PHILIPS

SERVICE

Electron optics / Nuclear and electrochemical equipment / X-Ray analysis / Cryogenic equipment / Test and measuring equipment / Process instrumentation / Industrial Data Processing Systems / Weighing / Welding / Numerical Control / Textile equipment

industrial equipment division

PHILIPS

20-4-1972 PM 6631 - PM 6632 - PM 6633 Cd 745

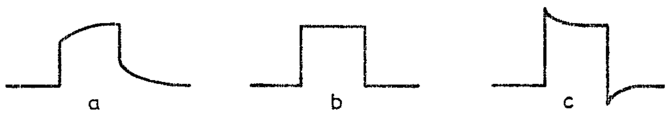
TEST AND MEASURING INSTRUMENTS

Already issued: PM 6631 Cd 646
PM 6632 Cd 702
PM 6633 Cd 701

Concerning : Modifications in the service manuals

PM 6631

- The code numbers of the coils L101 and L102 should read 5322 158 10271
- Figure 12 is incorrect and should be replaced by the figure below.



a. under compensation of attenuator
b. correct attenuator adjustment
c. over compensation of attenuator

Fig. 1. Pulse diagram for correct pulse shape adjustment

PM 6632

- Diode TIV 305 (Z401), code no. 4822 130 30201 will not be delivered anymore by the Central Service Dept.
- Alternative type: HP 5082-2800 (Hewlett Packard), code no. 5322 130 30635.

In the -/01 service manual, the figure-subscriptions of figures 15, 16 and 16a should read:

Fig. 15. Printed wiring board PM 6632-5
Fig. 16. Printed wiring board PM 6632-4 (components side)
Fig. 16a. Printed wiring board PM 6632-4 (soldering side)

PM 6633

- Capacitors C126 and C128 have been cancelled.
- Value of R133 and potentiometer RV101 should be changed to 10 kΩ.
  Code no. for RV101: 4822 100 10035.
- The identification mark near C122 should be omitted. Code no. for C122: 4822 122 30026.
- Parallel to capacitor C122, an RC network R1 - C1 has been connected (Fig. 2).
- Due to the above mentioned modifications, also figure 7 in the service manual has been modified.
  The revised circuit board drawings are shown in Fig. 3.

