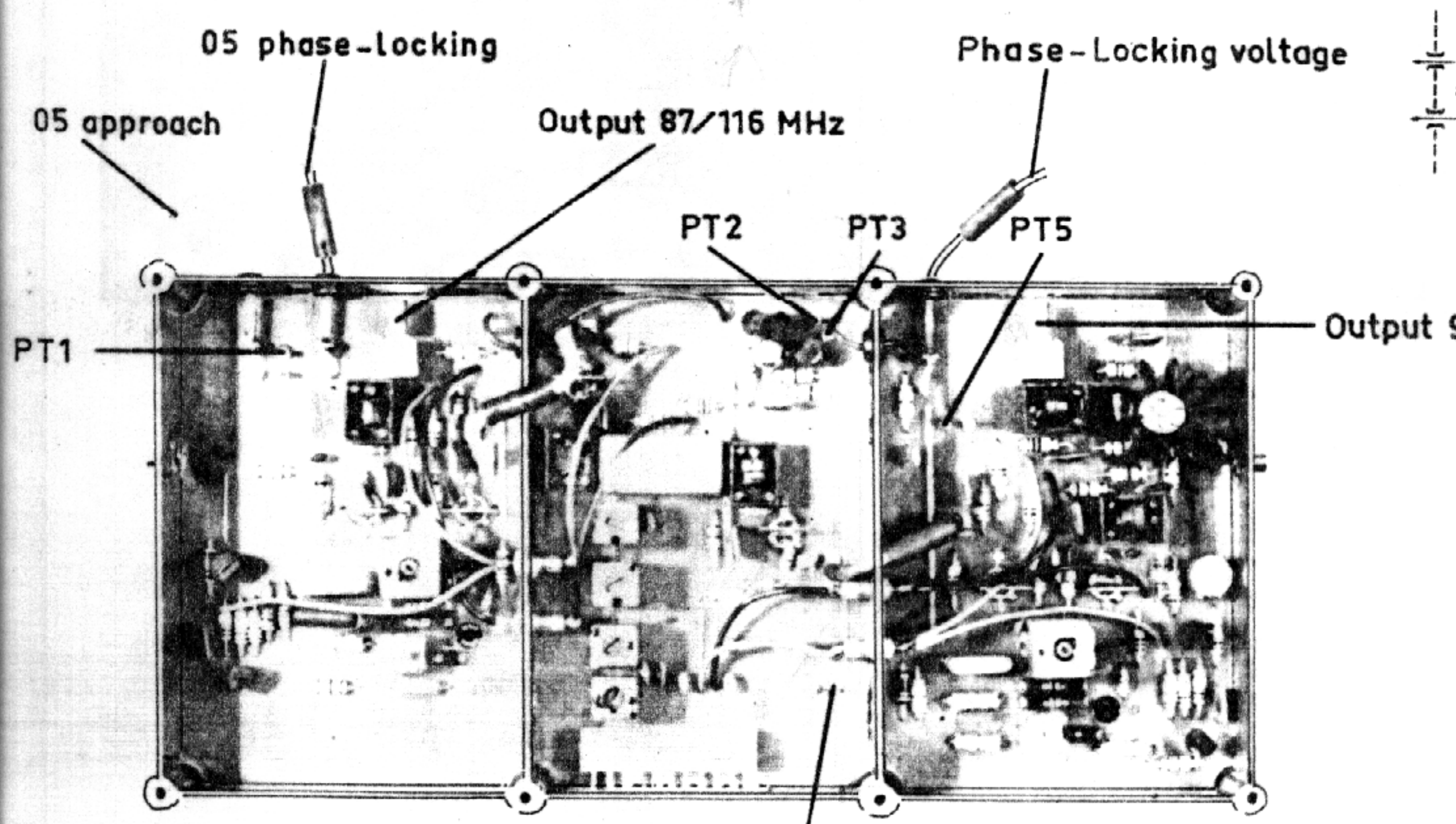
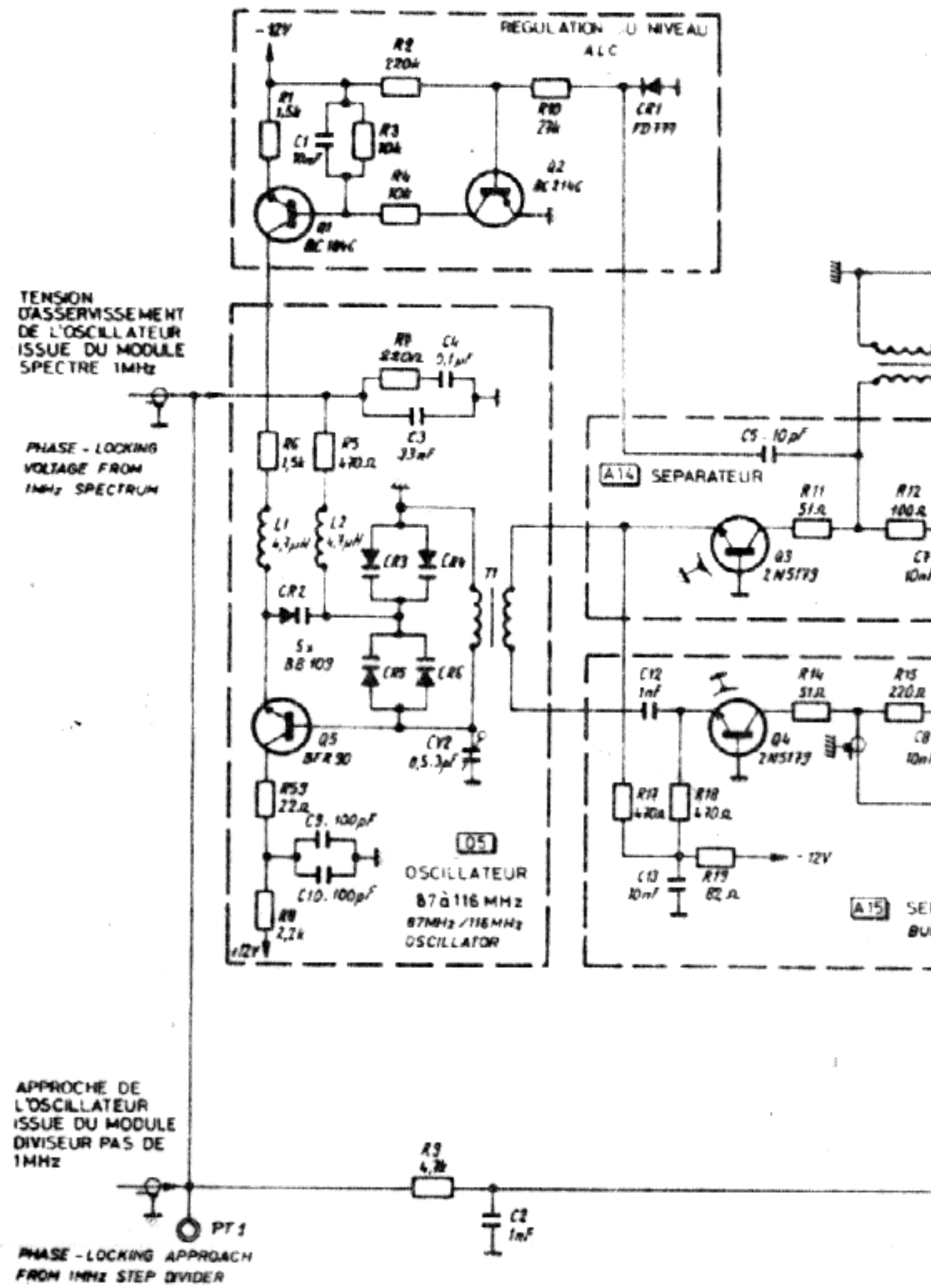
WIRING AND COMPONENT LAYOUT
DIAGRAM N° 932137 C 2/2

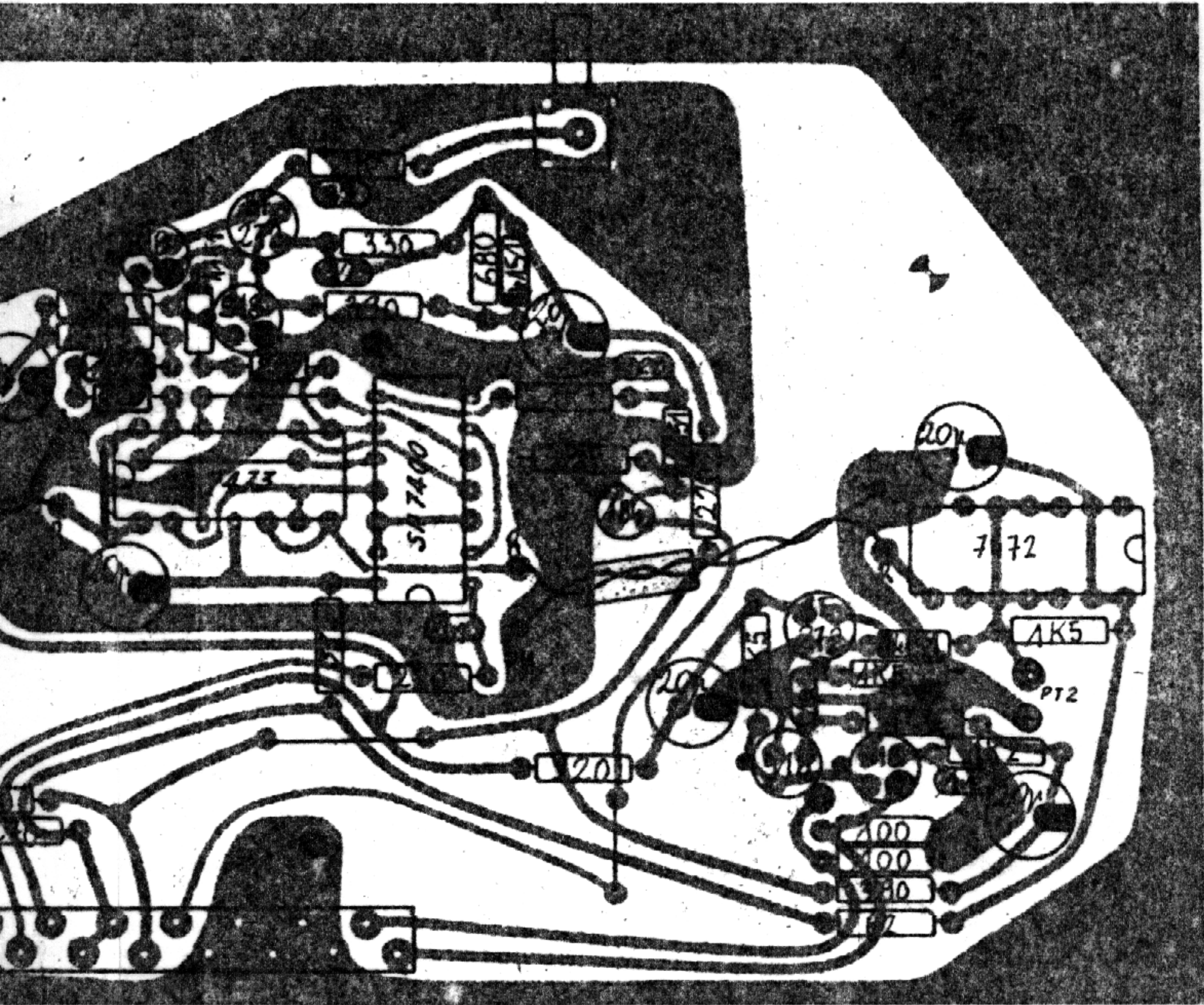


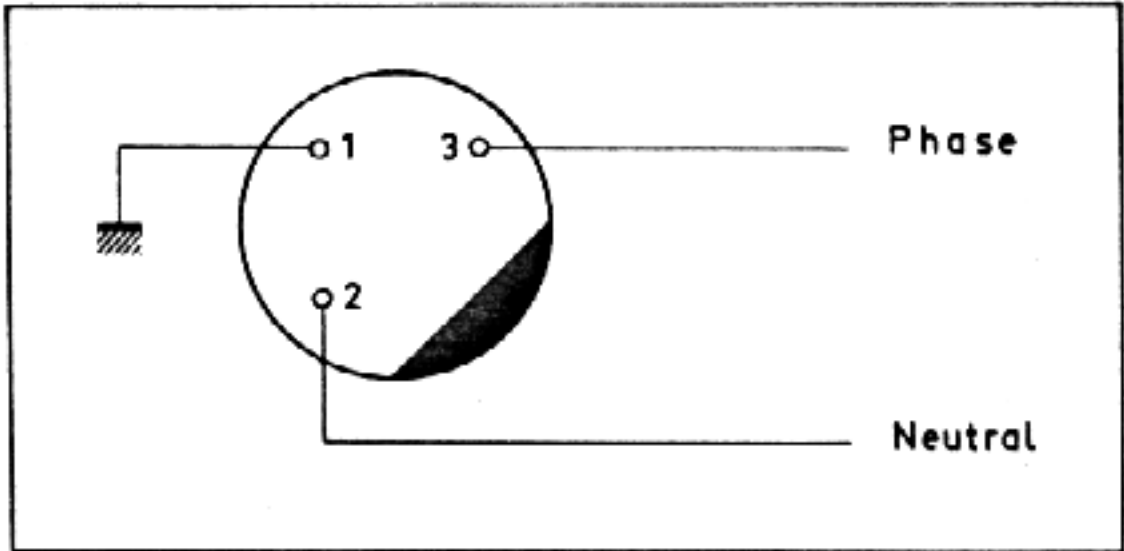
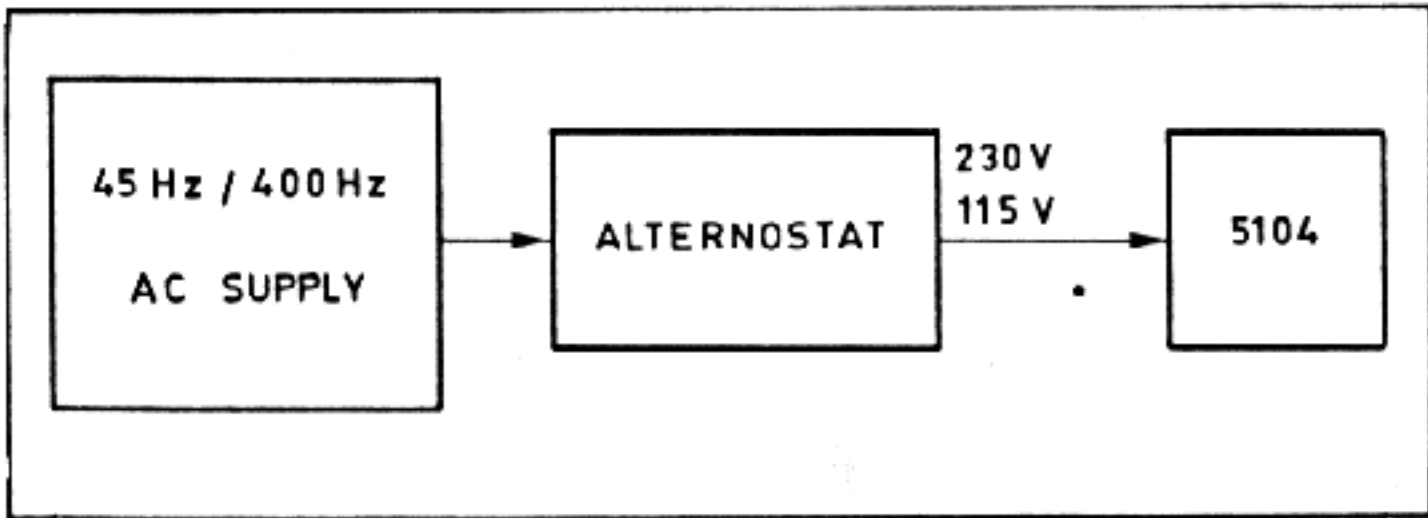
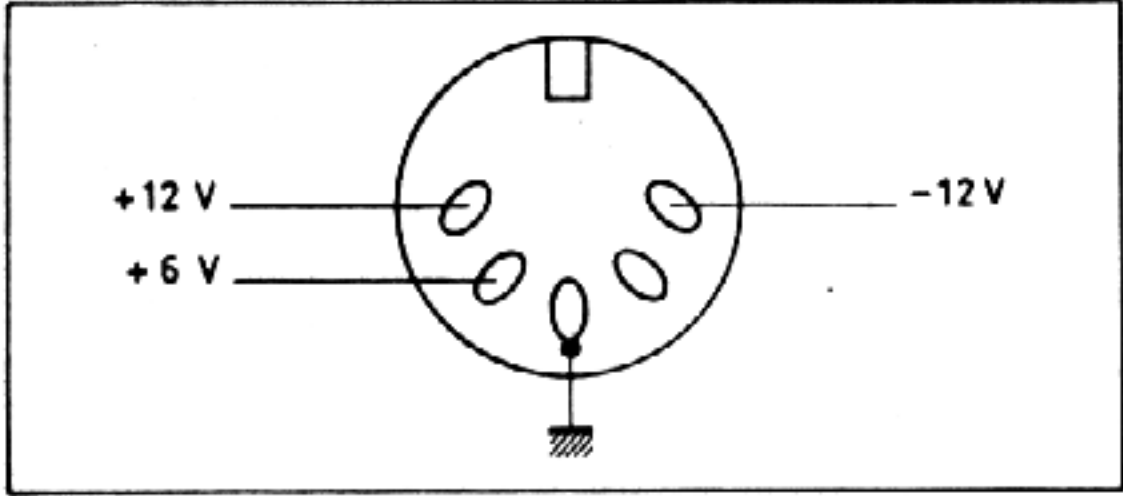
OUTPUT MODULE
CIRCUIT DIAGRAM N° 976887

