PHILIPS

Colour/monochrome pattern generator

PM 5544

9449 055 440..

BBC

9499 490 07511

730815/2/03/04/05

Mod'd back to 75% EBU Bars (from 95% Bars). CEG. 30.3.93.

PHILIPS

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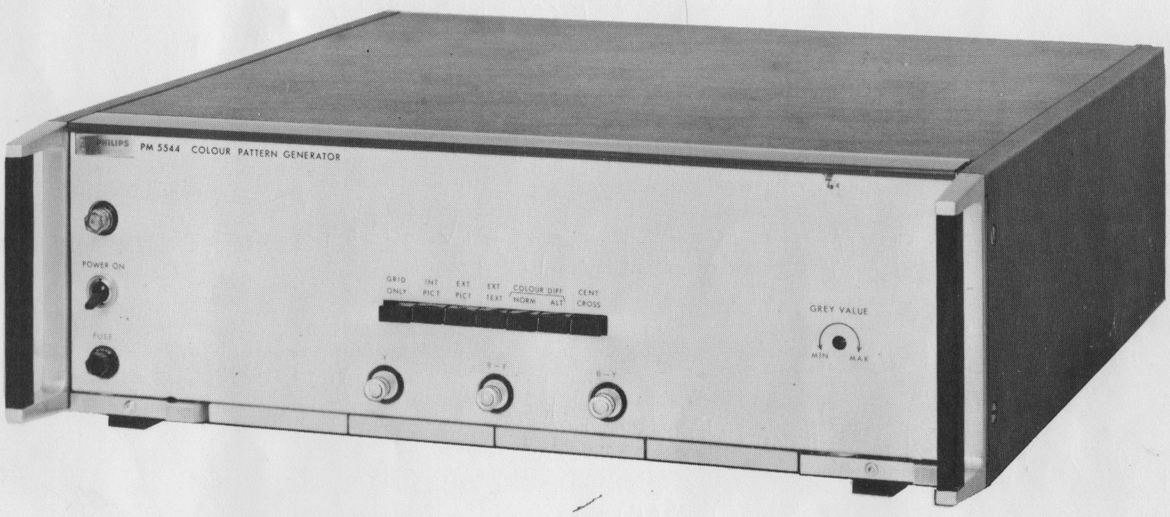

Operating and service manual

Important:

In correspondance concerning this instrument, please quote the complete type and serial number, as given on the identification plate at the rear of the instrument.

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I. Introduction

GENERAL INFORMATION

The PHILIPS PM 5544 is an all-solid state pattern generator for colour as well as CCIR monochrome television. The patterns are electronically generated and serve for various purposes, similar to those of the well known slide test pictures as e.g. the RTMA test card, test card "C" and the British test card "F".

The patterns are intended for visual inspection and enable supervision and quality assessment of TV transmitters, microwave links and studios. If transmitted they offer TV dealers and servicemen the highly appreciated possibility of obtaining an impression of the quality of aerial system and receiver in one overall view.
The output signals of the PM 5544 (R, G, B as well as Y, R-Y, B-Y) can e.g. be encoded by the PHILIPS PAL Encoder PM 5554. The required sync and blanking input signals can be supplied by the PHILIPS TV Sync generator PM 5531 or by the PHILIPS Colour TV sync. generator PM 5532.
There are two versions of this pattern generator:

PM 5544G for the 625 lines system, 50 Hz field frequency
PM 5544M for the 525 lines system, 60 Hz field frequency

A PM 5544G can easily be modified to a PM 5544M (see chapter VII-F).

NB. To extend the applications one can order a PHILIPS Text generator PM 5543 (see chapter XII-d).

II. Technical data

Properties expressed in numerical values with stated tolerances, are guaranteed by us. Numerical values without tolerances represent the properties of an average instrument and merely serve as guide.

A. System

Monochrome	625 lines, 50 Hz-field frequency and 525 lines, 60 Hz-field frequency
Colour	The instrument is developed for PAL Standard, but can be used for other systems as well

B. Pattern

A number of pattern combinations can be selected with the aid of pushbuttons.
The pattern contains the following information:

1. Cross hatch raster

forms 13 x 17 squares, height: 21 lines/field, width: 2.8 μs (for M version 17 lines field)
Line-thickness, horizontal: one line/field; vertical: 230 ns. *)
The raster is surrounded by black/whiter castellations. On some of the left hand castellations alternating (R-Y) information is superimposed for checking the burst gate of a receiver or decoder.

2. Background of the cross hatch raster

Video amplitude continuously adjustable between 0 and approx. 80 % of white (screwdriver control at front panel).

3. Colour difference fields

Saturation $\leqslant$ 100 %

a. Information "COLOUR DIFFerence NORMal"
Signals that after encoding represent:

- (R-Y) = 0
- (B-Y) = 0
- (G-Y) = 0

constant luminance value, equal for all six signals

These signals are all present both in positive and negative phasing (after encoding).

b. Information "COLOUR DIFFerence ALTernating" (not visible on a correctly aligned receiver)
Signals which after encoding represent:

- (R-Y) information that is **not** line sequentially phase-inverted.
- (B-Y) information that is **indeed** line sequentially phase-inverted.

The luminance value is identical to the videoamplitude of the background.

**) The value of 230 ns has been selected to minimize cross colour*

4. Electronic circle

The circle is generated by logic circuits with a ferrite core memory. Diameter 12 units of the cross hatch raster, corresponding to approx. 83 % of the vertical scanning.
Radius error: < 1 %.
Location: centre of circle is centre of pattern.
The circle is locked to the cross hatch raster.

5. Signal within the circle area *)

From top to bottom:

a. *Black rectangle:* width approx. 11.2 μs.
b. *White rectangle with black needle pulse:* width of needle pulse 230 ns (T 50 %)
c. *Square wave signal:* Repetition frequency 250 kHz, videoamplitude 75 % of white, and identical to that of the R-G-B-information in the colour bar signal.
d. *Colour bar signals:* yellow-cyan-green-magenta-red-blue, 75 % contrast 100 % saturation.
e. *White crosses:* width vertical lines 230 ns, one horizontal line per field. The scanning sequence of the horizontal line is contrary to that of the horizontal white lines of the cross hatch raster. The centre cross represents the centre of the circle as well as the pattern.
f. *Frequency gratings:* sine wave, from left to right 0.8 MHz – 1.8 MHz – 2.8 MHz – 3.8 MHz – 4.8 MHz, amplitude 100 % of white. (for M version, 0.5 MHz – 1 MHz – 2 MHz – 3 MHz – 4 MHz).
g. *Grey levels:* six levels 0 % – 20 % – 40 % – 60 % – 80 % – 100 % of full-white, amplitude of each level within 5 % of its nominal level. Number of levels may be increased to eleven or decreased to five (internal soldering) to obtain 11,1 %-steps or 25 % steps, resp.
h. *Black rectangle with white needle pulse:* width of needle pulse 230 ns (T 50 %). For transmitter identification the signal of monochrome slide scanner can be gated into this rectangle via a Schmitt-trigger circuit (only 100 % contrast). The white needle pulse will then be switched off.
i. *Colour transient:* yellow-red-yellow, width of red bar approx. 2.6 μs, contrast 75 %, saturation 100 %.

C. Inputs

a. Sync. and blanking *)**

Amplitude	: 2–8 V_{pp}, negative
Permissible hum	: 100 %
Input impedance	: high, for looping-through (75 Ω-system)

b. External text

Suitable for monochrome slide scanner, via internal Schmitt-trigger circuit (100 % contrast)

Sensitivity	: 0.5–2 V_{pp}, synchronised video without sync. and set-up
Polarity	: positive or negative, can be switched internally.
Input impedance	: high, for looping-through (75 Ω-system)

c. External picture

R-G-B-input suitable for colour camera or colour slide scanner

Matrixing error	: ⩽ 2 %
Required amplitude	: 700 mV_{pp} (video without sync and set-up) for 100 % saturation
Polarity	: positive
Frequency response	: < 3 dB at 5 MHz
Input impedance	: high, for looping-through (75 Ω-system)

**) External video information from e.g. a colour camera or a colour slide scanner may be gated into the circle area, to replace the electronically generated information.*
****) The pattern geometry is adjusted for a field blanking of 25 lines.*

D. Outputs

a. **Y, R-Y, B-Y** (two sets of outputs from one amplifier system)

Amplitude R-Y, B-Y	: 1.05 V_{pp}, without sync and set-up
Amplitude Y	: 700 mV_{pp}, without sync and set-up
Polarity Y-signal	: positive
Output impedance	: 75 Ω

b. **R, G, B**

Amplitude	: 700 mV_{pp}, without sync and set-up
Polarity	: positive
Matrixing error	: $\leqslant$ 2 %
Output impedance	: 75 Ω

c. Service output

Special output via measuring amplifier for service purposes.

d. Rise and fall times

Video transitions	: < 100 ns

E. Power supply

Mains voltage	: 115 V ±20 % or 230 V ±20 %
Mains frequency	: 50 Hz or 60 Hz (48 – 62 Hz)
Power consumption	: 65 W at 230 V
Fuse	: for 115 V range: 1000 mA, delayed action for 230 V range: 500 mA, delayed action

F. Temperature range

Operating conditions	: 0 to +45 °C
Storage conditions	: –30 °C to +70 °C

G. Mechanical data

Width	: 6/6 module in PHILIPS universal 19" system
Height	: 132 mm (3 units)
Depth	: 435 mm
Weight	: 12 kg (without cabinet)

III. Accessories

1 Operating and service manual
1 Mains flex
6 BNC-75 Ω-loads
10 BNC connectors
2 Extension boards, enabling measurements in the instrument when it is in operation.

IV. Description of the simplified block diagram

The function of the generator can be devided into two parts (see fig. IV-1).
One performs a circle generator generating the circle gate signal. The other one is a test pattern generator which partly generates a complete field signal and partly a signal which can be gated into the circle.
This latter signal can be substituted by an externally supplied signal.
The generator has to be driven with sync and blanking signals applied from e.g. the PHILIPS TV pulse generator PM 5530.

Sync separator

This unit has high ohmic input amplifiers to obtain looped-through facilities. The line and frame pulses necessary for synchronizing the generator are obtained in the respective separator circuits.

Line register

The line register is a 21:1 divider which is counting line pulses. The pulses obtained from this divider are specially coded to facilitate the generation of the circle and are controlling in combination with the vertical divider all vertical information in the test patterns.

Vertical divider

This section generates all the gating signals on the field frequency basis. The signals are decoded to give the horizontal lines as well as the intervals in vertical directions.

630 kHz oscillator

This oscillator being controlled by the line pulses generates pulses controlling every horizontal information.

Horizontal divider

The signal from the 630 kHz oscillator is passing on to the divider to obtain the horizontal gating pulses.

Decoder system

The signals from the "vertical divider" and the "horizontal divider" are combined in a decoder system to give the gating pulses to as well the field as the circle patterns.

Field information gate

The field test patterns are controlled by the applied gating pulses. The test patterns are supplied to the video mixer as video signals.

Circle information gate

The circle test patterns are controlled by the applied gating pulses. The test patterns are supplied as video signals to the video mixer.

Video mixer

This section is adding the video signal of the circle pattern to that of the field pattern by means of the circle gate signal.
By means of the pushbutton SK4 the circle pattern can be substituted by an externally supplied signal.

R-G-B matrix

In this circuit the Y, (R-Y) and (B-Y) signals from the "video mixer" are converted into R, G, B signals.

The circle generator

The circuitry consists of the "circle register" with the "15 MHz clock oscillator", a ferrite core memory controlled by the "interval decoder" and the "read out decoder".

Circle register

The circle gate signal is obtained by a counting register being operated from the "15 MHz clock oscillator".
The register is set for each line from the ferrite core memory.

The ferrite core memory

The memory is a non-destructive type operating with 10 different programmes selected by the "interval decoder".

Interval decoder

This unit is a read-in circuit securing the correct sequence of the programmes to the memory.

Read-out decoder

It controls the sequence of the setting of "circle register".

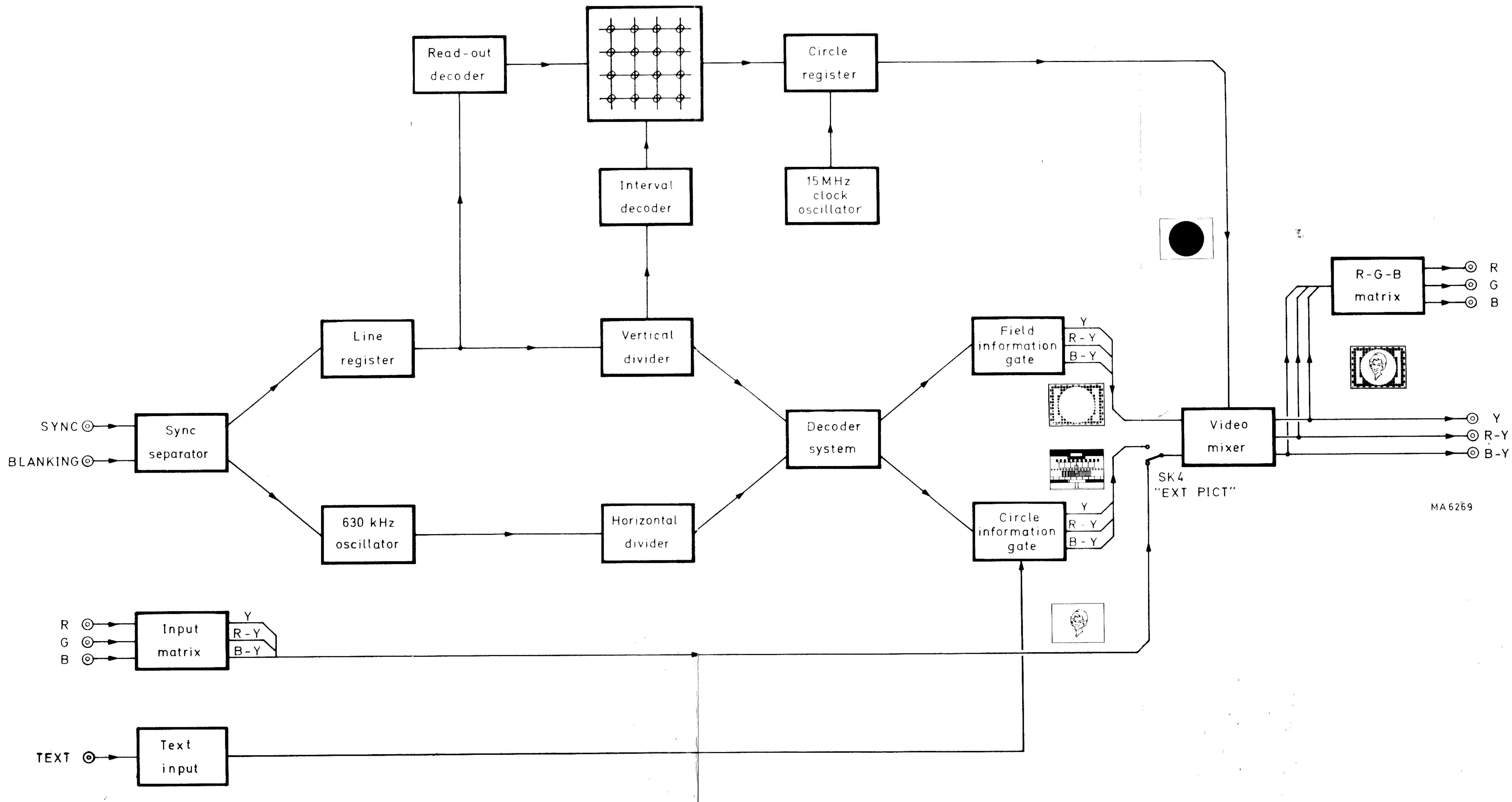


Fig. IV-1. Simplified block diagram

V. Description of the detailed block diagram

The block diagram is divided into two parts.
Part 1 (Fig. V-1) contains mainly the input circuits and the circuits generating the gate signals for part 2.
Part 2 (Fig. V-2) contains mainly the linear generators for the test pattern.

BLOCK DIAGRAM (fig. V-1)

A. Sync and blanking inputs

The "Input amplifiers" amplify and reshape the blanking and sync signals being applied from a TV pulse generator. The amplifiers have high input impedances and they deliver pulses which are independent of the amplitude of the applied input pulses.
Two pulse separating circuits separate the line and frame pulses out of the complete sync signal.

B. Horizontal pulse system

This part generates the basic horizontal pulses and it consists of the "630 kHz oscillator" and the "Horizontal dividers".
The start of the oscillator is for every line controlled by the line pulse (f_H).
The frequency of the oscillator is kept constant by means of a special control circuit.
Before the signal is supplied to the dividers it passes the "2:1 divider".
The "Horizontal dividers" (I and II) are Johnson counters generating the horizontal control pulses for the gate systems and for the start circuit of the circle clock oscillator.

C. Vertical pulse system

The "Line register", the "16:1 divider" and the "Vertical decoder" generate the pulses controlling the circle generator and the vertical picture content.
The "Line register" is a 21:1 divider which counts the line pulses. The start and the stop of the register are controlled by the frame pulses.
The field control circuit is controlled by the field pulses as well as the pulses from the start/stop circuit.
The "White lines generator" is controlled by the $\bar{u}$ and $\bar{s}$ pulses from the "Line register" and it supplies the horizontal white lines (V_L) in the raster.
An adder circuit supplies this signal with blanking ($\overline{V_L}$').
The V_L signal drives also the flip-flop supplying the horizontal bars (V_B) used for the vertical borders.
The generator for the center line is controlled by the $\bar{r}$, $\bar{s}$, $\bar{u}$, $\bar{t}$, $\bar{v}$, $\bar{h}$ and $\bar{h}$ pulses from the "Line register".
This generator supplies a raster of horizontal white lines, which are placed between the raster of V_L (the lines V4, V6, V8 etc.).

The field sequence of these lines, however, are opposite to the one of the other white horizontal lines to obtain the special interlacing center line V_I'. The center line V_I' is selected in the gate after the generator.
The "16:1 divider" generates the pulses for the "Vertical decoder" and for the "Vertical center cross gate".
The divider is counting the $\overline{V_L}$' and $\overline{V_I}$ pulses. These pulses appear for every 25 lines (the V_I pulses are placed between the V_L' pulses).
The A, B, C and D pulses from the "16:1 divider" are combined in the "Vertical decoder" in order to obtain the vertical control pulses for the gate system and for the "Interval decoder" in the circle generator.

D. The circle generator

This generator consists of the "Memory", the "Read out decoders", the "Circle register" with the clock oscillator and the "Interval decoder" and it generates the circle gate signal "ϕ".
The "Memory" is a ferrite core memory which contains 10 different programmes. The programmes are coded by the wiring of the cores.
Each program gives the information for 21 succeeding lines. The 10 programmes together give the full information for the circle properties for the two fields.
A program is read out line by line by means of the "Read out decoders". A line will be read out when both "X" read out decoders" supply the respective cores with current in the same direction (see "the principle of the circle generator" chapter XI).
The "Circle register" consists of two counters each one with 8 binary dividers.
The counters count the pulses from the "15 MHz clock oscillator" and they are line by line preset by the binary information from the memory.
The one counter gives information about the left side, and the other one about the right side of the circle and these two signals form the circle gate signal "ϕ".
The program for the respective interval of 21 lines is read in by the "Interval amplifiers" which are controlled by the "Interval decoders".

E. The gate system

This group of gates controls the test pattern generators (see block diagram fig. V-1).
The gates combine the basic pulses from the "Horizontal dividers" and the "Vertical decoder" in order to obtain the necessary, complex signals.
The gates for the colour signals are: "± (R-Y) gate", "± (B-Y) gate", "(R-Y)", "(G-Y) gate" and "(B-Y) gate".

The pictures in the block diagram show the areas controlled by the gates. (These pictures can be displayed by means of the test amplifier, see section VII-D).

The gates for the black and white signals are: "Colour diff. luminance gate", "Center cross gate", "Grey background gate" and "Bl/wh circle gate".
The Bl/wh circle gate" supplies the ϕ signal, which is used as a video information in the circle.
An external supplied text signal will be passed through this gate.
The "Σ adder circuit" supplies also a signal which is used direct as a video signal. This signal is the complete black and white picture information without the circle.
The signal consists of the grid raster and the border castellations. The grid raster is produced by combining the H_L and the V_L signals.
The border castellation is produced by combining the vertical bars H_B gates with the V_C signal and with the horizontal bars V_B gates with the H_C signal.
The "Narrow line generator" supplies from the H_L' signal vertical white lines of half the width of the normal lines. The signal is used in the (R-Y), (G-Y) and (B-Y) gates to obtain a colour step exactly in the middle of the white lines.

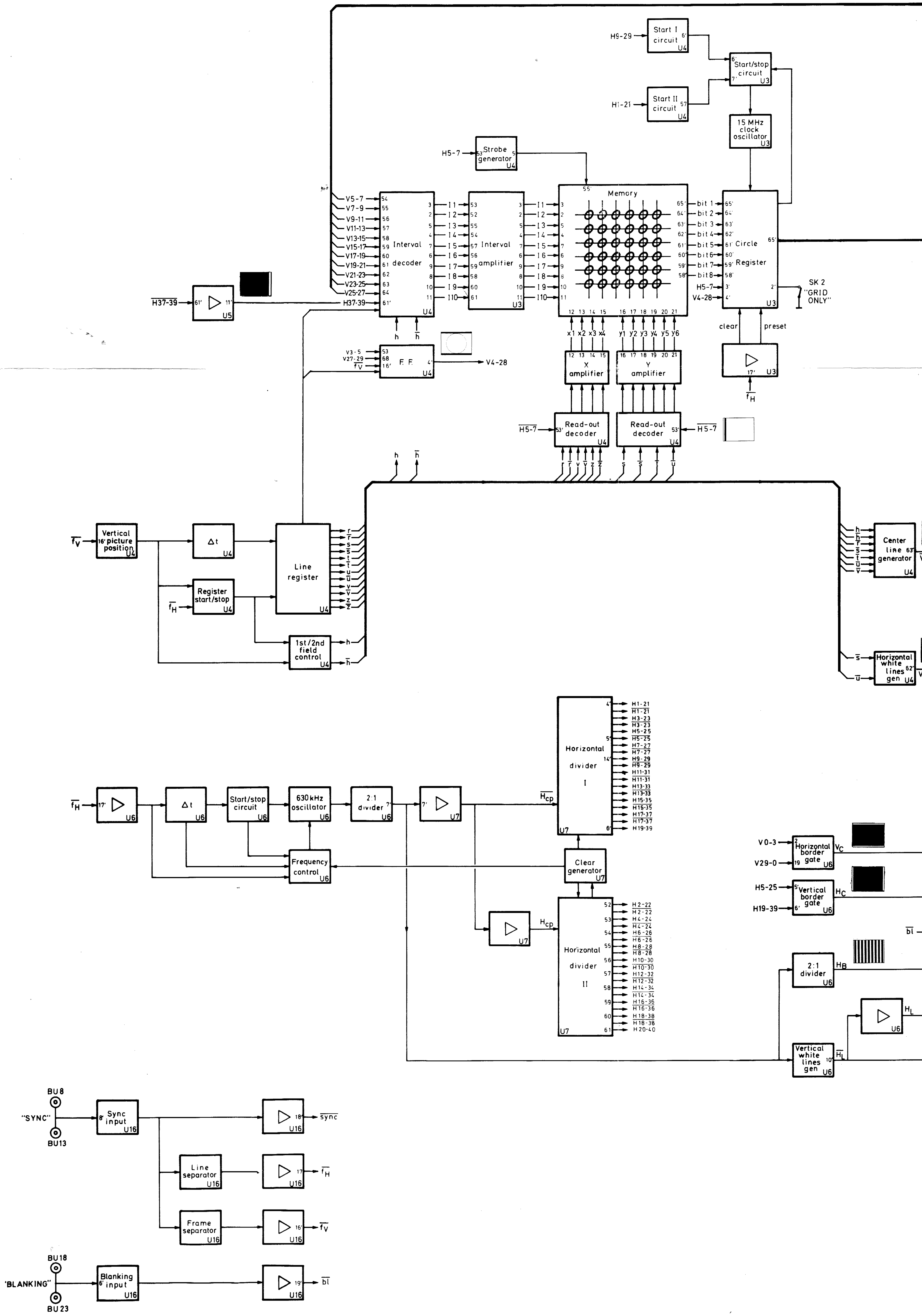
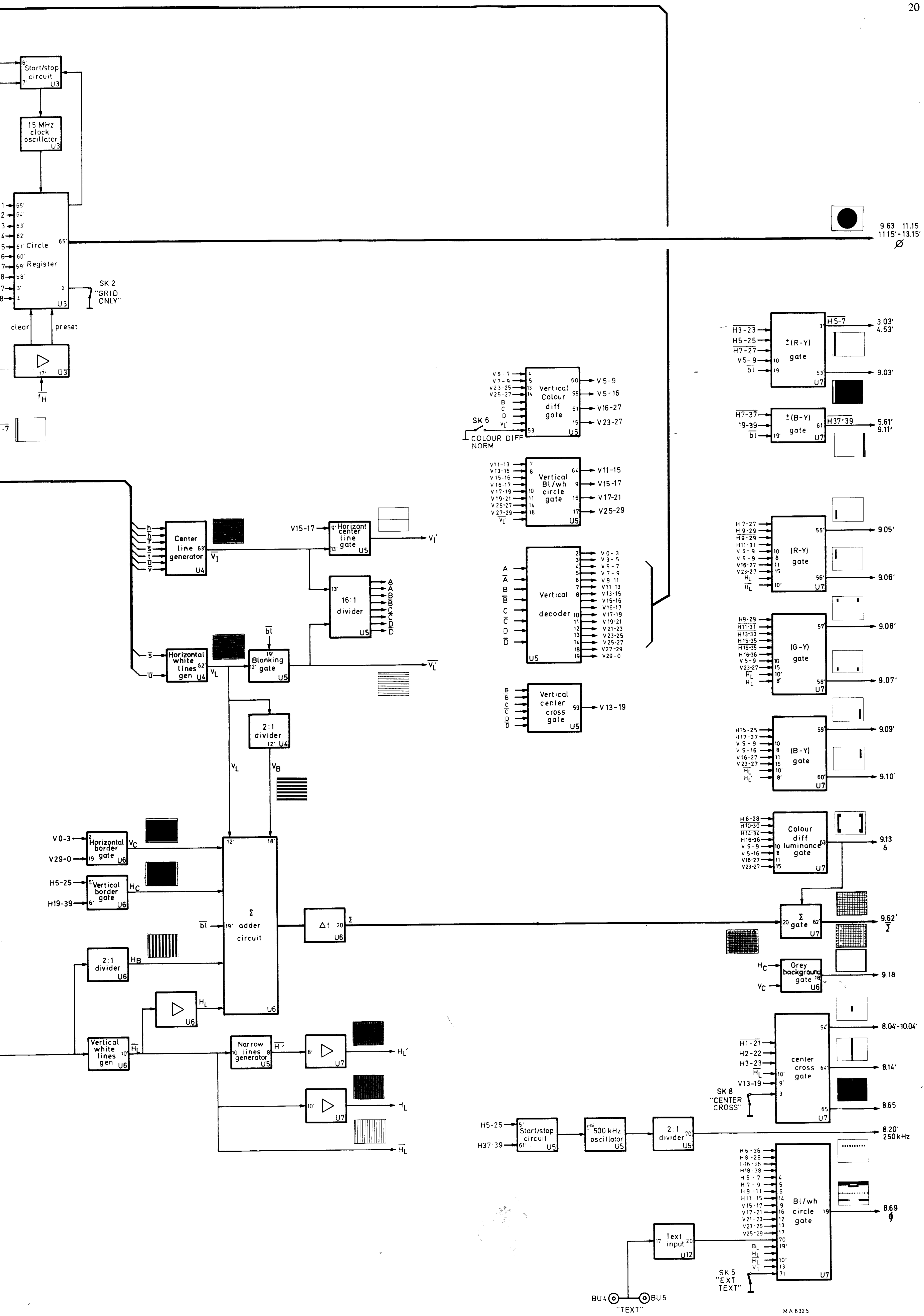


Fig. V-1. Detailed block diagram (part I)



Start/stop circuit U3
15 MHz clock oscillator U3
Circle Register U3
SK 2 "GRID ONLY"
clear
preset
U3
f_H
9.63 11.15
11.15'-13.15'
Ø
(R-Y) gate U7
3.03'
4.53'
9.03'
(B-Y) gate U7
5.61'
9.11'
Vertical Colour diff gate U5
V 5-9
V 5-16
V16-27
V 23-27
SK 6
COLOUR DIFF
NORM
Vertical Bl/wh circle gate U5
V11-15
V15-17
V17-21
V25-29
Center line generator U4
Horizont center line gate U5
V15-17
16:1 divider U5
Vertical decoder U5
(R-Y) gate U7
9.05'
9.06'
(G-Y) gate U7
9.08'
9.07'
Horizontal white lines gen U4
Blanking gate U5
2:1 divider U4
Vertical center cross gate U5
V 13-19
(B-Y) gate U7
9.09'
9.10'
Colour diff luminance gate U7
9.13
6
V0-3
V29-0
Horizontal border gate U6
H5-25
H19-39
Vertical border gate U6
Σ adder circuit U6
Δt U6
Σ gate U7
9.62'
Σ
2:1 divider U6
Grey background gate U6
9.18
Vertical white lines gen U6
Narrow lines generator U5
center cross gate U7
8.04'-10.04'
8.14'
8.65
SK 8 "CENTER CROSS"
Start/stop circuit U5
500 kHz oscillator U5
2:1 divider U5
H5-25
H37-39
8.20'
250 kHz
Bl/wh circle gate U7
8.69
ϕ
Text input U12
SK 5 "EXT TEXT"
BU4
BU5
"TEXT"
MA 6325

BLOCK DIAGRAM II (fig. V-2)

A. Grid information

This section contains the "(R-Y) and (B-Y) matrixes" and the luminance circuits for the grid information (the video signal without circle information).
The "(R-Y) and (B-Y) matrixes" are controlled by the gating signals coming from the respective gates in unit 7 (see the figures).
The ± (R-Y) and the ± (B-Y) signals (the special (R-Y) and (B-Y) signals being line sequentially phase inverted) are controlled by the "ALT control circuit" (SK7).
The resulting (R-Y) and (B-Y) signals are via an amplifier and clamping circuit applied to the respective "(R-Y) mixer" and "(B-Y) mixer" (unit 11 and 13).
The luminance information for the field is produced in the "Y adder" by the four applied signals: δ, grey field, $\overline{\Sigma}$ and ϕ.
The δ signal secures correct luminance of the colour difference signals. The "Grey field" is the background for the field (adjustable between 0 and 80 % of white).
The grid raster, the colour difference area and eventually the circle are gated out of the "Grey field" in order not to influence the luminance of these signals.
The $\overline{\Sigma}$ signal is the grid raster supplied with border castellation.
When SK2 "Grid only" is released the circle is gated out of the Σ signal by means of the applied ϕ signal.
The Y signal is via a clamping circuit applied to the "Y mixer" (unit 15).