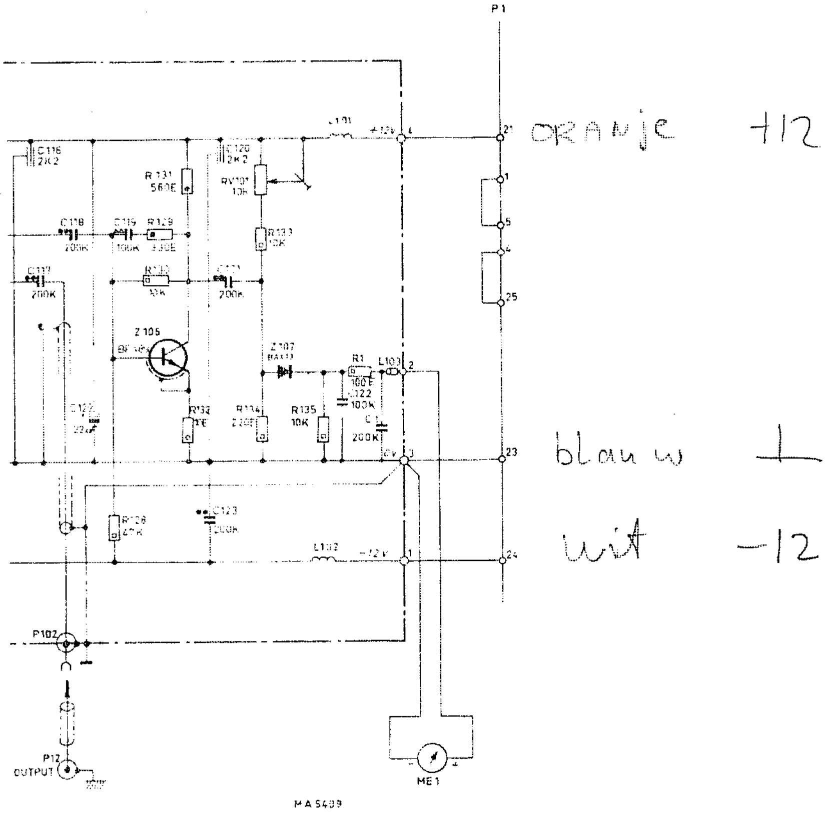


Fig. 2. Modified part of circuit diagram PM 6633

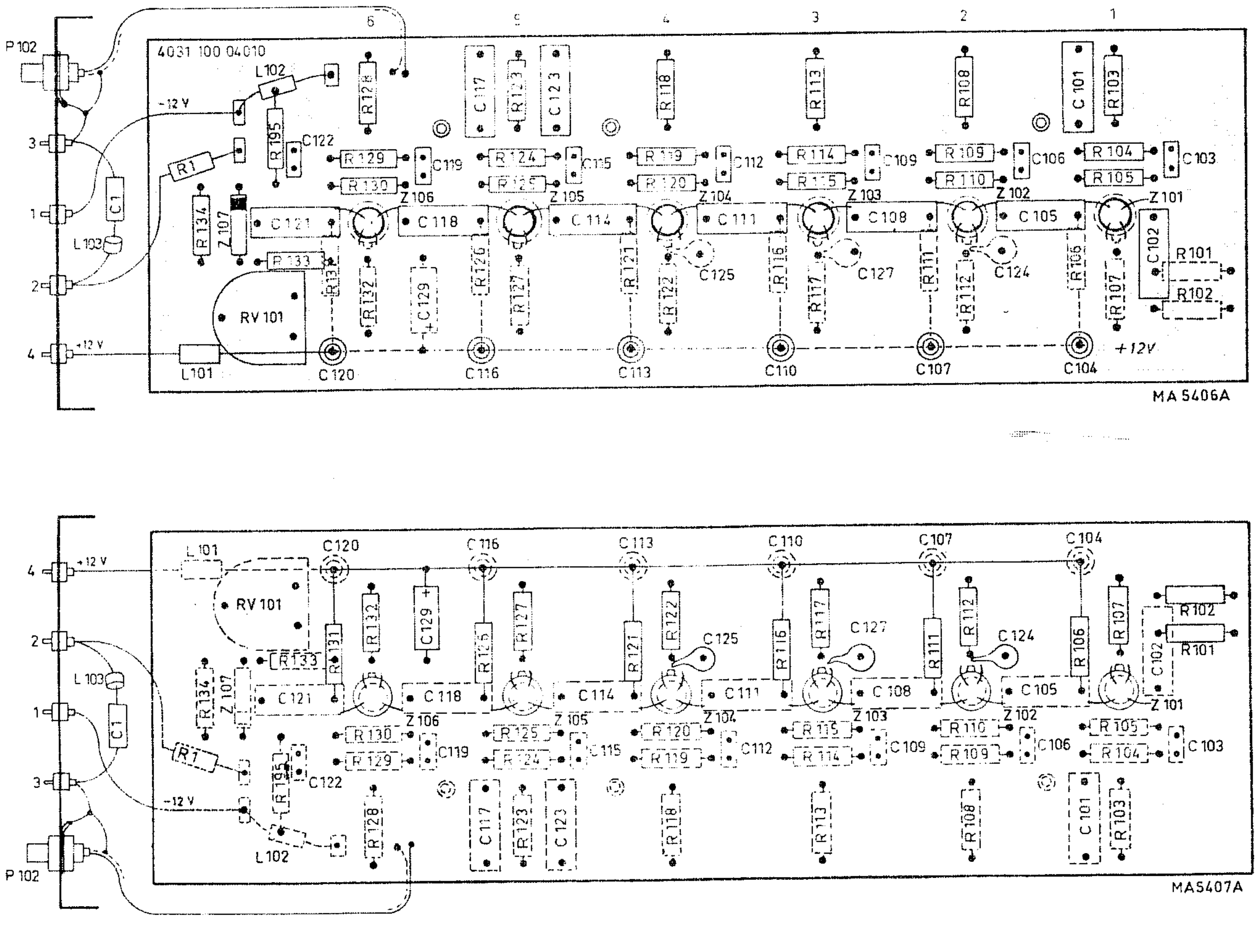


Fig. 3. Printed wiring board PM 6633

Description of the block diagram

IV

The signal to be measured is applied to the INPUT socket and is fed to an A.G.C. circuit, which controls the level of the signal so that the output amplitude from the pre-amplifiers is always constant. The A.G.C. circuit is controlled by the detector. Via a pulse shaper the signal is fed to a binary divider which divides the input frequency by two. After amplification, the frequency is divided by five in a quinary divider and is applied to the OUTPUT socket via an output amplifier.

If the amplitude of the input signal is too low, no output signal is obtained because the A.G.C. supplies no gating signal to the quinary divider. At a certain level of the input signal, a signal from the detector starts the A.G.C. function. The A.G.C. circuit then delivers a gating signal to the quinary which starts dividing.

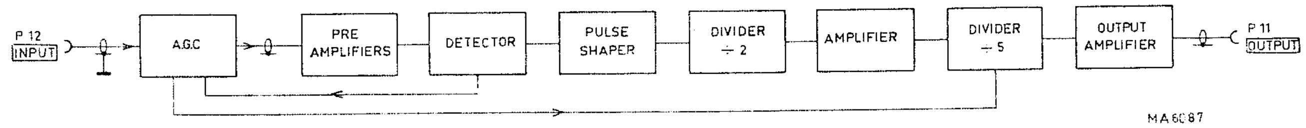


Fig. 5. Block diagram

Contents

List of figures

Circuit description

VII

1. AUTOMATIC GAIN CONTROL (A.G.C.)

The signal to be measured is fed from the input socket P12, to the amplifiers on circuit boards 1, 2 and 3 via connector 56, capacitor C506, diodes Z508 and Z507, capacitor C505 and connector 57.
Diodes Z508 and Z507 form an attenuator which is controlled by amplifier Z503–Z504 via inductance L503 and L506.

This amplifier is in turn controlled by a negative voltage from the detector diode Z401 on board 4. The higher the amplitude of the input signal, the higher the amplitude of the negative voltage, which is applied to the base of Z504 via connectors 42 on board 4 and 53 on board 5. Gate transistor Z505 is controlled by Schmitt trigger Z502–Z501 which is connected to the collector of Z503. When no signal is applied to the input socket P12, amplifiers Z504 and Z503 are fully conducting. Diodes Z508 and Z507 which receive a positive bias from the collector of Z503 are also fully conducting. In the Schmitt trigger, Z502 is conducting and Z501 is cut off.
Consequently, gate transistor Z505 is also cut off, and the +12 V supply to the divide by five circuit on board 4 is blocked.

When a signal of sufficient amplitude is applied to the input socket P12 it is fed through the A.G.C. circuit and the amplifiers on board 4 to the detector diode Z401 via connector 41. The negative voltage from the detector is applied to the base of amplifier transistor Z504. At a certain level, which can be set with potentiometer RV501, transistors Z504 and Z503 are cut off. The collector voltage of Z503 decreases and when it is about +2 V the Schmitt trigger switches over so that Z502 is cut off and Z501 is conducting. Gate transistor Z505 now switches on so that the +12 V supply is fed to the divide by five circuit on board 4 via connectors 52, 44 and potentiometer RV404.

At the same time, the attenuator diodes Z507 and Z508 successively conduct less. The input signal is then attenuated to a suitable value and an automatic gain control is provided. Thus, the input level at connector 41 on board 4 is kept constant.

As diodes Z507 and Z508 conduct less, diodes Z509 and Z506, which are cut off when no input signal is present, conduct proportionally more.
Therefore resistors R515 and R514 are connected to the input and the output respectively, thus maintaining the impedance at 50 Ω.

2. AMPLIFIERS

The circuit diagram of the amplifiers is shown in fig. 14. The amplifier system consists of three identical wide band amplifiers connected in series.
The signal from the A.G.C. circuit is applied to input A and is fed to transistor Z101 via capacitor C102. From the collector of Z101 the signal is fed to transistor Z102 through coupling capacitor C106.
The same signal path applies to amplifiers 2 and 3.
The supply voltage to the amplifiers is fed from pin 21 on connector P21 (see fig. 17), through the A.G.C. circuit on board 5 (connector 51, inductances L501, L504, and connector 57) to the input of the amplifier 1.
The amplifier supply voltage is applied to the transistors through coil L101 and resistors R103 and R108.
Amplifier 2 is supplied through coil L102 and the signal path to input A.
Similarly, the supply for amplifier 3 is fed through the signal path, but is blocked in this amplifier, so that no supply voltage is present at the output.