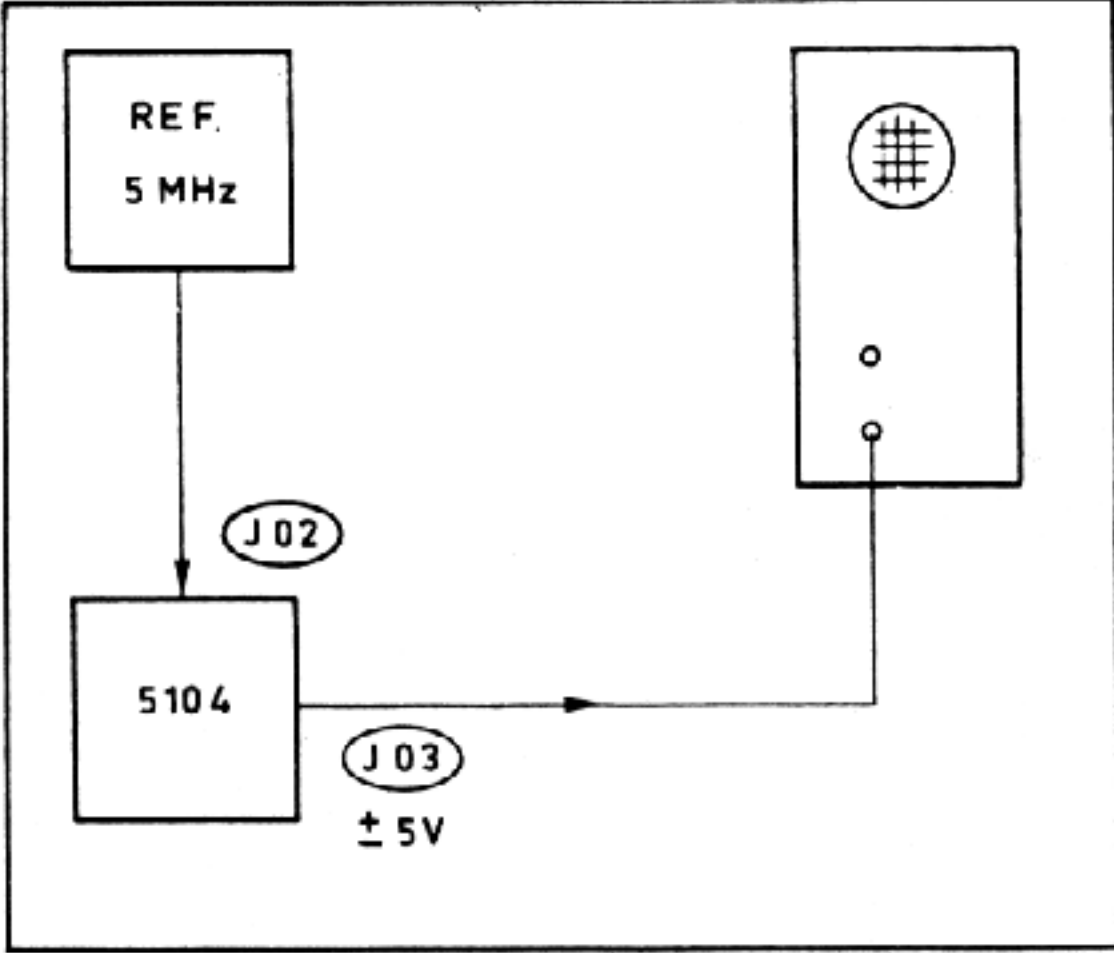
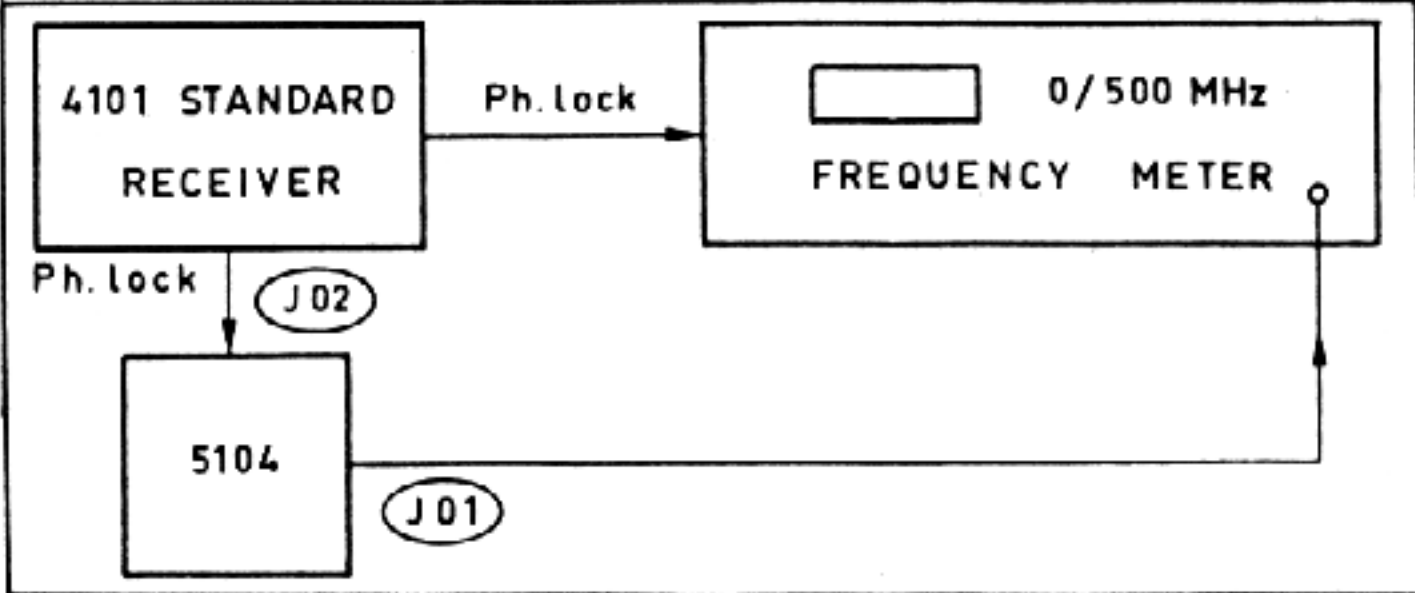


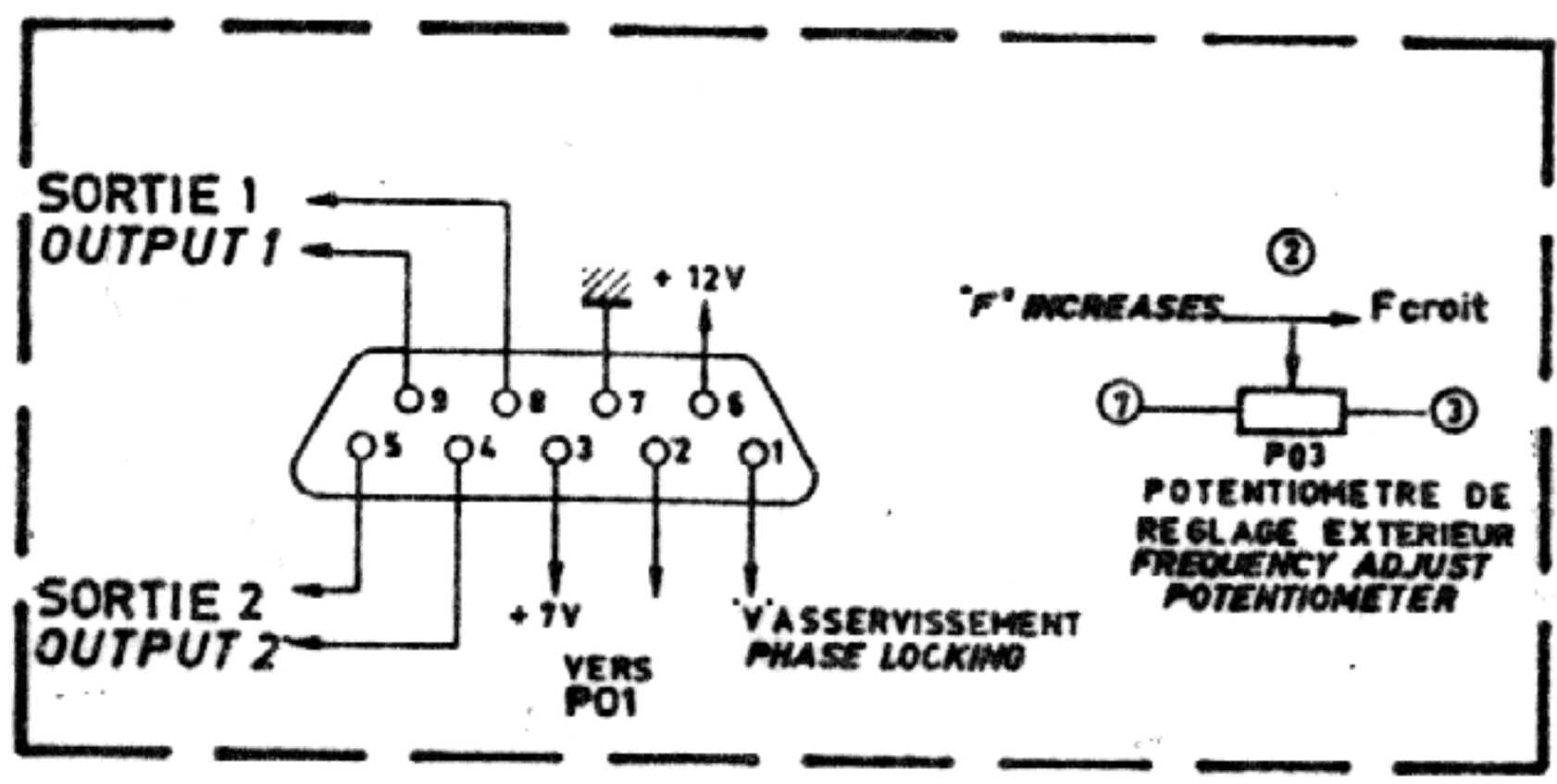
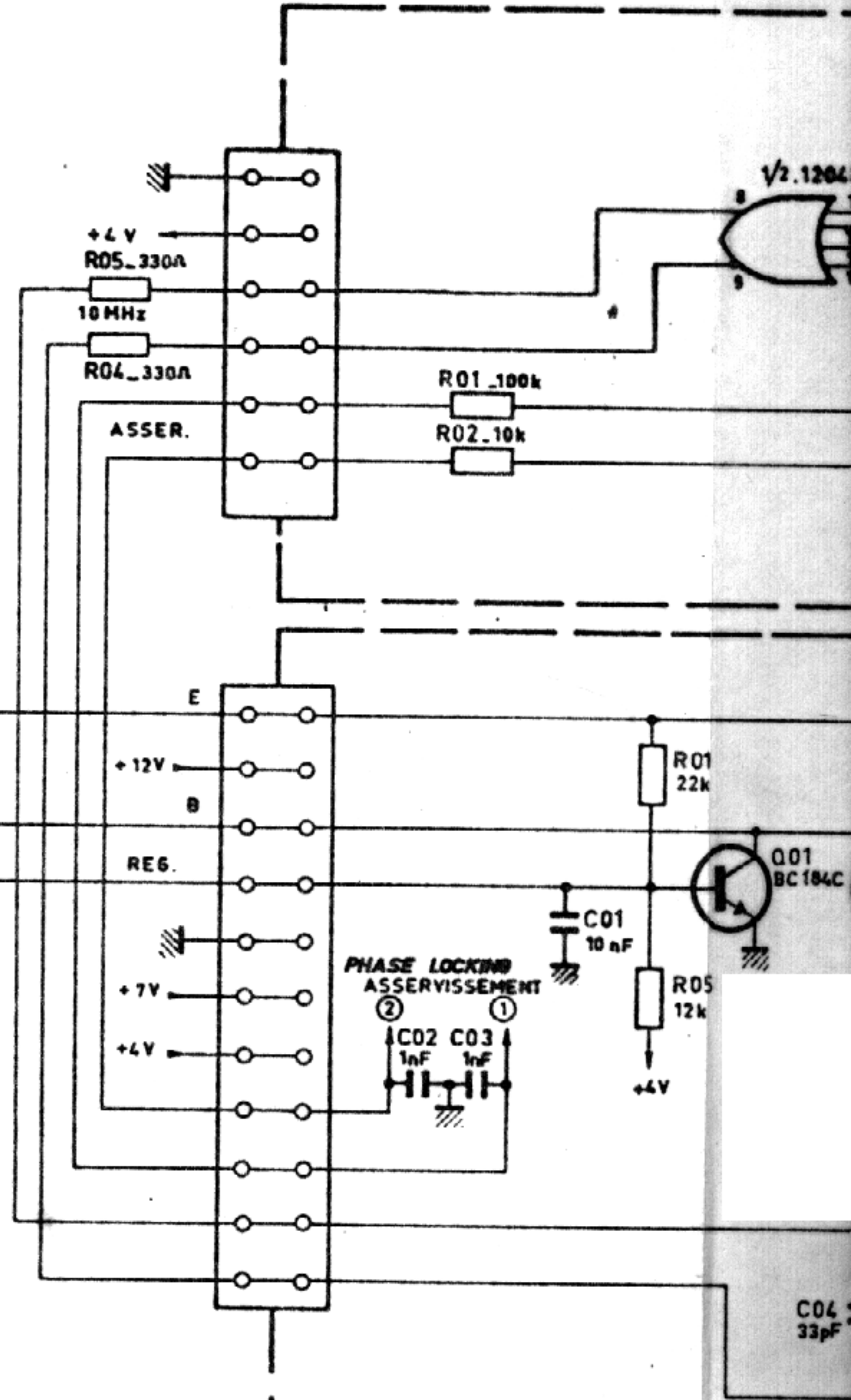
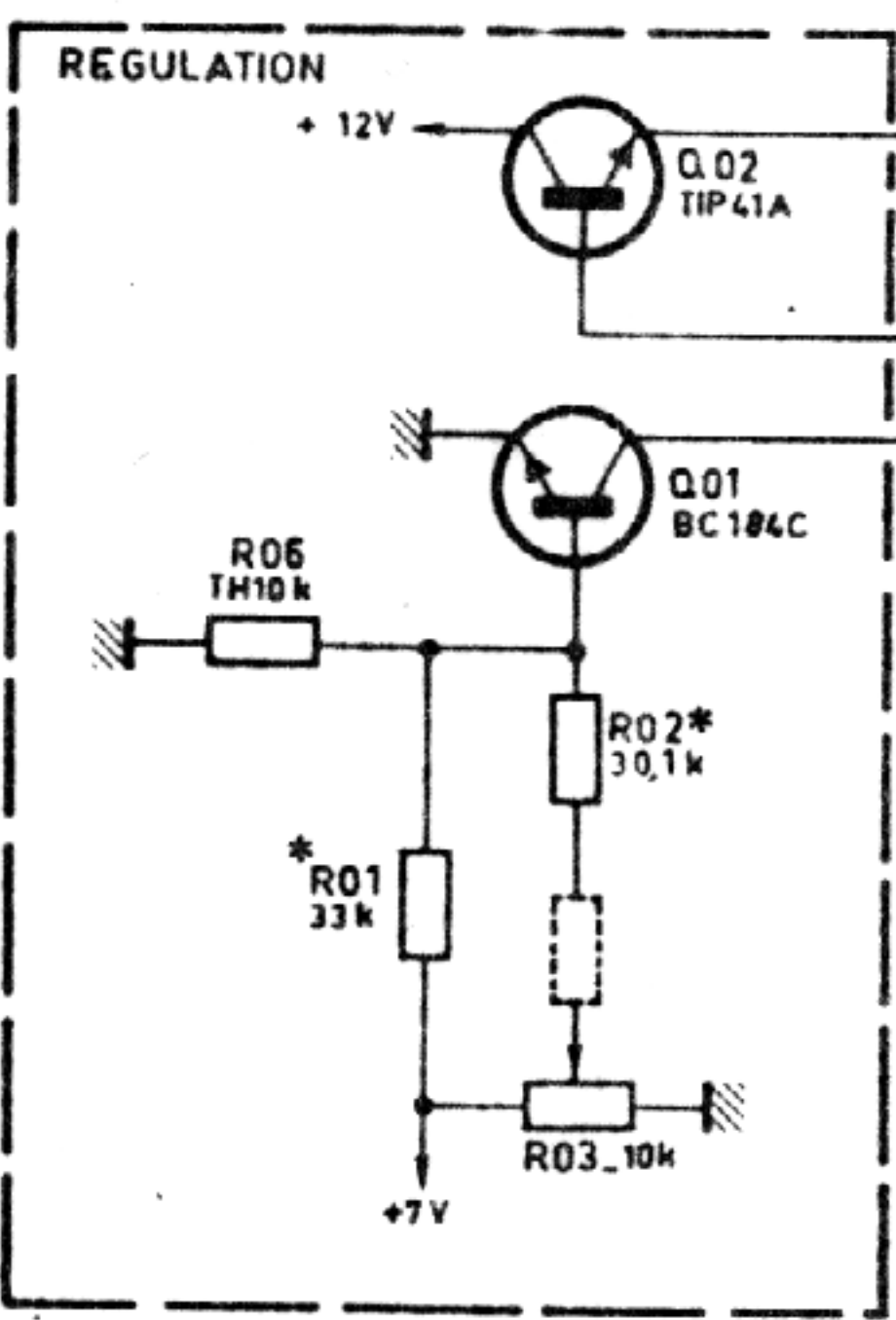
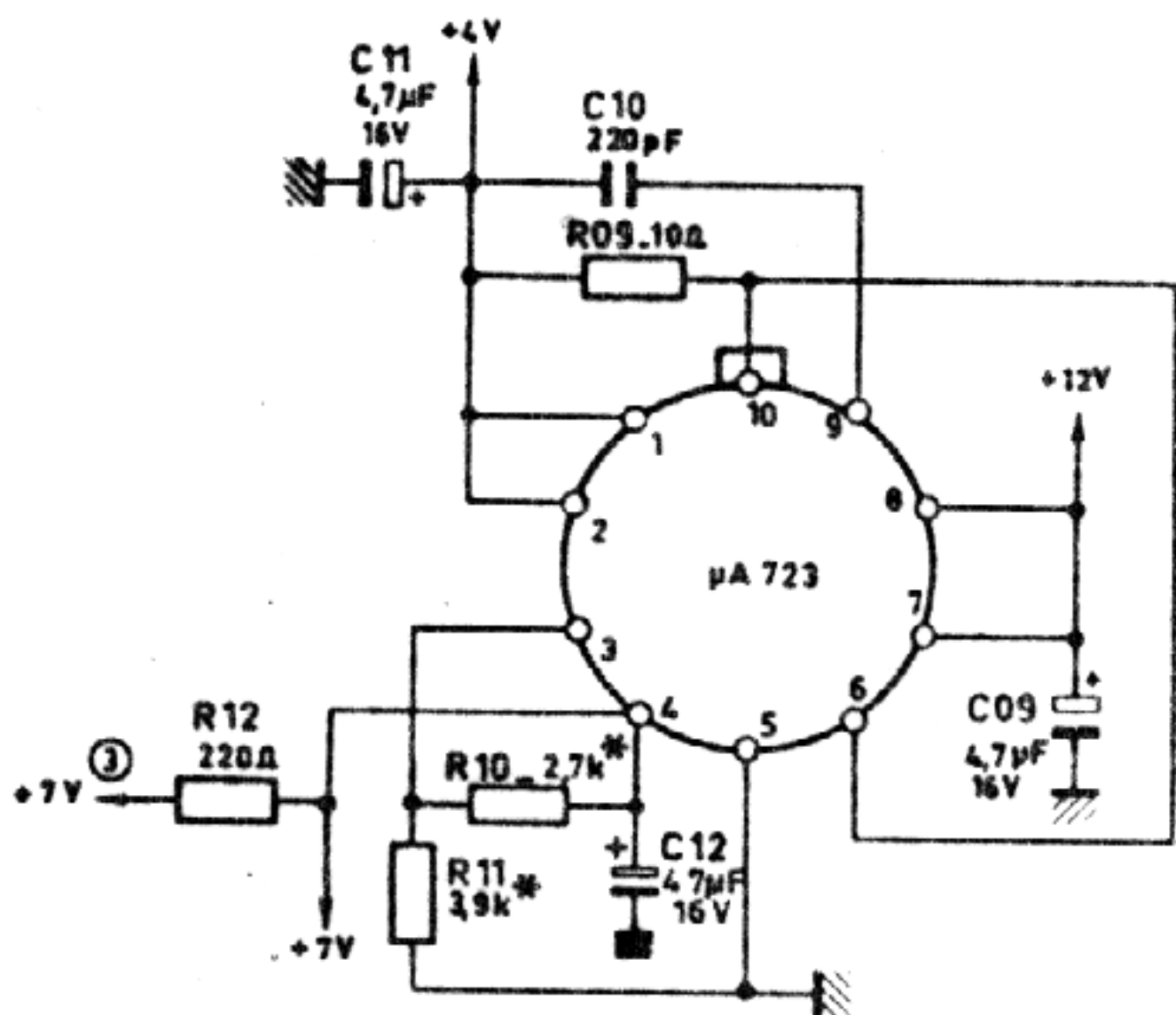