B. Circle information

The circle information could be either an externally supplied or an internally generated signal.
An external signal should be supplied as R, G, B signals (BU9, 10, 14, 15, 19, 20).
By means of the 3 matrixes the signals will be converted into Y, (R-Y) and (B-Y) signals.
These signals are applied to the respective mixers (unit 11 and 13) via the clamping circuits and a switching system.
The section for the internally generated signal contains:
The "Colour gate" with the matrix system, the "Staircase generator", the "Definition lines generator", the "Center cross gate" and an adder circuit to obtain the complete Y signal.
By means of the supplied signal the colour gate is generating a colour bar signal with a contrast of 75 %.
For the adjustment of some receivers it is important that the contrast of the 250 kHz and the colour bar signal are exactly the same.
Therefore the 250 kHz signal is generated in the "Colour gate".
The Y signals for the colour bar and the 250 kHz signal are obtained in the "Y matrix".
The (R-Y) and (B-Y) signals are obtained in the "(R-Y), (B-Y) matrix".
Via the clamping circuits and a switching system these signals are applied to the respective mixers (unit 15). The "Staircase generator" combines the supplied signals to a 6 levels staircase.
The staircase can be changed to 5 or 10 levels by means of internal soldering (see circuit diagram unit 8, Fig. XX-5).
The "Definition lines generator" is a dc controlled sine wave generator.
Consequently the frequency gratings from 0.8 to 4.8 MHz are controlled by a staircase signal from the "Frequency control" circuit.
The start/stop circuit is gating the area where the generator should be active.
The "Center cross generator" receives from unit 7 the necessary signals for generating the center cross.
This signal is added to the black and white signal generated in unit 7 and supplied to the Y adder.
The complete Y signal for the circle is obtained in the "Y adder".
The signal is applied to the "Y mixer" via the "Clamping" circuit and the "EXT/INT switch".

C. Video mixer

The field information are added to the circle information in the video mixers.
The Y, (R-Y) and (B-Y) signals with the circle information are applied to the switching system controlled by SK4 "EXT PICT". By the switching system either the externally applied or the internally generated signals are chosen as the circle signal. Then these signals are applied to the respective mixers ("Y mixer, (R-Y) mixer, (B-Y) mixer").
In the mixers the circle is gated out of the field signal and substituted of the circle signal.
From the mixers the video signals are applied to the respective output sockets via the output amplifiers.

D. R-G-B Matrix

In this matrix system being supplied with the Y, (R-Y) and (B-Y) signals the R, G and B signals are generated.
The R, G and B signals are via the output amplifiers applied to the respective output sockets.

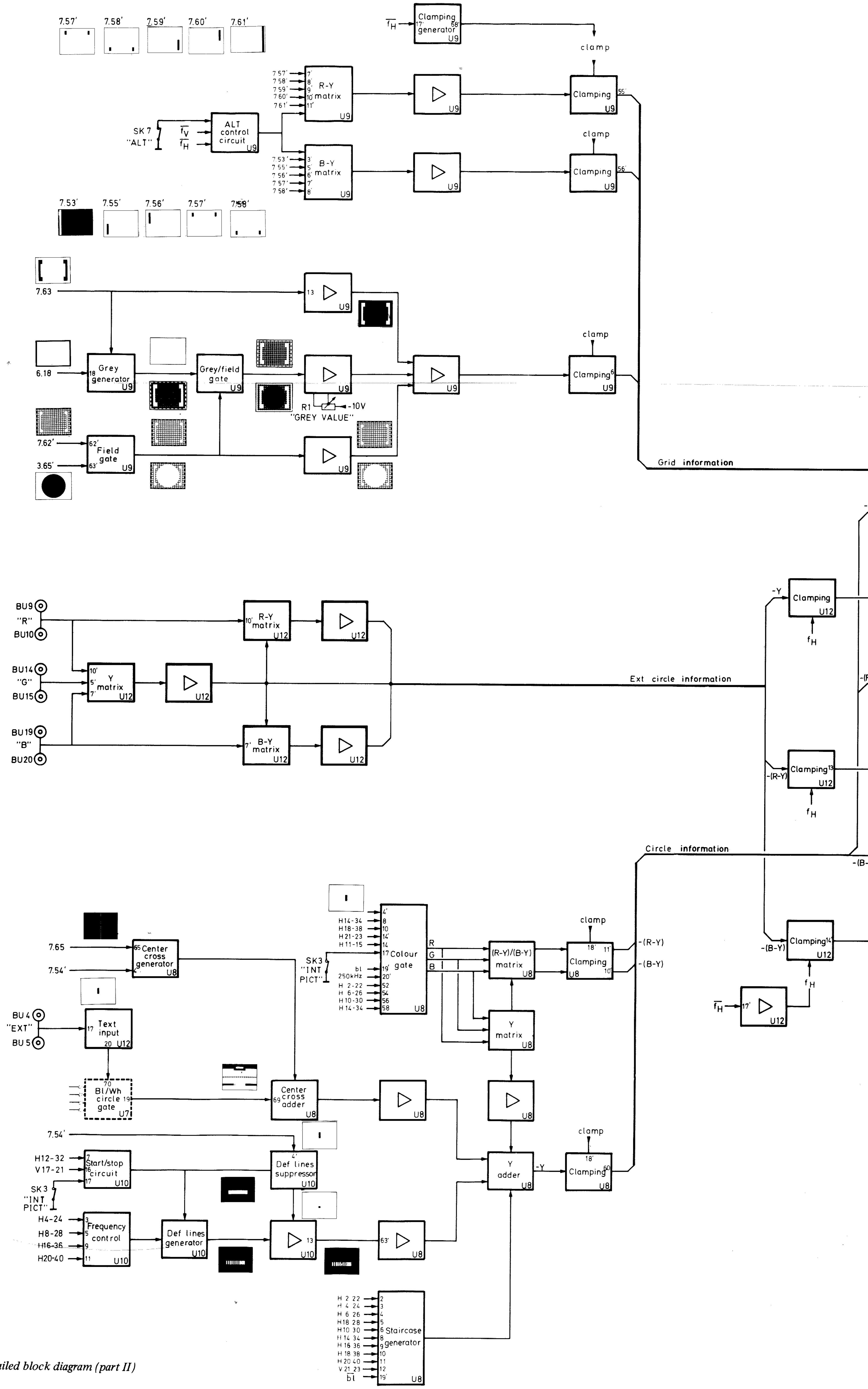
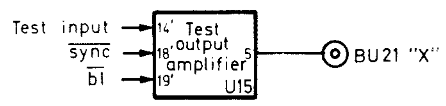
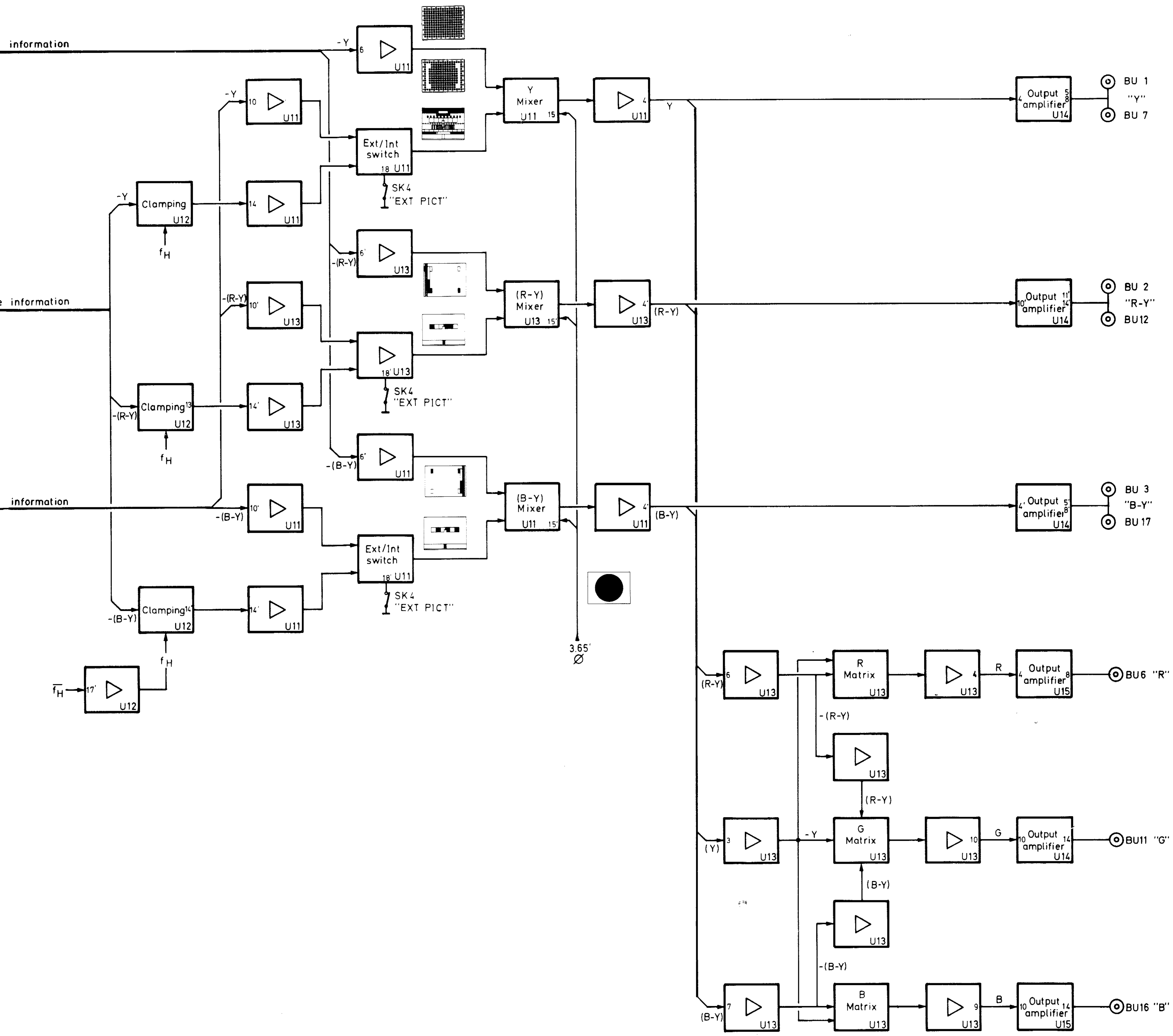


Fig. V-2. Detailed block diagram (part II)


Test input
sync
bl
Test output amplifier
U15
BU21 "X"


information
e information
information
-Y
-(R-Y)
-(B-Y)
Clamping
U12
f_H
$\overline{f_H}$
U11
U12
U13
Ext/Int switch
SK4 "EXT PICT"
Y Mixer
(R-Y) Mixer
(B-Y) Mixer
Y
(R-Y)
(B-Y)
3.65'
Output amplifier
U14
U15
BU 1 "Y" BU 7
BU 2 "R-Y" BU12
BU 3 "B-Y" BU 17
R Matrix
G Matrix
B Matrix
(Y)
R
G
B
BU6 "R"
BU11 "G"
BU16 "B"

MA 6326

VI. How to read the pulses in the diagrams

All signals in the generator are built up by pulses which can, with few exceptions, be located from a co-ordination system consisting of the grid raster (fig. VI-1a).
The pulses are indicated by the letter "H" or "V" followed by two figures.
The "H" pulses are pulses which occur with the line frequency.
The "V" pulses are pulses which occur with the field frequency.
The figures give the exact position of the pulse in the co-ordination system (fig. VI-1a).

Examples:

1. H1-21
   This is a positive going pulse going positively at 1 and negatively at 21 (fig. VI-1b).
2. $\overline{\text{H1-21}}$
   This one is the same pulse as 1 but inverted (fig. VI-1c).
3. If the pulse 2 is apllied to a NAND gate (IC 29/1 in unit 7) together with the pulse H3-23 (fig. VI-1d), the output of the NAND gate will supply a new pulse:
   $\overline{\text{H21-23}}$ (used in the center cross gate and the colour step generator).
   Another indication is used when an H and a V pulse are gated together (e.g. H21-23 and V13-19 to obtain a gate pulse for the center cross) or for special signals as e.g. the 250 kHz and the definition lines.
   In this case the diagrams are supplied with pictures showing the area covered by the respective gate pulses.
   Some complex signals are additionally supplied with a symbol e.g. Σ, ϕ, δ.
   These pictures can be found in the generator by means of a monitor and the built-in "test output amplifier" (see chapter VII-E).

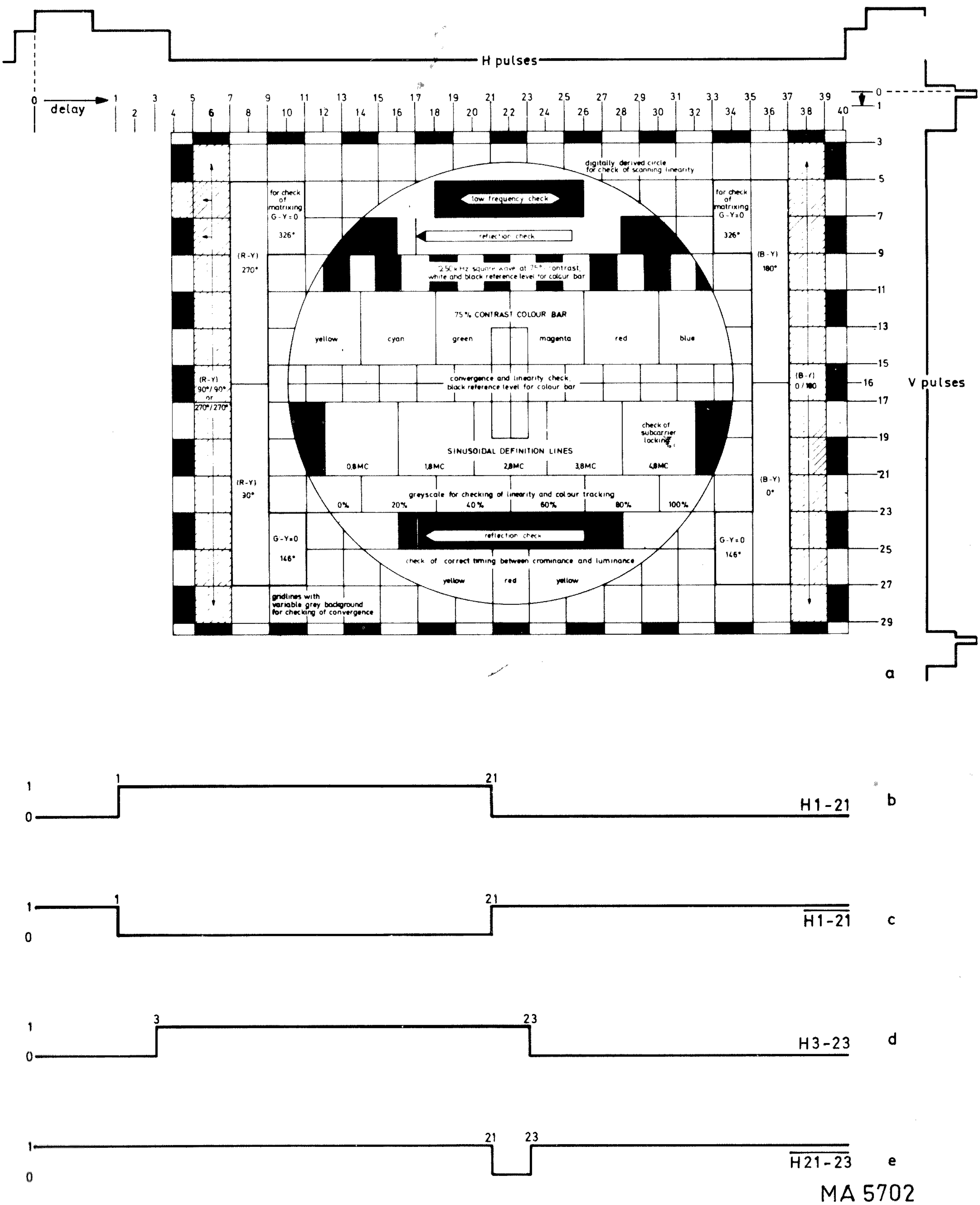


Fig. VI-1. Pulse diagram

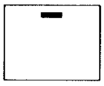
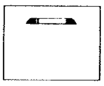
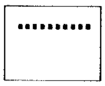
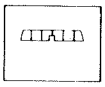
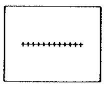
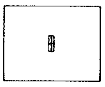
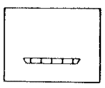
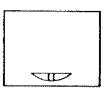
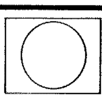
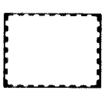
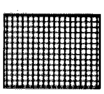
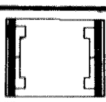
	Basic signals	Signal ways
	Black rectangle Unit 7 IC 24/2 controlled by: H6-26, H18-38 and V5-7	via IC28.terminal 19→ unit 8. IC2/1. IC3/1-TS2.TS4.terminal 60→ unit 11.
	Black needle pulse in white area Unit 7 Needlepulse : IC 24/1 controlled by: H_L.H16-36 and H18-38 White area : IC 25/1 controlled by: H8-28 and H16-36	via IC26/1.IC28.terminal 19→ unit 8.IC2/1 IC3/1.TS2.TS4.terminal 60→ unit 11.
	250 kHz square waves Unit 5 TS4 and TS5 (500 kHz oscillator).	via 2:1 divider IC2/1.terminal 70'→ unit 8 IC1/2.IC9/1-2(colour gate)via R-Y and B-Y matrix to terminals 10' and 11' and via Y matrix.TS6.TS4 to terminal 60→ units 11 and 13.
	Colourbars Unit 8 IC1.IC3.IC7.IC8.IC9 and IC10(Colour gate).	via R-Y.B-Y and Y matrix to terminal 10',11' and 60→ units 11 and 13.
	Circle grid Horizontal line: Unit 5. IC18. IC19. via terminal 9 to unit 7,where vertical lines ($\overline{H}_L$) are added in IC13/3.	via IC28.terminal 19→ unit 8. IC2/1. IC3/1.TS2.TS4.terminal 60→ unit 11.
	Convergence centercross Unit 7. IC23/1 - IC26/2 and IC29.	via terminal 54' and 65→ unit 8. IC1/1. IC2/2.IC2/1.IC3/1.TS2.TS4.terminal 60→ unit 11.
	Definition lines Unit 10.-Definition lines generator controlled in MHz by: H4-24, H8-28, H16-36 and H20-40 at terminals 3,5,9 and 11. Start/stop controlled by H12-32 and V17-21 at terminals 7 and 16.	via terminal 13' → unit 8. TS1.TS4. terminal 60 → unit 11.
	Luminance staircase Unit 8 IC3.-IV4. IC5. IC6 and IC7.	via TS3.TS4. terminal 60 → unit 11.
	White needle pulse in black area Unit 7 Needlepulse : IC 24/1 controlled by: H_L. H16-36 and H18-38 Black area : IC 25/2 controlled by: H8-28 and H16-36	via IC28 terminal 19→ unit 8. IC2/1. IC3/1. TS2.TS4.terminal 60→ unit 11.
	Yellow-red-yellow areas Unit 8 red :IC7/4 controlled by V25-29 and $\overline{bl}$ green:IC1/3 controlled by V25-29.*H21-23 and $\overline{bl}$ *H21-23 is generated in unit 7. (IC29/1).	via R-Y. B-Y and Y matrix to terminal 10', 11' and 60 → units 11 and 13.
	Circlegatesignal Ø Unit 3	via terminal 65' → units 9-11 and 13.
 	Bl/Wh.castellation. Unit 6 IC9 and IC10 Horizontal castellation controlled by:Vc and HB Vertical castellation controlled by:Hc and VB *VB is generated in unit 4. Grid raster. Unit 6 IC9/2-4-5 and IC10 Horizontal lines:VL (generated in unit 4). Vertical lines:HL	via terminal 20→ unit 7. IC13/2 → unit 9. IC6/4.IC6/1.TS22.TS24.terminal 6 → unit 11.
	Colour DIFF and ALT signals. Unit 7	→ unit 9. R-Y and B-Y matrix to terminals 55' and 56' → units 11 and 13.

Fig. VI-2. Basic signals

VII. Installation

A. Adjusting to the local mains voltage

The instrument can be used with mains voltages of 110 V and 220 V a.c.
Before using a new instrument check the adjustment.
If the instrument has to be adjusted to another mains voltage, resolder the connections to the primary windings of the supply transformer as shown in the figures below.

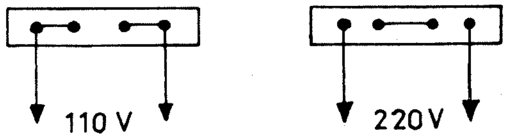


Fig. VII-1. Transformer connections 110-220 V

B. Earthing

Earth the instrument in accordance with the local safety regulations.
The metal cabinet can be earthed via:
Socket BU21 (see Fig. VIII-2) and the earthing core of the mains lead.
The electrical circuit can be earthed via:
Socket BU22 (see Fig. VIII-2) and the screening of the coaxial connection cables.
Avoid double earthing of the electrical circuit, because this may introduce hum phenomena.

C. Connecting the PM 5544 to the encoder PM 5554

The output signals Y ,R-Y and B-Y should preferably be used to prevent double matrixing when applying the video signals.
The following adjustments (see Fig. VII-2) should be carried out for correct encoding:

1. Connect an oscilloscope to the output of PM 5554.
2. Adjust R1 unit 14B (Y amplitude) to 1 V_{pp} including sync.
3. The peak levels of yellow and cyan should be equal to white. If that is not the case, adjust R1 unit 14A (B-Y amplitude) until the yellow amplitude is correct and R16 unit 14A (R-Y amplitude) until the cyan amplitude is correct.

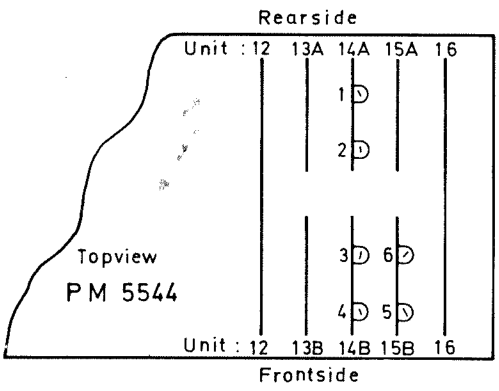


Fig. VII-2. Adjusting elements

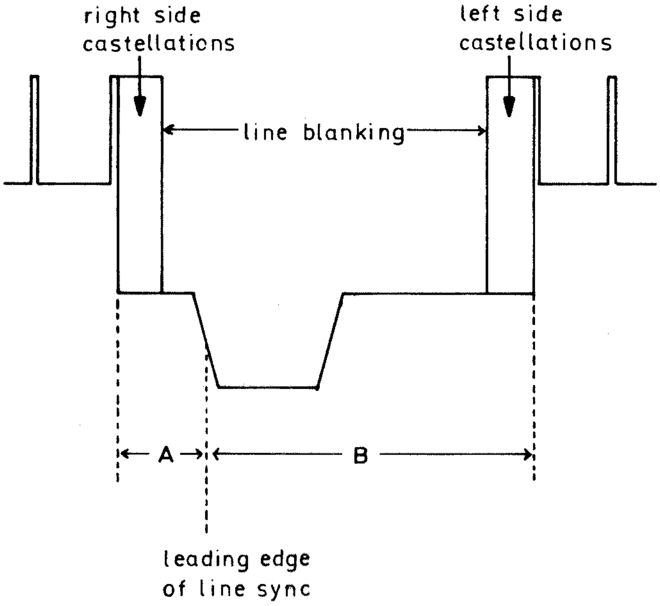
Adjusting elements

1. (R1 – unit 14A) – B-Y amplitude
2. (R16 – unit 14A) – R-Y amplitude
3. (R1 – unit 14B) – Y-amplitude
4. (R16 – unit 14B) – G-amplitude
5. (R16 – unit 15B) – B-amplitude
6. (R1 – unit 15B) – R-amplitude

D. Exact horizontal position of the picture

At delivery the horizontal position of the picture is accurate to approximately ±0.5 % of the line scanning time.
The position is measured with respect to the leading edge of the applied line sync. pulse.
When installing the instrument it is possible to obtain an accurate horizontal position in the order of ±0.1 %.
In this case the following adjustment procedure must be followed:

1. Connect a line triggered oscilloscope *) to the output from the encoder to which the PM 5544 is connected.
2. Adjust R6 and R41 on unit 6 in PM 5544 to obtain the following timing diagram.



*) The oscilloscope should have a very accurate time base.