3. DIVIDE-BY-TEN CIRCUIT

The signal from the amplifier is fed to the detector diode Z401 via connector 41. The detected voltage is fed back to the A.G.C. circuit on board 5 through connector 42. The signal is fed through capacitor C403 and resistor R401 tunnel diode Z402, which produces a signal shape suitable for driving the divide by two circuit. The tunnel diode bias is set by potentiometer RV401.
The divide by two circuit consists mainly of a matched pair of tunnel diodes, Z403 and Z404. Diode Z405 limits the total voltage across the tunnel diodes so that only one of them can be in the high voltage state.
Consider the situation when Z403 is in the low voltage state and Z404 is in the high voltage state, a high current is flowing through resistor R406, which is connected in parallel with Z404. Correspondingly, a low current is flowing through resistor Z405. The difference between these currents flows through the printed board inductance, located between junctions Z403–Z404 and R405–R406. When a negative pulse is applied to the circuit, the current through the tunnel diodes increases and Z403 switches to its high voltage state. Because both tunnel diodes cannot be in the high voltage state simultaneously the diode which has the lowest current switches to the low voltage state, in this case Z404.

This state remains until the arrival of the next negative pulse, when the diodes switch over again. Thus, the input frequency is divided by two.
The divided square-wave is fed via R407 to a differential amplifier consisting of emitter followers Z406–Z407, forming one branch, and transistors Z408–Z409 forming the other branch. The differential amplifier, which drives the divide-by-five circuit, is balanced with potentiometer RV403.
The square-wave signal is fed from the collector of Z408 to the divide by five circuit which uses transistors Z411...Z420.

The working of this circuit is, in principle, the same as that of the corresponding circuit in PM 6630. See description in PM 6630 Service Manual, chapter XI, section B.

The working point of the divide-by-five circuit is set with potentiometer RV404.
The signal is fed from the base of Z420 to the output amplifier Z426–Z427 via resistor R436.
The output whose frequency now is divided by ten, is fed from the collector of Z427 to the counter PM 6630 through capacitor C417 and output socket P11.

Replacing the amplifier circuit boards 1, 2and 3

VIII

A basic circuit board is used as spare part.
This board is provided with a cable clamp and a fixing bracket which should be removed (see Fig. 9).
Replacement of the circuit boards 1 and 2 can be carried out without modification. When replacing circuit board 3, coil L102 has to be connected to earth as shown in Fig. 10.

Caution

When modifying the board, avoid moving any component!
The H.F. properties of the amplifier can be changed.

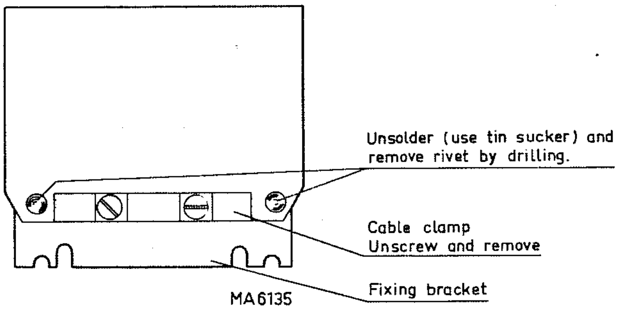


Fig. 9. Removal of cable clamp and fixing bracket

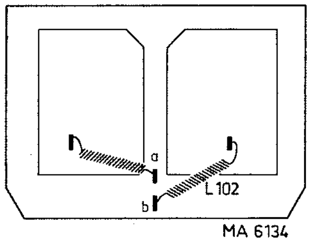


Fig. 10. Modification of circuit board 3

Checking and adjusting

IX

1. Instruments required

– Counter	PHILIPS PM 6630
– Interconnection cable	PHILIPS PM 9663
– Sampling oscilloscope	e.g. PHILIPS PM 3400
– Passive probe 10x, 500 Ω	e.g. PHILIPS PM 9342
– Sinewave generator 50 – 900 MHz with continuously variable attenuator, capable of supplying 2 Vrms into 50 Ω with low distortion	e.g. GENERAL RADIO Type 1215C, 50–250 MHz in combination with GENERAL RADIO Type 1362, 220–920 MHz
– Power supply	GENERAL RADIO 1267-B or 1269-A
– Digital multimeter	e.g. PHILIPS PM 2421
– BNC T-piece	e.g. PHILIPS PM 9067
– T-piece 50 Ω	e.g. PHILIPS PM 9584
– General Radio coupling capacitor	GENERAL RADIO GR874K
– General Radio 20 dB attenuator	GENERAL RADIO GR874–G20

The tolerances mentioned are factory tolerances; they apply when the instrument is readjusted completely. They may differ from the data given in chapter II.