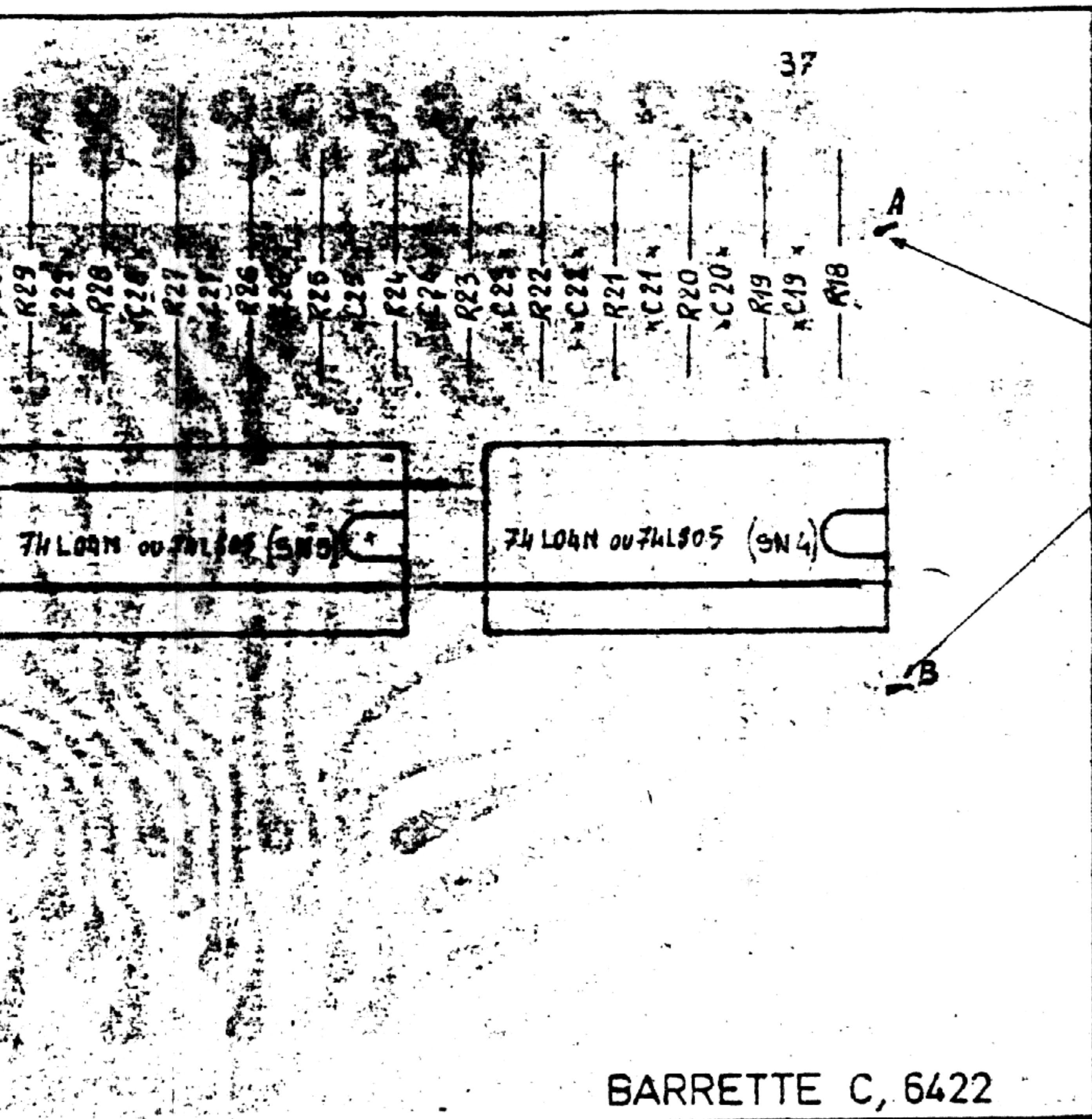




N° d' ESSAI appareils utilisés	CONDITIONS	SANCTIONS
<p>I</p> <p>II</p> <p>VHV DC Supply 1500 V</p>	<p>APPEARANCE</p> <p>Check that all the sub-units are correctly set up according to descriptive plates.</p> <p>MAINS INSULATION</p> <p>After setting the MAINS fuse, send a 1500 V DC voltage on the mains connector, on the one hand between point 2 and ground, and on the other hand between point 3 and ground (See figure VII-1)</p>  <p><i>Figure VII-1 - Mains connector insulation measurement</i></p>	<p>No leakage</p>
<p>III</p> <p>45 - 400 Hz</p> <p>115/230 V AC Supply</p> <p>Alternostat</p> <p>Ammeter</p> <p>DC Voltmeter</p>	<p>POWER SUPPLY</p> <p>Feed the instrument using a 45 Hz to 400 Hz AC supply and an alternostat, as shown in figure VII-2.</p>  <p><i>Figure VII-2 - Mains supply adjustment</i></p> <p>a) Make supply frequency vary from 45 Hz to 400 Hz successively on both mains voltages 115 V - 230 V. Measure the following voltages on the "ALIM" connector on the rear panel of the mainframe (see figure VII-3) :</p> <ul style="list-style-type: none"> + 12 V with regard to the ground - 12 V with regard to the ground + 6 V with regard to the ground  <p><i>Figure VII-3 - Supply DC voltages measurement</i></p>	<p>± 150 mV</p> <p>± 150 mV</p> <p>± 100 mV</p>

N° d' ESSAI appareils utilisés	CONDITIONS	SANCTIONS
<p>IV</p> <p>Reference synthesizer (F = 5 MHz) Oscilloscope Voltmeter</p>	<p>b) Repeat the preceding test (described in "a") making mains voltage vary from $\pm 10\%$ on both ranges.</p> <p>c) Check the current density absorbed by the instrument through an AC ammeter whatever the supply voltage. Apply the formula $P = UI$.</p> <p>MASTER OSCILLATOR PHASE-LOCKING</p> <p>- Realize the interface shown in figure VII-4.</p>  <p><i>Figure VII-4 - Internal master oscillator phase-locking</i></p> <ul style="list-style-type: none"> - Send the "5 MHz reference" frequency on the J02 input of the 5104 (input level : 20 mVrms at 1 Vrms/50 Ω), and connect the J03 output to the "A" channel of the oscilloscope. - Operate the P01 "MASTER OSCILLATOR FREQUENCY ADJUSTMENT" potentiometer to stop the signal on the oscilloscope from beating, caused by the non phase-locking of the internal master oscillator to the external source. - While operating P01, check, on the hand, that the voltage delivered by the J03 connector does vary from $\pm 5\text{ V}$ and on the other hand, that the DSO1 "alarm" pilot light is switched off. <p>OUTPUT FREQUENCY ALARM</p> <p>a) Local Mode</p> <p>- Realize the set shown in figure VII-5.</p> 	<p>DC voltages must not vary</p> <p>The power consumed must not exceed 12 VA</p>
<p>V</p> <p>ADRET 4101 standard receiver 0 - 500 MHz frequency meter, 10 Hz resolution</p>	<p><i>Figure VII-5 - Output frequency</i></p>	





BARRETTE C, 6422

WIRING AND COMPONENT LAYOUT
 DIAGRAM N° 931319 C

C36

C35

C34

R33

C33

R32

C32

R31

C31

R30

C30

R29

C29

R28

74LS05 (SN6)

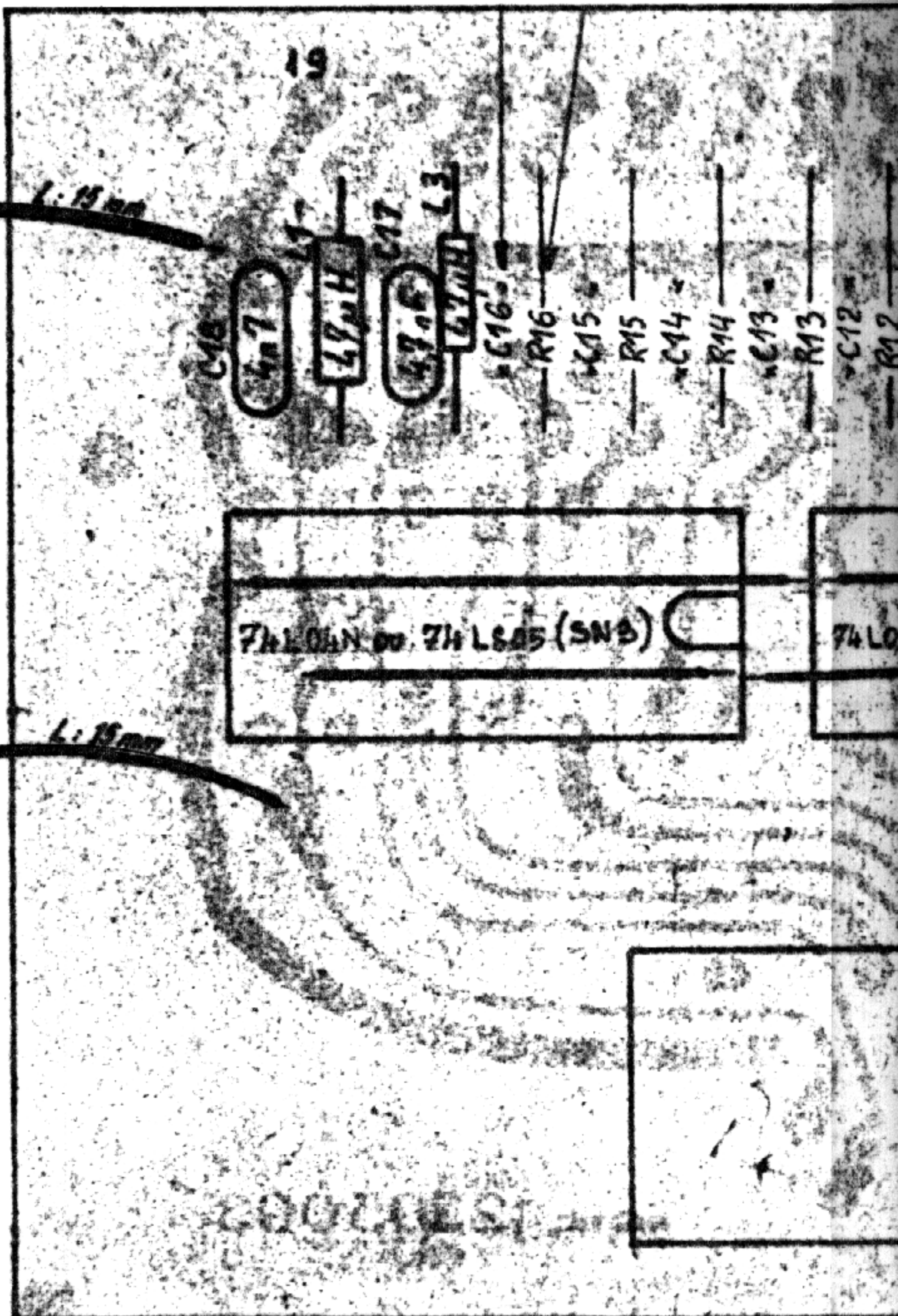
74LS05

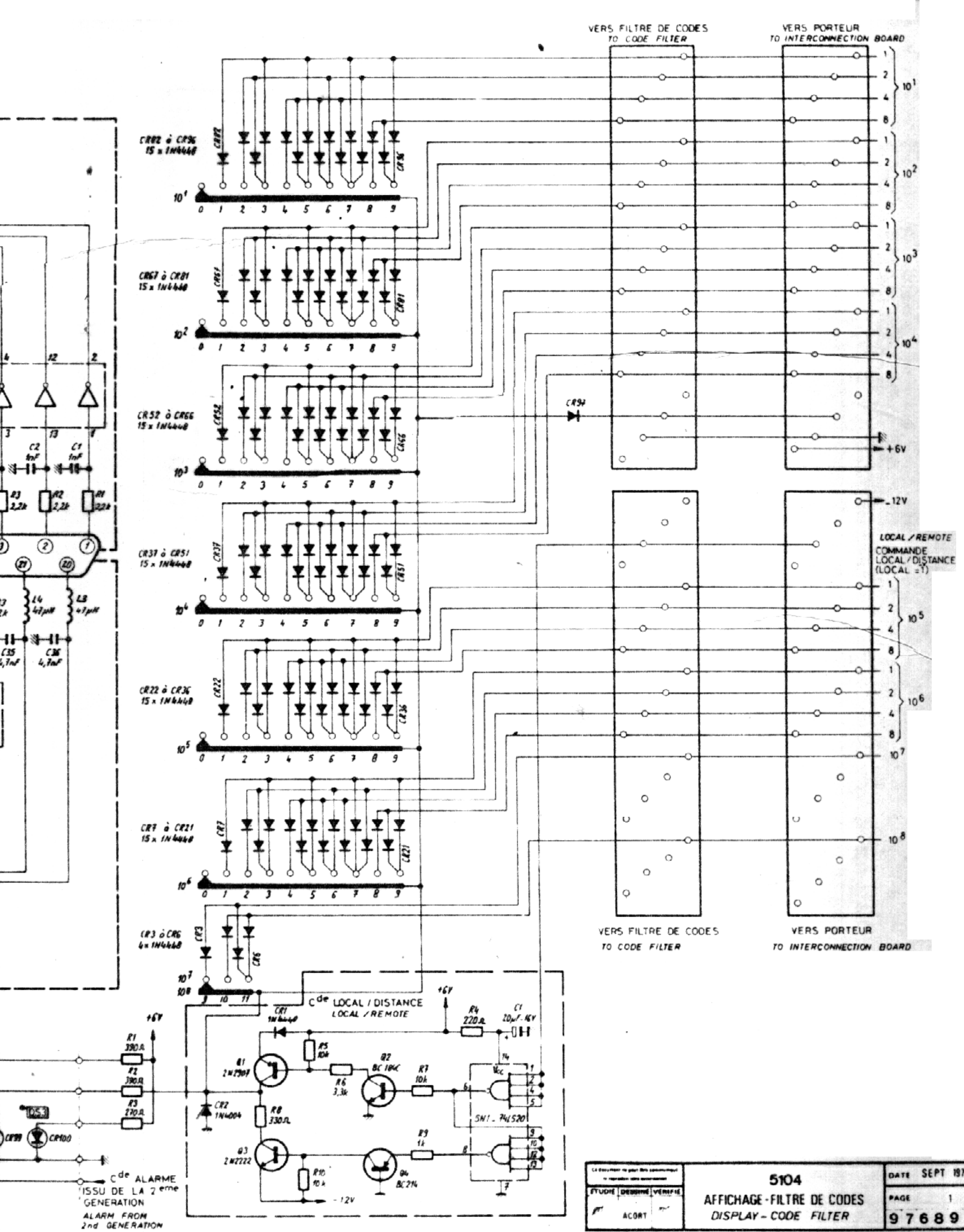
R15
C14
R14
C13
R13
C12
R12
C11
R11
C10
R10
C9
R9
C8
R8
C7
R7
C6
R6
C5
R5
C4
R4
C3
R3
C2
R2
C1
R1