Numbers of lines in the supplied fieldblanking	G version: Position of grid related to leading edge of sync (μs)		M version: Position of grid related to leading edge of sync (μs)	
	Left B	Right A	Left B	Right A
18	12.75	3.75	12.36	4.36
19	12.67	3.67	12.26	4.26
20	12.59	3.59	12.16	4.16
21	12.50	3.50	12.07	4.07
22	12.42	3.42	11.47	3.97
23	12.34	3.34	11.87	3.87
24	12.26	3.26	11.77	3.77
25	12.17	3.17	11.67	3.67

Without the first and last white line in the grid

When changing to another width of the supplied fieldblanking following other adjustments must be carried out:

Unit 3: oscillatorfrequency, start I and start II pulses
Unit 4: vertical position

E. Test output amplifier

This amplifier is a special amplifier added to promote the service ability of the instrument.
By means of this amplifier all signals in the pulse part of the generator can be made visible on the screen of a video monitor (see the pictures in the diagrams).
The amplifier supplies the measuring signal with (non-specified) sync and blanking signals for adapting to the monitor (sync. negative). The polarity of the signal can be inverted by means of internal soldering, (see circuit diagram unit 15A).

Connections

The monitor should be connected to output socket BU21: "X" (≈ 75 Ω).
The signal to be measured should be applied to terminal 14' at the test output print (unit 15A).

Warning

Do not short-circuit the terminals of the print plates, as this may damage the circuits.
Eventually an insulated wire, as shown in Fig. VII-3, can be used.

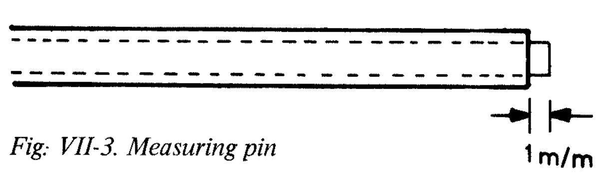


Fig: VII-3. Measuring pin

Other applications

The test output amplifier can also be used as a supplier of simple test signals with sync and blanking, e.g. the circle signal, the cross lines etc.

In some cases one of the output amplifiers (unit 14A, 14B or 15B) can be used only to make the pulse visible on the screen because the pulse amplitude is too low to be measured with the test output amplifier or the signal consists of several different levels which cannot be made visible by the test amplifier.
The pulses to be measured in this way are marked*. Then the monitor has to be connected to the output socket of that amplifier and the signal to be measured has to be applied to the input of that amplifier.
Besides complete sync. has to be supplied to the monitor (ext. sync.).

VIII. Survey of controls and sockets

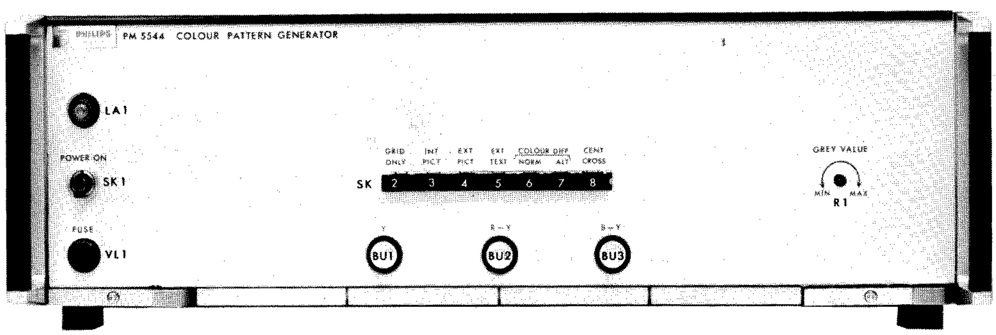


Fig. VIII-1. Front of the instrument

A. Front of the instrument (see fig. VIII-1)

LA1 Pilot lamp; lights up when the instrument is switched on

R1 "GREY VALUE"
screwdriver control for video amplitude of the grey background of the crosshatch raster.

SK1 "POWER ON"
mains switch; the instrument is switched on if the lever of the switch is placed upwards

SK2 "GRID ONLY"
by pressing the grid pattern is obtained.

SK3 "INT PICT"
by pressing the complete pattern is obtained

SK4 "EXT PICT"
by pressing the circle contents will be removed and replaced by a picture composed of an external R-G-B-source, which is connected to sockets BU9, BU14, BU19 or BU10, BU15, BU20

SK5 "EXT TEXT"
by pressing the white needle pulse in the lower black rectangle of the complete pattern will be removed and replaced by the signal, from a nomochrome flying-spot scanner, which is applied to sockets BU4 or BU5

SK6 "COLOUR DIFF - NORM"
by pressing some colour difference fields are added to the pattern

SK7	"COLOUR DIFF - ALT" by pressing two colour difference bars are added to the pattern. These will not be visible on a well-aligned receiver
SK8	"CENT CROSS" by pressing a white cross in a black background will be added exactly in the centre of the complete pattern
BU1	"–Y–" output socket for Y-signal (Ri = 75 Ω)
BU2	"R-Y" output socket for (R-Y) signal (Ri = 75 Ω)
BU3	"B-Y" output socket for (B-Y)-signal (Ri = 75 Ω)
VL1	safety fuse: 230 V – 500 mA, delayed action 115 V – 1000 mA, delayed action

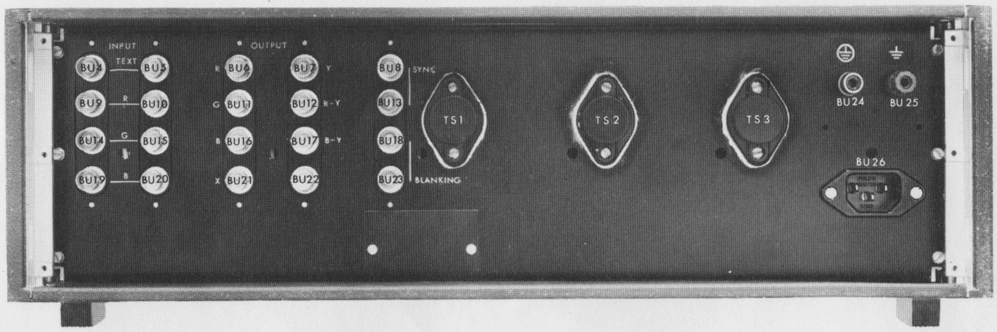


Fig. VIII-2. Rear of the instrument

B. Rear of the instrument (see fig. VIII-2)

BU4, BU5	”TEXT” interconnected input sockets for ”text”-signal from a monochrome flying spot scanner
BU6	”R” output socket for red-signal
BU7	”Y” output socket for luminance-signal
BU8, BU13	”Sync” interconnected input sockets for composite sync-signal (negative)
BU9, BU10	”R” interconnected input sockets for red-signal
BU11	”G” output socket for green-signal
BU12	”R-Y” output socket for colour difference signal (R-Y)
BU14, BU15	”G” interconnected input sockets for green-signal
BU16	”B” output socket for blue-signal
BU17	”B-Y” output socket for colour difference signal (B-Y)
BU18, BU23	”Blanking” interconnected input sockets for complete blanking signal

BU19, BU20	"B" interconnected input sockets for blue signal
BU21	"X" output socket for internal test amplifier
BU24	earthing socket connected to the metal cabinet
BU25	earthing socket connected to the electrical circuit
BU26	socket for mains connection

IX. Operating the PM 5544

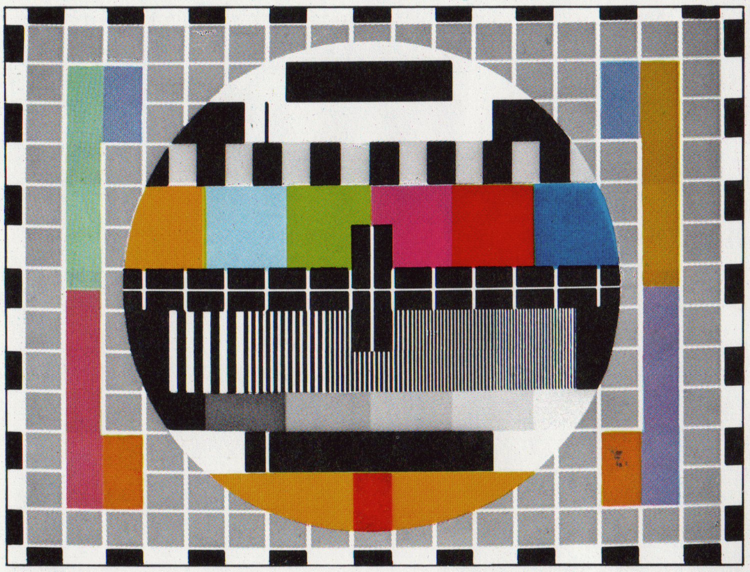


Fig. IX-1. Complete internal pattern

A. Internal pattern

The pattern is supplied if switch INT PICT is pressed. The signals representing this pattern are available as [R + G + B] as well as [Y + (R-Y) + (B-Y)] information.
The following information can be simultaneously switched on/off:

1. Colour difference - fields

By pressing switch COLOUR DIFF - NORM, the following fields are added to the pattern.
After encoding the left bar represents the [(B-Y) = 0]-phases, the upper part produces a signal of 270° [–(R-Y)] the lower part 90° [+ (R-Y)].
After encoding the right bar represents the [(R-Y) = 0]-phases, the upper part produces a signal of 180° [– (B-Y)] the lower part 0° [+ (B-Y)].
After encoding the inner blocks represent the [(G-Y) = 0]-phases, the upper ones produce a signal of 326°, the lower ones of 146°.

2. Alternating colour difference bars

By pressing switch COLOUR DIFF – ALT, the following bars are added to the pattern. **After** encoding the extreme left bar produces an (R-Y) signal that is **not** line-sequentially phase inverted. The phase of the latter can be 90° or 270°, but remains the same as long as the instrument is operating. This is because the instrument is not using the 12.5 Hz PAL information.
After encoding the extreme right bar produces a (B-Y) signal that is line sequentially phase inverted. On a well-aligned receiver these bars will not be visible. They do become visible if e.g. the receivers demodulator phases are not correct. The left bar then shows a yellowish or bluish colour.
The right bar becoming reddish or cyanic.

3. A white cross in the centre of the pattern

By pressing switch CENT CROSS the pattern will be provided with a white cross in a black background situated exactly in the centre of the pattern. The lower part of this background can be internally adjusted, if required to 2 - 3 % below black level setting of e.g. monitors.

4. Grid pattern

By pressing switch GRID ONLY, the circle with its contents is removed leaving a complete grid raster.

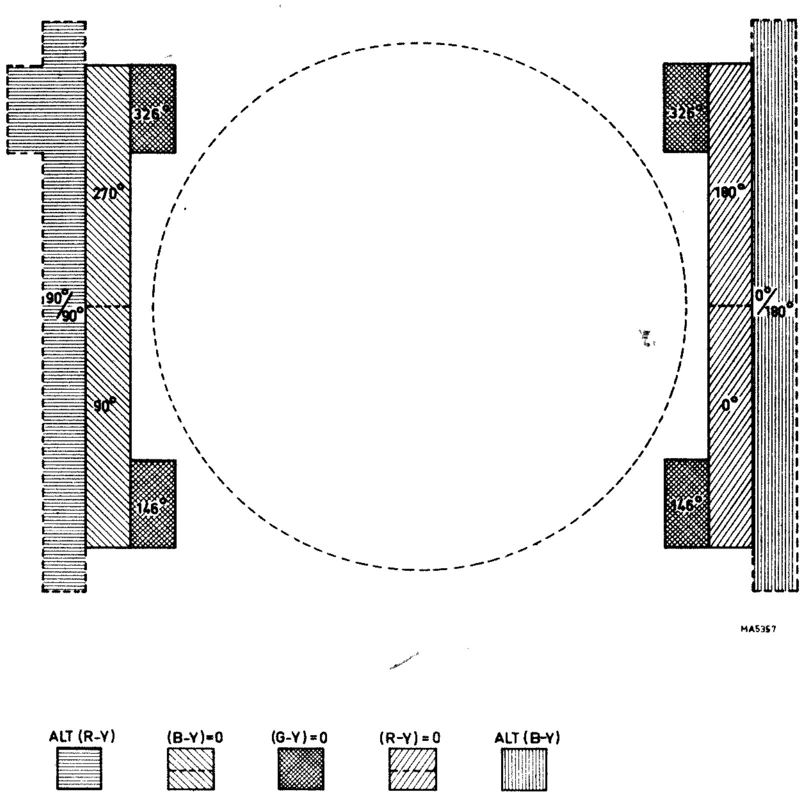


Fig. IX-2. Position and phasing of colour difference signals (after encoding)

B. Internal pattern with externally applied video

1. By pressing switch EXT PICT, the picture contents within the circle area will disappear and can be replaced by a picture composed of an external R-G-B-source.
The output signals of a colour camera or a colour slide-scanner, connected to sockets INPUT – R-G-B (rear of the instrument) will be gated into the circle area. This means that the external videoinformation will only show up within the area of the circle.
This facility is meant for transmitting colour pictures or slides in order to facilitate overall picture quality assessment and saturation setting.

2. Transmitter identification

If switch INT PICT is pressed, the white needle pulse in the lower black rectangle in the circle can be removed by pressing switch EXT TEXT.
The output signal of a monochrome flying-spot scanner, being connected to socket INPUT TEXT (rear of the instrument), will then be gated into the black rectangle via a Schmitt-trigger circuit. This means that the external videoinformation will only show up within the area of the black rectangle, whereas it can only be white or black because of the Schmitt-trigger circuit.

This text signal can be inverted by means of a little push-button on print-board VIDEO INPUT. This input circuit accepts signals with or without sync and set-up.
Releasing switch EXT TEXT removes the inserted text and replaces it by the white needle pulse again.

C. Minor changes in the patterns

In the foregoing patterns some minor changes are possible:

1. The video-amplitude of the background

By means of screwdriver control GREY VALUE (front of instrument) the video-amplitude of the background of pattern can be varied from 0 (= black) to approx. 80 % of white.

2. The greyscale steps

By means of a connection jumper on a p.w. board, the five grey steps can be increased to ten, or decreased to four.

3. Information for black level setting

If pushbuttons INT PICT, EXT PICT, and GRID ONLY are released, the frequency gratings will disappear from the pattern. The lower part of the black background of the centre cross can be adjusted to 2 - 3 % below black level by means of an internal control. In this way it is possible to obtain a horizontal black bar (instead of the frequency gratings) in which a small area is lightly below black level. By means of this provision the black level setting of display units can be checked and adjusted.

X. The pattern of the PM 5544

The patterns are intended for visual inspection on the screen of a monitor or a receiver, but they also clearly show the desired information on the screen of an oscilloscope, waveform monitor and vectorscope. If broadcasted, the patterns enable TV-servicemen to carry out an optimal adjustment and a quick functioncheck of a receiver just installed.
The following procedure for visual inspection is meant for orientation and does not pretend to be complete.
The sequence of the various checks is entirely determined by the composition of the patterns, and we would therefore, like to emphasize that in case of readjustments in the receiver, etc, a deviating sequence might have to be used. As a result of the complex nature of the pattern we do not recommend its use as a substitute for a service generator in a TV repair shop.

Procedure for visual inspection

1. Cross hatch raster (the dimensions of the raster are identical to the 14 x 19 lines raster)

It provides checking of:

- the picture geometry, such as horizontal and vertical scanning amplitude and linearity. The raster should form equal squares.
- the uniformity of focus and the pin-cushion correction. The focus of the cross hatch area and of the central area should be uniform, while at the same time the lines of the cross hatch should seem to be straight and parallel at normal viewing distance.
- the convergence of the shadow mask colour picture tube.
- the step-function response. The vertical lines should not show ringing or overshoot.

2. Grey background of the cross hatch raster

Although adjustable at any value between black and approx. 80 % of black-to-white level it is usually set to approx. 30 % video amplitude.
To a certain extent it provides an impression of the purity of th shadow mask tube.

3. Edge castellations

Black/white blocks, similar to those of test cards "C" and "F".
They provide checking of:

- the size and centring of the picture. The top and bottom castellations each cover 3.5 % of the vertical. scanning; on a screen with the usual over-scanning they will be partly visible. The cross hatch raster has a 1.30 aspect ratio and as most receivers have a display area with a 1.25 aspect ratio (5:4) it is usual for the side castellations to appear just in the display area of the receiver.

- the sync separator performance (by means of the right-hand border). A malfunction appears as a horizontal displacement of those parts of the picture where the white blocks are found.
- the burst gate performance. On a few of the left hand castellations some special (R-Y) information can be present (this information is after encoding **not** line sequentially phase inverted and is therefore normally invisible).
  A malfunction appears as colouring of the extreme left and right parts of the cross hatch background in the 2nd and 3rd square from the top.

4. Electronic circle

Diameter 12 units of the cross hatch raster, the centre of the circle also being the centre of the picture. It provides checking of:

- the picture geometry and the scanning linearity.
- the picture aspect ratio. The circle should appear truly circular if the picture has the standard 1.33 aspect ratio (4:3).

5. Black rectangle in the top area of the cirle

Similar to the one of test card "C" and "F".
It provides checking of the low-frequency response. Poor response shows as streaking from the edges of this rectangle to the righthand side.

6. White rectangle with black needle line in the top area of the circle

It provides a check on whether reflections are present in the received television signal. Reflections from hills, large buildings, aerial systems or signal distribution are most easily seen as displaced images of the black needle line.

7. Black/white blocks in the upper area of the circle

250 kHz-square waves with a videoamplitude of 75 %.
They provide checking of the square wave response and should not show over or undershoot.
Because their video amplitude is identical to that of the R-G-B-information in the colour bar, a provision is present to check the amplitude-ratio of the R-G-B-signals applied to the colour picture tube. Switch off the red and green gun, and adjust the contrast and saturation controls so that there is no difference in brigthness between the blue blocks of the colour bar and those of the 250 kHz-square wave. Switch on the red gun and switch off the blue gun.
There may not be a difference in brightness between the red blocks of the colour bar and the red parts of the 250 kHz-square-wave. The green amplitude can be checked in the same way. A phasing-fault in the green matrix can be seen as a mutual difference in brightness between the green blocks of the colour bar.

8. Colour bar

Standard colour bar, with 75 % contrast and 100 % saturation, recommended by EBU. It provides an instant orientating check on the most important functions of the colour circuits.

9. Black bar with white crosses in the central area of the circle

The horizontal white line is composed of two TV lines, one in each field. As their scanning rhythm is contrary to that of the other horizontal white lines, it provides a very effective checking of the interlacing. Any faulty interlacing appears as a deviating thickness of this horizontal white line, compared with the other horizontal white lines.
The white crosses provide a check on the convergence in the central area of the picture.
The centre white cross shows faults in the static convergence of the picture as well as indicating the centre of the picture.

10. Blocks of frequency gratings

Five blocks of gratings each consisting of vertical stripes corresponding to the following frequencies recommended by EBU:
= 0.8 – 1.8 – 2.8 – 3.8 – 4.8 MHz = (for M version 0.5 – 1 – 2 – 3 – 4 MHz)
They provide checking of:

- Resolution and bandwidth. The gratings are sine-wave signals and should (possibly with the exception of the 4.8 MHz block) appear so that they extend in value from black to white.
- Chroma bandwidth. On a colour receiver the 3.8 and 4.8 MHz blocks will show cross-colour. Both have a different spacing from the colour subcarrier (approx. 630 and 370 kHz resp.) and the absence of cross colour will show too narrow a chroma-bandwidth. If the locking between the subcarrier-frequency and the line frequency is correct, the cross colour in the 4.8 MHz-block will show a typically non-moving pattern.

11. Greyscale steps

Six rectangles of 0 % – 20 % – 40 % – 60 % – 80 % – 100 % video amplitude. The number of rectangles can be increased to ten (10 %-steps) or decreased to five (25 %-steps).
In all cases there is a constant difference in brightness between the adjacent rectangles.
They provide checking of:

- the linearity of the transmission path.
  The adjacent rectangles should show a constant change in contrast.
- the greyscale tracking of a colour picture tube. The various rectangles should not show any colouring.

12. Black rectangle segment in the lower area of the circle

If this rectangle contains a white needle line, it serves the same purpose as mentioned in section 6. This rectangle could however be used with inserted white text for transmitter identification.

13. Yellow-Red-Yellow segment in the bottom area of the circle

75 % contrast – 100 % saturation colour transient, with high luminance steps.
It provides a check on transient performance and group-delay differences between luminance and chrominance.

14. Colour difference fields

On the left and right hand side of the circle some fields with colour difference information are present. To prevent non-linear distortion in the transmission path having a different influence on the various signals, they have a constant luminance as well as a constant chrominance amplitude. Their lay-out and phasing may be derived from the figure in section "Operating the PM 5544".
They serve for indicating the proper function of the mains circuits in the chroma channel.
To the extreme left and right is a vertical bar with colour difference information which is line sequentially phase inverted (ALT-signals) before encoding. On a correctly aligned colour receiver they are **not** visible.
The combination of normal and alternating colour difference areas provides a check on the performance of the colour decoding circuits of a receiver, in particular as regards the PAL properties.

In principle the following errors can be recognized in the picture:

- *Incorrect subcarrier phase to (R-Y) demodulator*
  This error causes a colouring of the extreme right-hand side bar "ALT (B-Y)".
- *Incorrect subcarrier phase to (B-Y) demodulator*
  This error causes a colouring of the extreme left hand side bar "ALT (R-Y)".
- *Incorrect subcarrier phase to both demodulators*
  This error causes a colouring of both bars at the extreme sides of the pattern (ALT-bars).
  Depending on the phasing, the colouring is bluish (left) and cyanic (right) or yellowish (left) and reddish (right).

- *Incorrect amplitude-ratio between direct and delayed signals of the PAL-delay line*
  This error causes "venetian blinds" in both bars at the sides of the pattern (ALT-bars)
  In the other bars (NORM bars), these "venetian blinds" will also be slightly noticeable.
- *Incorrect phase-relation between direct and delayed signals of the PAL-delay line*
  This error causes "venetian blinds" in all colour difference bars. In the bars at the sides (ALT bars) moreover there is a change in colouring.
- *Incorrect (G-Y) matrixing*
  - Switch off the green gun of the colour picture tube.
  - Increase the brilliance of the picture until the black parts of the pattern show a dark grey colour.
  - Vary the saturation of the picture while observing the former green block of the colour bar (3 rd block from the left).
    It must be possible to obtain the same dark grey colour in this block as in the black areas.
    If the (R-Y) and (B-Y) and (G-Y) signals do not have the correct ratio the latter will not be possible.
- *Incorrect amplitude of (G-Y)*
  - Cary out the foregoing check; if the (R-Y) to (B-Y) signal – ratio is correct, switch on the green gun again and switch off the red and blue guns.
  - When varying the saturation, the four (G-Y) = 0 fields should remain constantly green. A change in brilliance of these green fields indicates that the matrixing of (G-Y) is incorrect.

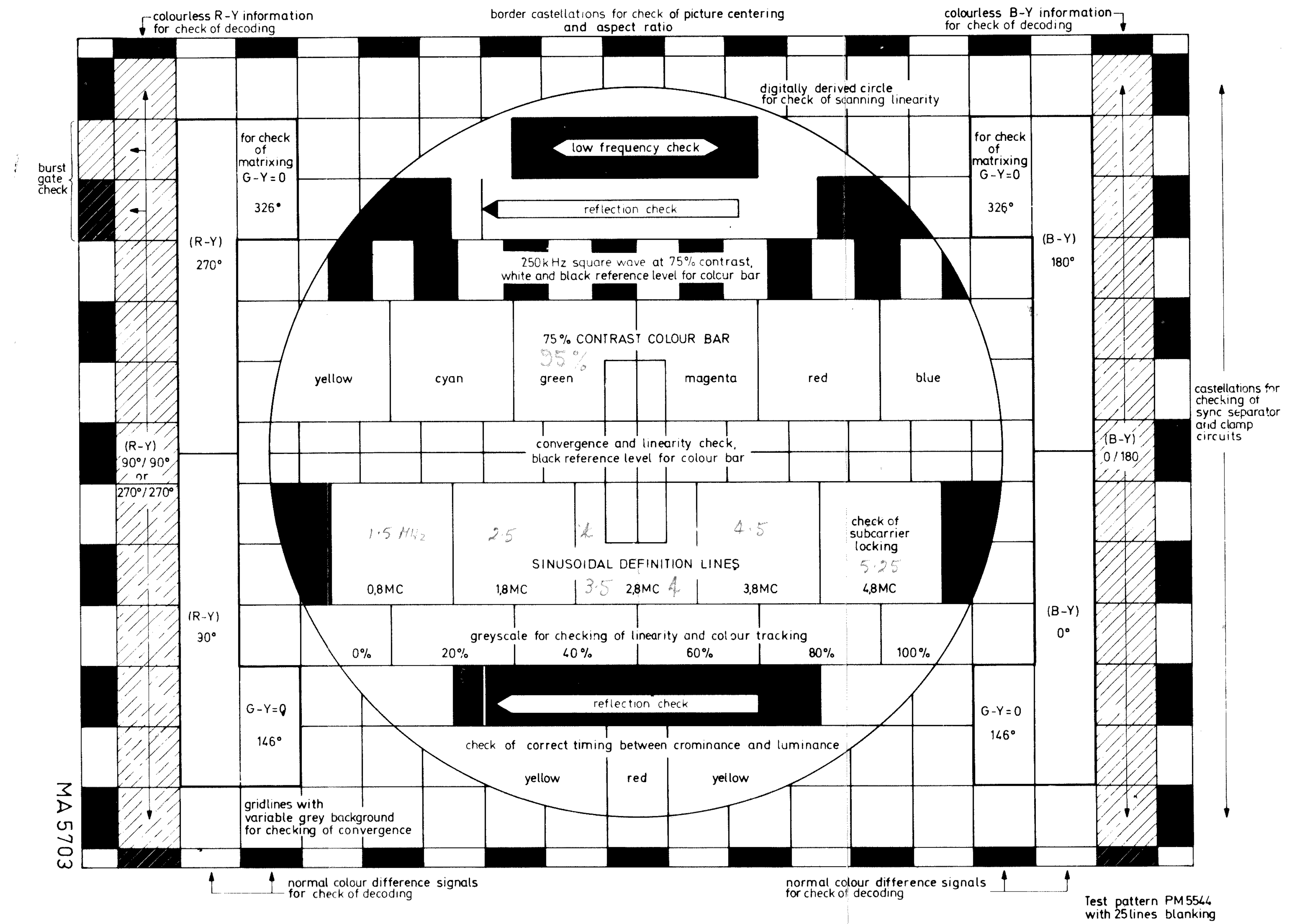


Fig. X-1. Explanation of test pattern

XI. The principle of the circle generator

The circle on the TV screen is built up by a number of line segments BCD (Fig. XI-1). For each line of the pattern the length of BCD has a very definite value determined by the size of the circle.
The size of the circle in proportion to the entire TV pattern is expressed in quantities of time, (the time it takes to scan the line segments AB, CD respectively).
This time has been converted into a binary figure that is characteristic for each single line. The conversion of the binary figure into time is made in two electronic counters or registers, which count a number of pulses from a clock pulse oscillator.

For each line one circle register counts the number of pulses corresponding to the distance AB, and the other one counts the number of pulses corresponding to the distance CD.

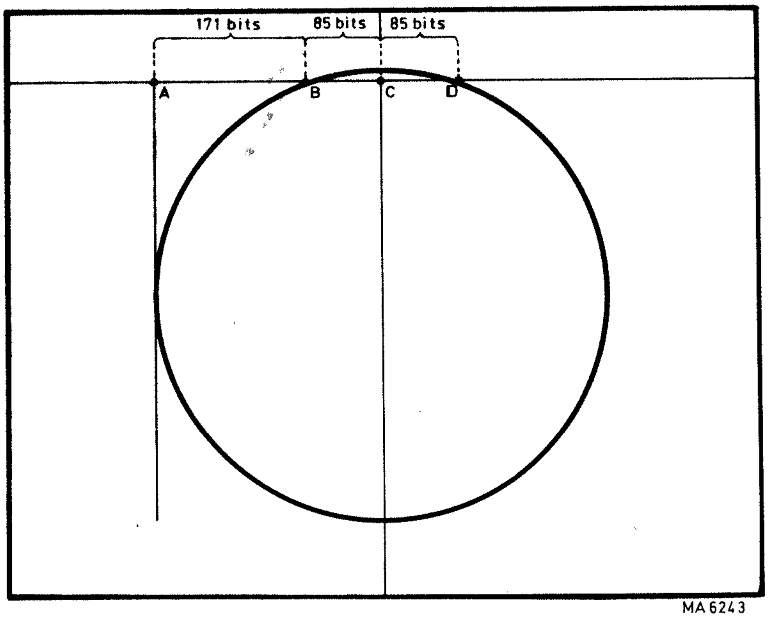
In this way the semicircles B and D are converted into a number of figures, each line having its typical binary figure, corresponding to the distance AB and CD.