A.1. Connect the measuring circuit as shown in fig. 11

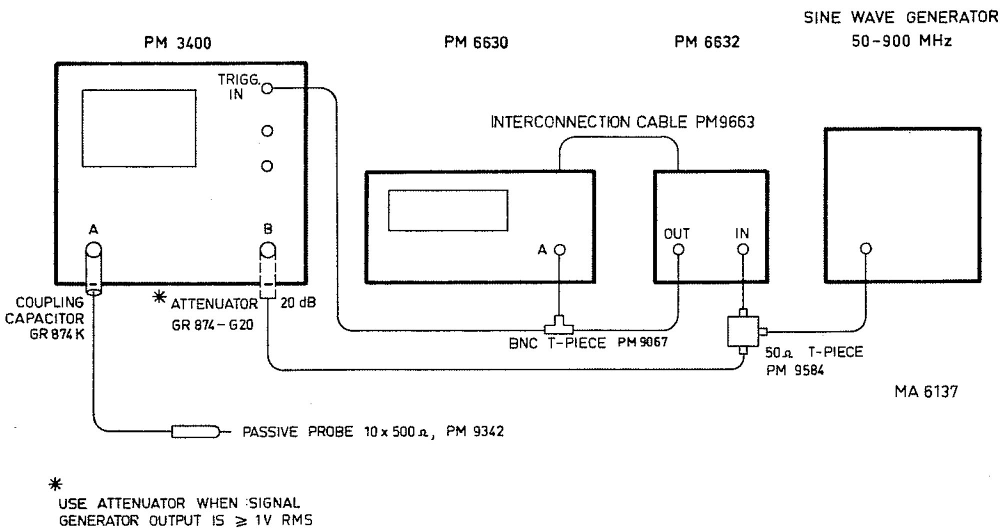


Fig. 11. Measuring set up

A.2. Instrument settings

– PM 6630	FUNCTION	Sub-unit
	TIME BASE	1 ms
	LEVEL	0
	SENSITIVITY	50 mV
	IMPEDANCE	1 MΩ
	COUPLING	AC
– PM 3400	SENSITIVITY	TRIGG
	TRIGG.	EXT–
	TIME SCALE MAGN.	x1
	TIME/cm	5 ns
	TIME POSITION	Fully clockwise
	Horizontal mode	NORMAL
	mV/cm A	50 mV
	B	10 mV
	Vertical mode	A and B

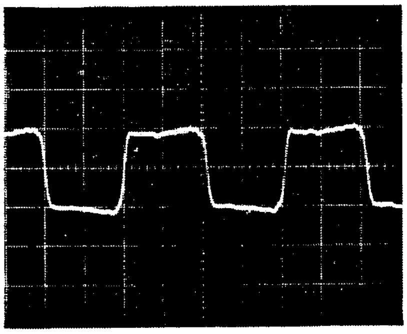
B.1. Checking the supply voltage

- Check the +12 V and –12 V supply voltage on tags 51 and 55 resp. on circuit board 5.
  Tolerance: ± 1 %.

B.2. Adjusting amplifier Z406, Z407 – Z408, Z409 (RV403)

- Set the signal generator to 350 MHz, output amplitude 100 mVrms.
- Connect the oscilloscope to the mid-point of the ring counter on board 4 (measuring point "A" in fig. 16).
- Check that the pulse shape is similar to that in fig. 12.
- If necessary, adjust RV403.

0—



200 mV/cm

5 ns/cm

MA 6139

Fig. 12. Waveform at the mid-point ("A") of the ring counter

B.3. Adjusting emitter level of Z504 (RV501)

- Set the signal generator to 350 MHz, max. attenuation.
- Turn RV501 fully counter-clockwise.
- Interconnect tags GATE and "+12 V" on board 5.
  CAUTION: Be careful not to short-circuit the DETECTOR tag.
- Increase the output amplitude of the signal generator (approx. 10 mVrms) until the counter shows the correct frequency.
- Remove the interconnection.
- Turn RV501 clockwise until the counter shows correct frequency.
- Slowly decrease the signal amplitude.
- The counter display should now vanish without showing erroneous value.
- Increase the signal amplitude continuously to 1 Vrms. Check that the counter displays correct frequency.

B.4. Adjusting ring counter bias (RV404)

- Set the signal generator frequency to 800 MHz, output amplitude 100 mVrms.
- Turn RV404 and note the range within which the counter displays correct frequency.
- Set RV404 in the middle of this range.

B.5. Adjusting tunnel diode bias of pulse shaper (RV401)

- Set the signal generator to 800 MHz.
- Turn RV401 as far counter-clockwise as possible to obtain correct counting with the lowest usable signal level (approx. 10 mVrms).

B.6. Adjusting tunnel diode bias of binary counter (RV402)

- Turn RV402 as far counter clockwise as possible to obtain correct counting at 800 MHz with the lowest usable level (approx. 10 mVrms).
- Set the signal generator to 50 MHz, output amplitude 10 mVrms.
- If the counter displays double frequency, RV402 is set too far clockwise.
- If the counter does not display correct frequency, RV402 or RV401 is set too far counter-clockwise.

NOTE: *As the settings of RV401 and RV402 are mutually dependent, points B5 and B6 should be repeated a number of times until the optimum settings are obtained.*

CAPACITORS

Nr.	Code number	Value	Voltage (V)	Description
C401...C402	4822 124 20385	100 μF	16	Electrolytic
C403	4822 122 30127	10 nF		Ceramic
C404	4822 122 30043	10 nF	40	Ceramic plate
C407...C417	4822 122 30043	10 nF	40	Ceramic plate
C501...C502	4822 124 20358	12 μF	16	Electrolytic
C503	4822 122 30043	10 nF	40	Ceramic plate
C504	4822 121 40257	330 nF	100	Polycarbonate
C505	4822 122 30133	1 nF	50	Ceramic plate
C506	4822 122 30132	100 pF	50	Ceramic plate

POTENTIOMETERS

Nr.	Code number	Value
RV401	4822 100 10112	1 kΩ
RV402	4822 100 10137	470 Ω
RV403	4822 100 10075	100 Ω
RV404	4822 100 10075	100 Ω
RV501	4822 100 10124	220 Ω

RESISTORS

Nr.	Code number	Value	Tolerance (%)	Power (W)	Description
R401	4822 111 30245	47 Ω	5	0.1	
R402	4822 111 30074	56 Ω	5	0.1	
R405	4822 111 30383	68 Ω	5	0.1	
R406	4822 111 30383	68 Ω	5	0.1	
R407	4822 111 30324	100 Ω	5	0.1	
R408	4822 111 30263	3.3 kΩ	5	0.1	
R409	4822 111 30269	1 kΩ	5	0.1	Carbon
R410	4822 111 30174	22 Ω	5	0.1	
R411	4822 111 30263	3.3 kΩ	5	0.1	
R412	4822 111 30265	2.2 kΩ	5	0.1	
R413	4822 111 30324	100 Ω	5	0.1	
R414	4822 111 30074	56 Ω	5	0.1	
R416...R420	4822 111 30269	1 kΩ	5	0.1	
R421...R425	4822 111 30325	150 Ω	5	0.1	
R426...R430	4822 111 30263	3.3 kΩ	5	0.1	
R431...R435	4822 111 30312	4.7 kΩ	5	0.1	
R436...R437	4822 111 30269	1 kΩ	5	0.1	Carbon
R438	4822 111 30074	56 Ω	5	0.1	
R439	4822 111 30348	27 Ω	5	0.1	
R440	4822 111 30265	2.2 kΩ	5	0.1	
R441	4822 111 30328	330 Ω	5	0.1	
R442	4822 116 30111	150 Ω		0.6	NTC resistor
R443	4822 111 30244	10 Ω	5	0.1	
R444	4822 111 30174	22 Ω	5	0.1	Carbon
R514...R515	4822 111 30067	39 Ω	5	0.1	