to A
See 931319C

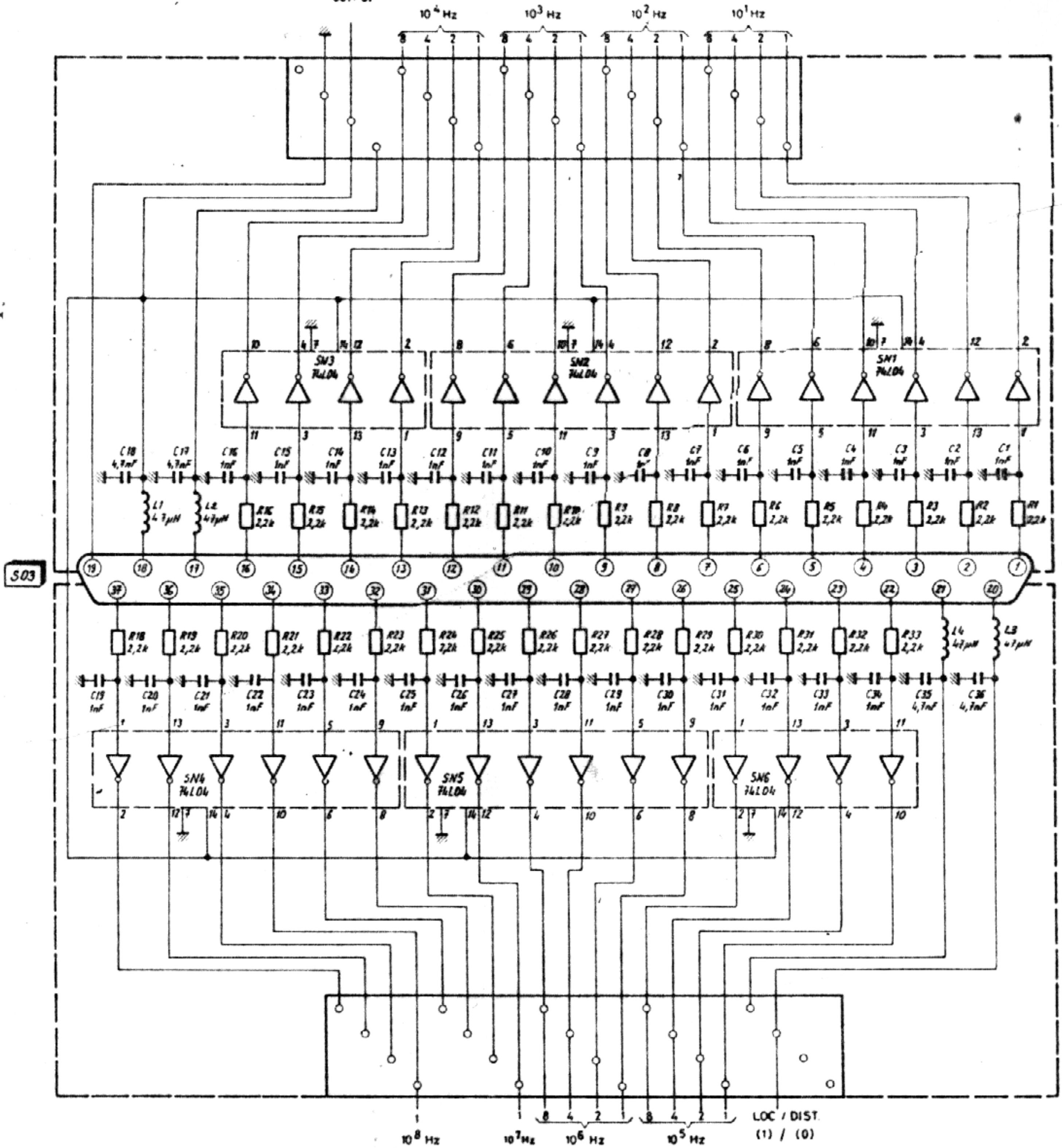
to B
See 931319C



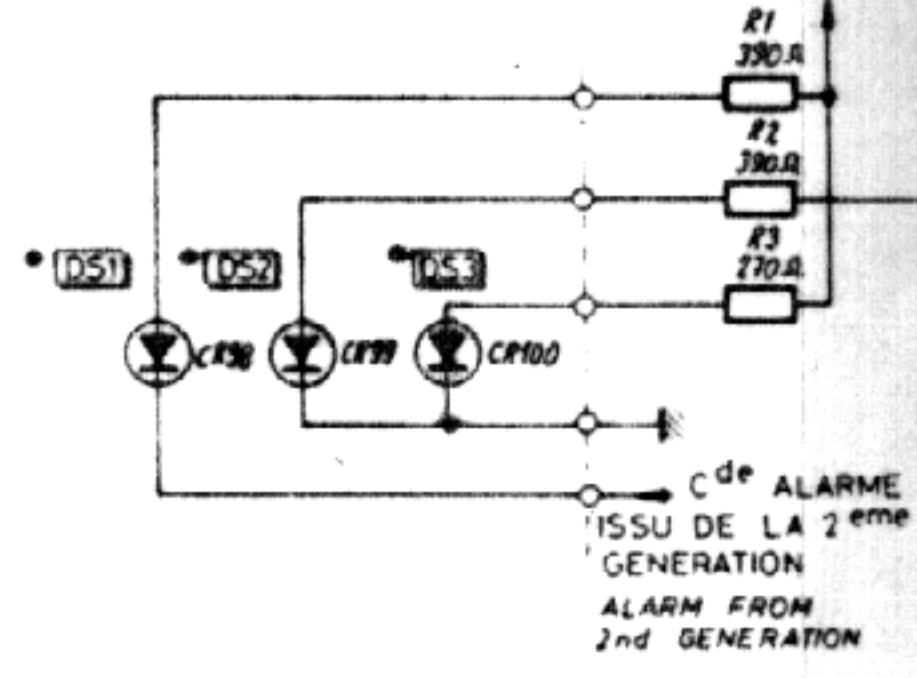


5104		DATE SEPT 1976
AFFICHAGE - FILTRE DE CODES		PAGE 1 1
DISPLAY - CODE FILTER		9 7 6 8 9 5

SORTIE
"0" LOCAL / DISTANCE "1"
LOCAL / REMOTE
OUTPUT



• NOTA DS1 = ALARME (rouge)
ALARM (red)
DS2 = DISTANCE (jaune)
REMOTE (yellow)
DS3 = (vert)
GREEN



CR92 à CR96
15 x 1N4448
10¹
CR87 à CR91
15 x 1N4448
10²
CR82 à CR86
15 x 1N4448
10³
CR77 à CR81
15 x 1N4448
10⁴
CR72 à CR76
15 x 1N4448
10⁵
CR67 à CR71
15 x 1N4448
10⁶
CR62 à CR66
15 x 1N4448
10⁷
CR57 à CR61
15 x 1N4448
10⁸
16V

CHAPTER VI
ELECTRICAL DIAGRAMS

N° d' ESSAI appareils utilisés	CONDITIONS	SANCTIONS
<p>ADRET spectrum analyzer Model 6303/6100 Subtractive mixer ECF 59 5104 reference</p>	<p>b) Non harmonic signals</p> <ul style="list-style-type: none"> - All the non-harmonic signals, except those corresponding to the network frequency, are - Nevertheless, synthesize the 90.1 MHz and 119.1 MHz frequencies on the 5104. - Synthesize the 90.04 MHz and 119.04 MHz frequencies <p>c) Phase noise</p> <ul style="list-style-type: none"> - Realize the interface shown in figure VII-7 <div data-bbox="694 532 1612 1246" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <pre> graph TD REF["5104 REF. F= 117 MHz"] --> MIXER["ECF 59"] UT["5104 UNDER TEST F= 119.99999 MHz"] --> MIXER MIXER --> ANALYSER["6100/6303 ANALYSER"] ANALYSER --> RECORDING["GRAPHIC RECORDING"] </pre> </div> <p>Figure VII-7 - Phase noise measurement</p> <ul style="list-style-type: none"> - Proceed to calibration of the "6100/6303 - and-recording table" set/unit - Draft a first spectrum with a 100 Hz/div. dispersion Check that the phase noise measured at 300 Hz and 1 kHz is respectively - Draft a second sepctrum with a 1 kHz/div. dispersion Check that the phase noise measured at 10 kHz is <p>d) Mains signals</p> <ul style="list-style-type: none"> - Check on both above-mentioned spectra that the signals corresponding to the network frequency are 	<p><-80 dB</p> <p>Check that the signals at ± 100 kHz are <-80 dB</p> <p>Check that the signals at ± 40 kHz are <-80 dB</p> <p><-106 dB and <-112 dB</p> <p><-120 dB</p> <p><-60 dB</p>

- Phase-lock the frequency meter and the 5104 to the same "standard source" (4101)
 - Synthesize the 90 MHz frequency, then move each (K01) switch through all its positions
 - Check that the "Alarm" voltage obtained after a frequency variation is
- Refer to figure VII-6 for the localization of the control point

Check that displayed and synthesized frequencies correspond

> 3 V

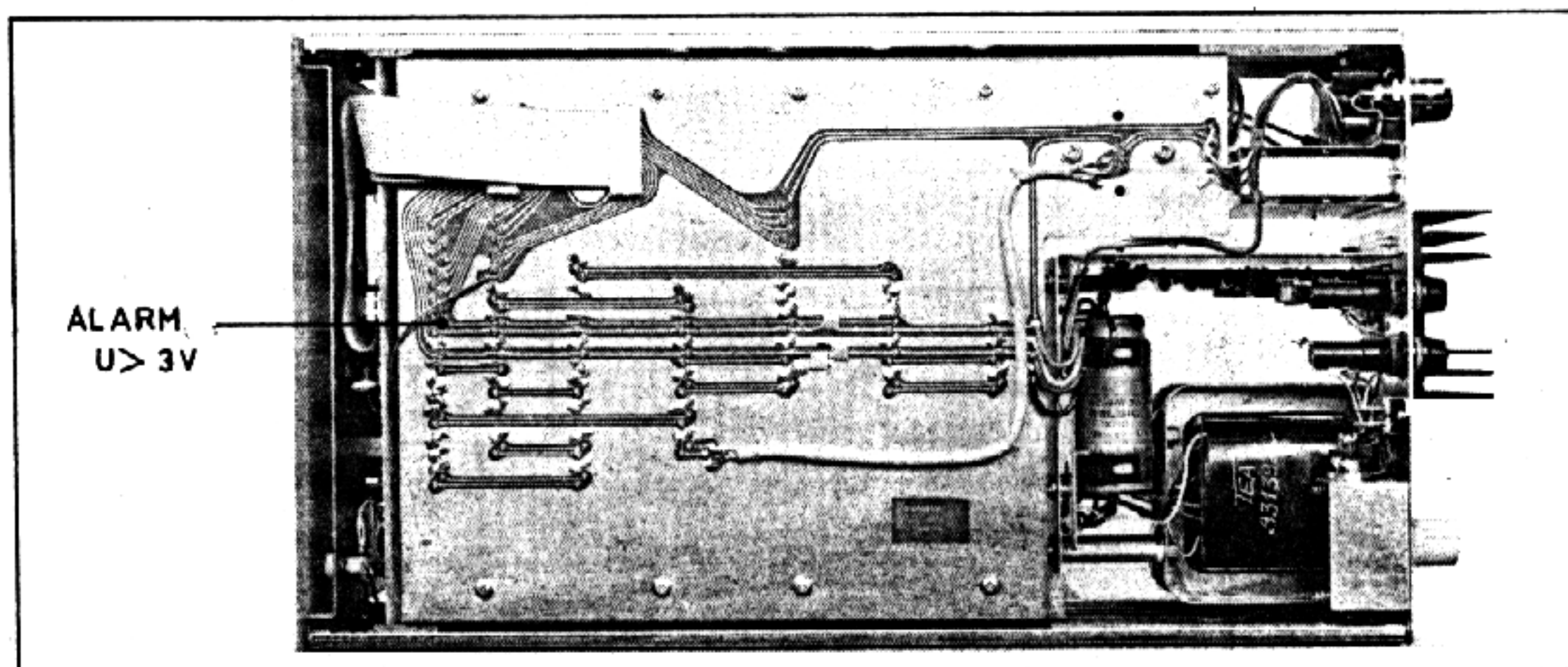


Figure VII-6 - Alarm voltage measurement

ECF 134 + 5104
special head
(frequency
programmer)

b) Remonte Mode

- Connect the programmer to the (S03) "FREQUENCY PROGRAMMING" connector of the 5104.
- Send an "0" logic level (0 V to + 0.7 V/0.2 mA) on pin 20 of (S03).
- Program the 90 MHz frequency, then all the codes corresponding to the different steps.

The DS02 "remote" pilot light must be switched on check that displayed and synthesized frequencies correspond.

VI

OUTPUT LEVEL

- Connect the voltmeter to the (J01) output of the 5104, through a 50 Ω load.