These figures are stored in a magnetic-core memory from which they are transferred to the circle register for each line. The right semicircle D is made as an image of the left semicircle, as BC = CD.
In each field the circle will contain 252 lines.
The lengths of the line segments AB, BC and CD correspond to a whole number of clock-pulses, the frequency of which (approx. 15 MHz) is high enough to produce a sufficiently smooth circle. At a lower frequency the circle would be serrated.
The time it takes to scan the line ABC will be approx. 17 μs, while the number of clock-pulses (bits) covering this time should be a "round" binary figure, i.e. 2, 4, 8, 16, 32, 64, 128, 256 or 512.
In practice 256 bits will meet the requirements which results in a frequency of approx. 15 MHz.

A. The Circle registers

The memory contains information about the distances AB and CD for each line. This information is stored in binary form.
Fig. XI-1 shows, for example, a line for which the distance AB is equal to 171 clock pulses (bits), and the distance CD to 256 – 271 = 85 bits.

The figure 171 is in binary form = 10101011, and at the beginning of the line in question this figure is read out of the memory and put into the two circle registers (Fig. XI-2), which thus will respectively be set via the set inputs for this figure and via the reset inputs for the complementary figure 01010100 = 85 bits.
At point A the 15 MHz oscillator is started, and the register being set to 10101011 begins to count. The register is connected so that it counts down from 10101011 to zero.
Passing zero the register delivers a pulse to the flip-flop oscillator which determines point B on the circle; thereby the distance AB will correspond exactly to 171 pulses.
At point C the register set to 01010100 begins to count down to zero.
Passing zero the register delivers a pulse which again triggers the flip-flop determining the point D on the circle.



'ig. XI-1. *Principle of the circle generator*

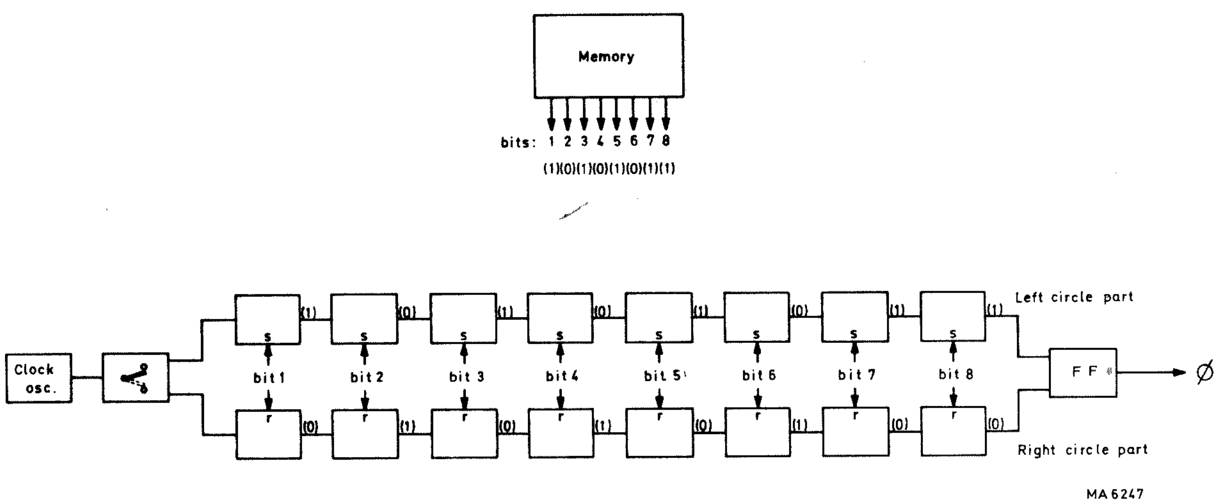


Fig. XI-2. Principle of the circle registers

B. The Memory

The amount of information to be stored in the memory is so large that a ferrite core is the obvious solution.
For each line the counter of the circle register is actuated so that it forms the correct binary figure.
For a circle with 252 lines it should be done by means of a rectangular matrix with 252 inputs and 8 outputs; this means a matrix with 8 x 252 = 2016 cores.

However, the size of the memory has been reduced considerably by dividing the circle in groups of lines (intervals), each containing 21 lines. This will be described later on.
The size of the memory will, therefore, only be 21 x 8 = 168 cores.
The one wanted of a 21 line-group is selected during the read-out time, and the read-in is effected by means of different read-in wires, one for each interval. So the real memory function has been placed in the wiring of the read-in wires. Each wire passes some cores and by-passes others, depending on the value of the binary figures.

Consequently the wiring of the interval wires through the cores is rather complicated.
As soon as the interval wires have distributed the information for the 21 binary figures as magnetism in the selected cores, the figures are read-out line after line.
When the read-out of the 21st, line is finished the interval wires for the next interval will place another 21 binary (8 bits) figures in the memory, and then these figures are read-out and transferred to the register, etc.

C. The Line-selector register

As mentioned, the memory is sensed line after line through the successive 21 lines. For this process 21 sensing wires and 21 continuous sensing pulses would be necessary. The 21 pulses could be obtained from a shift register of 21 positions and triggered by line pulses.

Instead of this a binary divider (line-selector register) is used, followed by a decoder unit (line-selector decoder).
Each binary figure will be decoded and delivers control signals for each single line.
This simplification of the "decoder matrix" is made by placing parts of the decoding in the wiring of the memory. Instead of decoding down to 21 pulses, the decoder delivers 4 x 6 pairs of pulses on only 10 sensing wires (X- and Y-wires). Each sensing line actually consists of 2 wires connected in parallel. Only when the pulses of the two wires are in phase, the current will be strong enough to change the magnetization in the cores and to produce an output signal for the counting register. Out of 24 (4 x 6) combinations for the 625 system only 21 will be used. For the 525 system 17 are used.

D. The Interval selector

The circle is built up of 252 lines in each field, and these lines are divided into 12 groups of intervals (10 different), each containing 21 lines. For a complete frame of two consecutive fields 24 intervals will be needed in total. However, not all intervals are different. The interlacing, which in principle makes the two fields different, has no influence on the central part of the circle, so the 4 intervals, numbered 9, 10 in Fig. XI-3 in the middle of the circle can be used for both fields. The two intervals at the top of the first field can be considered an image of the corresponding intervals at the bottom of the second field. Consequently only 8 intervals are needed for this part of the circle, and the whole circle can be built up of 8 + 2 = 10 intervals. The position of these intervals in the circle is shown in Fig. XI-3. To select the right interval for the right place in the circle, the interval selector is used. It consists of a number of gates and is supplied with pulses, which according to certain combinations will deliver magnetizing forces in the correct succession.

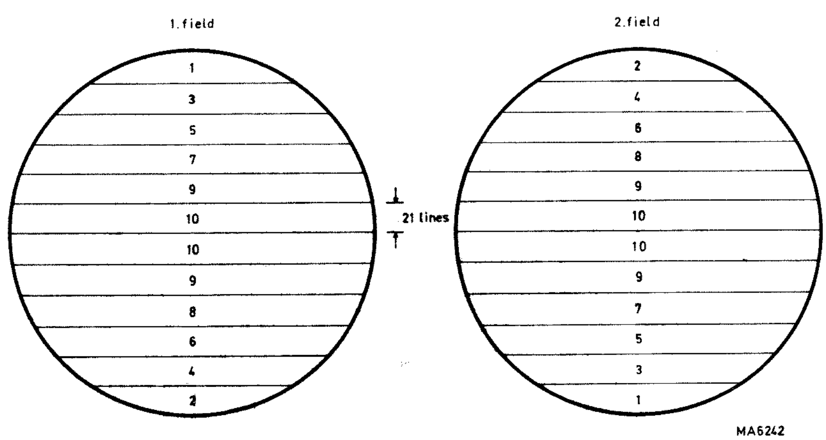


Fig. XI-3. Interval of the two fields

XII. Modifications

A. Modifying a PM 5544G to a PM 5544M or vica versa

The following units have to be changed or replaced:
(See also the concerned chapters in the documentation).

Unit 2 : replace by the correct version
Unit 4 : change two jumpers
Unit 10: three resistors should be replaced.

After the modification the generator has to be adjusted.

B. Adding sync to the Y-signal

When the pattern generator is also used as a black/white generator there could be a need of a Y-signal with sync.
The following modification makes it possible to add sync to the Y-signal in a simple way. Please notic that in this case, the composite signal does not meet the standard.

If the applied sync is terminated with 75 Ω:
Connect a resistor of 450 Ω ± 20 Ω between the sync input socket and the Y-output socket.
Change R14 or R15 of unit 14B (depends on which output socket is used) to 88 Ω.

If applied sync is unterminated the values of the resistors are 910 Ω and 81 Ω.

Besides the Y-output voltage should be adjusted to 1 V_{p-p}, included sync. This means that the amplitude of the other Y-output will be more than 0.7 V.

C. Changing the output voltage to 1 V_{p-p}

Replace the resistors R13 and R28 in units 14^A, 14^B and 15^B by a resistor of 82 Ω.

The amplitude should be:

Y, R, G and B : 1 V_{p-p}
(R-Y) and (B-Y) : 1.5 V_{p-p}

A slight re-adjustment can be necessary.
This can be done by means of the potentiometers R1 and R16 in units 14^A, 14^B and 15^B.

d. Text-Generator PM 5543

In order to extend the applications of the pattern generator one can order the PHILIPS TEXT generator PM 5543.
This generator consist of one printed wiring board which can easily be mounted in the pattern generator. In the /01 version two contact-blocs have to be mounted and wired as stated in the wiring diagram which has already been done in the /02 version.
The text of the PM 5543 can be put in the upper black bar, the lower black bar as well as in both bars. Any text can be made just by soldering jumpers on the printed wiring board.

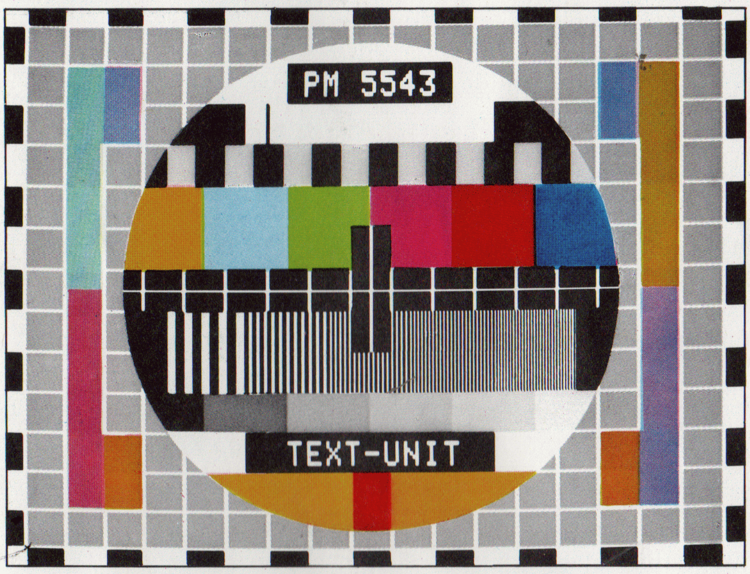


Fig. XII-1. Complete internal pattern with text

PM 5544/05 BBC version

MANUAL CHANGES

3. Colour difference fields
   b. Information "COLOUR DIFFerence ALTernating"
   This part is irrelevant in the BBC version.

5. Signal within the circle area
   Change d to read:
   Colour bar signals: yellow-cyan-green-magenta-red-blue. 95% BBC

   Change f to read:
   Frequency gratings: sine wave, from left to right 1.5-2.5-3.5-4.0-4.5-5.25 MHz,
   amplitude 71.4% of white.

   Change h to read:
   Black rectangle: For transmitter identification the signal of monochrome slide scanner can be gated into this rectangle via a Schmitt-trigger circuit (only 100% contrast).

   Change i to read:
   Colour transient: yellow-red-yellow
   width of red bar approx. 2.6 μs, 95% BBC.

BLOCK DIAGRAM II (fig. V-2).

A. Grid information
   Line five and six are irrelevant.

B. Circle information
   Change line nine to read: By means of the supplied signal the colour gate is generating a 95% BBC colour bar signal.

   Change line twenty to read: Consequently the frequency gratings from 1.5 to 5.25 MHz are controlled by a staircase signal from the "Frequency control circuit".

   Fig. V-2. Detailed block diagram (part II)
   Switch SK7 "ALT" disconnected from ground

VIII. Survey of controls and sockets.

SK7. Change to read:
   TEXT SWITCH
   by pressing the upper text "BBC 1" will be removed and the lower text "BBC 2" will be applied.

IX. Operating the PM 5544.

2. Alternating colour difference bar.
This part is irrelevant in the BBC version.

X. The pattern of the PM 5544.

3. Edge castellations

the burst gate performance.
Change to read "some special (R-Y) information is present".

7. Black/white blocks in the upper area of the circle.
Change to read: 250 kHz - square waves with a video-amplitude of 75% and 25% set-up.

8. Colour bar.
Change to read: Standard colour bar BBC 95%.
It provides an instant orientating check on the most important functions of the colour circuits.

10. Blocks of frequency gratings.
Change to read: Six blocks of gratings each consisting of vertical stripes corresponding to the following frequencies:
1.5-2.5-3.5-4.0-4.5-5.25 MHz.

Chroma bandwidth
This part is irrelevant in the BBC version.

13. Yellow-Red-Yellow segment in the bottom area of the circle.
Change to read: 95% BBC colour transient

14. Colour difference fields.
The explanation concerning the ALT-signals is irrelevant in the BBC version.

Following points in the text are irrelevant in the BBC version:
Incorrect subcarrier phase to (R-Y) demodulator
Incorrect subcarrier phase to (B-Y) demodulator
Incorrect subcarrier phase to both demodulators

Incorrect amplitude-ratio between direct and delayed signals of the PAL-delay line.
Change to read: This error causes slightly noticeable "venetian blinds" in the NORM bars.

Incorrect phase-relation between direct and delayed signals of the PAL-delay line.
The explanation concerning the ALT-signals is irrelevant in the BBC version.

XX. Unit 8 Circle matrix.

4. Change to read "25% set-up is applied on the 250 kHz signal and the colour-bar in order to obtain the BBC colour-bar (95%)".

XXII. Unit 10 Definition lines.

Page 135
Change the mentioned frequencies to read:
1.5-2.5-3.5-4.0-4.5-5.25 MHz.

Change the mentioned H-pulses to read:
H14-34, H18-38, H2-22, H6-26 and H10-30.

Checking and adjusting
Change to read:

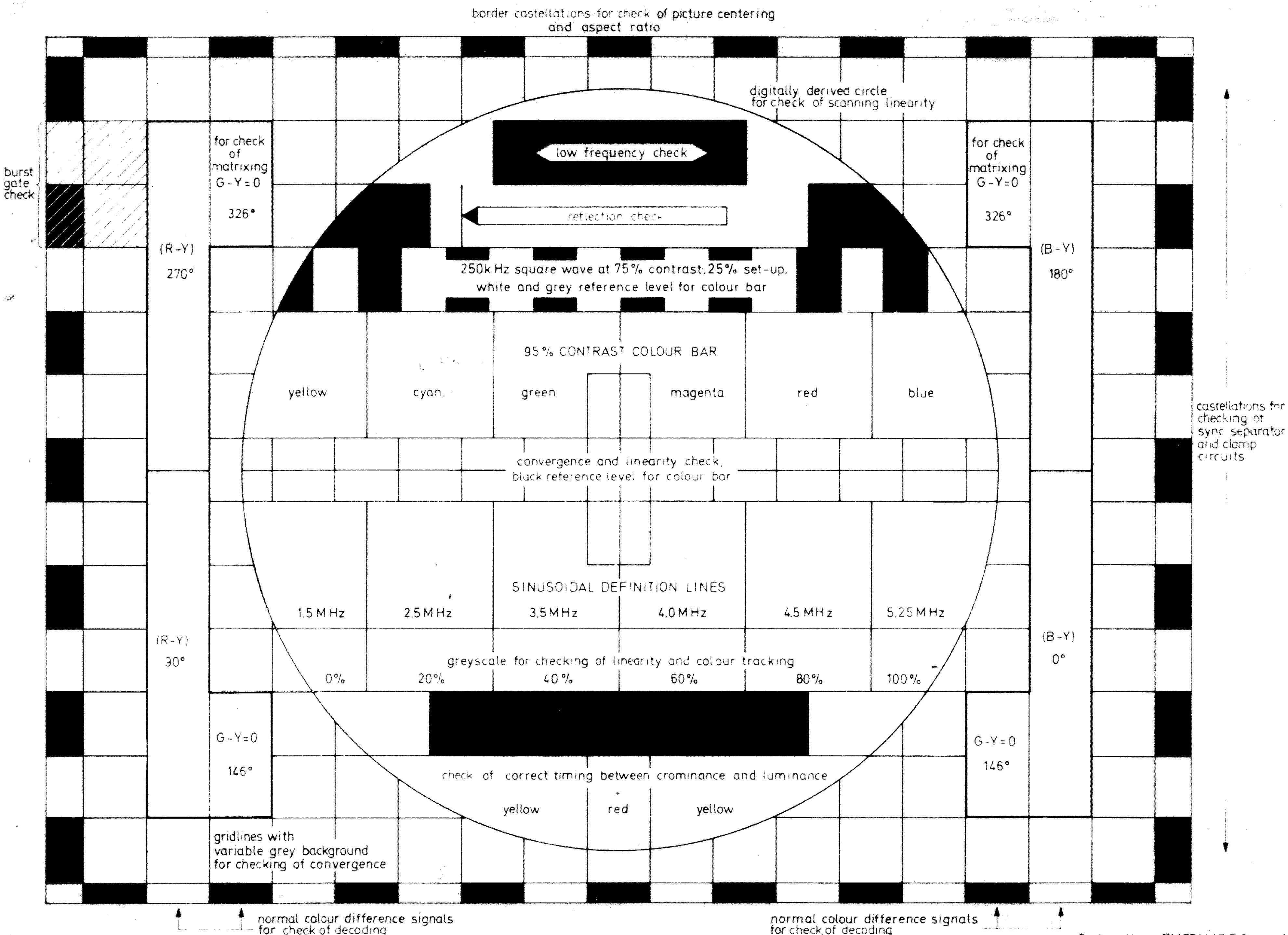
5. Adjusting 1.5 MHz
Connect the oscilloscope to terminal 13^1.
Trigger ext. with pulse: $\overline{F_H}$ (e.g. terminal 67^1-unit 9).
Put the oscilloscope in pos.: 0.2 μs/div
delay: ∿ 12 μs (5 s x 2.40)
Adjust R24 in such a way that 3 sinewaves of 1.5 MHz cover 10 divisions on the screen of the oscilloscope.

6. Adjusting 5.25 MHz.
Connect and trigger the oscilloscope according to point 5.
Put the oscilloscope in pos.: 0.2 μs/div.
delay: ∿ 43 μs (5 s x 8.50)
Adjust C4 in such a way that 10.5 sinewaves of 5.25 MHz cover 10 divisions on the screen of the oscilloscope.

Repeat the points 5 and 6.

7. Checking the other frequencies
Connect the oscilloscope according to point 5.
Put the oscilloscope in pos.: 0.2 μs/div.
Check that the following frequencies cover 10 div ± 0.5 div.:
At 2.5 MHz = 5 sinewaves
3.5 MHz = 7 sinewaves
4.0 MHz = 8 sinewaves
4.5 MHz = 9 sinewaves

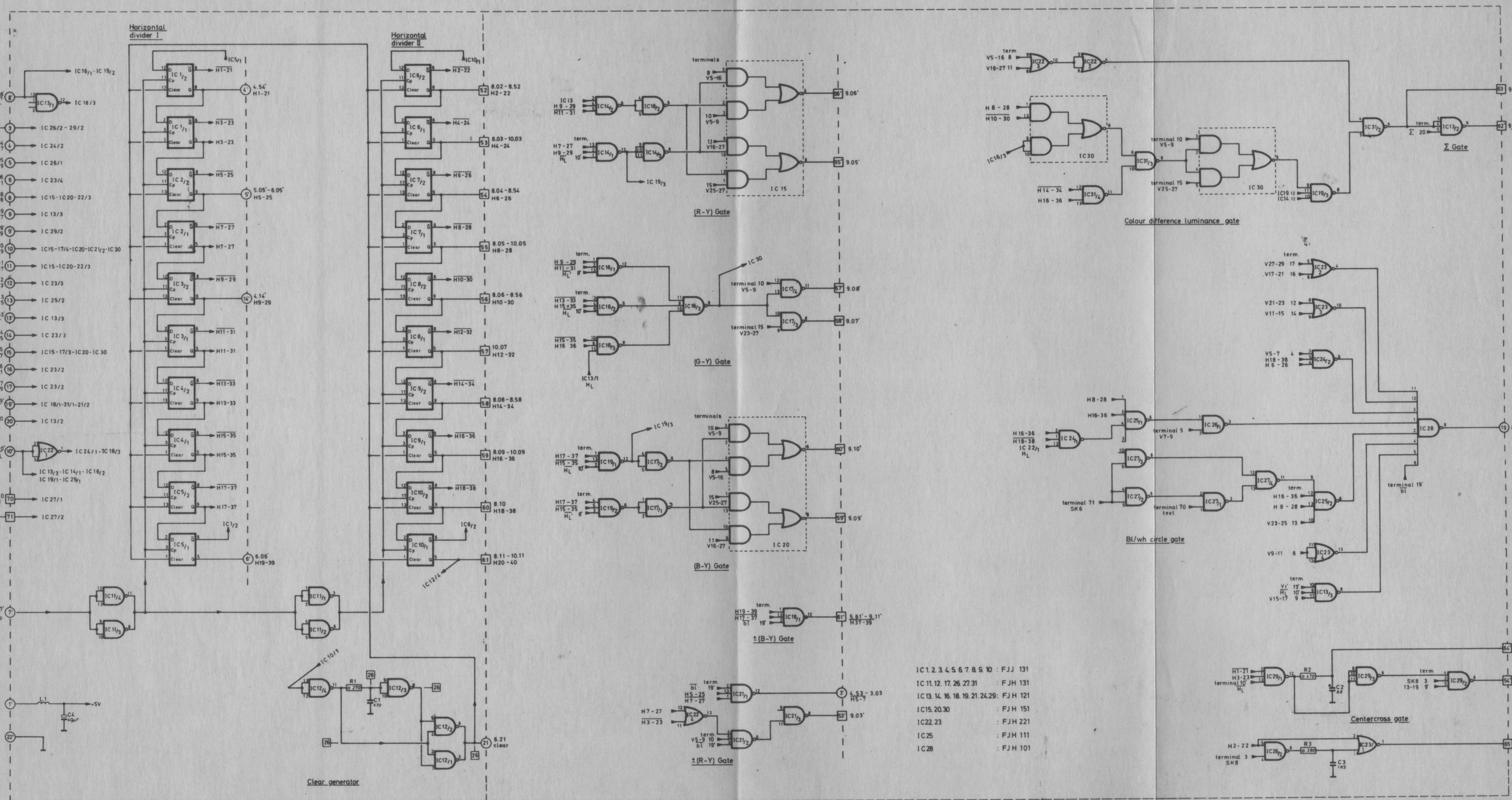
Point 8 is irrelevant in the BBC version