MISCELLANEOUS

Nr.	Qty	Code number	Description
L1...L2	2	4822 526 10083	
L5...L6	2	4822 526 10083	
L401...L403	3	4822 526 10011	Ferroxcube head
L404	1	4822 526 10025	
L501...L503	3	4822 158 10275	Inductance 3.3 μH
L504...L506	3	4822 526 10011	Ferroxcube bead
	3	4822 216 90369	Printed wiring board with components (units PM 6632 1-2-3)*
	1	4822 216 90401	Printed wiring board with components (unit PM 6632 4)
	1	4822 216 90402	Printed wiring board with components (unit PM 6632–5)
	5	4822 255 40089	Transistor holder

SEMI-CONDUCTORS

Transistors

Type	Code number	
BC107B	4822 130 40332	Z501, Z502, Z504
BC178	4822 130 40355	Z503, Z505 (Alt. BC177)
BFS17	4822 130 40781	Z406, Z407, Z408, Z409, Z411...420, Z426, Z427

Diodes

Type	Code number	
BAW56	4822 130 30691	Z421...425
BAX13	4822 130 40182	Z1, Z3...8, Z405, Z510
BZY88-C5V6	4822 130 30193	Zenerdiode Z511
HP 5082-3080	4822 130 30762	Z506...509
TD253B	4822 130 30636	Tunnel diode Z402
TD253B	4822 130 40837	Tunnel diode Z403, Z404 (matched pair)
TIV305	~~4822 130 30201~~	Z401
= HP5082-2800		NR: 5322 130 30635

*) Printed wiring board PM 6632–3 must be modified at replacement (see chapter VIII).