Check that the measured output level is + 13 dBm ± 1 dB

VII

SPECTRAL PURITY

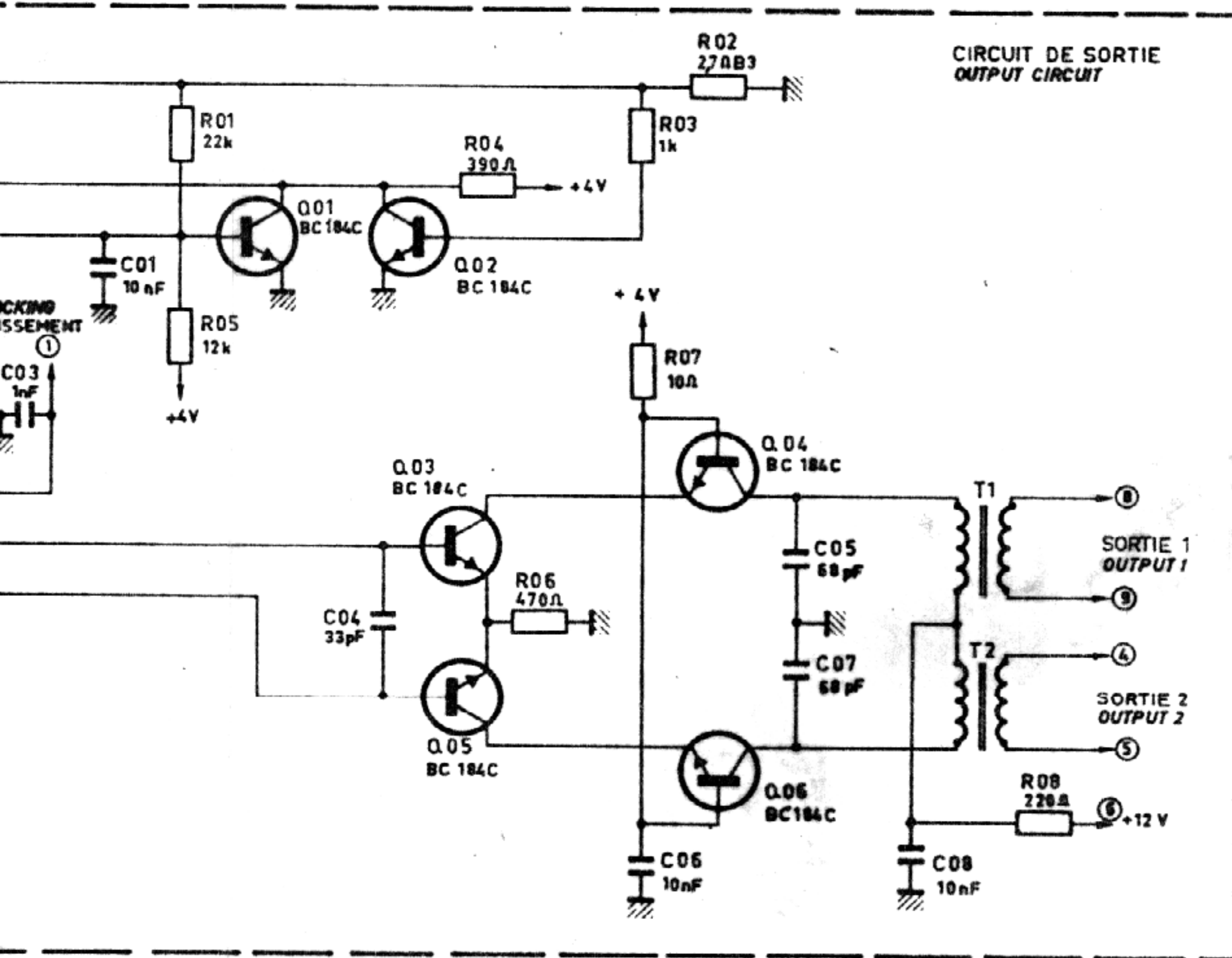
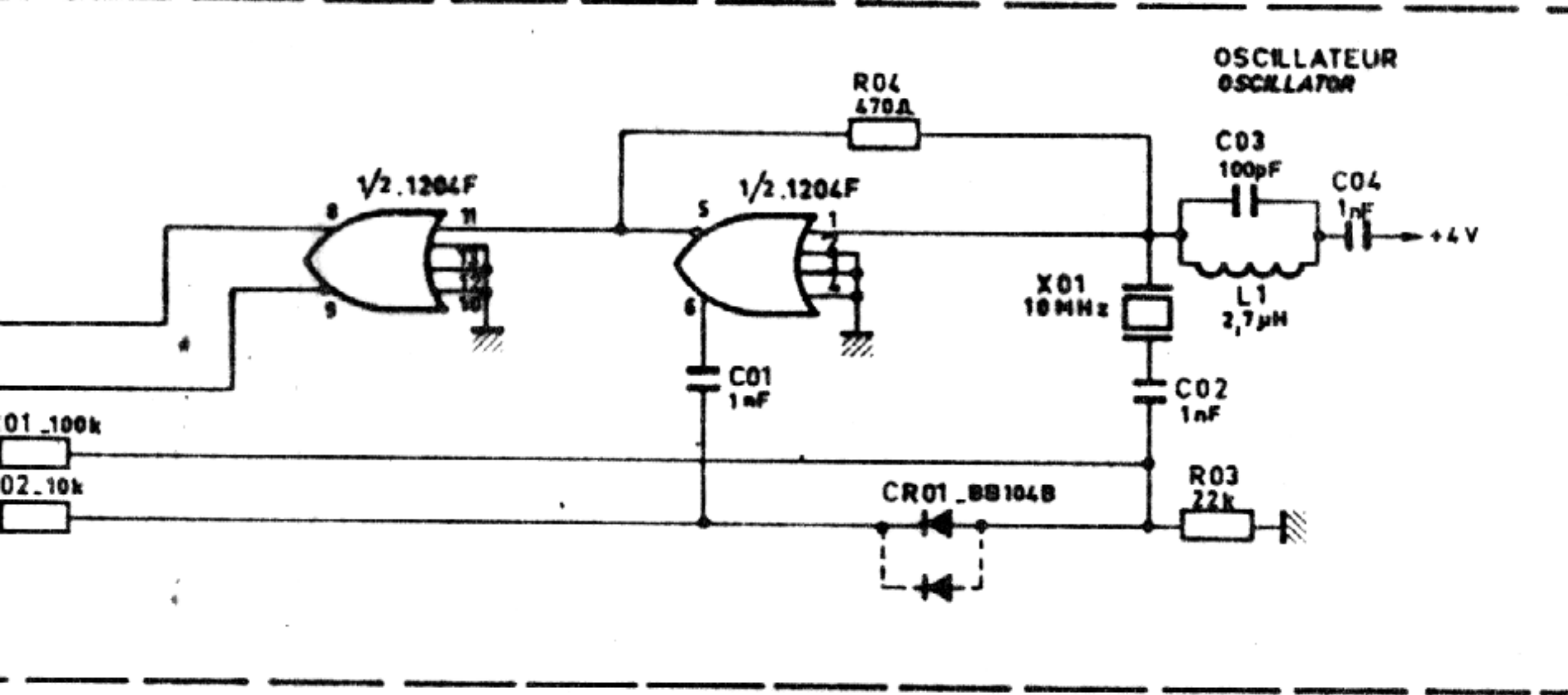
- Connect the spectrum analyzer to the (J01) output of the 5104 through a 50 Ω load.

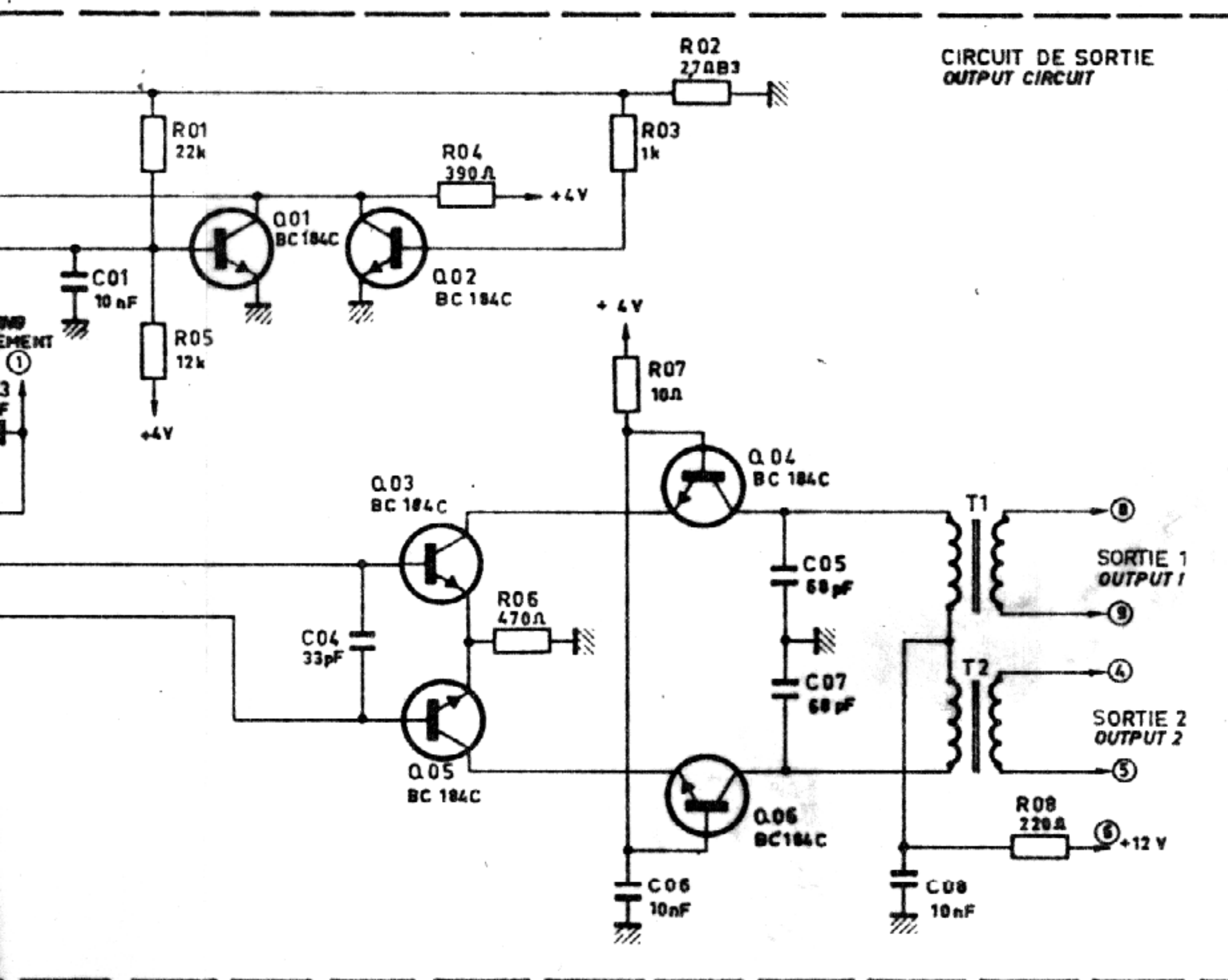
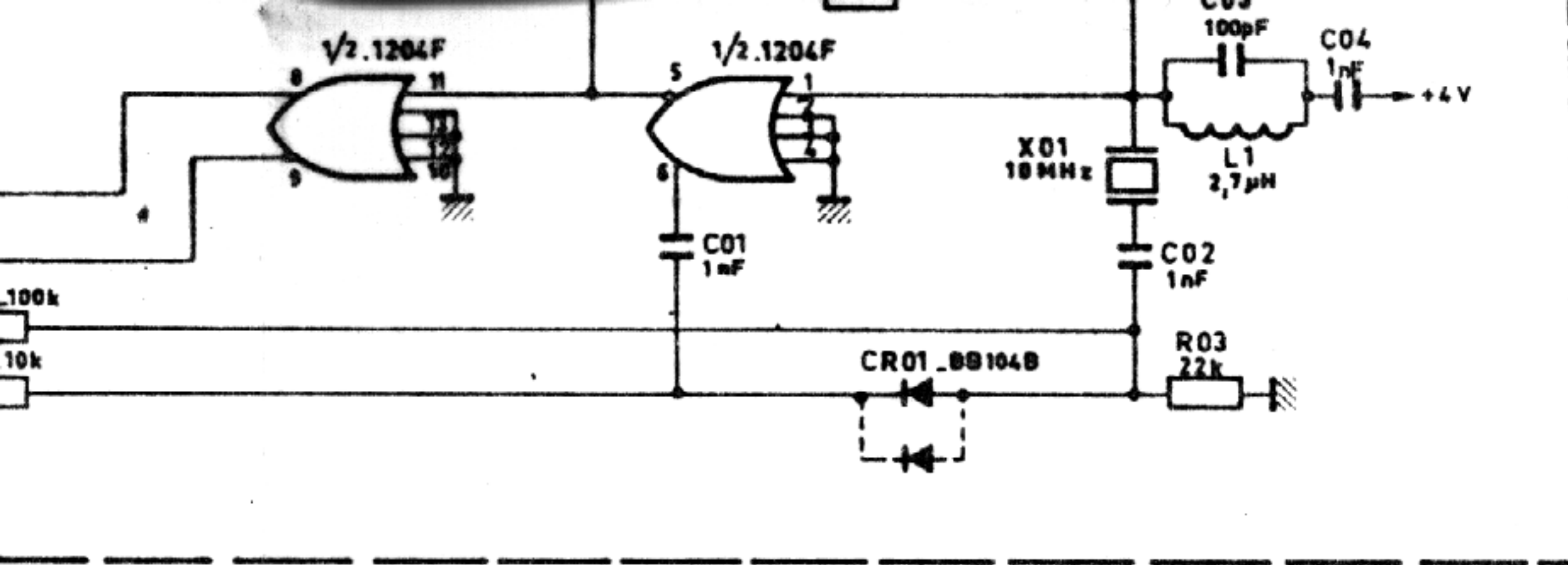
Spectrum analyzer

a) Harmonic signals

- Synthesize different frequencies between 90 MHz and 120 MHz

Check that the harmonic signals are <-26 dB





<small>Se document ne peut être réimprimé ni reproduit sans autorisation</small>			adnat électronique		DATE : JUIN 1975
ETUDE	DESSIN	VERIFIE	PILOTE 623 623 MASTER OSCILLATOR		PAGE : 1/1
	ACORT				9 7 9 9 7 7

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
RESISTANCES <i>RESISTORS</i>			
R45	22100110	100 5 % 1/4 W	S07 SOVCOR
R46	22100122	220 5 % 1/4 W	S07 SOVCOR
R47	22100212	1,2 k 5 % 1/4 W	S07 SOVCOR
 CONDENSATEURS <i>CAPACITORS</i>			
C01	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C02	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C03	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C04	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C05	31200082	82 pF 100 V 2 %	C333 CB/C 82E COGECO
C06	31200133	330 pF 100 V 2 %	C333 CH/C 330E COGECO
C07	31200082	82 pF 100 V 2 %	C333 CB/C 82E COGECO
C08	31200056	56 pF 100 V 2 %	C333 CB/C 56E COGECO
C09	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C10	31200082	82 pF 100 V 2 %	C333 CB/C 82E COGECO
C11	31200056	56 pF 100 V 2 %	C333 CB/C 56E COGECO
C12	31200133	330 pF 100 V 2 %	C333 CB/C 56E COGECO
C13	31200133	330 pF 100 V 2 %	C333 CB/C 56E COGECO
C14	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C15	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C16	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C17	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C18	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C19	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C20	31200047	47 pF 100 V 2 %	C333 CB/C 47E COGECO
C21	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C22			
C23	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C24	31500310	10 nF 63 V + 50-20 %	GP Marquage clair I.T.T.
C25	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C26	37000400	1 µF 35 V 20 %	PAIF TAS 1 L.T.T.
C27	32004800	33 nF 100 V 10 %	C280 AE/A 330 k COGECO
C28	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C29	31200033	33 pF 100 V 2 %	C333 CB/C 33E COGECO
C30	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C31	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C32	31200068	68 pF 100 V 2 %	C333 CB/C 68E COGECO
C33	31200°68	68 pF 100 V 2 %	C333 CB/C 68E COGECO
CV1	36000500	1,8/10 pF 100 V 2 %	R.T.C.

REPERES	REFERENCE ADRET	DESIGNATION			REFERENCE FABRICANT
RESISTANCES RESISTORS					
R01	22100082.	82	5 %	1/4 W	S07 SOVCOR
R02	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R03	22100315	15 k	5 %	1/4 W	S07 SOVCOR
R04	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R05	22100118	180	5 %	1/4 W	S07 SOVCOR
R06	22100118	180	5 %	1/4 W	S07 SOVCOR
R07	22100110	100	5 %	1/4 W	S07 SOVCOR
R08	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R09	22100315	15 k	5 %	1/4 W	S07 SOVCOR
R10	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R11	22100156	560	5 %	1/4 W	S07 SOVCOR
R12	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R13	22100082	82	5 %	1/4 W	S07 SOVCOR
R14	22100147	470	5 %	1/4 W	S07 SOVCOR
R15	22100227	2,7 k	5 %	1/4 W	S07 SOVCOR
R16	22100115	150	5 %	1/4 W	S07 SOVCOR
R17	22100115	150	5 %	1/4 W	S07 SOVCOR
R18	22100118	180	5 %	1/4 W	S07 SOVCOR
R19	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R20	22100118	180	5 %	1/4 W	S07 SOVCOR
R21	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R22	22100147	470	5 %	1/4 W	S07 SOVCOR
R23	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R24	22100322	22 k	5 %	1/4 W	S07 SOVCOR
R25	22100133	330	5 %	1/4 W	S07 SOVCOR
R26	22100168	680	5 %	1/4 W	S07 SOVCOR
R27	22100139	390	5 %	1/4 W	S07 SOVCOR
R28	22100110	100	5 %	1/4 W	S07 SOVCOR
R29	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R30	22100147	470	5 %	1/4 W	S07 SOVCOR
R31	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R32	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R33	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R34	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R35	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R36	22100122	220	5 %	1/4 W	S07 SOVCOR
R37	22100247	4,7 k	5 %	1/4 W	S07 SOVCOR
R38	22100110	100	5 %	1/4 W	S07 SOVCOR
R39	22100327	27 k	5 %	1/4 W	S07 SOVCOR
R40	22100239	3,9 k	5 %	1/4 W	S07 SOVCOR
R41	22100318	18 k	5 %	1/4 W	S07 SOVCOR
R42	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R43	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R44	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
TRANSISTORS			
Q01	43001100	BC 214	TEXAS INSTRUMENTS
Q02	43002200	BF 272	S.G.S.
Q03	43000400	2N 918	I.T.T.
Q04	43000400	2N 918	I.T.T.
Q05	43000500	2N 2369	MOTOROLA
Q06	43000700	2N 2894	MOTOROLA
Q07	43001900	BC 184C	TEXAS INSTRUMENTS
CIRCUITS INTEGRES INTEGRATED CIRCUITS			
SN01	41507404	74 LS04	TEXAS INSTRUMENTS
SN02	41574122	74 LS122	TEXAS INSTRUMENTS
SN03	41507400	74 LS00	TEXAS INSTRUMENTS
SN04	41507473	74 LS73	TEXAS INSTRUMENTS
SN05	41507490	74 LS90	TEXAS INSTRUMENTS
SN06	41507490	74 LS90	TEXAS INSTRUMENTS
SN07	41507490	74 LS90	TEXAS INSTRUMENTS
SN08	41507495	74 LS90	TEXAS INSTRUMENTS
SN09	41507451	74 LS51	TEXAS INSTRUMENTS
SN10	41507473	74 LS73	TEXAS INSTRUMENTS
SN11	41507420	74 LS20	TEXAS INSTRUMENTS
SN12	41574136	74 LS136	TEXAS INSTRUMENTS
SN13	41507490	74 LS90	TEXAS INSTRUMENTS
SN14	41574136	74 LS136	TEXAS INSTRUMENTS
CONNECTEUR CONNECTOR			
	14310013	31 Points (mâle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS <i>CAPACITORS</i>			
C07	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C08	31200033	33 pF 100 V 2 %	C333 CB/C 33E COGECO
C09	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C10	32323300	3,3 nF 400 V 10 %	2211-347-15-332-RTC
C11	32005200	47 nF 100 V 10 %	C280 AE/A 47K COGECO
C12	370015	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C13	370015	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C14	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C15	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C16	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C17	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C18	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C19			
C20	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C21	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C22	32006500	0,1 μ F 250 V 10 %	C280 AE/A 100K COGECO
BOBINAGES <i>COILS</i>			
T01	02159100	Néosid F10B	ADRET ELECTRONIQUE
T02	02177000	Néosid F10	ADRET ELECTRONIQUE
T03	02177100	Néosid F10	ADRET ELECTRONIQUE
T04	02177200	Néosid F10	ADRET ELECTRONIQUE
DIODES			
CR01	45002600	BB 109	SESCOSEM
CR02	45002600	BB 109	SESCOSEM
CR03	45002600	BB 109	SESCOSEM
CR04	45002600	BB 109	SESCOSEM
CR05	45003100	1N 4448	I.T.T.
CR06	45003100	1N 4448	I.T.T.
CR07	45003100	1N 4448	I.T.T.
CR08	45003100	1N 4448	I.T.T.
CR09	45003100	1N 4448	I.T.T.
CR10	45003100	1N 4448	I.T.T.