Test pattern PM5544/BBC version with 25 lines blanking

73-11-14 MK

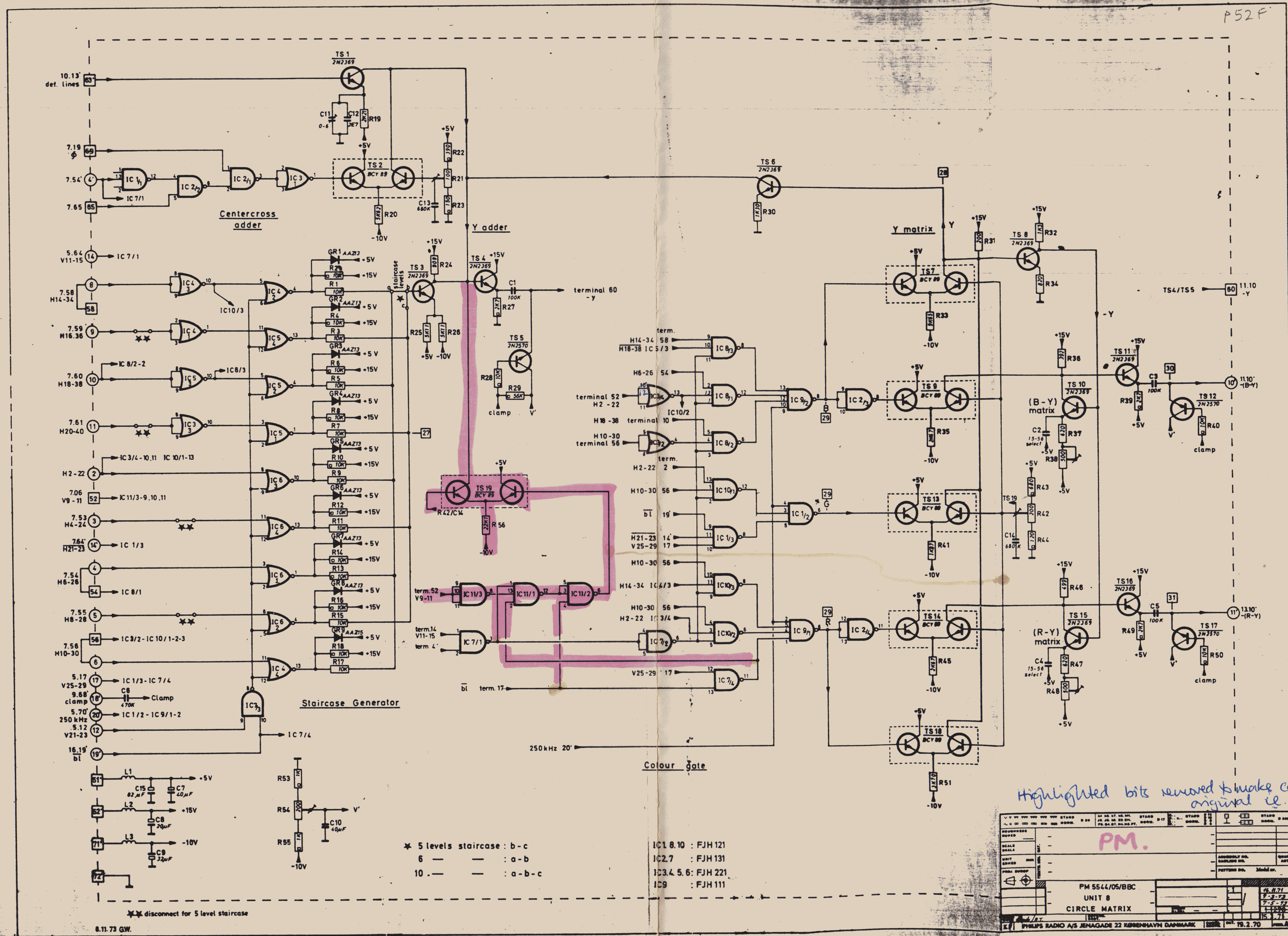
P52E



73-11-08

CROSS GATE UNIT 7 PM 5544/05/BBC

P52F

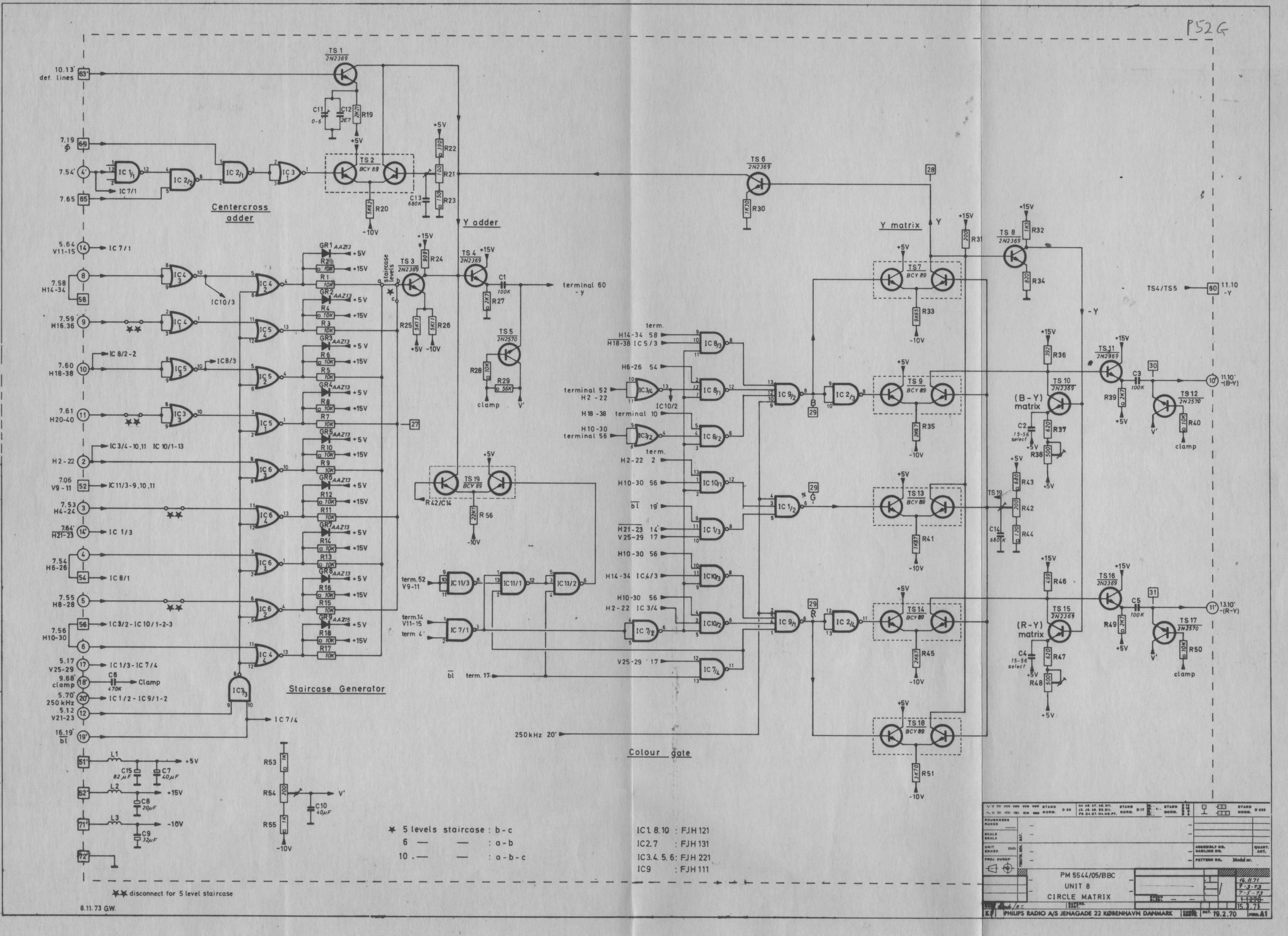


IC11
3 - 12
1 - 345
2 - 11
5 - 13
6 - ?
7 - 7
8 - 13
14 - 14

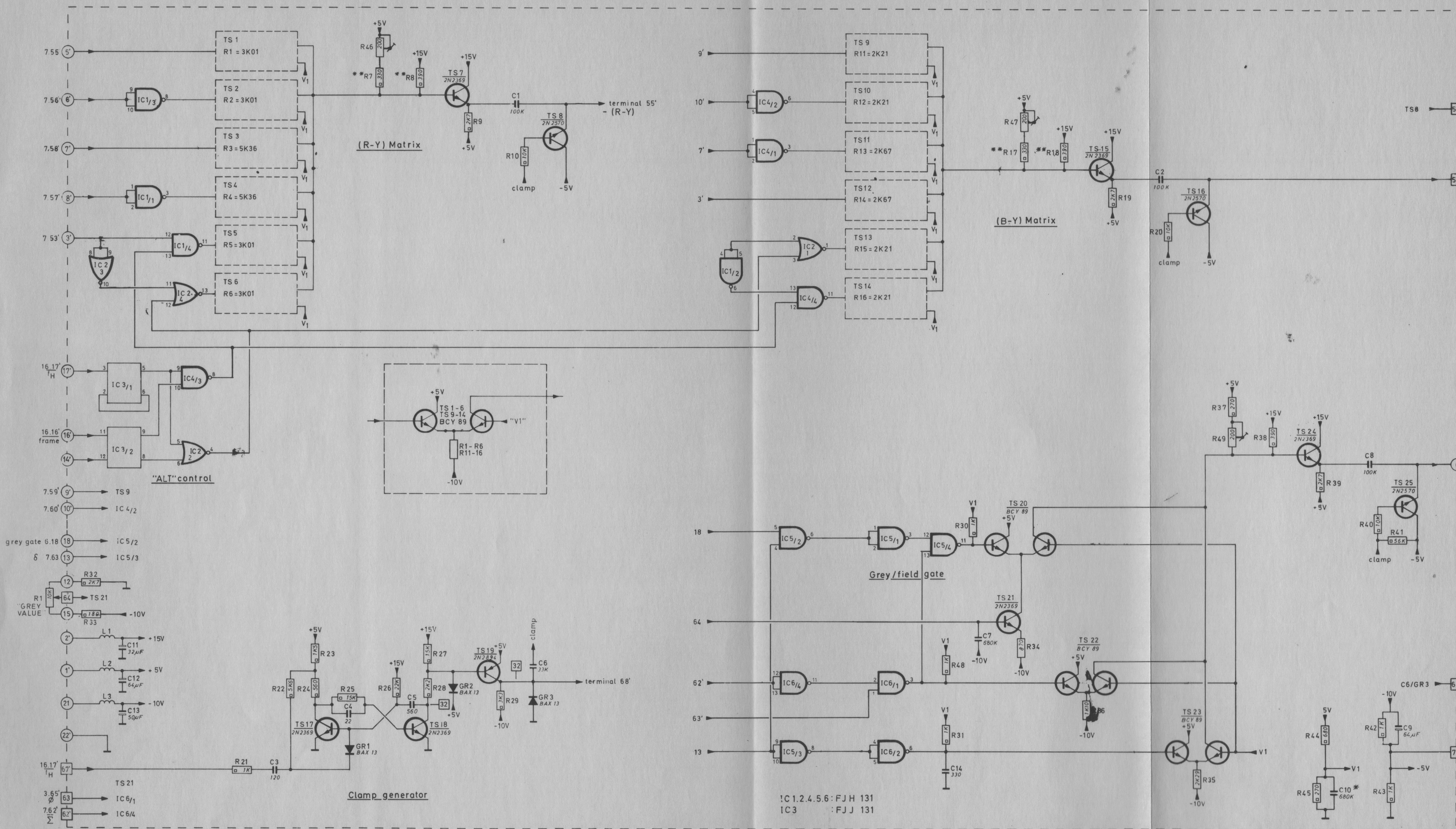
Term
52 - 9

Highlighted bits removed to make cct like original i.e. EBU Bars.

CEG
30.3.93


P52G
Centercross adder
Y adder
Staircase Generator
staircase levels
terminal 60 -y
Y matrix
(B-Y) matrix
(R-Y) matrix
Colour gate
10.13' def. lines
7.19 Φ
7.54'
7.65
5.64 V11-15
7.58 H14-34
7.59 H16.36
7.60 H18-38
7.61 H20-40
H2-22
7.06 V9-11
7.53 H4-24
7.64' H21-23
7.54 H6-26
7.55 H8-28
7.56 H10-30
5.17 V25-29
9.68' clamp
5.70' 250 kHz
5.12 V21-23
16.19' bl
TS 1 2N2369
TS 2 BCY 89
TS 3 2N2369
TS 4 2N2369
TS 5 2N2570
TS 6 2N2369
TS7 BCY 89
TS 8 2N2369
TS 9 BCY 89
TS 10 2N2369
TS 11 2N2369
TS 12 2N2570
TS13 BCY 89
TS14 BCY 89
TS 15 2N2369
TS16 2N2369
TS 17 2N2570
TS18 BCY 89
TS 19 BCY 89
TS4/TS5
11.10 -Y
11.10' -(B-Y)
13.10' -(R-Y)
clamp
250kHz 20'
term. 17
★ 5 levels staircase : b - c
6 — — : a - b
10 . — — : a - b - c
IC1. 8.10 : FJH 121
IC2.7 : FJH 131
IC3.4. 5. 6: FJH 221
IC9 : FJH 111
★★ disconnect for 5 level staircase
8.11.73 GW.
PM 5544/05/BBC
UNIT 8
CIRCLE MATRIX
PHILIPS RADIO A/S JENAGADE 22 KØBENHAVN DANMARK
19.2.70

P52H



19-2-70 Lind 1.12.70 A.T.
3.4.70 Lind 12.3.73 MK
15.10.70 Lind 8.11.73 G.H.

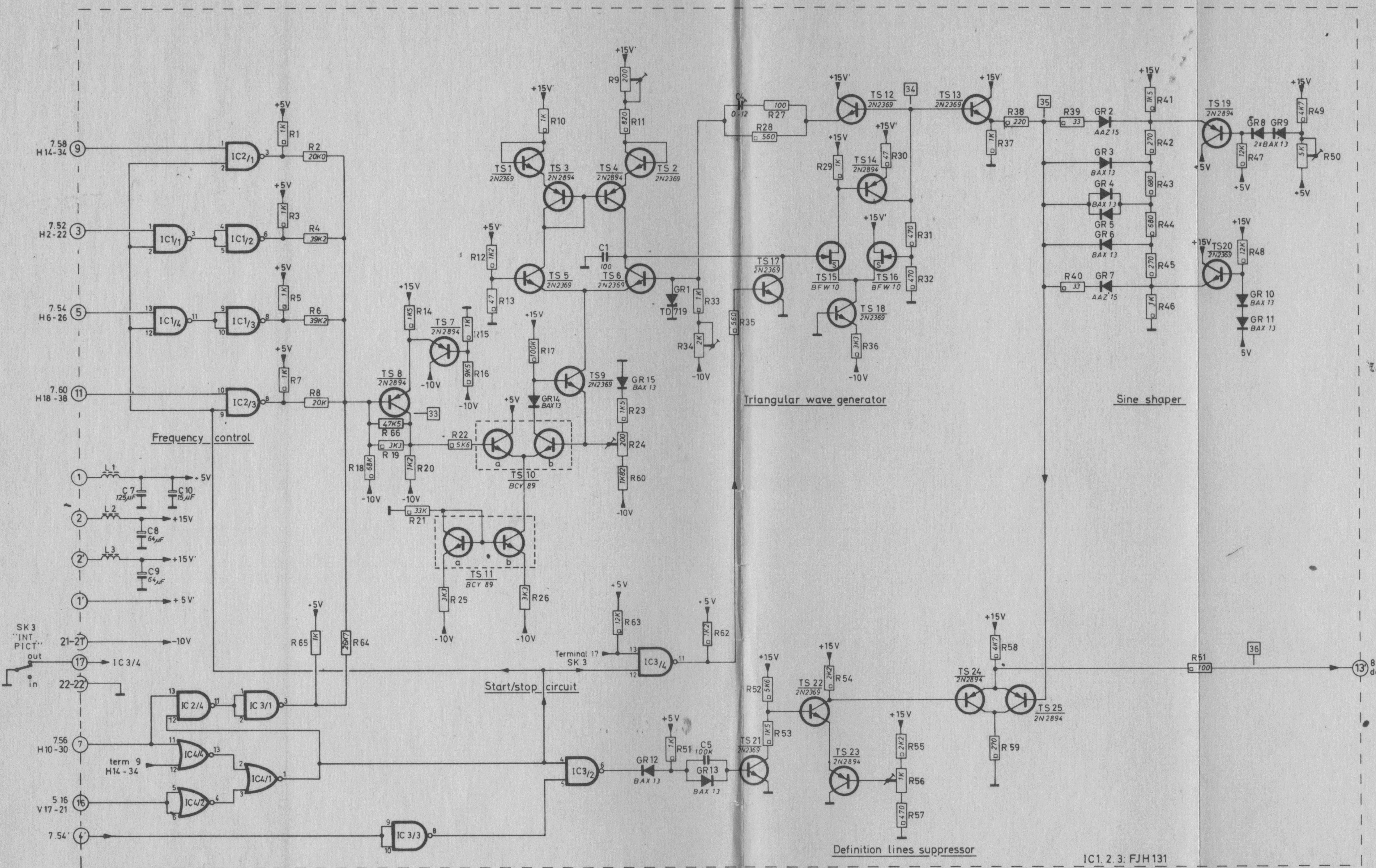
** From 03 version: R7, R17 = 332E 1%
R8, R18 = 392E 1%

GRID MATRIX UNIT 9 PM5544/05/BBC

* From 05 version: C10 = 150 µF

A

p52 J



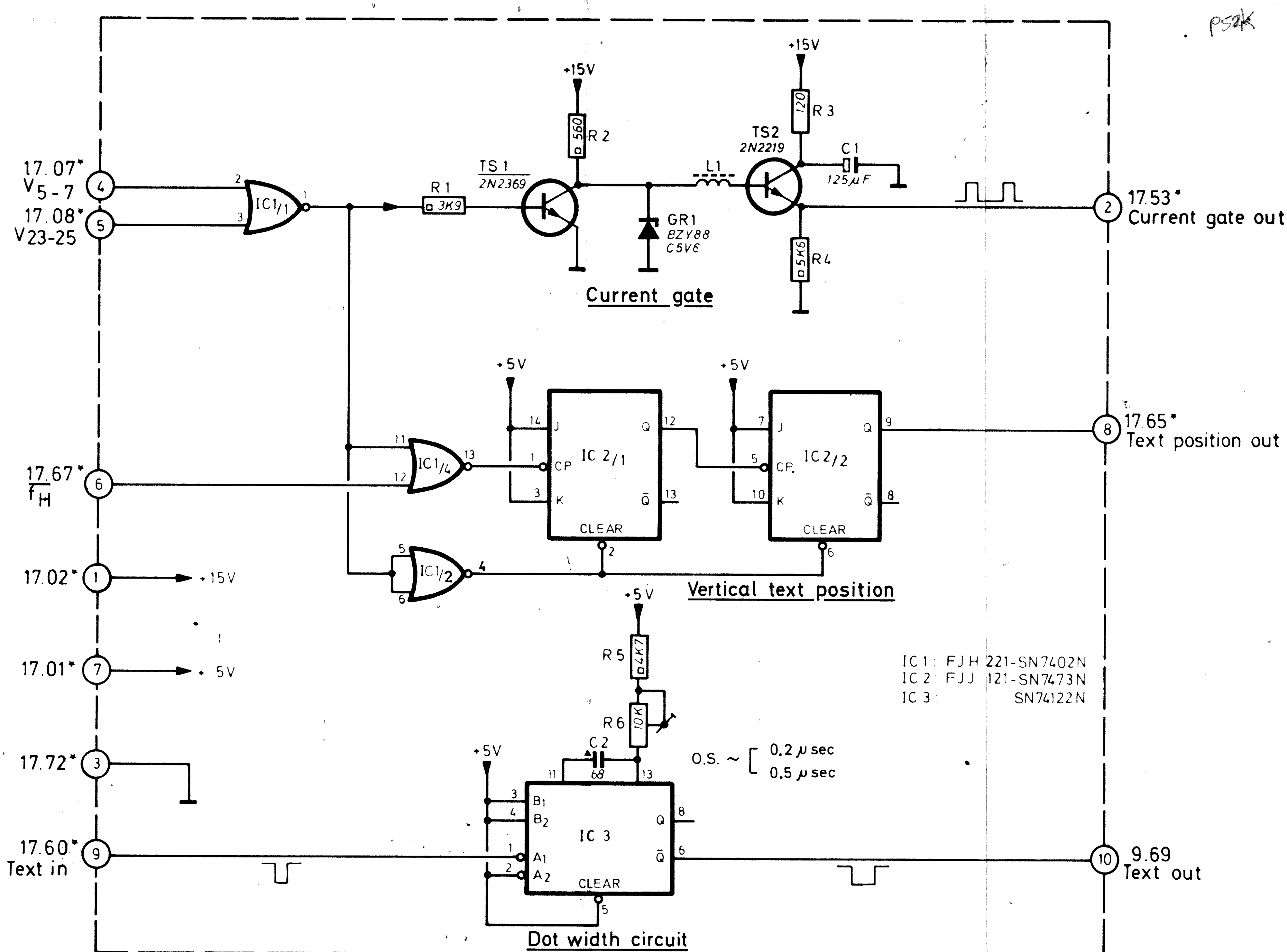
~~2. 4. 70~~ ~~1. 12. 70~~
~~23. 6. 70~~ ~~15. 3. 71~~
~~1. 10. 70~~ G.W. 12. 4. 72 A.T.
8-5-73 MK
8-11-73 G.W.

Definition lines.

UNIT 10 – PM5544/05/BBC

Erratum:
In M version: R 2 = 47K
R 8 = 22K
R 16 = 5K6

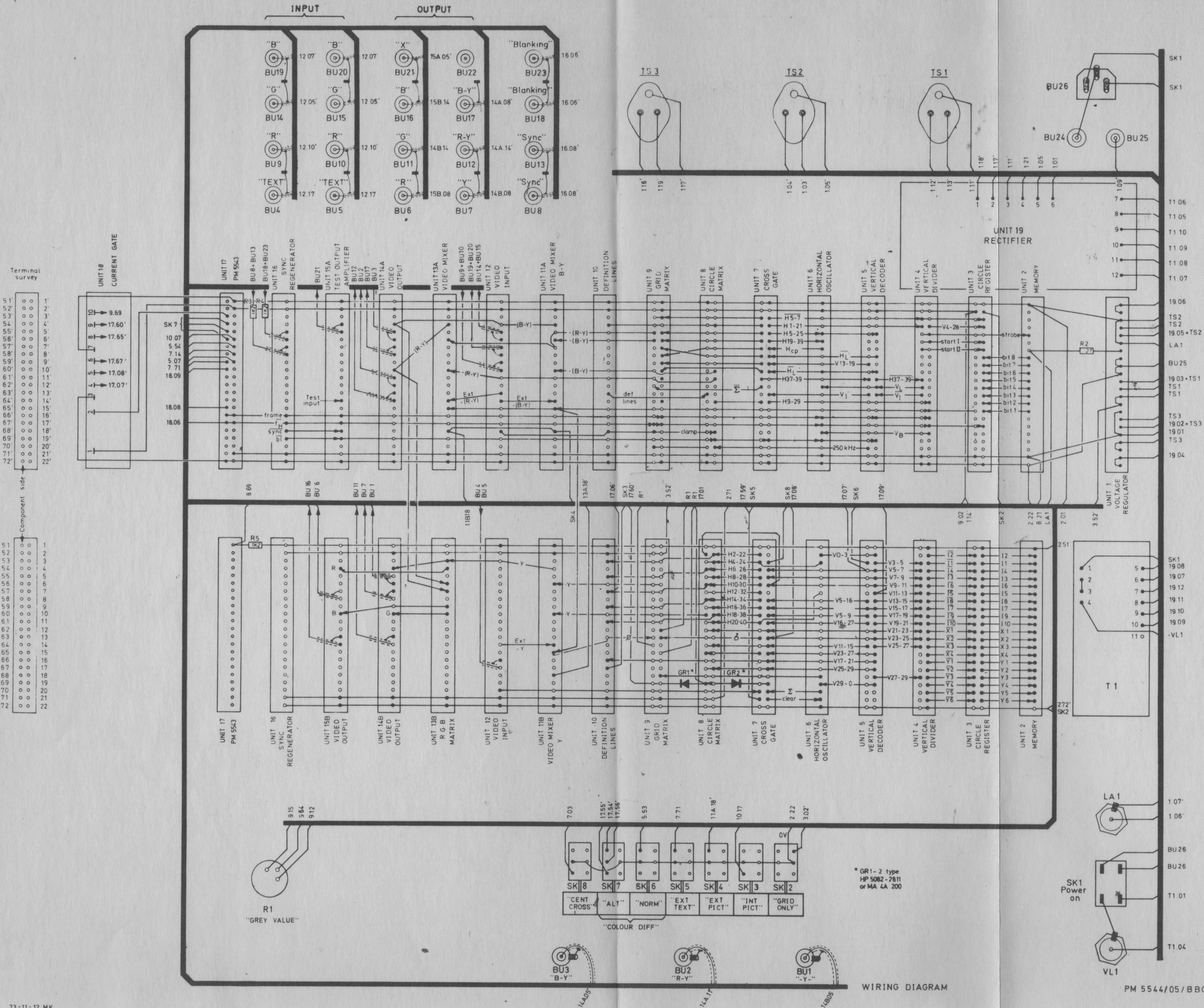
KF PHILIPS RADIO A/S JENAGADE 22 KØBENHAVN DANMARK 18.2.70 FORM A1



23.3.73 A.T.
29.6.73 MK.
12.10.73 MK.
24.10.73 A.T

CURRENT GATE

UNIT 18 PM 5544/06
4008 108 78191



WIRING DIAGRAM

PM 5544/05/BBC

73-11-12 MK

SERVICE INSTRUCTIONS

In the following chapters the circuitry of the units has been explained.
The service adjustments, if any, have been described at the end of the chapter concerned.

Please bear in mind the following notes:

- The unit to be checked or adjusted, should be placed on an "Extension board", delivered with the instrument.
- The tolerances mentioned, are factory tolerances which apply when readjusted the instrument. They may differ from those shown in section "General information" chapter II "Technical data".
- The voltages shown in the diagram and the oscillograms published have been measured with respect to terminal 22 in a PM 5544 connected to 220 V.
- The d.c. voltages have been measured with a PHILIPS d.c. voltmeter PM 2400.
- The oscillograms have been measured with a PHILIPS oscilloscope PM 3250 in combination with a PHILIPS TV sync. separator probe PM 9347.
- The oscillograms have been photographed with a PHILIPS camera outfit PM 9380.
- The diagrams are provided with figures for reference; $\boxed{27}$ in the diagram for example, refers to oscillogram no. 27.

  The instrument should have been switched on for more than 15 minutes before the checkings and adjustments are carried out.

Common adjustments

The units 8, 9, 11, 12, 13, 14 and 15 have so-called common adjustments which secure the correct amplitude and level ratio of the output signals.
These adjustments are numbered and attention should be paid that all these adjustments must be carried out and in the given sequence.
At delivery the instrument is adjusted for accepting a fieldblanking pulse with a duration of 25 lines.
If a blanking signal with another duration is supplied, the following adjustments should be carried out:

Unit 6: oscillator start and oscillator frequency
Unit 3: oscillator frequency, start I and start II pulses
Unit 4: vertical position

In case of fault finding or adjustment make sure that the sync and blanking pulses from unit 16 are present with the right amplitude and shape.

On the next page, a survey of adjusting elements is stated, enabling to make some adjustments without using the extension board.

N.B. Switch off the mains when exchanging printed wiring boards

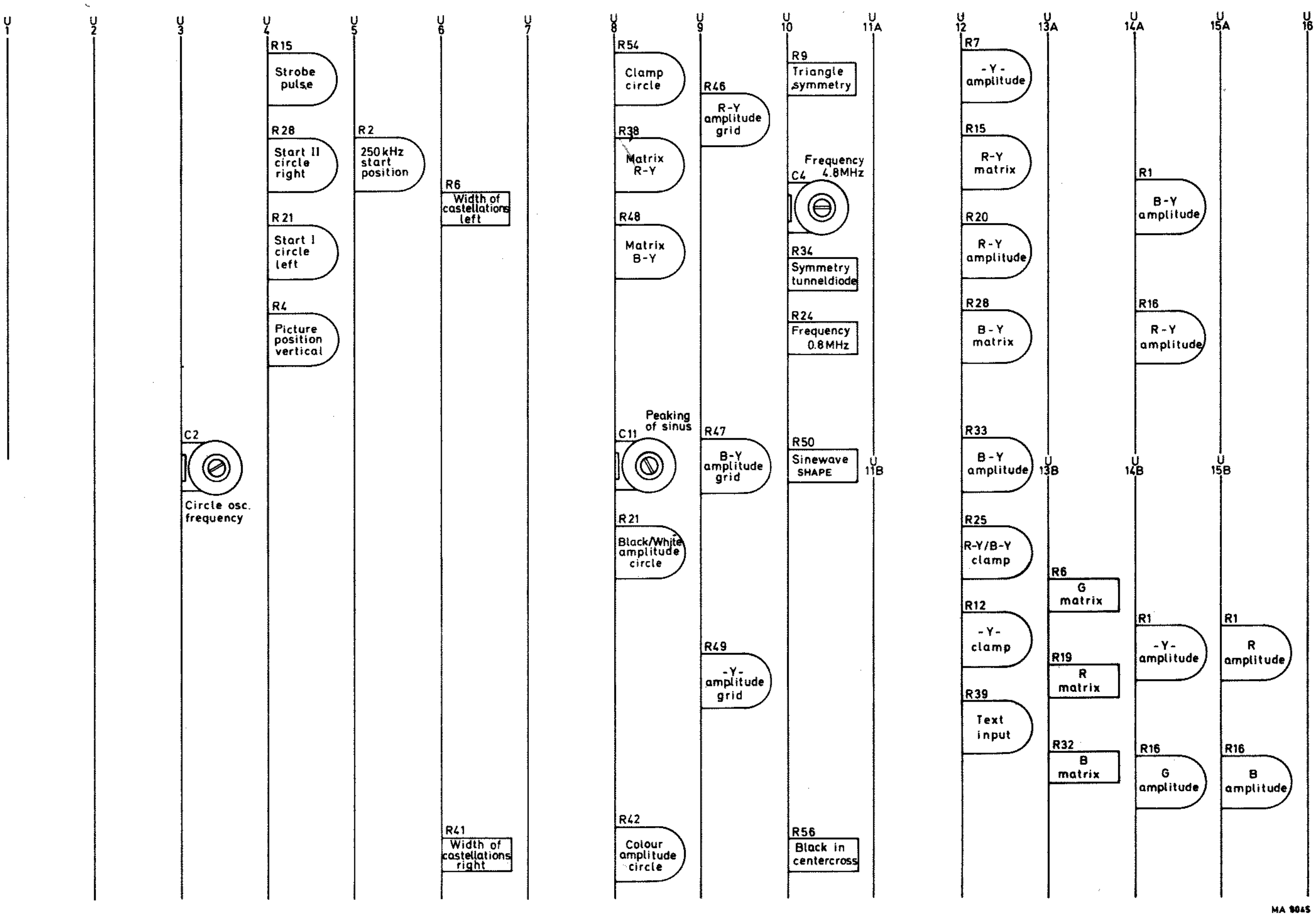


Fig. XIII-1. Adjustment survey

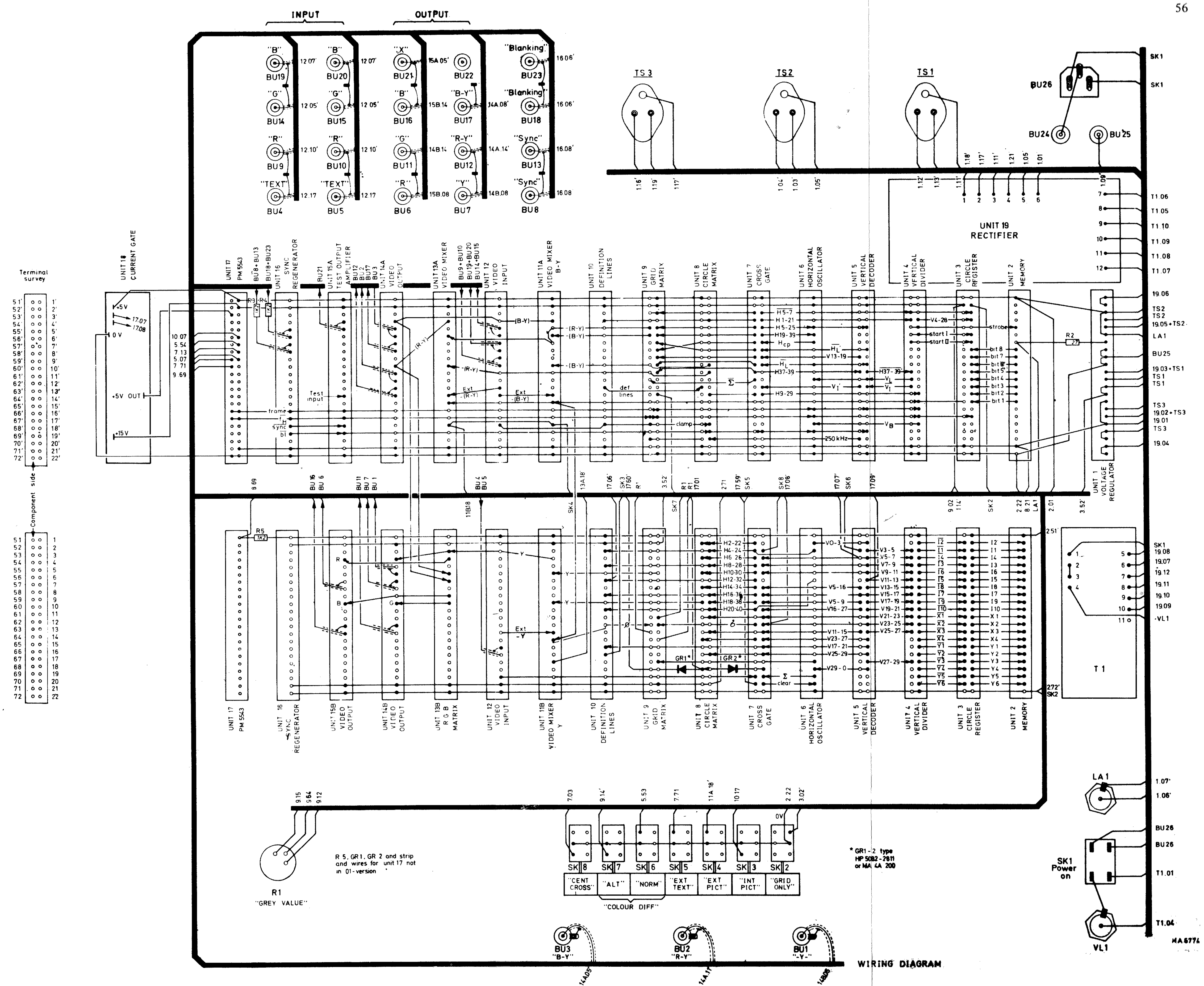


Fig. XIII-2. Wiring diagram

XIII. Unit 1 Power supply

The power supply is a conventional stabilized rectifier supplying d.c. voltages of +15 V, +5 V and − 10 V.