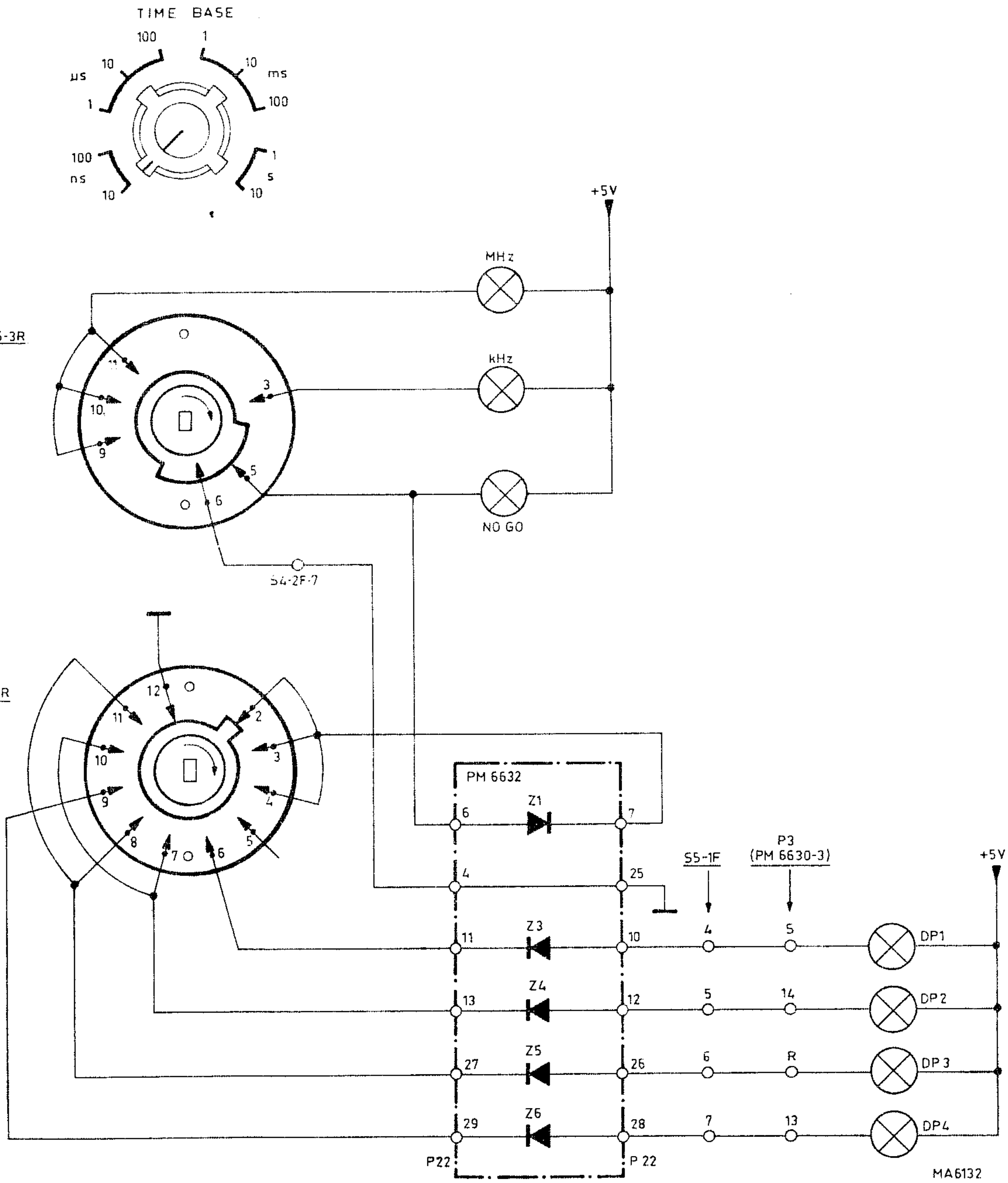


Fig. 13. Connections of measuring unit and decimal point indicator to switch S5

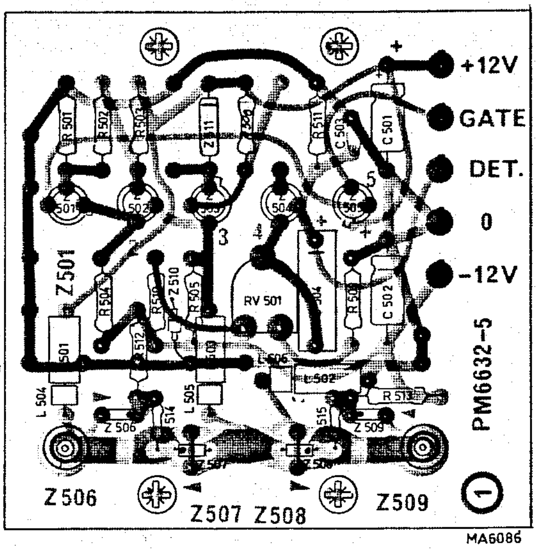


Fig. 15. Printed wiring board PM 6632-5

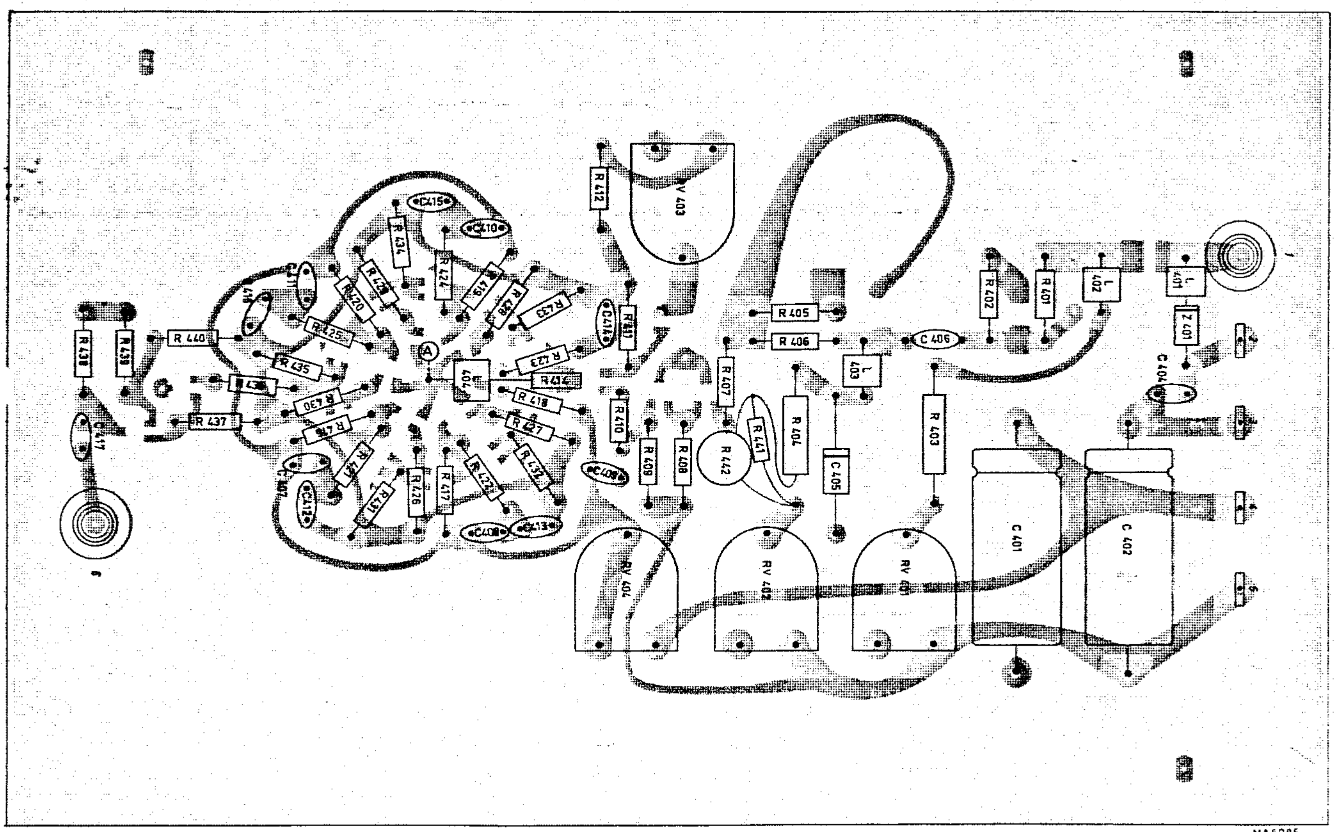


Fig. 16. Printed wiring board PM 6632-4

Fig. 16a. Printed wiring board PM 6632–1

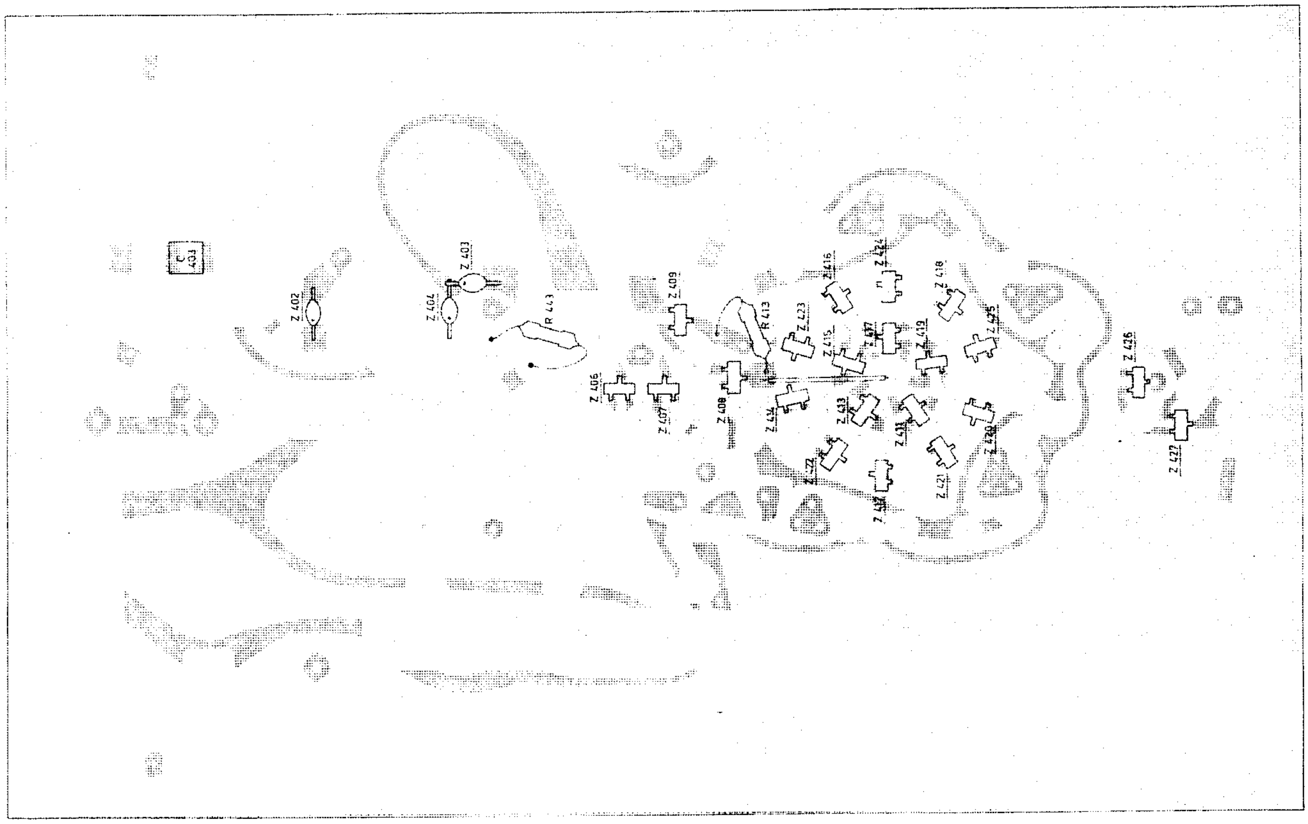
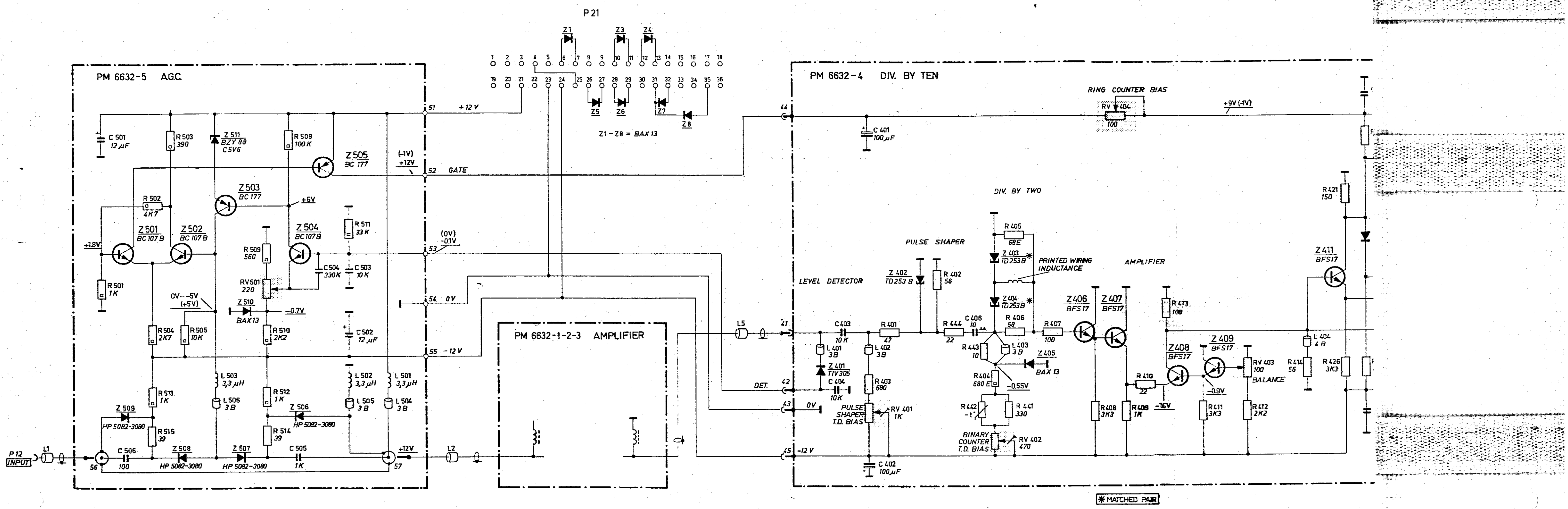


Fig. 16a. Printed wiring board PM 6632–61



P 21
Z1 - Z8 = BAX 13
PM 6632-5 AGC
+12 V
GATE
0 V
-12 V
C 501 12 μF
R 503 390
Z 511 BZY 88 C5V6
R 508 100 K
Z 505 BC 177
Z 503 BC 177
R 502 4K7
Z 501 BC 107 B
Z 502 BC 107 B
Z 504 BC 107 B
R 501 1K
R 509 560
RV 501 220
Z 510 BAX 13
R 511 33 K
C 504 330 K
C 503 10 K
C 502 12 μF
R 504 2K7
R 505 10K
R 510 2K2
L 503 3,3 μH
L 502 3,3 μH
L 501 3,3 μH
L 506 3 B
L 505 3 B
L 504 3 B