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
RESISTANCES			
<i>RESISTORS</i>			
R01	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R02	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R03	22100112	120 5 % 1/4 W	S07 SOVCOR
R04	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R05	22100239	3,9 k 5 % 1/4 W	S07 SOVCOR
R06	22100318	18 k 5 % 1/4 W	S07 SOVCOR
R07	22100327	27 k 5 % 1/4 W	S07 SOVCOR
R08	22100256	5,6 k 5 % 1/4 W	S07 SOVCOR
R09	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R10	22100133	330 5 % 1/4 W	S07 SOVCOR
R11	22100139	390 5 % 1/4 W	S07 SOVCOR
R12	22100168	680 5 % 1/4 W	S07 SOVCOR
R13	22100347	47 k 5 % 1/4 W	S07 SOVCOR
R14	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R15	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R16	22100122	220 5 % 1/4 W	S07 SOVCOR
R17	22100122	220 5 % 1/4 W	S07 SOVCOR
R18	22100082	82 5 % 1/4 W	S07 SOVCOR
R19	22100147	470 5 % 1/4 W	S07 SOVCOR
R20	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R21	22100315	15 k 5 % 1/4 W	S07 SOVCOR
R22	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R23	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R24	22100047	47 5 % 1/4 W	S07 SOVCOR
R25	22100022	22 5 % 1/4 W	S07 SOVCOR
R26	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R27	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R28	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R29	22100115	150 5 % 1/4 W	S07 SOVCOR
R30	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R31	22100347	47 k 5 % 1/4 W	S07 SOVCOR
R32	22100122	220 5 % 1/4 W	S07 SOVCOR
R33	22100139	390 5 % 1/4 W	S07 SOVCOR
CONDENSATEURS			
<i>CAPACITORS</i>			
C01	31200056	56 pF 100 V 2 %	C333 CB/C 56E COGECO
C02			
C03	31200010	10 nF 100 V 2 %	C333 CB/C 10E COGECO
C04	31200015	15 pF 100 V 2 %	C333 CB/C 10E COGECO
C05			
C06	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CIRCUITS INTEGRES <i>INTEGRATED CIRCUITS</i>			
SN14	41507473	74 LS73	TEXAS INSTRUMENTS
SN15	41107412	7412	TEXAS INSTRUMENTS
MO1	42001100	TBA 673	R.T.C.
CONNECTEUR <i>CONNECTOR</i>			
	14350046	TM 35 points (Mâle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
BOBINAGES			
<i>COILS</i>			
T07	02167500	Néosid F10	ADRET ELECTRONIQUE
T08	02167500	Néosid F10	ADRET ELECTRONIQUE
T09	02148700	Néosid F10B	ADRET ELECTRONIQUE
DIODES			
CR01	45002100	BB 104B	R.T.C.
CR02	45002100	BB 104B	R.T.C.
CR03	45003100	1N 4448	I.T.T.
CR04	45003100	1N 4448	I.T.T.
CR05	45003100	1N 4448	I.T.T.
CR06	45003100	1N 4448	I.T.T.
CR07	45003100	1N 4448	I.T.T.
CR08	45003100	1N 4448	I.T.T.
TRANSISTORS			
Q01	43001100	BC 214C	TEXAS INSTRUMENTS
Q02	43000500	2N 2369	MOTOROLA
Q03	43001900	BC 184C	TEXAS INSTRUMENTS
Q04	43001900	BC 184C	TEXAS INSTRUMENTS
Q05	43002200	BF 272	S.G.S.
Q06	43000400	2N 918	I.T.T.
Q07	43000400	2N 918	I.T.T.
CIRCUITS INTEGRES			
<i>INTEGRATED CIRCUITS</i>			
SN01	41507490	74 LS90	TEXAS INSTRUMENTS
SN02	41507400	74 LS00	TEXAS INSTRUMENTS
SN03	41507473	74 LS73	TEXAS INSTRUMENTS
SN04	41507400	74 LS00	TEXAS INSTRUMENTS
SN05	41507490	74 LS90	TEXAS INSTRUMENTS
SN06	41507473	74 LS73	TEXAS INSTRUMENTS
SN07	41507495	74 LS95	TEXAS INSTRUMENTS
SN08	41507490	74 LS90	TEXAS INSTRUMENTS
SN09	41574136	74 LS136	TEXAS INSTRUMENTS
SN10	41507490	74 LS90	TEXAS INSTRUMENTS
SN11	41574136	74 LS136	TEXAS INSTRUMENTS
SN12	41507490	74 LS90	TEXAS INSTRUMENTS
SN13	4157136	74 LS136	TEXAS INSTRUMENTS

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS <i>CAPACITORS</i>			
C04	32002900	10 nF 160 V 10 %	C280 AE/A 10K COGECO
C05	31200056	56 pF 100 V 2 %	C333 CB/C 56E COGECO
C06			
C07	31200056	56 pF 100 V 2 %	C333 CB/C 56E COGECO
C08			
C09	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C10	31200968	6,8 pF 100 V \pm 0,25 pF	C333 CB/N 6E8 COGECO
C11	31200082	82 pF 100 V \pm 2 %	C333 CB/C 82E COGECO
C12			
C13	31200956	5,6 pF 100 V \pm 0,25 pF	C333 CB/N 5E6 COGECO
C14	31200082	82 pF 100 V 2 %	C333 CB/C 82E COGECO
C15			
C16	31200956	5,6 pF 100 V \pm 0,25 pF	C333 CB/N 5E6 COGECO
C17	31200082	82 pF 100 V 2 %	C333 CB/C 82E COGECO
C18			
C19	31200968	6,8 pF 100 V \pm 0,25 pF	C333 CB/N 6E8 COGECO
C20	31200082	82 pF 100 V 2 %	C333 CB/C 82E COGECO
C21			
C22	31200033	33 pF 100 V 2 %	C333 CB/C 33E COGECO
C23	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C24	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C25	32007200	0,1 µF 40 V 5 %	
C26	37000400	1 µF 35 V 20 %	PAIF TAS 1 L.T.T.
C27	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C28	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C29	31200022	22 pF 100 V 2 %	C333 CB/C 22E COGECO
C30	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C31	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C32	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C33	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C34	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C35	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C36	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
BOBINAGES <i>COILS</i>			
T01	02135600	Néosid F10B	ADRET ELECTRONIQUE
T02	02101400	Néosid F2	ADRET ELECTRONIQUE
T03	02162800	Néosid F2	ADRET ELECTRONIQUE
T04	02176800	Néosid F2	ADRET ELECTRONIQUE
T05	02176900	Néosid F10	ADRET ELECTRONIQUE
T06	02167500	Néosid F10	ADRET ELECTRONIQUE

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
RESISTANCES			
RESISTORS			
R01			
R02	22100122	220 5 % 1/4 W	S07 SOVCOR
R03	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R04	22100168	680 5 % 1/4 W	S07 SOVCOR
R05	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R06	22100068	68 5 % 1/4 W	S07 SOVCOR
R07	22100068	68 5 % 1/4 W	S07 SOVCOR
R08	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R09	22100110	100 5 % 1/4 W	S07 SOVCOR
R10	22100110	110 5 % 1/4 W	S07 SOVCOR
R11	22100227	2,7 k 5 % 1/4 W	S07 SOVCOR
R12	22100268	6,8 k 5 % 1/4 W	S07 SOVCOR
R13	22100068	68 5 % 1/4 W	S07 SOVCOR
R14	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R15	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R16	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R17	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R18	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R19	22100068	68 5 % 1/4 W	S07 SOVCOR
R20	22100256	5,6 k 5 % 1/4 W	S07 SOVCOR
R21	22100122	220 5 % 1/4 W	S07 SOVCOR
R22	22100133	330 5 % 1/4 W	S07 SOVCOR
R23	22100122	220 5 % 1/4 W	S07 SOVCOR
R24	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R25	22100322	22 k 5 % 1/4 W	S07 SOVCOR
R26	22100018	18 5 % 1/4 W	S07 SOVCOR
R27	22100168	680 5 % 1/4 W	S07 SOVCOR
R28	22100139	390 5 % 1/4 W	S07 SOVCOR
R29	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R30	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R31	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R32	22100082	82 5 % 1/4 W	S07 SOVCOR
R33	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R34	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R35	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R36	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
CONDENSATEURS			
CAPACITORS			
C01	33000900	250 pF 250 V 2 %	TVE 15C LAFAB
C02	33000900	250 pF 250 V 2 %	TVE 15C LAFAB
C03			

NOMENCLATURE:

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
BOBINAGES			
<i>COILS</i>			
T01	02177300	Néosid F2	ADRET ELECTRONIQUE
T02	02147800	Néosid F2	ADRET ELECTRONIQUE
T03	02140700	Néosid F2	ADRET ELECTRONIQUE
T04	02147800	Néosid F2	ADRET ELECTRONIQUE
T05	02116000	Néosid F2	ADRET ELECTRONIQUE
T06	02112800	Néosid F10B	ADRET ELECTRONIQUE
T07	02163500	Néosid F10B	ADRET ELECTRONIQUE
T08	02177400	Néosid F10	ADRET ELECTRONIQUE
T09	02135100	Néosid F10B	ADRET ELECTRONIQUE
T10	02177500	Néosid H20	ADRET ELECTRONIQUE
DIODES			
CR01	45003100	1N 4448	I.T.T.
CR02	45003100	1N 4448	I.T.T.
CR03	45003100	1N 4448	I.T.T.
CR04	45003100	1N 4448	I.T.T.
CR05	45003100	1N 4448	I.T.T.
CR06	45003100	1N 4448	I.T.T.
CR07	45002600	BB 109	SESCOSEM
CR08	45002600	BB 109	SESCOSEM
CR09	45002600	BB 109	SESCOSEM
CR10	45002600	BB 109	SESCOSEM
TRANSISTORS			
Q01	43000500	2N 2369	MOTOROLA
Q02	43000700	2N 2894	MOTOROLA
Q03	43000500	2N 2369	MOTOROLA
Q04	43000700	2N 2894	MOTOROLA
Q05	43001900	BC 184C	TEXAS INSTRUMENTS
Q06	43001900	BC 184C	TEXAS INSTRUMENTS
Q07	43002200	BF 272	S.G.S.
Q08	43000400	2N 918	TEXAS INSTRUMENTS
Q09	43000400	2N 918	TEXAS INSTRUMENTS
Q10	43001900	BC 184C	TEXAS INSTRUMENTS
Q11	43001000	2N 2907	TEXAS INSTRUMENTS
Q12	43001100	BC 214C	TEXAS INSTRUMENTS
Q13	43001100	BC 214C	TEXAS INSTRUMENTS

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CIRCUITS INTEGRES <i>INTEGRATED CIRCUITS</i>			
SN01	41507490	74 LS90	TEXAS INSTRUMENTS
SN02	41507473	74 LS73	TEXAS INSTRUMENTS
SN03	41507400	74 LS00	TEXAS INSTRUMENTS
SN04	42001100	TBA 673	R.T.C.
SN05	41507404	74 LS04	TEXAS INSTRUMENTS
CONNECTEUR <i>CONNECTOR</i>			
	14310013	TM 31 points (mâle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS <i>CAPACITORS</i>			
C14	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C15	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C16	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C17	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C18	31200033	33 pF 100 V 2 %	C333 CB/C 33E COGECO
C19	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C20	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C21	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C22	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C23	31200033	33 pF 100 V 2 %	C333 CH/C 100E COGECO
C24	31500310	10 nF 63 V + 50-20%	GOX 767 14 L.C.C.
C40	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C41	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
BOBINAGES <i>COILS</i>			
T03	02167700	Tore H20	ADRET ELECTRONIQUE
T04	02177900	Tore H20	ADRET ELECTRONIQUE
T05	02147900	Néosid F2	ADRET ELECTRONIQUE
T06	02149100	Néosid F10B	ADRET ELECTRONIQUE
T07	02149100	Néosid F10B	ADRET ELECTRONIQUE
T08	02161200	Néosid F2	ADRET ELECTRONIQUE
TRANSISTORS			
Q06	43002000	2N 5179	R.C.A.
Q07	43002000	2N 5179	R.C.A.
Q08	43001900	BC 184C	TEXAS INSTRUMENTS
Q09	43001100	BC 214C	TEXAS INSTRUMENTS
Q10	43001000	2N 2907	TEXAS INSTRUMENTS
Q11	43001900	BC 184C	TEXAS INSTRUMENTS
M	42002700	ML-1	
CONNECTEUR <i>CONNECTOR</i>			
	14110014	TM 11 (mâle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
BOBINAGES <i>COILS</i>			
T01	02177800	F 100	ADRET ELECTRONIQUE
T02	02177900	H 20	ADRET ELECTRONIQUE
L01	53000300	4,7 μ H 2,5 A 10 %	53801 OREGA
L02	53000300	4,7 μ H 2,5 A 10 %	53801 OREGA
DIODES			
CR01	45001300	FD 777	FAIRCHILD
CR02	45002600	BB 109	SESCOSEM
CR03	45002600	BB 109	SESCOSEM
CR04	45002600	BB 109	SESCOSEM
CR05	45002600	BB 109	SESCOSEM
CR06	45002600	BB 109	SESCOSEM
TRANSISTORS			
Q01	43001900	BC 184C	TEXAS INSTRUMENTS
Q02	43001100	BC 214C	TEXAS INSTRUMENTS
Q03	43002000	2N 5179	R.C.A.
Q04	43002000	2N 5179	R.C.A.
Q05	43002500	BFR 90	R.T.C.
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> CARTE MELANGEUR MIXER BOARD </div>			
RESISTANCES <i>RESISTORS</i>			
R20	22100127	270 5 % 1/4 W	S07 SOVCOR
R21	29000033	33 5 % 1/8 W	C3 SOVCOR
R22	29000033	33 5 % 1/8 W	C3 SOVCOR
R23	22100182	820 5 % 1/4 W	S07 SOVCOR
R24	22100127	270 5 % 1/4 W	S07 SOVCOR
R25	29000122	220 5 % 1/8 W	C3 SOVCOR
R26	29000033	33 5 % 1/8 W	C3 SOVCOR
R27	29000039	33 5 % 1/8 W	C3 SOVCOR
R28	22100182	820 5 % 1/4 W	S07 SOVCOR
R29	22100110	100 5 % 1/4 W	S07 SOVCOR
R30	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R31	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R32	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
		OSCILLATEUR 87 à 116 MHz 87/116 MHz OSCILLATOR	
RESISTANCES <i>RESISTORS</i>			
R01	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R02	22100322	220 k 5 % 1/4 W	S07 SOVCOR
R03	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R04	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R05	22100147	470 5 % 1/4 W	S07 SOVCOR
R06	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R07	22100122	220 5 % 1/4 W	S07 SOVCOR
R08	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R09	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R10	22100327	27 k 5 % 1/4 W	S07 SOVCOR
R11	29000051	51 5 % 1/8 W	C3 SOVCOR
R12	29000110	100 5 % 1/8 W	C3 SOVCOR
R13	22100127	270 5 % 1/4 W	S07 SOVCOR
R14	29000051	51 5 % 1/8 W	C3 SOVCOR
R15	22100122	220 5 % 1/4 W	S07 SOVCOR
R16	22100051	51 5 % 1/4 W	S07 SOVCOR
R17	22100147	470 5 % 1/4 W	S07 SOVCOR
R18	22100147	470 5 % 1/4 W	S07 SOVCOR
R19	22100082	82 5 % 1/4 W	S07 SOVCOR
R59	29000022	22 5 % 1/8 W	C3 SOVCOR
CONDENSATEURS <i>CAPACITORS</i>			
C01	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C02	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C03	323223300	3,3 nF 400 V ± 10 %	2211-347-15-332-RTC
C04	32006500	0,1 µF 250 V 10 %	C280 AE/A 100K COGECO
C05	31200010	10 pF 100 V 2 %	C333 CB/C 10E COGECO
C06			
C07	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C08	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C09	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C10	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C11			
C12	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C13	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
TRANSISTORS			
Q04	43000500	2N 2369	MOTOROLA
Q05	43000700	2N 2894	MOTOROLA
Q06	43001900	BC 184C	TEXAS INSTRUMENTS
Q07	43000500	2N 2369	MOTOROLA
Q08	43000500	2N 2369	MOTOROLA
Q09	43000400	2N 918	I.T.T.
Q10	43000400	2N 918	I.T.T.
Q11	43000500	2N 2369	MOTOROLA
CIRCUITS INTEGRES INTEGRATED CIRCUITS			
SN01	41507473	74 LS73	TEXAS INSTRUMENTS
SN02	41507490	74 LS90	TEXAS INSTRUMENTS
SN03	41507410	74 LS10	TEXAS INSTRUMENTS
SN04	41574122	74 LS122	TEXAS INSTRUMENTS
SN05	41005400	SP 640B	PLESSEY
SN06	41174162	74162N	TEXAS INSTRUMENTS
SN07	41507483	74 LS83N	TEXAS INSTRUMENTS
SN08	41174163	74 163N	TEXAS INSTRUMENTS
SN09	41507400	74 LS00	TEXAS INSTRUMENTS
SN10	41507490	74 LS90	TEXAS INSTRUMENTS
SN11	41507400	74 LS00	TEXAS INSTRUMENTS
SN12	42000900	741	FAIRCHILD
SN13	41507430	74 LS30	TEXAS INSTRUMENTS
CONNECTEUR CONNECTOR			
	14270116	TM27 (mâle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS			
<i>CAPACITORS</i>			
C01	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C02	31200022	22 pF 100 V 2 %	C333 CB/C 22E COGECO
C03	37001500	22 µF 100 V + 50-20 %	GP Marquage clair I.T.T.
C04	37001500	22 µF 100 V + 50-20 %	GP Marquage clair I.T.T.
C05	37001500	22 µF 100 V + 50-20 %	GP Marquage clair I.T.T.
C06	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C07	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C08	37001800	15 µF 16 V + 50-20 %	Série 122 R.T.C.
C09	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C10	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C11	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C12	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C13	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C14	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C15	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C16	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C17	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C18	32006500	0,1 µF 250 V 10 %	C280 AE/A 100K COGECO
C19	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C20	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C21	37001300	10 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C22	37001300	10 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
BOBINAGES			
<i>BOILS</i>			
L01	43001400	330 nH 1,1 A 10 %	53806 OREGA
DIODES			
CR01	45003100	1N 4448	I.T.T.
CR02	45003100	1N 4448	I.T.T.
CR03	45003100	1N 4448	I.T.T.
CR04	45003100	1N 4448	I.T.T.
CR05	45003100	1N 4448	I.T.T.
CR06	45003100	1N 4448	I.T.T.
TRANSISTORS			
Q01	43002200	BF 272	S.G.S.
Q02	43000400	2N 918	I.T.T.
Q03	43000400	2N 918	I.T.T.