The reference voltage for the stabilizing circuits is obtained from the Zener diode GR104 (the junction GR104/R118 + R136 is adjusted to 5.3 V).

The +5 V stabilized Zener voltage, is used as a reference voltage for the +15 V, which again is used as a reference voltage for the − 10 V and Zener supply for +5 V.
The rectifiers are provided with current limiting circuits to protect the circuits of the generator.

These limiting circuits are:

for +15 V: TS102 - R111 (limiting at 600 mA)
for + 5 V: TS106 - R123 (limiting at 1.8 A)
for -10 V: TS110 - R133 (limiting at 600 mA)

In case of shortcircuiting the current limiting circuits will interrupt the +15 V, which means that all three voltages will be interrupted.
A shortcircuiting of any of the three voltages will be indicated by interruption of the signal lamp LA1.
In case of service in the power supply the current limiting circuits must be interrupted. This can be done by disconnecting point A from B and point C from D. In this case point D should be supplied with an external voltage of +15 V.

Checking and adjusting

Measuring equipment:

D.C. voltmeter : e.g. PHILIPS 2400
Oscilloscope : e.g. PHILIPS PM 3250

+5 V d.c.

Connect the voltmeter to terminal 3' (earth at terminal 9').
The voltage should be +5 V ±0.05 V.
If not, check the voltage at TS108b/R136.
This voltage should be $+5.3\ \text{V}\ {}^{+0\ \text{V}}_{-0.1\ \text{V}}$

Select, if necessary, R136 (withing 820 Ω - 100 kΩ) for correct voltage ($+5.3\ \text{V}\ {}^{+0\ \text{V}}_{-0.1\ \text{V}}$)

Reconnect the voltmeter to terminal 3' and select, if necessary, another value for R120 (0 - 100 kΩ) until +5 V ±0.05 V is obtained.

+15 V d.c.

Connect the voltmeter to terminal 13' (earth at terminal 9').
The voltage should be +15 V ±0.3 V.

−10 V d.c.

Connect the voltmeter to terminal 18' (earth at terminal 9').
The voltage should be −10 V ±0.2 V.

Ripple voltage

Connect the oscilloscope to terminals 3', 13' and 18' respectively.
The 100 Hz ripple voltage must not exceed 1 mV_{p-p}.

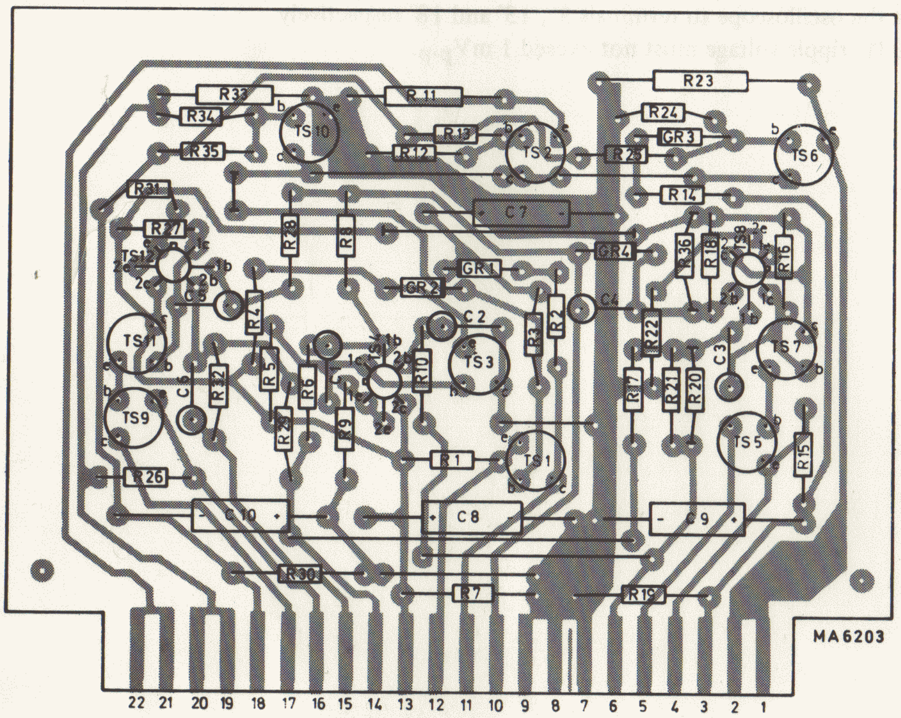


Fig. XIII-3. Printed wiring board, voltage regulator, unit 1

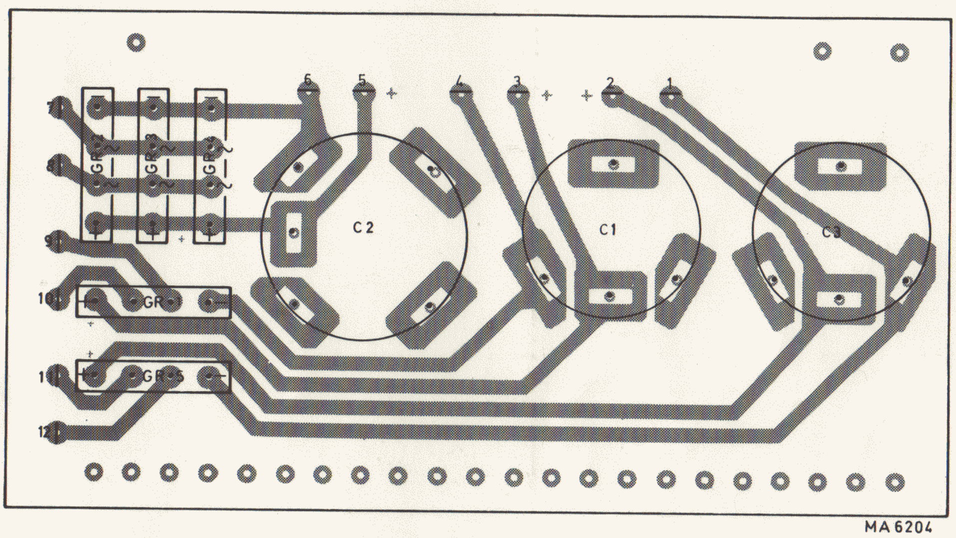


Fig. XIII-4. Printed wiring board, rectifier, unit 17

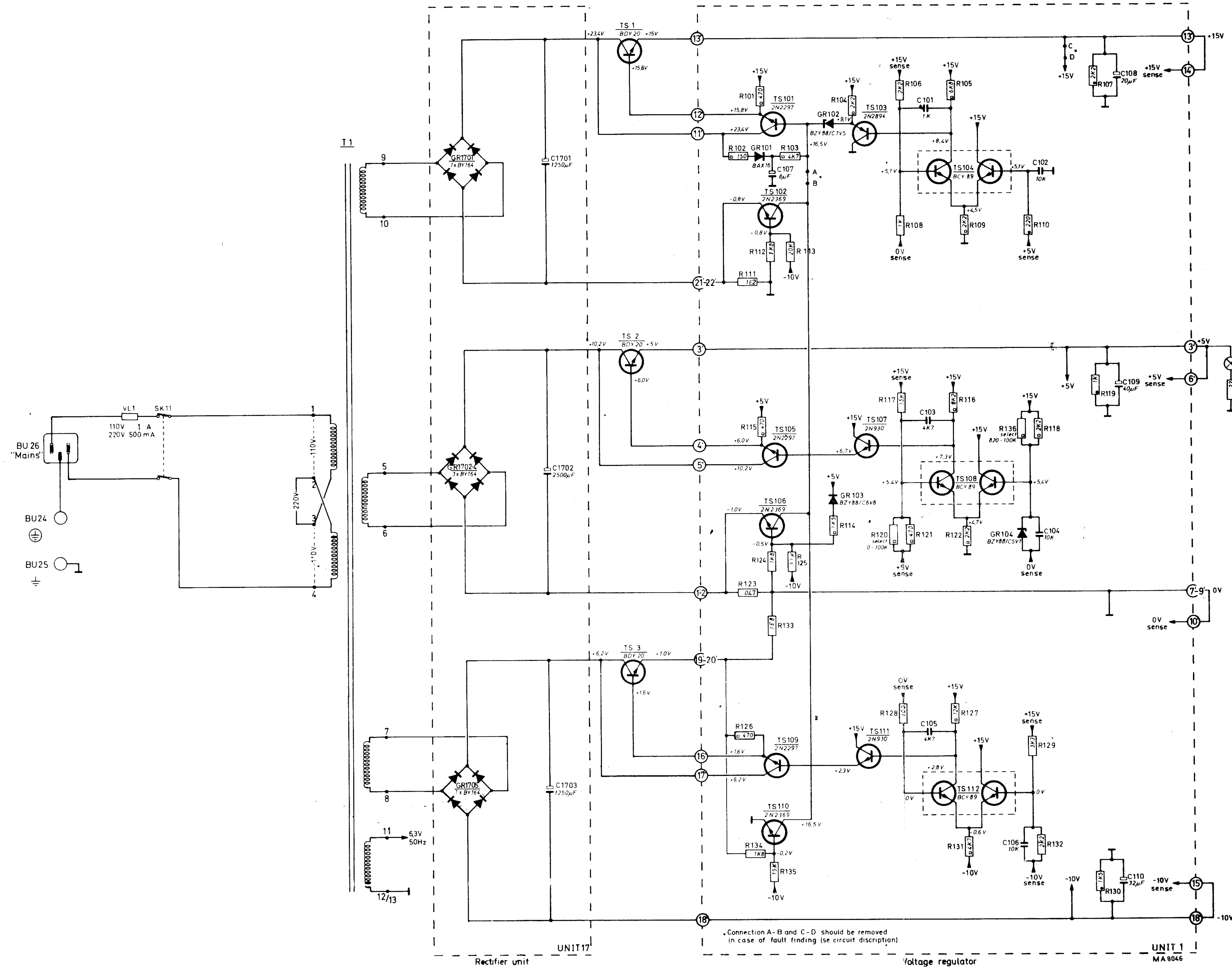


Fig. XIII-5. Circuit diagram, rectifier, unit 17 and voltage regulator, unit 1

XIV. Unit 2 Memory

This unit consists of the ferrite core memory with the read-in, the read-out and the sense amplifier circuits (Fig. XIV-1).

The ferrite core matrix

Each interval covers 21 lines, while the information for each line is a binary figure of 8 bits. The memory is formed as a matrix of 21 lines, each containing 8 ferrite cores.

These cores are from row to row turned 90° to obtain read-out pulses with the same polarity at the vertical read-out wires.
The interval read-in wires (I 1 - I 10) pass the cores where the binary figure should be "1", and by-pass them if the figure should be "0" (See Fig. XIV-2). Each line consists of the line selector wires X1 - X4 and Y1 - Y6. Each wire is driven with half current pulses in the same phase so that only a combination can select a line.
With the four X-wires and the six Y-wires 24 combinations are possible, which represent a selection of 24 lines.
However, for the 625-lines system the first 21 combinations are used, while for the 525-lines system only the first 17 combinations are used.
Before a read-in takes place, all cores are automatically set to zero by the preceding read-out pulse.
On reading-in a current flows through one of the 10 selected interval wires (I 1 - I 10) to reverse the magnetic state of the corresponding cores. The cores not being passed, are not set.
The reading-in of a new interval is made when the end of the last line of the preceding interval is produced by the circle register.

At the beginning of each line of an interval, the half-current pulses, which pass through the X and Y-line selector wires, cannot separately cause the cores to reverse their magnetic state. If these half-current pulses in both wires coincide, they set the cores of the line concerned to zero. When the cores are set to zero, a voltage on the vertical read-out wires is induced and passed on to the sense amplifiers IC1 - IC4.

The sense amplifiers supply the pulses bit 1 - bit 8 which are used for setting the respective flip-flops of the circle register (unit 3). At the beginning of the next line the X- and Y-wires again carry half-current pulses, so that the information for this line is also transferred to the circle register. This process is repeated line after line until all information for the 21 lines is transferred. At the end of the 21st line the information of the next interval is read in and the setting to zero is made.

The sense amplifiers

These amplifiers are integrated circuits, specially developed for the purpose.
The circuit is connected to the read-out wires in the memory.
As the read-out wires are threaded through all cores, all induced signals are amplified. This implies that the unwanted signals from the cores through which only half-current pulses are flowing will also be amplified and create false pulses. However, because of the non-linear hysteresis loop of the cores only the full current pulses are delayed about 0.75 μs.

To obtain these correct pulses a gate pulse (the so-called strobe pulse) is supplied to the integrated circuits.
The strobe pulse Z (positive going) is generated in unit 4.
The output pulses from the sense amplifiers (positive going) are applied to the circle register in unit 3.

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3250

The read-in current

Connect the oscilloscope to R1 (at the memory side).
Earth at terminal 22'.
The voltage should be 10.5 - 13.0 V_{p-p}.
(This corresponds to a current of 0.76 - 1.04 A in the interval wires).

The read-out current

Connect the oscilloscope to R2 respectively R3 (at the memory side). Earth at terminal 22'.
The voltage should be 11.9 - 13.5 V_{p-p} at each point.
(This corresponds to a current of 380 - 465 mA in the Y respectively the X wires).

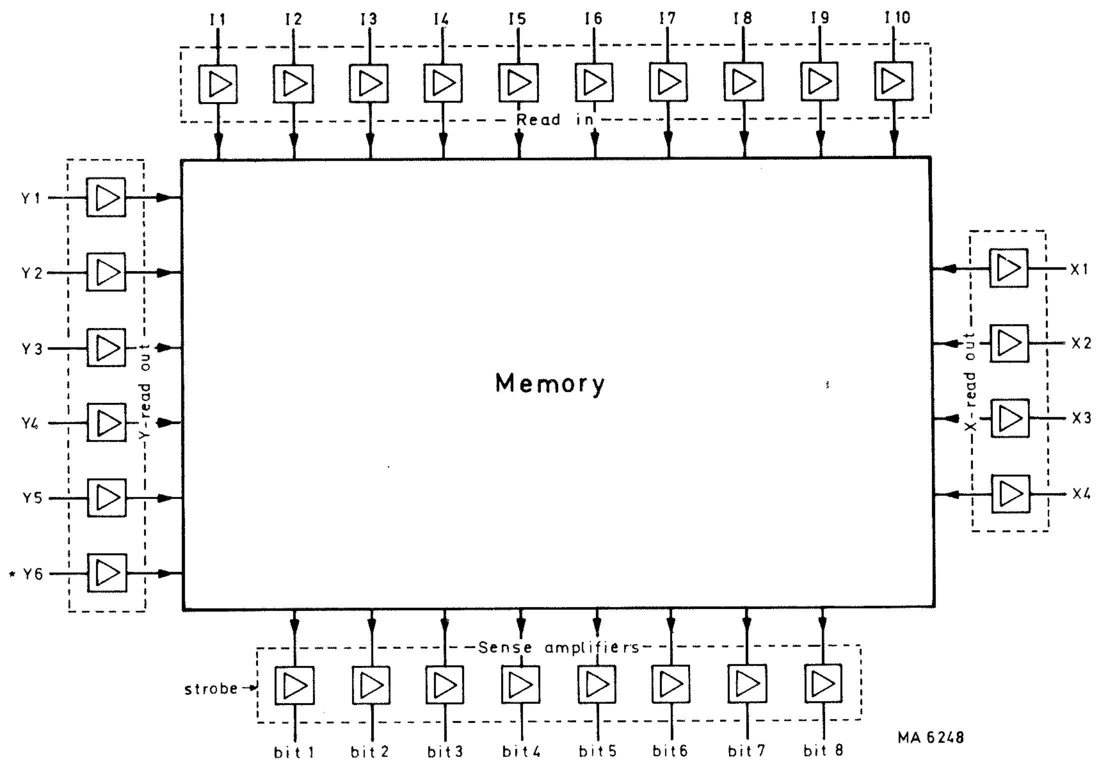


Fig. XIV-1. Block diagram, memory, unit 2

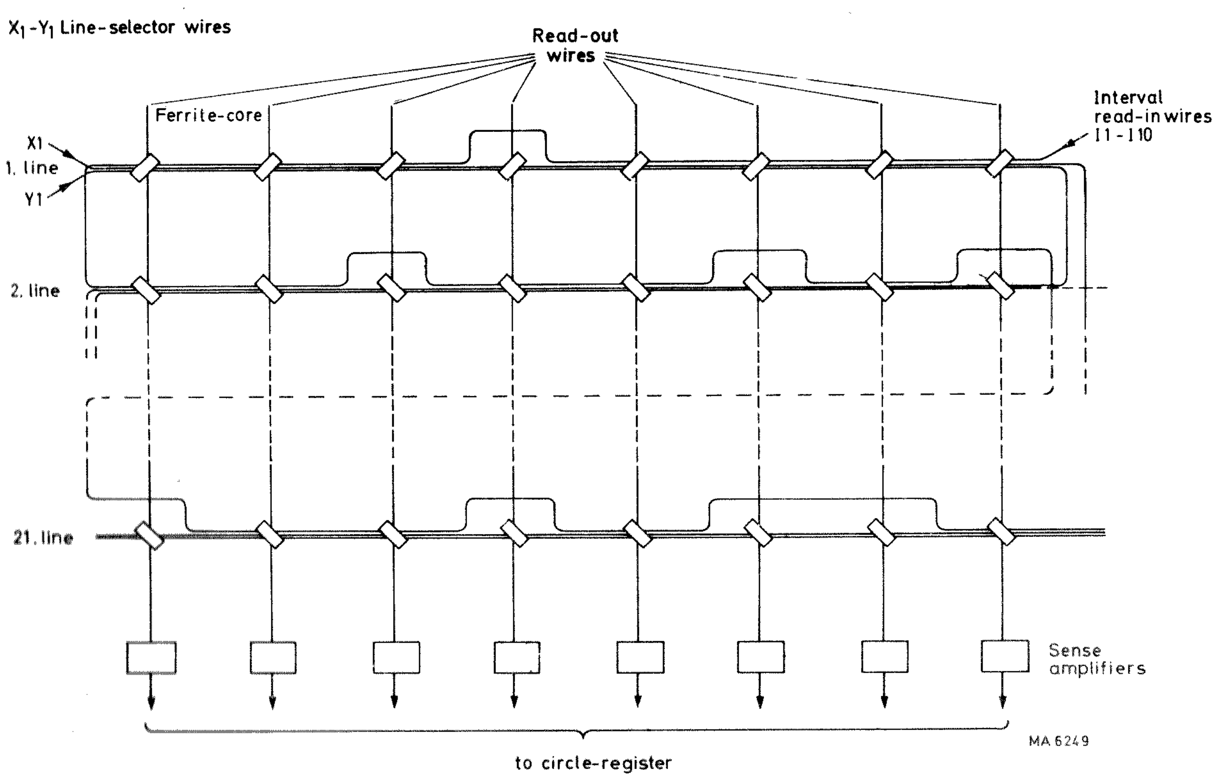
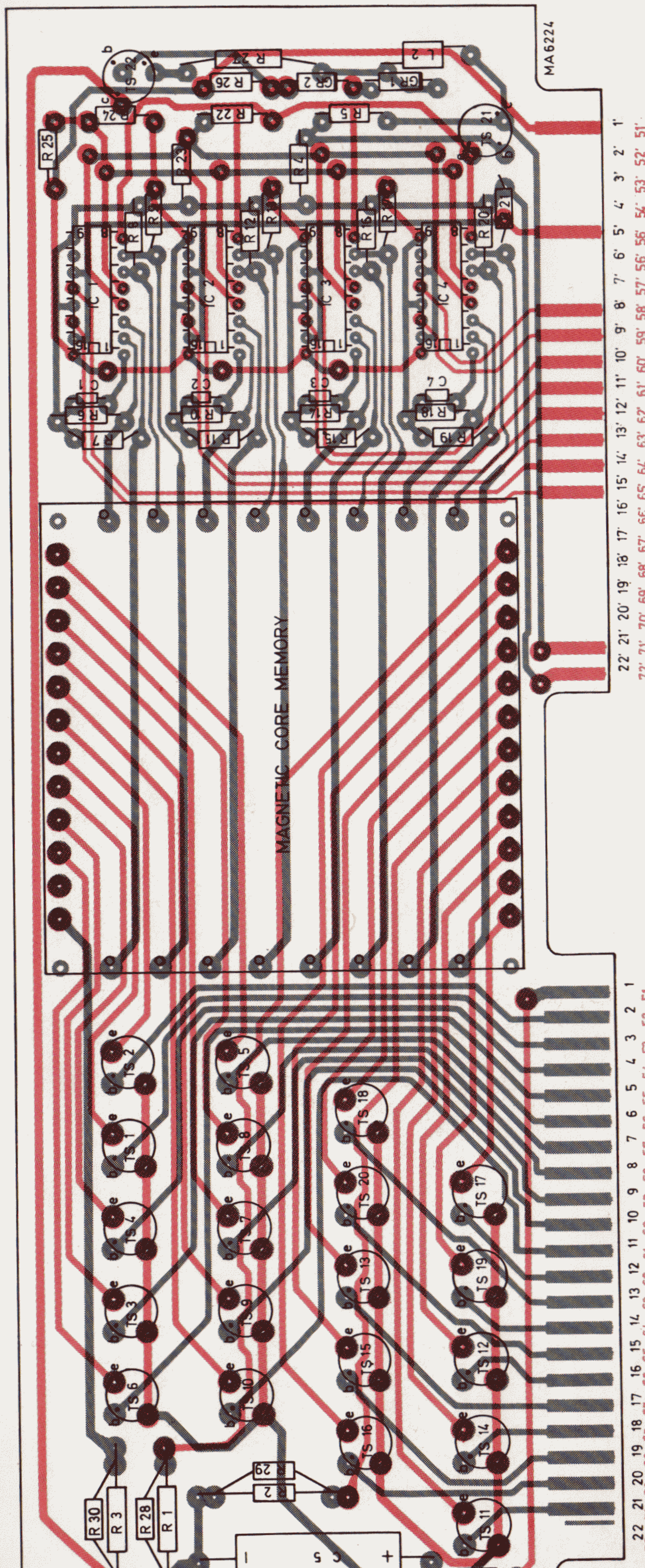


Fig. XIV-2. Principle of the memory



Erratum:
In the M version TS11 is removed and the wiring of the magnetic core matrix is of a different structure.

Fig. XIV-3. Printed wiring board, memory (G version), unit 2

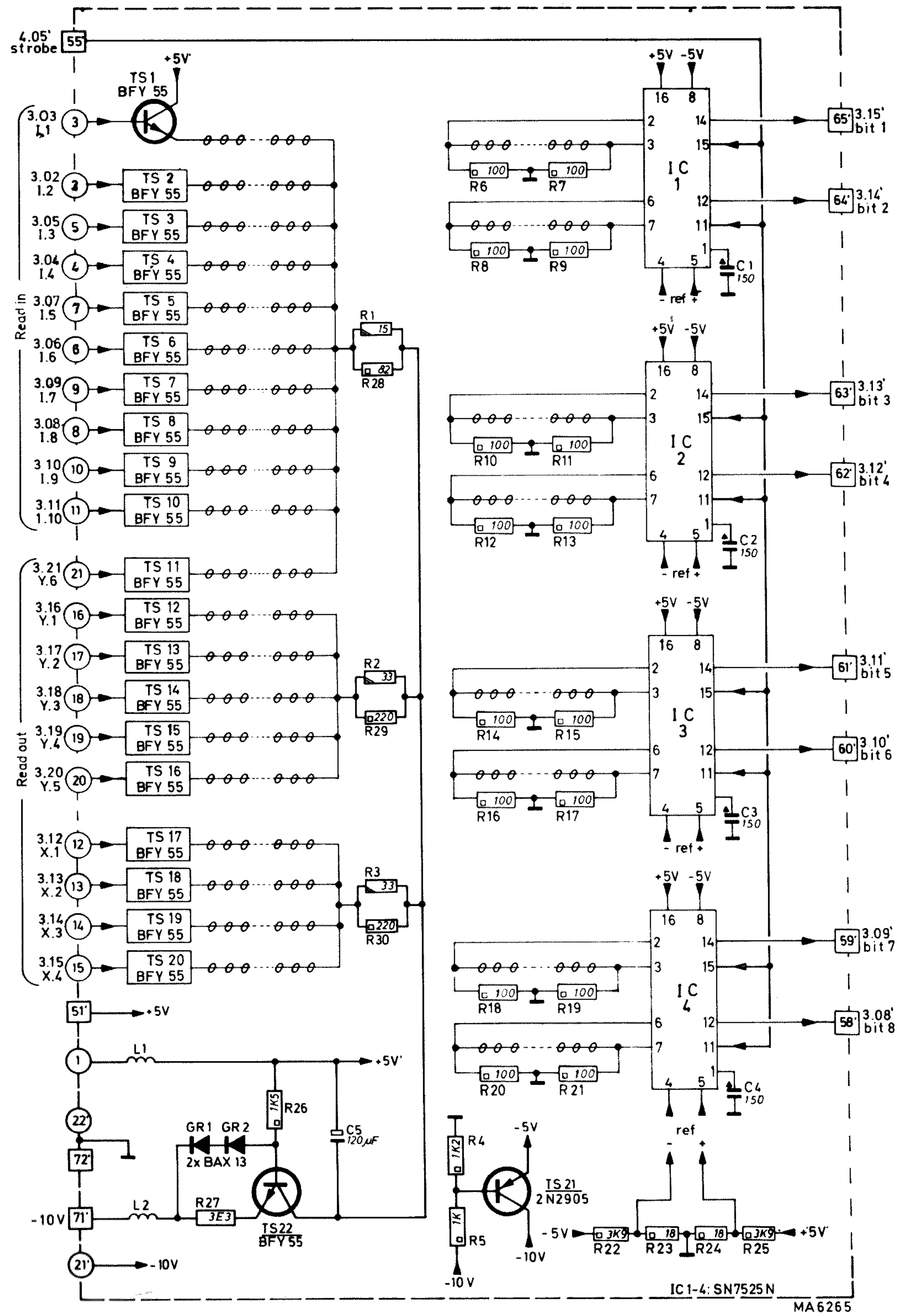


Fig. XIV-4. Circuit diagram, memory (G version), unit 2

N.B. From /05 version a 22 μF/10 V el. capacitor C6 is added between point 1 and 22'/72';
and a 15 μF/10 V el. cap. C7 is added between GR1 and point 22'/72'.