R 513 1K
R 512 1K
R 515 39
R 514 39
Z 509 HP 5082-3080
Z 506 HP 5082-3080
Z 508 HP 5082-3080
Z 507 HP 5082-3080
C 506 100
C 505 1K
P 12 INPUT
PM 6632-1-2-3 AMPLIFIER
PM 6632-4 DIV. BY TEN
RING COUNTER BIAS
RV 404 100
+9V (-1V)
C 401 100 μF
DIV. BY TWO
PULSE SHAPER
LEVEL DETECTOR
PRINTED WIRING INDUCTANCE
AMPLIFIER
R 405 68E
Z 403 TD 253 B
Z 404 TD 253 B
Z 402 TD 253 B
R 402 56
R 444 22
C 406 10
R 406 68
R 407 100
C 403 10 K
R 401 47
L 401 3B
L 402 3B
Z 401 TIV 305
C 404 10K
R 403 680
R 443 10
L 403 3B
Z 405 BAX 13
R 404 680 E
-0.55V
R 442
R 441 330
PULSE SHAPER T.D. BIAS
RV 401 1K
BINARY COUNTER T.D. BIAS
RV 402 470
C 402 100 μF
DET.
Z 406 BFS17
Z 407 BFS17
Z 408 BFS17
Z 409 BFS17
Z 411 BFS17
R 413 100
R 410 22
R 408 3K3
R 409 1K
-1.6V
R 411 3K3
-0.9V
RV 403 100 BALANCE
R 412 2K2
R 414 56
L 404 4 B
R 426 3K3
R 421 150
✱ MATCHED PAIR