REPERES	REFERENCE ADRET	DESIGNATION			REFERENCE FABRICANT
RESISTANCES RESISTORS					
R01	22100122	220	5 %	1/4 W	S07 SOVCOR
R02	22100133	330	5 %	1/4 W	S07 SOVCOR
R03	22100168	680	5 %	1/4 W	S07 SOVCOR
R04	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R05	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R06	22100122	220	5 %	1/4 W	S07 SOVCOR
R07	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R08	22100082	82	5 %	1/4 W	S07 SOVCOR
R09	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R10	22100315	15 k	5 %	1/4 W	S07 SOVCOR
R11	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R12	22100122	220	5 %	1/4 W	S07 SOVCOR
R13	22100115	150	5 %	1/4 W	S07 SOVCOR
R14	22100310	10 k	5 %	1/4 W	S07 SOVCOR
R15	22100310	10 k	5 %	1/4 W	S07 SOVCOR
R16	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R17	22100315	15 k	5 %	1/4 W	S07 SOVCOR
R18	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R19	22100015	15	5 %	1/4 W	S07 SOVCOR
R20	22100118	180	5 %	1/4 W	S07 SOVCOR
R21	22100147	470	5 %	1/4 W	S07 SOVCOR
R22	22100051	51	5 %	1/4 W	S07 SOVCOR
R23	22100122	220	5 %	1/4 W	S07 SOVCOR
R24	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R25	22100110	100	5 %	1/4 W	S07 SOVCOR
R26	22100133	330	5 %	1/4 W	S07 SOVCOR
R27	22100010	10	5 %	1/4 W	S07 SOVCOR
R28	22100133	330	5 %	1/4 W	S07 SOVCOR
R29	22100310	10 k	5 %	1/4 W	S07 SOVCOR
R30	22100056	56	5 %	1/4 W	S07 SOVCOR
R31	22100133	330	5 %	1/4 W	S07 SOVCOR
R32	22100310	10 k	5 %	1/4 W	S07 SOVCOR
R33	22100082	82	5 %	1/4 W	S07 SOVCOR
R34	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R35	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R36	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R37	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R38	22100327	27 k	5 %	1/4 W	S07 SOVCOR
R39	22100122	220	5 %	1/4 W	S07 SOVCOR
R40	22100122	220	5 %	1/4 W	S07 SOVCOR
R41	22100315	15 k	5 %	1/4 W	S07 SOVCOR
R42	22100110	100	5 %	1/4 W	S07 SOVCOF
R43	22100056	56	5 %	1/4 W	S07 SOVCOR
R44	22100110	100	5 %	1/4 W	S07 SOVCOR
R45	22100139	390	5 %	1/4 W	S07 SOVCOR

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
TRANSISTORS			
Q07	43001900	BC 184C	TEXAS INSTRUMENTS
Q08	43002200	BF 272	S.G.S.
Q09	43000400	2N 918	I.T.T.
Q10	43000400	2N 918	I.T.T.
Q11	43000700	2N 2894	MOTOROLA
Q12	43000200	2N 5179	R.C.A.
Q13	4300200	2N 5179	R.C.A.
Q14	43000200	2N 5179	R.C.A.
CIRCUITS INTEGRES			
<i>INTEGRATED CIRCUITS</i>			
SN01	41507430	74 LS30	TEXAS INSTRUMENTS
SN02	41507490	74 LS90	TEXAS INSTRUMENTS
SN03	41507404	74 LS04	TEXAS INSTRUMENTS
SN04	41507400	74 LS00	TEXAS INSTRUMENTS
SN05	41507473	74 LS73	TEXAS INSTRUMENTS
SN06	41507400	74 LS00	TEXAS INSTRUMENTS
SN07	41507490	74 LS90	TEXAS INSTRUMENTS
SN08	41174196	74 196L	TEXAS INSTRUMENTS
CONNECTEUR			
<i>CONNECTOR</i>			
	14230004		

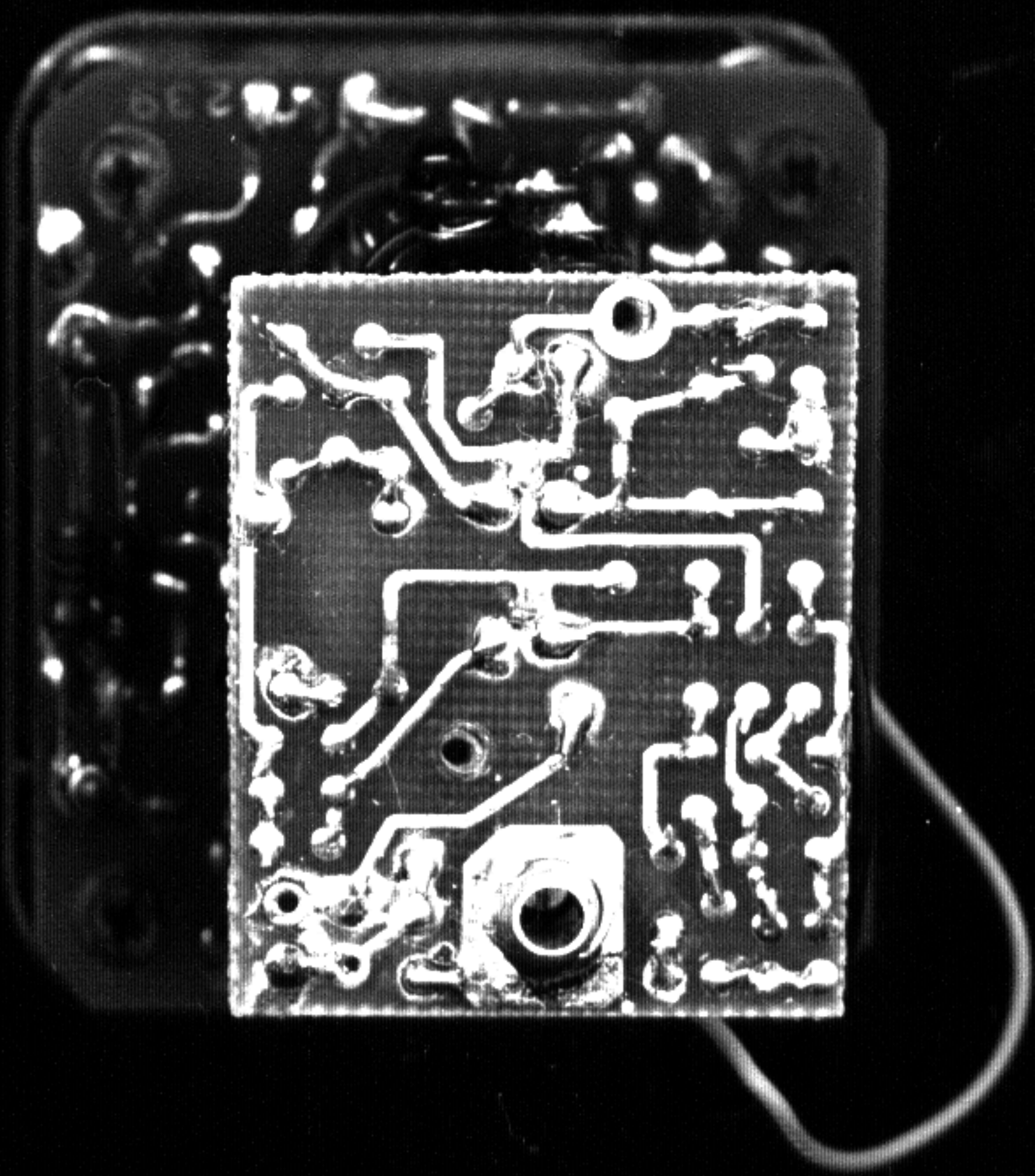
REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS			
<i>CAPACITORS</i>			
C31	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C32	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C33	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
BOBINAGES			
<i>COILS</i>			
T01	02127700	Néosid F10B	ADRET ELECTRONIQUE
T02	02177600	F2	ADRET ELECTRONIQUE
T03	02177600	F2	ADRET ELECTRONIQUE
T04	02167700	H20	ADRET ELECTRONIQUE
T05	02167700	H20	ADRET ELECTRONIQUE
T06	02167700	H20	ADRET ELECTRONIQUE
T07	02166100	Néosid F40	ADRET ELECTRONIQUE
T08	02149700	Néosid F40	ADRET ELECTRONIQUE
L01	53001800	470 nH + 10 %	53814 OREGA
L02	53001600	330 nH + 10 %	53810 OREGA
DIODES			
CR01	45000200	1N 4151	I.T.T.
CR02	45000200	1N 4151	I.T.T.
CR03	45003100	1N 4448	I.T.T.
CR04	45003100	1N 4448	I.T.T.
CR05	45003100	1N 4448	I.T.T.
CR06	45003100	1N 4448	I.T.T.
CR07	45003100	1N 4448	I.T.T.
CR08	45003100	1N 4448	I.T.T.
CR09	45003100	1N 4448	I.T.T.
CR10	45003000	ESM 247	SESCOSEM
CR11	45003000	ESM 247	SESCOSEM
CR12	45001900	BB105B	SESCOSEM
CR13	45003100	1N 4448	I.T.T.
TRANSISTORS			
Q01	43002200	BF 272	S.G.S.
Q02	43000400	2N 918	I.T.T.
Q03	43000400	2N 918	I.T.T.
Q04	43002000	2N 5179	R.C.A.
Q05	43000500	2N 2369	MOTOROLA
Q06	43000500	2N 2369	MOTOROLA

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
RESISTANCES <i>RESISTORS</i>			
R45	22100110	100 5 % 1/4 W	S07 SOVCOR
R46	22100212	1,2 k 5 % 1/4 W	S07 SOVCOR
R47	29000033	33 5 % 1/8 W	C3 SOVCOR
R48	22100122	220 5 % 1/4 W	S07 SOVCOR
R49	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R50	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R51	22100218	1,8 k 5 % 1/4 W	S07 SOVCOR
R52	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R53	22100047	47 5 % 1/4 W	S07 SOVCOR
CONDENSATEURS <i>CAPACITORS</i>			
C01	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C02	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C03	31200022	22 pF 100 V 2 %	C333 CB/C 22E COGECO
C04	31200122	220 pF 100 V 2 %	C333 CB/C 22E COGECO
C05	31200122	220 pF 100 V 2 %	C333 CBMC 22E COGECO
C06	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C07	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C08	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C09	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C10	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C11	31200056	56 pF 100 V 2 %	C333 CB/C 56E COGECO
C12	33001800	680 pF 250 V 5 %	TVE 15C LAFAB
C13	33001800	680 pF 250 V 5 %	TVE 15C LAFAB
C14	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C15	31200047	47 pF 100 V 2 %	C333 CB/C 47E COGECO
C16	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C17	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C18	31200022	22 pF 100 V 2 %	C333 CB/C 22E COGECO
C19	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C20	32006500	0,1 µF 250 V 10 %	C280 AE/A 100K COGECO
C21	31200112	120 pF 63 V ± 2 %	632 58121 COGECO
C22	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C23	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C24	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C25	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C26	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C27	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C28	37001500	22 µF 16 V + 50-20 %	GP Marquage clair I.T.T.
C29	31200039	39 pF 100 V 2 %	C333 CB/C 39E COGECO
C30			

REPERES	REFERENCE ADRET	DESIGNATION			REFERENCE FABRICANT
RESISTANCES					
RESISTORS					
R01	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R02	22100122	220	5 %	1/4 W	S07 SOVCOR
R03	22100133	330	5 %	1/4 W	S07 SOVCOR
R04	22100168	680	5 %	1/4 W	S07 SOVCOR
R05	22100139	390	5 %	1/4 W	S07 SOVCOR
R06	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R07	22100122	220	5 %	1/4 W	S07 SOVCOR
R08	22100056	56	5 %	1/4 W	S07 SOVCOR
R09	22100182	820	5 %	1/4 W	S07 SOVCOR
R10	22100039	39	5 %	1/4 W	S07 SOVCOR
R11	22100127	270	5 %	1/4 W	S07 SOVCOR
R12	29000033	33	5 %	1/8 W	C3 SOVCOR
R13	22100112	120	5 %	1/4 W	S07 SOVCOR
R14	22100056	56	5 %	1/4 W	S07 SOVCOR
R15	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R16	22100315	15 k	5 %	1/4 W	S07 SOVCOR
R17	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R18	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R19	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R20	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R21	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R22	22100122	220	5 %	1/4 W	S07 SOVCOR
R23	22100112	120	5 %	1/4 W	S07 SOVCOR
R24	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R25	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R26	22100122	220	5 %	1/4 W	S07 SOVCOR
R27	22100168	680	5 %	1/4 W	S07 SOVCOR
R28	22100139	390	5 %	1/4 W	S07 SOVCOR
R29	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R30	22100222	2,2 k	5 %	1/4 W	S07 SOVCOR
R31	22100322	22 k	5 %	1/4 W	S07 SOVCOR
R32	22100133	330	5 %	1/4 W	S07 SOVCOR
R33	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R34	22100122	220	5 %	1/4 W	S07 SOVCOR
R35	22100018	18	5 %	1/4 W	S07 SOVCOR
R36	22100133	330	5 %	1/4 W	S07 SOVCOR
R37	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R38	22100310	10 k	5 %	1/4 W	S07 SOVCOR
R39	22100110	100	5 %	1/4 W	S07 SOVCOR
R40	29000033	33	5 %	1/8 W	C3 SOVCOR
R41	22100122	220	5 %	1/4 W	S07 SOVCOR
R42	22100122	220	5 %	1/4 W	S07 SOVCOR
R43	22100212	1,2 k	5 %	1/4 W	S07 SOVCOR
R44	22100047	47	5 %	1/4 W	S07 SOVCOR