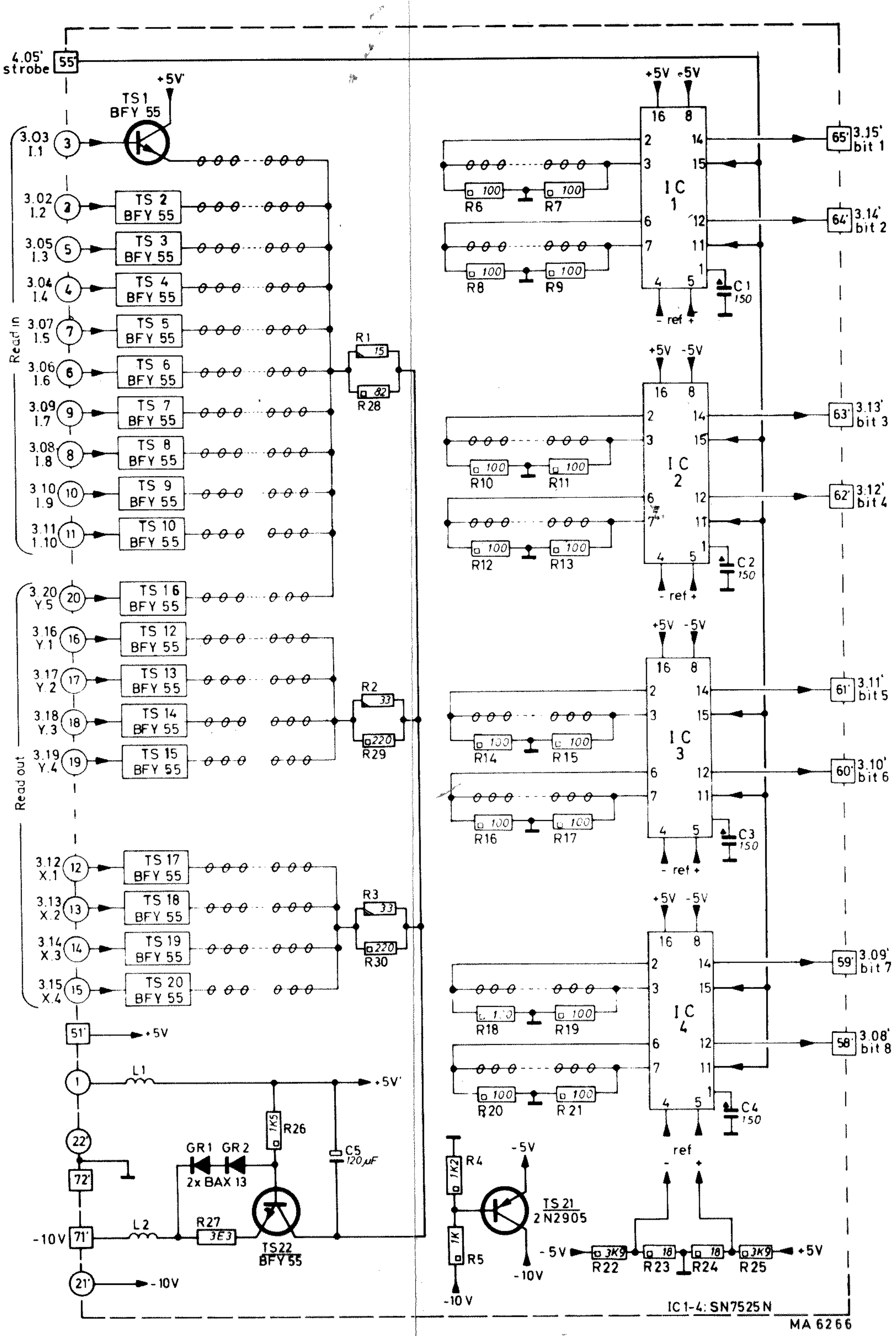


Fig. XIV-5. Circuit diagram, memory (M version), unit 2

XV. Unit 3 Circle register

This unit contains the circle register with the 15 MHz clock oscillator.
In addition the unit contains the read-out amplifiers (Y and X amplifiers) and the read-in amplifiers (interval amplifiers).

The circle register consists of two rows of binary counters:
IC2, 4, 6 and 8 generating the left part, and IC12, 13, 14 and 15 generating the right part of the circle.

The counters are set, respectively reset, by the bits 1 to 8 from the memory.

The 15 MHz clock oscillator TS1 and TS2 is an emitter coupled multivibrator.
The oscillator is controlled via TS3 by a start-stop circuit (IC1, IC11 and IC17).

The start-stop circuit consists of two bistable multivibrators IC17 and IC1, partly controlled by IC11.

The functioning of the register is as follows (see Fig. XV-1):

1. At the moment t1 a $\overline{f_H}$ pulse, amplified by IC16, is applied to the register.
   The pulse to the register for the left circle part is applied to the clear input and will set all outputs to "0".
   The pulse to the register for the right circle part is applied to the pre-set input and will accordingly set all outputs to "1".
2. At the moment t2 the memory will be read-out, and via the IC3, 5, 7 and 9 the bits are applied to the set inputs of one register, and to the re-set inputs of the other one.
   To prevent the register for the left circle from counting on the set pulses (the output was set to "0" by the clear pulse), the counter row is supplied with the gates IC3, 5, 7 and 9.
   These gates will only be open for the pulses, when the counter is in action.
3. At the moment t3 output 11 of flip-flop IC1 will shift to "1" by the "start I" pulse (from unit 4), which will open the gates for the left circle counter.
   At the same moment output 12 of flip-flop IC17 will shift to "0", which will start the 15 MHz oscillator.
   The counter will then count up to the read-in figure.
   When the figure is reached, output 6 of IC8 supply a pulse, which via IC10/2 and 10/1, shift the flip-flop IC11, which determinate the left side of the circle.
   Output 3 of IC10 will also shift flip-flop IC17 and stop the 15 MHz oscillator.
4. At the moment t4 the same proces will be repeated for the right side circle counter. Then the counter and the oscillator will be started by the "start II" pulse.
   When the counter has reached the read-in figure, flip-flop ICII will be shifted back again and determinate the right side of the circle.

The circle pulse "ϕ" passes the gate IC17/2 to the video mixers (units 11 and 13).
By means of the gate the circle pulse can be suppressed (SK2 "GRID ONLY").
The pulse V4-28 gates the circle in vertical direction and suppresses eventual false circle signals.

Checking and adjusting

See unit 4

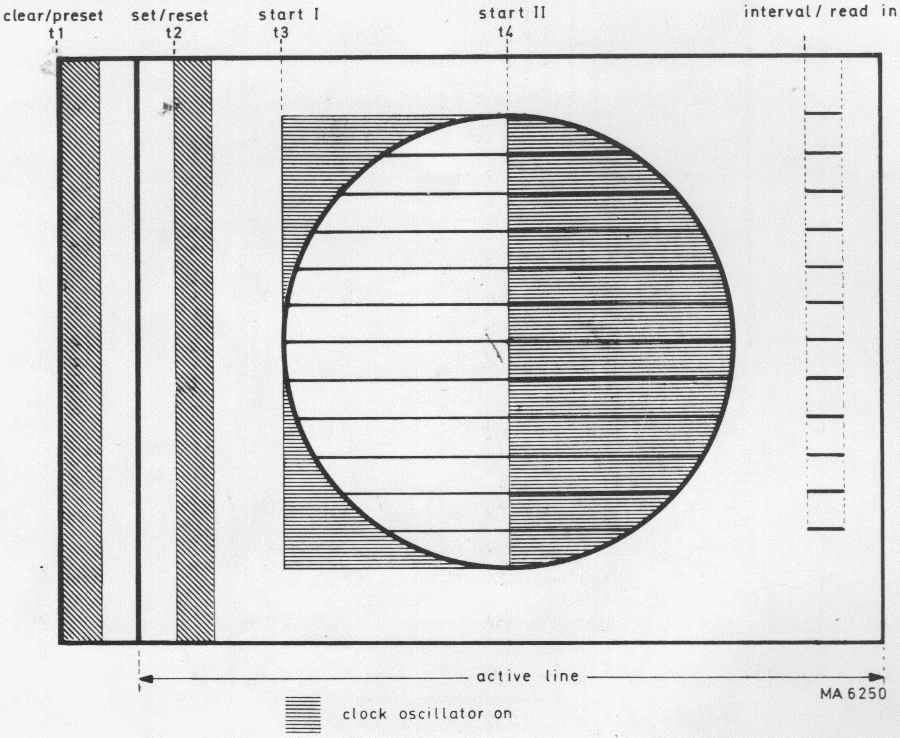
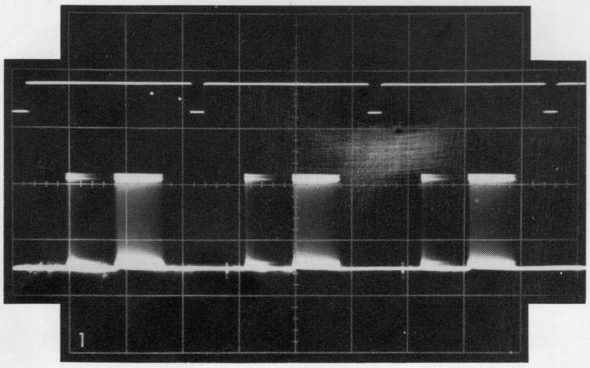


Fig. XV-1. Circle register



2 V/div. 20 μs/div.

Ref.: $\overline{f_H}$. pulse

Fig. XV-2. Oscillogram, unit 3

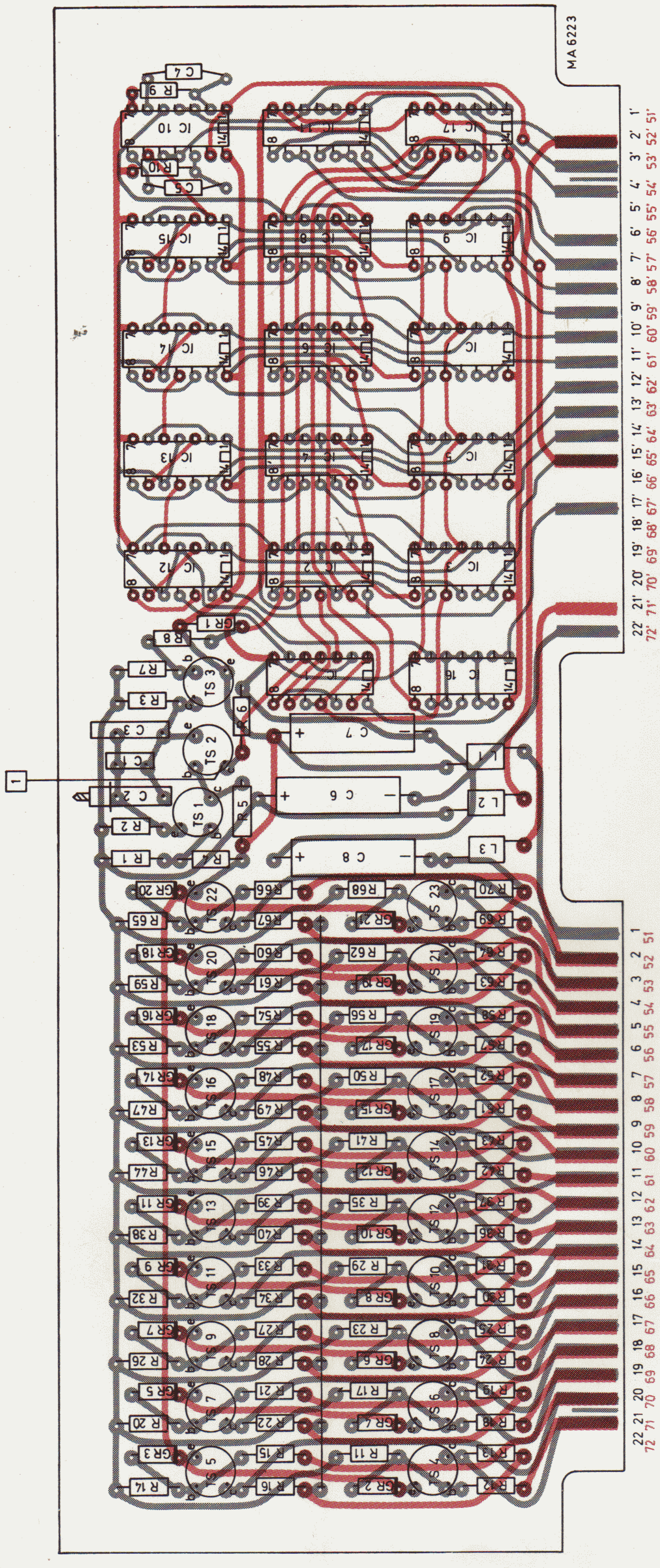


Fig. XV-3. Printed wiring board, circle register, unit 3

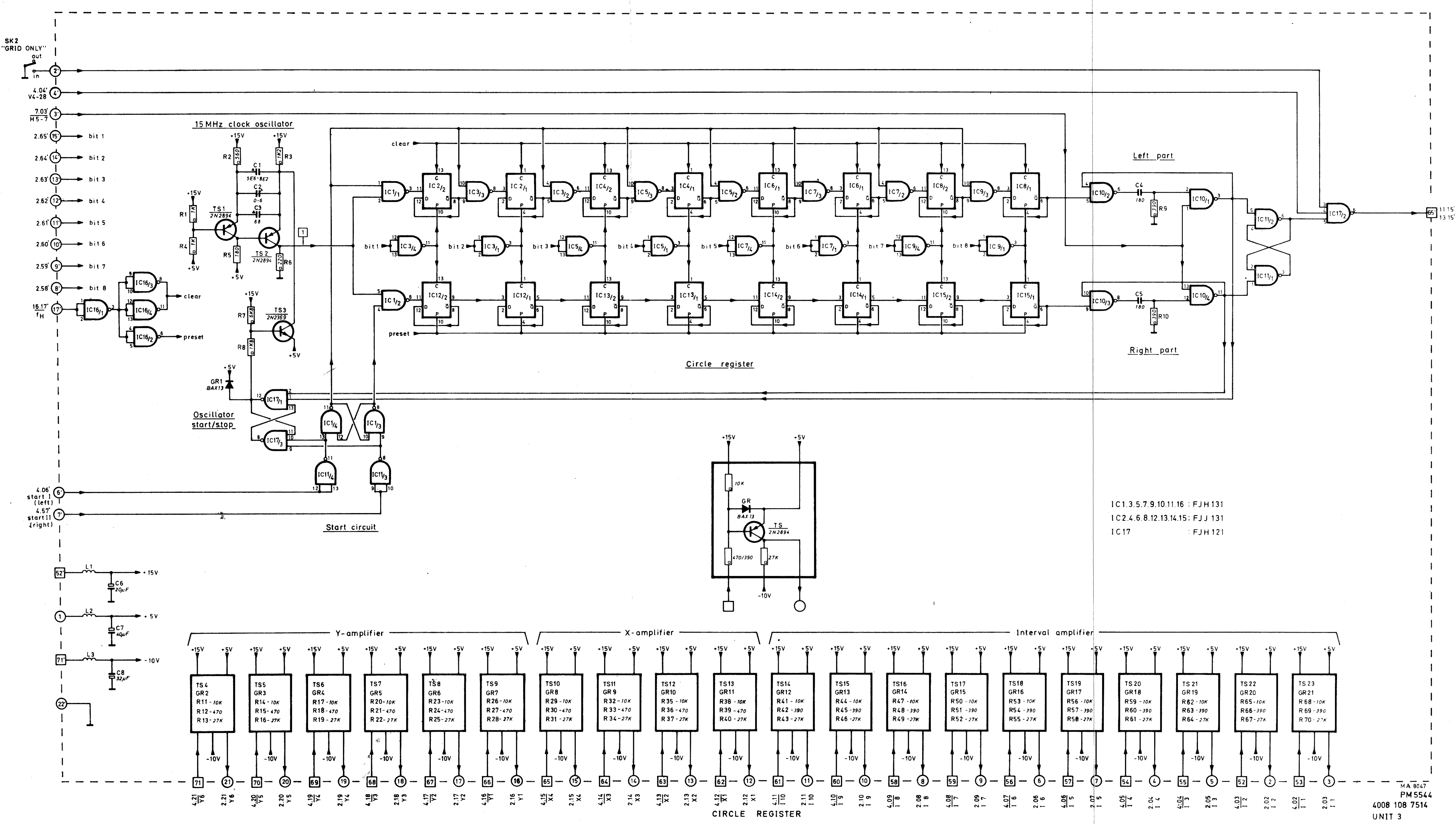


Fig. XV-4. Circuit diagram, circle register, unit 3

XVI. Unit 4 Vertical divider

This unit contains the "Line register" and the control circuits for the circle generation: "Circle interval decoder", "X and Y read-out decoders", "Strobe generator" and the start pulse generators for the circle register.

The line register is a 21 divider (M-version: 17 divider) counting on the line pulses $\overline{f_H}$.
To obtain the correct sequence of the pulses, the counter is set for every field by the $\overline{\text{field}}$ pulses.

As the pulses from the counter should first appear in the active field period, a certain delay is introduced from the frame pulse (front porch) to the start of the divider.

This delay is obtained in two ways. The $\overline{\text{field}}$ pulse supplied to terminal 16' is prolonged in the one-shot IC1/2 - TS1.
The delay can be adjusted by R4.
Via the gate IC3/4 this prolonged pulse controls the supply of the line pulses ($\overline{f_H}$) to the divider.
Via IC2/1 the prolonged $\overline{\text{field}}$ pulse is also used for setting of the divider (Fig. XVI-1).
IC2/1 is coupled as a one-shot by means of C2/R8 and supplies a negative going pulse at the field front edge.
The divider is not set to "0" but to 16, which gives an extra delay of 5 lines, 7 for M-version (16 are 5 pulses before 21 or 0).

The field control pulse "h" (25 Hz) is also controlled by the prolonged $\overline{\text{field}}$ pulse which is supplied to TS2.
TS2 is coupled as a one-shot, which supplies a positive going pulse, that is wide enough to let the first line pulse from IC3/4 in every second field (Fig. XVI-1e) passes the gate IC2/2.

The flip-flop IC2/3+4 in the field control circuit will thus be shifted with a frequency of 25 Hz (Fig. XVI-1g).

The "Circle interval decoder" is controlled by a pulse from the "Line register".
This pulse, appearing every 21st (17 in M-version) line, controls the read-in currents to the memory.
The pulses applied to the terminals 53-64 are determinating, together with the field control pulses h and $\overline{h}$, which of the intervals should be read in.

The "X and Y read-out decoders" are supplied with the r, s, t, u, v and z pulses from the "Line register" and supply the read-out currents to the memory in the right sequence.

The strobe generator IC12/2 - TS3 is a one-shot, triggered by the front of the $\overline{\text{H5-7}}$ pulse and followed by another one-shot IC12/1+4.
The first one-shot controls the delay (adjustable by R15) and the other one the width of the strobe pulse.

The start I and start II generators IC13 - TS4 respectively IC12 - TS5 are one-shot oscillators triggered by the front of the H9-29 pulse and the rear of the H1-21 pulse respectively.
The circuits control the circle registers for respectively the left and the right part of the circle (unit 3).

The "Horizontal line/bar generator" generates from the u and s pulses the white horizontal lines and the white bars, which are used for the border castellation.

The "Center line generator" supplies white lines in pairs (in two successive fields) with the contrary field sequence (controlled by the field control pulses h and $\overline{h}$).

N.B. For modifying this unit into an M-version two jumpers have to be removed and the following connections made:
$\overline{S}$ (IC4/1 - 14) to IC8/1-1 and IC8/1 - 3 to IC9/4 -12.

Checking and adjusting

Measuring equipment:

Oscilloscope : e.g. PHILIPS PM 3250
Bl/Wh monitor: e.g. PHILIPS LDH2110

The adjustments in unit 3 and unit 4 secure a proper symmetry and placing of the circle.
When adjusting, the following sequence must be observed.

1. The strobe pulse. Unit 4

Connect the Bl/Wh monitor to BU7 "Y-OUTPUT".
Remove unit 12.
Press SK4 "EXT. PICT."
Observe that the circle is without line tearing.
If tearings occur, adjust R15.

2. The start I pulse. Unit 4

Connect the oscilloscope to terminal 4 at unit 11B.
Trigger ext. with pulse $\overline{f_H}$ (e.g. terminal 17' - unit 4).
(Put the oscilloscope in pos.: 0.5 μs/div. - delay: $\approx$75 μs (10 μs x 7.50).
Press SK4 "EXT. PICT."
The start of the circle should be half the way between the 3rd and the 4th of the vertical white lines (see Fig. XVI-2).
If not, adjust R21.

3. The oscillator frequency. Unit 3

Connect the Bl/Wh monitor to BU7 "Y-OUTPUT".
Remove unit 12.
Press SK4 "EXT. PICT."
The distance a-b should be equal to c-d (see Fig. XVI-3).
If not, readjust C2.

4. The start II pulse. Unit 4

Connect the oscilloscope to terminal 4 at unit 11B.
Trigger ext. with pulse $\overline{f_H}$ (e.g. terminal 17' - unit 4).
Put the oscilloscope in pos.: 0.5 μs/div. - delay: $\approx$45 μs (10 μs x 4.40).
Press SK4 "EXT. PICT."
The right part of the circle should stop half-way between the 3rd and the 4th last vertical white line (see Fig. XV-4).
If not, readjust R28.

5. Vertical position of the test pattern. Unit 4

Connect the oscilloscope to terminal 4 at unit 11B.
Trigger ext. with $\overline{\text{field}}$ pulse, e.g. terminal 16' - unit 4.
Put the oscilloscope in pos.: 0.2 ms/div. x 2 -
delay : ≈ 18 ms (2 ms x 9.20) and
≈ 20 ms (2 ms x 10.0) resp.
The black/white castellations in the top and in the bottom of the picture should consist of a number of lines according to the survey table (Fig. XVI-5).
In case of deviation, adjust R4 until correct numbers are obtained.

Note:

When adjusting, make sure that the interlacing is correct.
(The first and the last lines in the circle should be of the same length).
The number of lines depends on the width of the supplied field blanking.

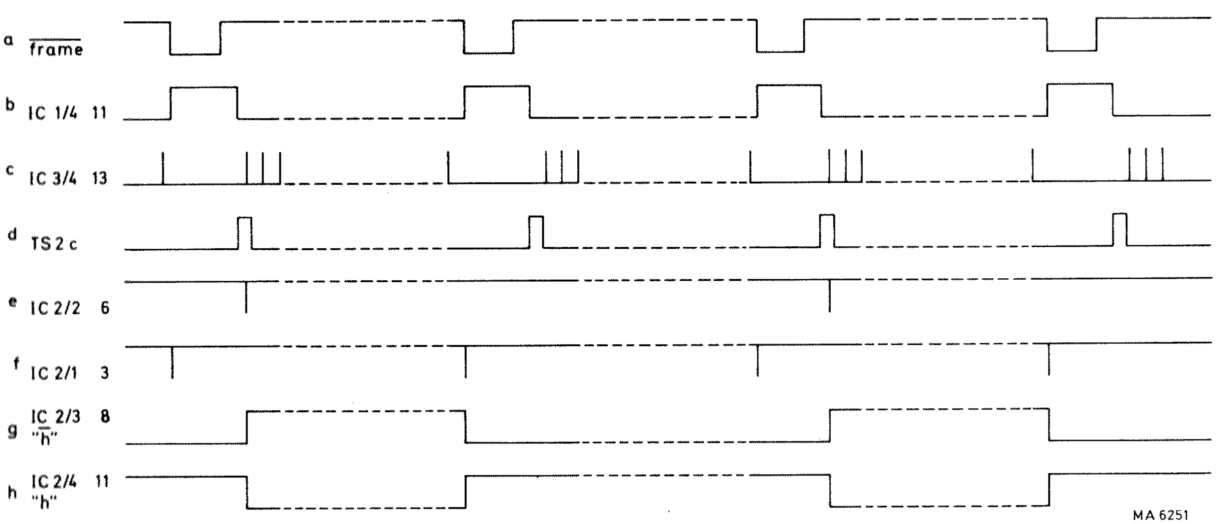


Fig. XVI-1. Pulse diagram, vertical divider

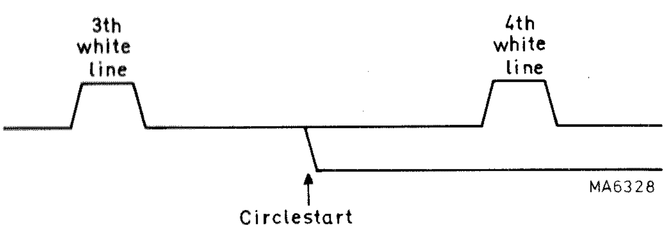


Fig. XVI-2. Pulse diagram, start of the circle

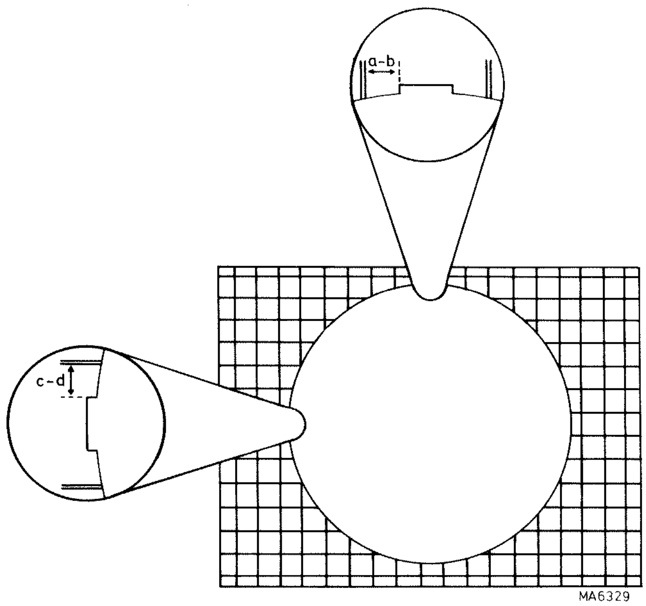


Fig. XVI-3. Pulse diagram, frequency adjustment

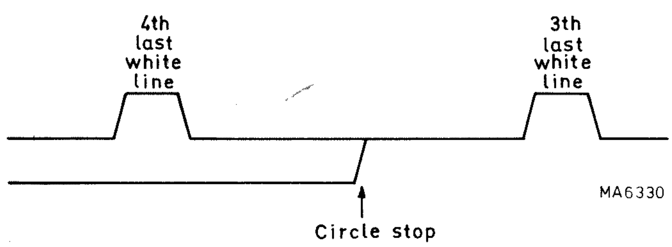


Fig. XVI-4. Pulse diagram, stop of the circle

Numbers of lines in the supplied fieldblanking	G-version				M-version			
	Numbers of lines in the black/white castellation.*							
	1.field		2.field		1. field		2.field	
	upper	lower	upper	lower	upper	lower	upper	lower
18	10	10 1/2	10 1/2	10	11	11 1/2	11 1/2	11
19	10	9 1/2	9 1/2	10	11	10 1/2	10 1/2	11
20	9	9 1/2	9 1/2	9	10	10 1/2	10 1/2	10
21	9	8 1/2	8 1/2	9	10	9 1/2	9 1/2	10
22	8	8 1/2	8 1/2	8	9	9 1/2	9 1/2	9
23	8	7 1/2	7 1/2	8	9	8 1/2	8 1/2	9
24	7	7 1/2	7 1/2	7	8	8 1/2	8 1/2	8
25	7	6 1/2	6 1/2	7	8	7 1/2	7 1/2	8