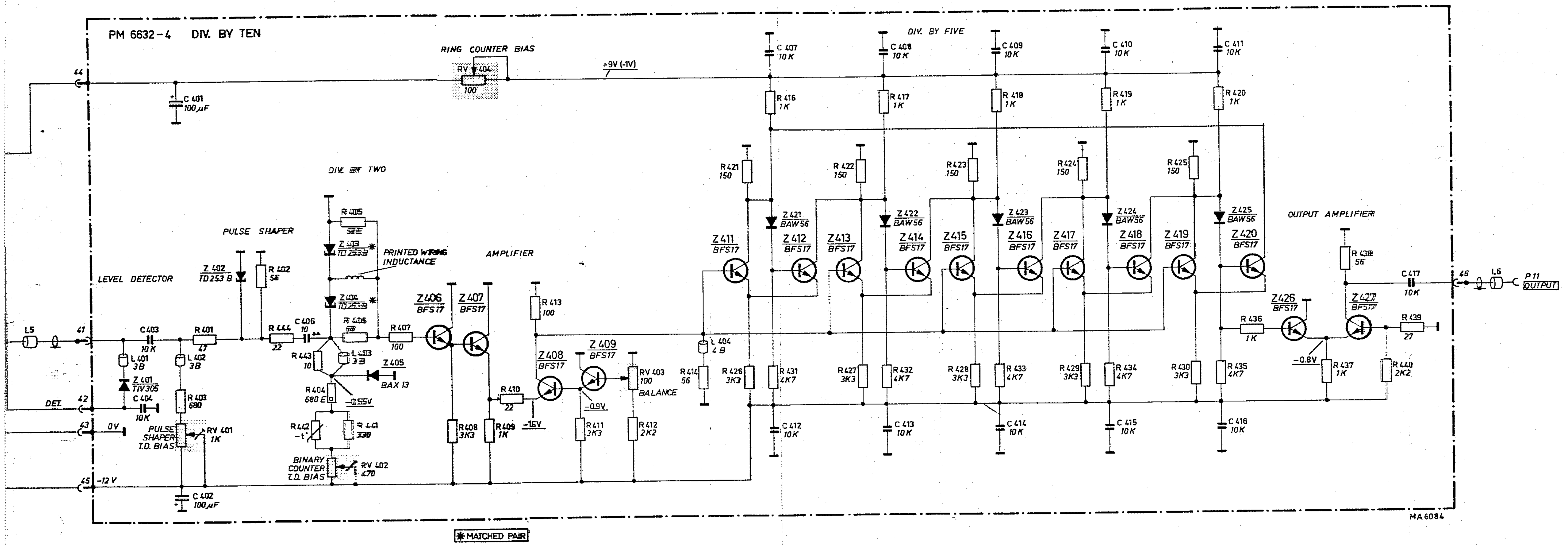


Fig. 17. A.G.C. circuit and divide-by-10 circuit diagrams

VOLTAGES SERVE FOR GUIDANCE ONLY.

VOLTAGES IN BRACKETS APPLY ONLY WHEN NO INPUT SIGNAL IS APPLIED.

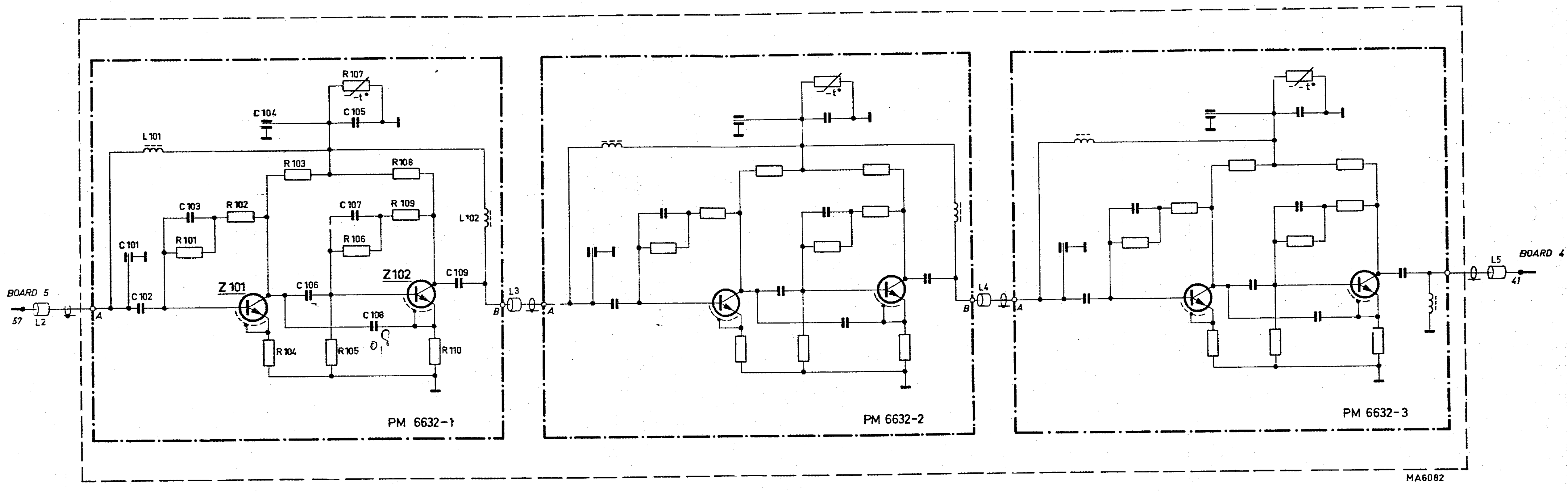


Fig. 14. Circuit diagram of the amplifier circuits PM 6632-1, 2, 3