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
		OSCILLATEUR 90/120 MHz 90/120 MHz OSCILLATOR	
RESISTANCES RESISTORS			
R33	22100147	470 5 % 1/4 W	S07 SOVCOR
R34	29000122	220 5 % 1/8 W	C3 SOVCOR
R35	22100182	820 5 % 1/4 W	S07 SOVCOR
R36	22100410	100 k 5 % 1/4 W	S07 SOVCOR
R37	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R38	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R39	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R40	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R41	22100322	22 k 5 % 1/4 W	S07 SOVCOR
R42	22100139	390 5 % 1/4 W	S07 SOVCOR
R43	29000051	51 5 % 1/8 W	C3 SOVCOR
R44	22100015	15 5 % 1/4 W	S07 SOVCOR
R45	22100147	470 5 % 1/4 W	S07 SOVCOR
R46	22100010	10 5 % 1/4 W	S07 SOVCOR
R47	22100033	33 5 % 1/4 W	S07 SOVCOR
R48	22100127	270 5 % 1/4 W	S07 SOVCOR
R49			
R50	29000022	22 5 % 1/8 W	C3 SOVCOR
R51	29000051	51 5 % 1/8 W	C3 SOVCOR
R52	29000122	220 5 % 1/8 W	C3 SOVCOR
R53	29000022	22 5 % 1/8 W	C3 SOVCOR
R54	22100182	820 5 % 1/4 W	S07 SOVCOR
R55	22100182	820 5 % 1/4 W	S07 SOVCOR
R56	29000022	22 5 % 1/8 W	C3 SOVCOR
R57	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R58	22100010	10 5 % 1/4 W	S07 SOVCOR
R60	22100022	22 5 % 1/4 W	S07 SOVCOR
POTENTIOMETRE POTENTIOMETER			
P01	21531000	10 k 20 % 1/2 W	BC6-Y VARIOHM
CONDENSATEURS CAPACITORS			
C25	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C26	31200068	68 pF 100 V 2 %	C333 CB/C 68E COGECO
C27	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
POTENTIOMETRES			
<i>POTENTIOMETERS</i>			
C28	32005200	47 nF 100 V 10 %	C280 AE/A 47K COGECO
C29	37000700	4,7 μ F 25 V + 50-20 %	GP Marquage clair I.T.T.
C30	31200010	10 pF 100 V 2 %	C333 CB/C 10E COGECO
C31	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C32	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C33	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C34	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C35	31200110	100 pF 100 V 2 %	C333 CH/C 100E COGECO
C36	31500310	10 nF 63 V + 50-20 %	GOX 767 14 L.C.C.
C37	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C38	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C39	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
CV1	36001100	1 à 3,5 pF	C050/3ES R.T.C.
BOBINAGES			
<i>COILS</i>			
T01	02177800	F 100	ADRET ELECTRONIQUE
T10	02167700	Tore H20	ADRET ELECTRONIQUE
T11	02177900	Tore H20	ADRET ELECTRONIQUE
L03	53003000	4,7 μ H 2,5 A 10 %	53801 OREGA
L04	53003000	4,7 μ H 2,5 A 10 %	53801 OREGA
DIODES			
CR07	45002600	BB 109	SESCOSEM
CR08	45002600	BB 109	SESCOSEM
CR09	45002600	BB 109	SESCOSEM
CR10	45002600	BB 109	SESCOSEM
CR11	45002600	BB 109	SESCOSEM
CR12	45001300	FD 777	FAIRCHILD





ADRET ELECTRONIQUE FRANCE
12, avenue Vladimir Komarov • BP 33 78192 Trappes Cedex • France • Tél. 051.29.72
Télex ADREL 697821 F • Siret 679805077 - 00014 • CCP Paris 21 797 04 •

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
S01	14050009	Prise PERENA	F15F PERENA
S02	14370010	Connecteur 37 points (fem)	DC37S SOURIAU
J01	14002005	BNC	R90250 RADIALL
J02	14002005	BNC	R90250 RADIALL
J03	14001023	Douille isolée	DN4D - J. RENAUD
J04	14001011	Douille	D23203 MFOM
K01	15302084	Inverseur 2 pos.	254/DB0 CHAUME
F01	17002300	250 mA FST6332	034-3411 ARNOULD
F02	17002300	250 mA FST6332	034-3411 ARNOULD
	17002500	Porte-fusible	31 2010 ARNOULD
P01	21231005	10 k 5 % 3 W	Mod. 534 SPECTROL
	65004700	Compte tours série 1370	D221 AMPHEND

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
DIODES			
CR01	45003100	1N 4448	I.T.T.
CR02	45000400	1N 4004	I.T.T.
CR03			
à	45003100	1N 4448	I.T.T.
CR97			
CR98	40000100	LED rouge	H P
CR99	40000700	LED jaune	H P
CR100	40000600	LED verte	
TRANSISTORS			
Q01	43001000	2N 2907	TEXAS INSTRUMENTS
Q02	43001900	BC 184C	TEXAS INSTRUMENTS
Q03	43000100	2N 2222	TEXAS INSTRUMENTS
Q04	43001100	BC 214C	TEXAS INSTRUMENTS
CIRCUIT INTEGRE INTEGRATED CIRCUIT			
SN01	41507420	74 LS20	TEXAS INSTRUMENTS

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS <i>CAPACITORS</i>			
C19 à	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C34			
C35	31200247	4,7 nF 100 V 10 %	C332 CA/A 4K7 COGECO
C36	31200247	4,7 nF 100 V 10 %	C332 CA/A 4K7 COGECO
BOBINAGES <i>COILS</i>			
L03	53004201	47 µH 0,19 A 10 %	53862 OREGA
L04	53004201	47 µH 0,19 A 10 %	53862 OREGA
CIRCUITS INTEGRES <i>INTEGRATED CIRCUITS</i>			
SN04	41307404	74 L04 N	TEXAS INSTRUMENTS
SN05	41307404	74 L04 N	TEXAS INSTRUMENTS
SN06	41307404	74 L04 N	TEXAS INSTRUMENTS
AFFICHAGE/DISPLAY			
RESISTANCES <i>RESISTORS</i>			
R01	22100139	390 5 % 1/4 W	S07 SOVCOR
R02	22100139	390 5 % 1/4 W	S07 SOVCOR
R03	22100127	270 5 % 1/4 W	S07 SOVCOR
R04	22100122	220 5 % 1/4 W	S07 SOVCOR
R05	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R06	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R07	22100310	10 k 5 % 1/4 W	S07 SOVCOR
R08	24000133	330 5 % 1/4 W	S07 SOVCOR
R09	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R10	22100310	10 k 5 % 1/4 W	S07 SOVCOR
CONDENSATEURS <i>CAPACITORS</i>			
C01	37001500	22 µF 16 V + 50 - 20 %	GP Marquage clair I.T.T.

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
FILTRE DE CODE/CODE FILTER CARTE A/A-BOARD			
RESISTANCES RESISTORS			
R01 à R16	29000222	2,2 k 5 % 1/8 W	C3 SOVCOR
CONDENSATEURS CAPACITORS			
C01 à C16	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C17	31200247	4,7 nF 100 V 10 %	C332 CA/A 4K7 COGECO
C18	31200247	4,7 nF 100 V 10 %	C332 CA/A 4K7 COGECO
BOBINAGES COILS			
L01	53004201	47 µH 0,19 A 10 %	53862 OREGA
L02	53004201	47 µH 0,19 A 10 %	53862 OREGA
CIRCUITS INTEGRES INTEGRATED CIRCUITS			
SN01	41307404	74 L04N	TEXAS INSTRUMENTS
SN02	41307404	74 L04N	TEXAS INSTRUMENTS
SN03	41307404	74 L04N	TEXAS INSTRUMENTS
CARTE B/B-BOARD			
RESISTANCES RESISTORS			
R18 à R33	29000222	2,2 k 5 % 1/8 W	C3 SOVCOR

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
DIODES			
CR01	46000500	ZPD 6,2	I.T.T.
CR02	45003100	IN 4448	I.T.T.
CR03	45003100	IN 4448	I.T.T.
TRANSISTORS			
Q03	48000800	2N 2905	TEXAS INSTRUMENTS
Q04	48000800	2N 2905	TEXAS INSTRUMENTS
Q05	48000800	2N 2905	TEXAS INSTRUMENTS
Q06	48000800	2N 2905	TEXAS INSTRUMENTS
Q07	48000600	2N 2219	TEXAS INSTRUMENTS
Q08	48000600	2N 2219	TEXAS INSTRUMENTS
Q11	48001300	TIP 41A	TEXAS INSTRUMENTS
Q12	48001300	TIP 41A	TEXAS INSTRUMENTS
Q13	48001300	TIP 41A	TEXAS INSTRUMENTS
Q14	43001900	BC 184C	TEXAS INSTRUMENTS
Q15	43001900	BC 184C	TEXAS INSTRUMENTS
Q16			
Q17			
Q18	43001100	BC 214C	TEXAS INSTRUMENTS
Q19	43001100	BC 214C	TEXAS INSTRUMENTS
CONNECTEUR CONNECTOR			
	14120015	TB12 (femelle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
		CARTE REGULATION REGULATION BOARD	
RESISTANCES RESISTORS			
R01			
R02			
R03	25001619	6,19 k 1 % 1/4 W	ROSENTHAL SMA 207
R04	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R05	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R06	22100233	3,3 k 5 % 1/4 W	S07 SOVCOR
R07	25001562	5,62 k 1 % 1/4 W	ROSENTHAL SMA 207
R08	22100247	4,7 k 5 % 1/4 W	S07 SOVCOR
R09	25001619	6,19 k 1 % 1/4 W	ROSENTHAL SMA 207
R11	22100222	2,2 k 5 % 1/4 W	S07 SOVCOR
R12	25001511	5,11 k 1 % 1/4 W	ROSENTHAL SMA 207
R13	25001511	5,11 k 1 % 1/4 W	ROSENTHAL SMA 207
R14	22100215	1,5 k 5 % 1/4 W	S07 SOVCOR
R15	22100227	2,7 k 5 % 1/4 W	S07 SOVCOR
R16	22100312	12 k 5 % 1/4 W	S07 SOVCOR
R17	25001511	5,11 k 1 % 1/4 W	ROSENTHAL SMA 207
R18	25001511	5,11 k 1 % 1/4 W	ROSENTHAL SMA 207
R19	22100168	680 5 % 1/4 W	S07 SOVCOR
R20	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R21	22100210	1 k 5 % 1/4 W	S07 SOVCOR
R23	28000856	0,56 10 % 3 W	SFERNICE RWM
R24	28000856	0,56 10 % 3 W	SFERNICE RWM
R25	28000827	0,27 10 % 3 W	SFERNICE RWM
CONDENSATEURS CAPACITORS			
C03	37001700	22 μ F 10 % 15 V	L.T.T. CTS 13
C04	37000900	4,7 μ F 10 % 25 V	L.T.T. CTS 13
C05	37001700	22 μ F 10 % 15 V	L.T.T. CTS 13
C06	37001700	22 μ F 10 % 15 V	L.T.T. CTS 13
C07	37001700	22 μ F 10 % 15 V	L.T.T. CTS 13
C08	37001700	22 μ F 10 % 15 V	L.T.T. CTS 13
C09			
POTENTIOMETRE POTENTIOMETER			
P01	211065	1 k 20 % 1/2 W	BECKMAN 89P

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
		ENTREE - REDRESSEMENT FILTRACE INPUT - FILTER - RECTIFIER	
FILTRE SECTEUR LINE FILTER	02010602		
TRANSFORMATEUR TRANSFORMER	10001500		
CONDENSATEURS CAPACITORS			
C01	35004100	6800 μ F 16 V + 50-10 %	RELSIC 026 SIC SAFCO
C02	35003400	3300 μ F 40 V + 50-10 %	RELSIC 026 SICSAFCO
C03	35003400	3300 μ F 40 V + 50-10 %	RELSIC 026 SIC SAFCO
DIODES			
CR01	45000500	5401	GENERAL INSTRUMENTS
CR02	45000500	5401	GENERAL INSTRUMENTS
CR03	45000400	4004	GENERAL INSTRUMENTS
CR04	45000400	4004	GENERAL INSTRUMENTS
CR05	45000400	4004	GENERAL INSTRUMENTS
CR06	45000400	4004	GENERAL INSTRUMENTS

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CIRCUITS INTEGRES <i>INTEGRATED CIRCUITS</i>			
SN03	41507430	74 LS30	TEXAS INSTRUMENTS
SN04	41107472	7472 N	TEXAS INSTRUMENTS
CONNECTEUR <i>CONNECTOR</i>			
	14170163	TM 17 (mâle)	TRELEC

REPERES	REFERENCE ADRET	DESIGNATION	REFERENCE FABRICANT
CONDENSATEURS <i>CAPACITORS</i>			
C08	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C09	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C10	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C11	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C12	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C13	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C14	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C15	31200210	1 nF 100 V 10 %	C332 CA/A 1K COGECO
C16	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
C17	37001500	22 μ F 16 V + 50-20 %	GP Marquage clair I.T.T.
DIODES			
CR01	45003100	1N 4448	I.T.T.
CR02	45003100	1N 4448	I.T.T.
CR03	45003100	1N 4448	I.T.T.
CR04	45003100	1N 4448	I.T.T.
CR05	45003100	1N 4448	I.T.T.
CR06	45003100	1N 4448	I.T.T.
CR07	45003100	1N 4448	I.T.T.
CR08	45003100	1N 4448	I.T.T.
TRANSISTORS			
Q01	43002200	BF 272	S.G.S.
Q02	43000400	2N 918	I.T.T.
Q03	43000400	2N 918	I.T.T.
Q04	43001900	BC 184C	TEXAS INSTRUMENTS
Q05	43002200	BF 272	S.G.S.
Q06	43000400	2N 918	TEXAS INSTRUMENTS
Q07	43000400	2N 918	TEXAS INSTRUMENTS
Q08	43002200	BF 272	S.G.S.
Q09	43000400	2N 918	TEXAS INSTRUMENTS
Q10	43000400	2N 918	TEXAS INSTRUMENTS
CIRCUITS INTEGRES <i>INTEGRATED CIRCUITS</i>			
SN01	41507473	74 LS73	TEXAS INSTRUMENTS
SN02	41507400	74 LS00	TEXAS INSTRUMENTS

REPERES	REFERENCE ADRET	DESIGNATION			REFERENCE FABRICANT
RESISTANCES					
<i>RESISTORS</i>					
R01	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R02	22100133	330	5 %	1/4 W	S07 SOVCOR
R03	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R04	22100122	220	5 %	1/4 W	S07 SOVCOR
R05	22100168	680	5 %	1/4 W	S07 SOVCOR
R06	22100139	390	5 %	1/4 W	S07 SOVCOR
R07	22100233	3,3 k	5 %	1/4 W	S07 SOVCOR
R08	22100122	220	5 %	1/4 W	S07 SOVCOR
R09	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R10	22100082	82	5 %	1/4 W	S07 SOVCOR
R11	22100322	22 k	5 %	1/4 W	S07 SOVCOR
R12	22100127	270	5 %	1/4 W	S07 SOVCOR
R13	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R14	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R15	22100210	1 k	5 %	1/4 W	S07 SOVCOR
R16	22100139	390	5 %	1/4 W	S07 SOVCOR
R17	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R18	22100122	220	5 %	1/4 W	S07 SOVCOR
R19	22100212	1,2 k	5 %	1/4 W	S07 SOVCOR
R20	22100110	100	5 %	1/4 W	S07 SOVCOR
R21	22100110	100	5 %	1/4 W	S07 SOVCOR
R22	22100122	220	5 %	1/4 W	S07 SOVCOR
R23	22100082	82	5 %	1/4 W	S07 SOVCOR
R24	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R25	22100139	390	5 %	1/4 W	S07 SOVCOR
R26	22100212	1,2 k	5 %	1/4 W	S07 SOVCOR
R27	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R28	22100215	1,5 k	5 %	1/4 W	S07 SOVCOR
R29	22100122	220	5 %	1/4 W	S07 SOVCOR
R30	22100212	1,2 k	5 %	1/4 W	S07 SOVCOR
R31	22100110	100	5 %	1/4 W	S07 SOVCOR
R32	22100110	100	5 %	1/4 W	S07 SOVCOR
CONDENSATEURS					
<i>CAPACITORS</i>					
C01	31200082	82 pF	100 V	2 %	C333 CB/C 82E COGECO
C02	31200022	22 pF	100 V	2 %	C333 CB/C 22E COGECO
C03	37001500	22 µF	16 V	+ 50-20 %	GP Marquage clair I.T.T.
C04	37001500	22 µF	16 V	+ 50-20 %	GP Marquage clair I.T.T.
C05	31200012	12 pF	63 V	± 2 %	Série C632 COGECO
C06	37001500	22 µF	16 V	+ 50-20 %	GP Marquage clair I.T.T.
C07	37001500	22 µF	16 V	+ 50-20 %	GP Marquage clair I.T.T.