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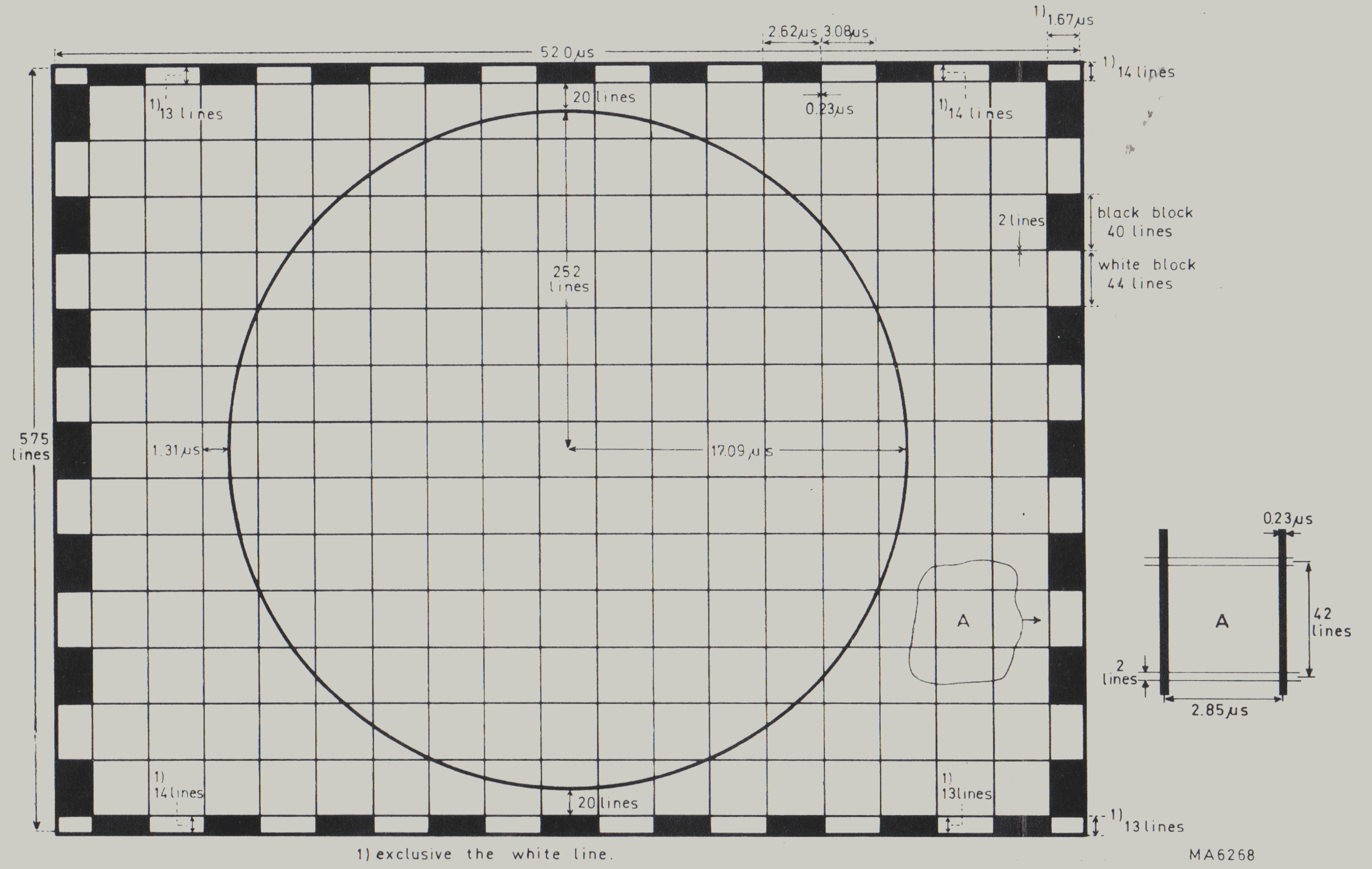
* When changing to another width of the supplied fieldblanking following other adjustments must be carried out:

Unit 6 : oscillatorstart and oscillatorfrequency.

Unit 3 : oscillatorfrequency, start I and start II pulses.

Fig. XVI-5. Survey of the vertical position of the test pattern



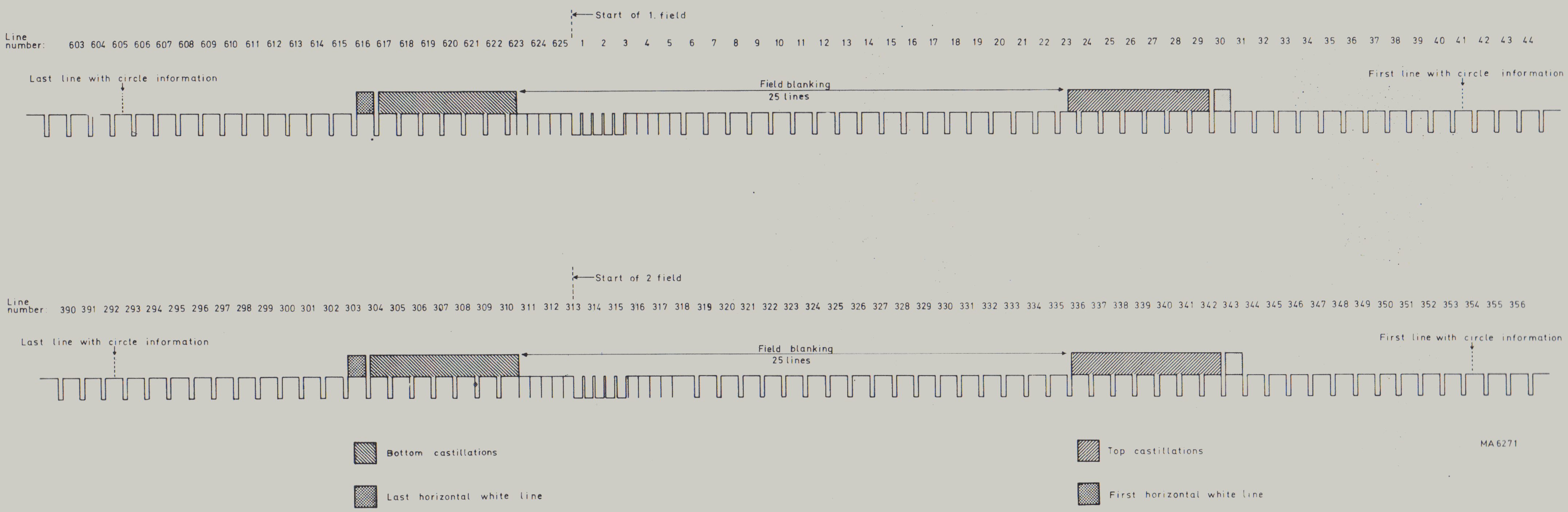
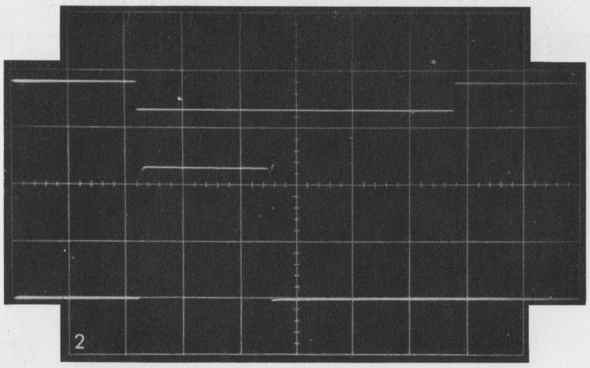
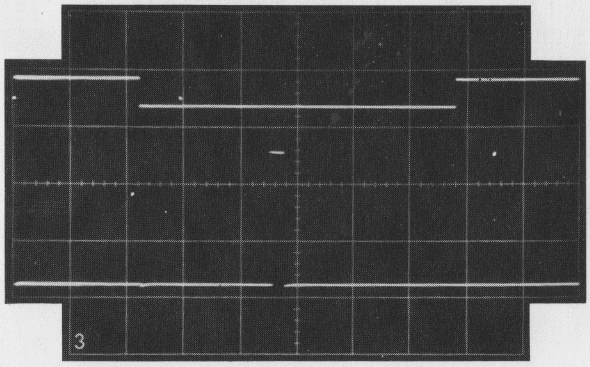


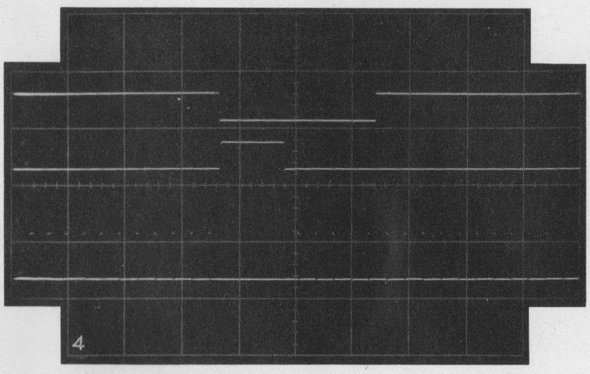
Fig. XVI-5a. Example of the vertical position of the test pattern for 25 lines field blanking



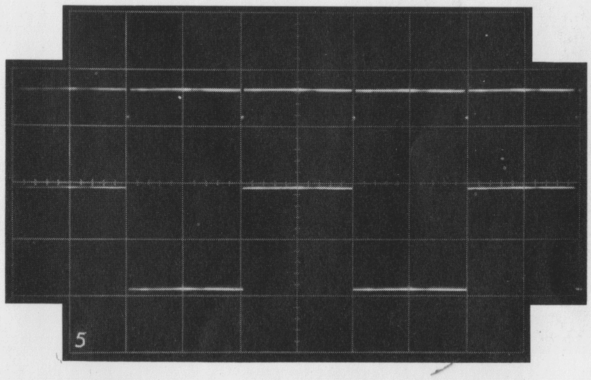
2 V/div. 0.1 ms/div.
Ref.: field pulse



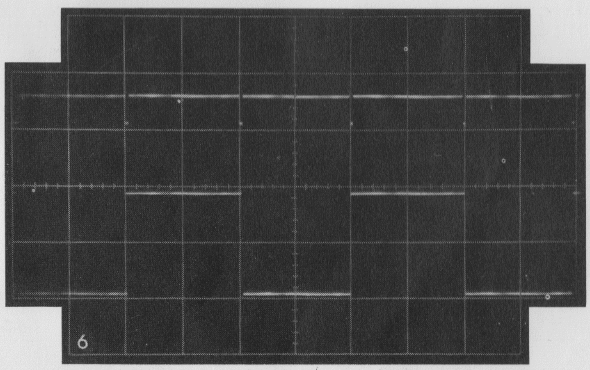
2 V/div. 0.1 ms/div.
Ref.: field pulse



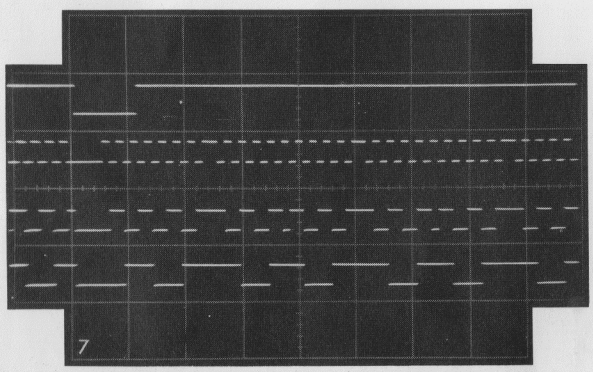
5 V/div. 0.2 ms/div.
Ref.: field and IC ¼ - 11 pulse



2 V/div. 10 ms/div.
Ref.: field pulse

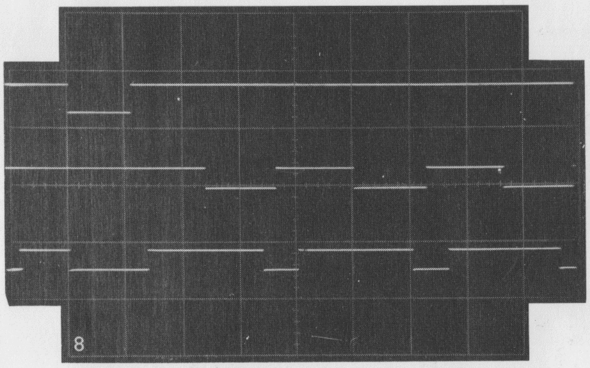


2 V/div. 10 ms/div.
Ref.: field pulse



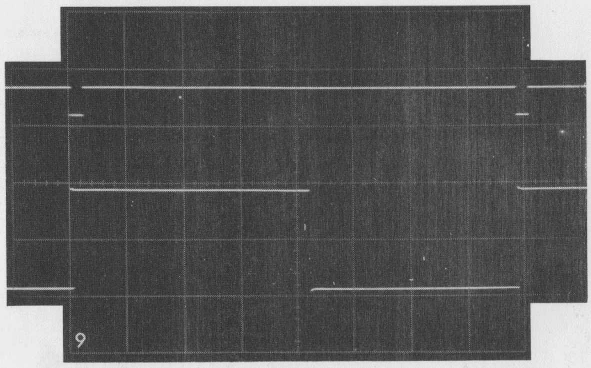
10 V/div. 0.5 ms/div.
(r-s-tpulses)
Ref.: field pulse

Fig. XVI-6. Oscillograms, unit 4



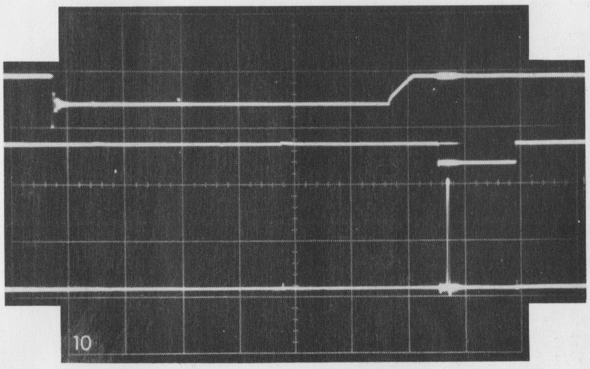
10 V/div. 0.5 ms/div.
(u-v pulses)

Ref.: field pulse



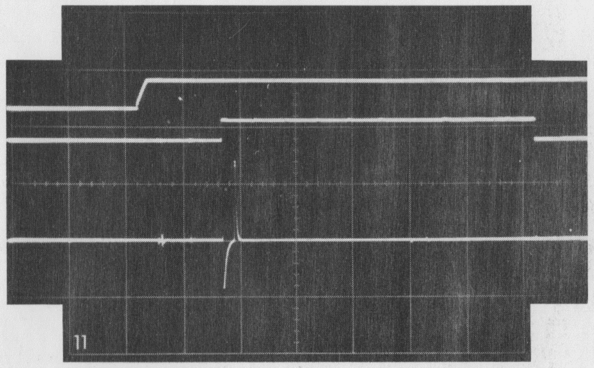
2 V/div. 2.5 ms/div.
(z pulse)

Ref.: field pulses



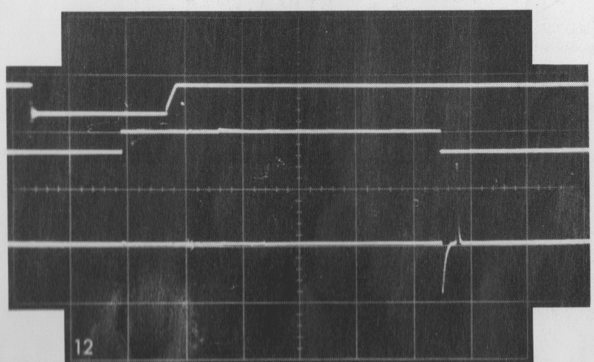
2 V/div. 2 μs/div.

Ref.: $\overline{\text{bl}}$ and $\overline{\text{H5.7}}$



1 V/div. 5 μs/div.

Ref.: $\overline{\text{bl}}$ and H9-29



1 V/div. 5 μs/div.

Ref.: $\overline{\text{bl}}$ and H1-21

Fig. XVI-6. Oscillograms, unit 4

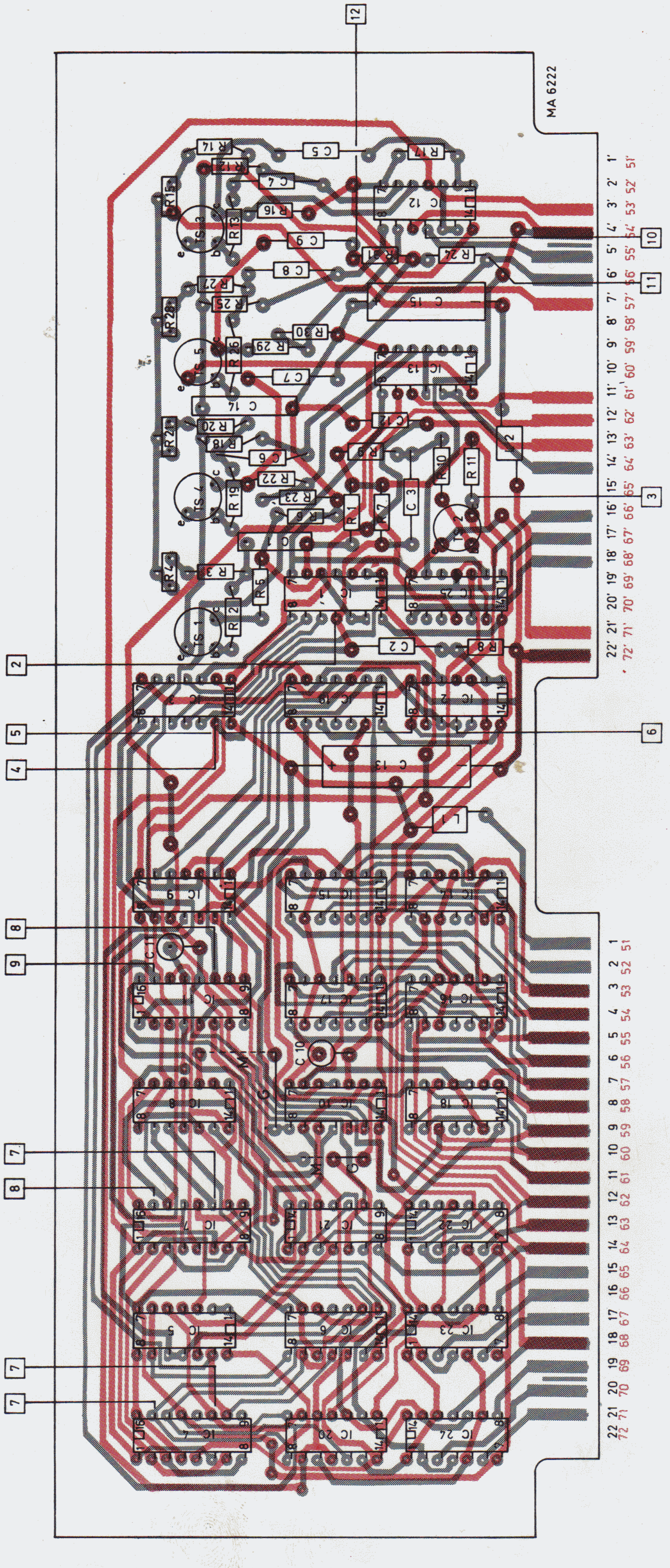
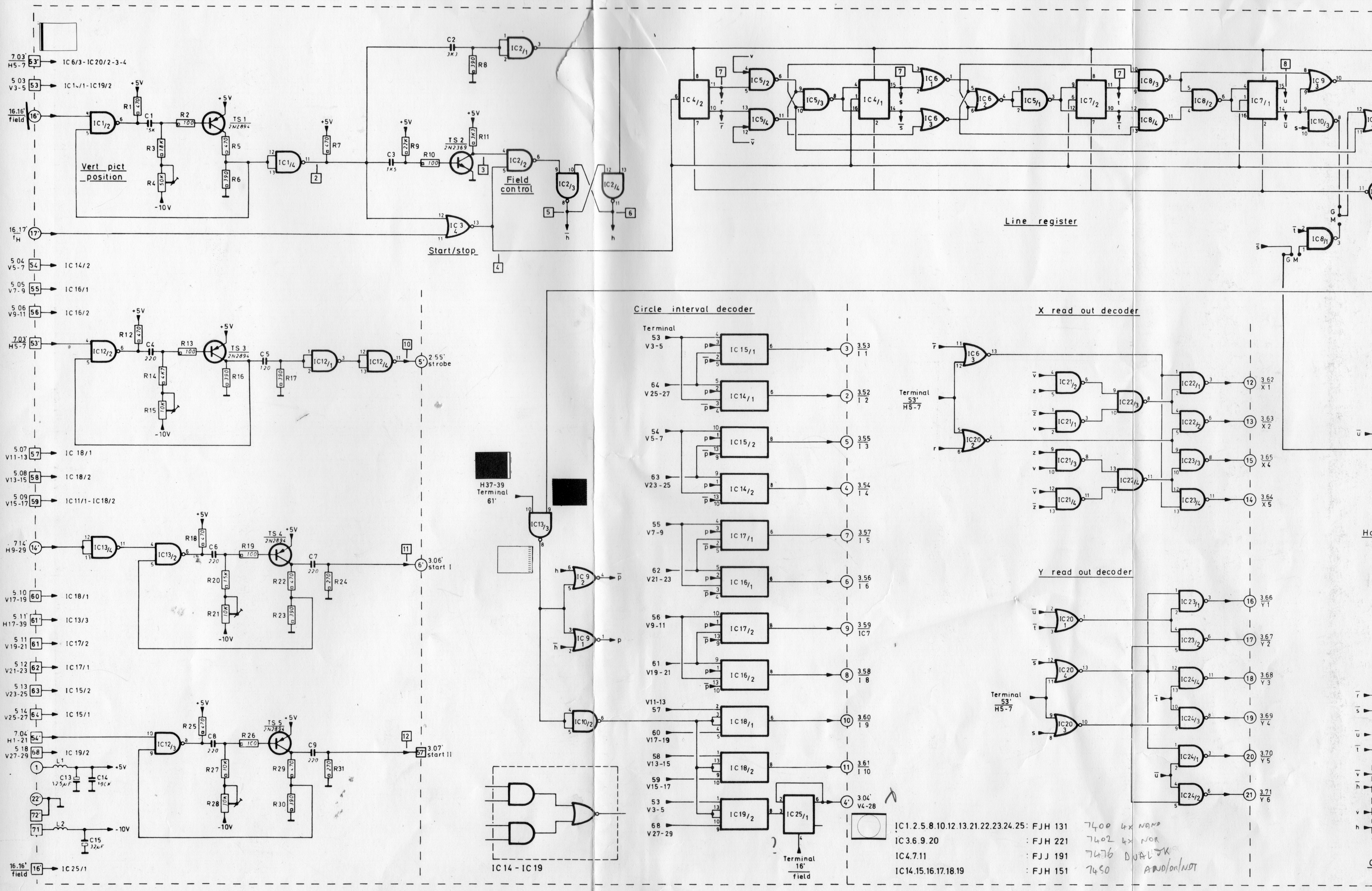
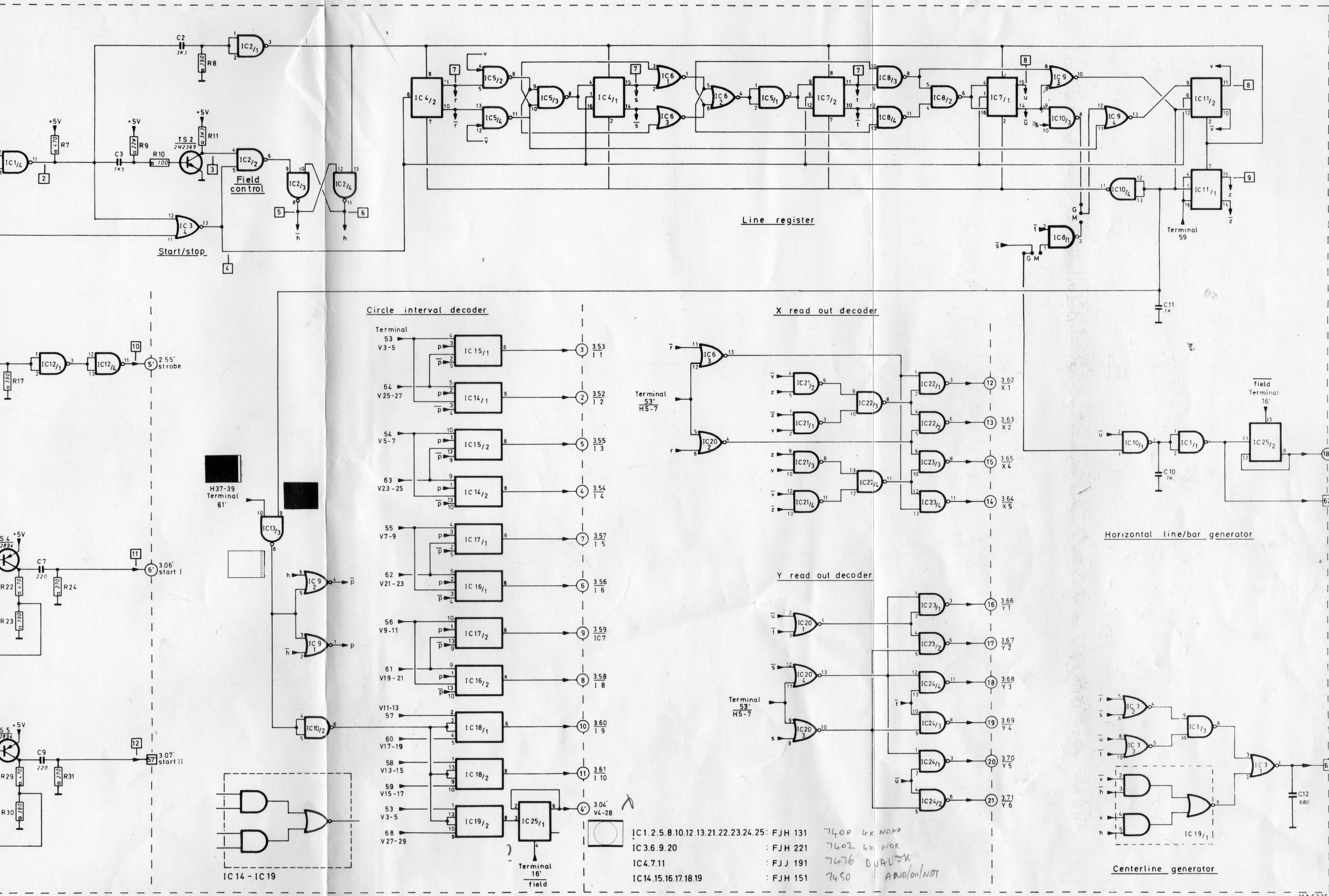


Fig. XVI-7. Printed wiring board, vertical divider, unit 4



XVI-8. Circuit diagram, vertical divider, unit 4

N.B. At point 14 read for X5 : X3



N.B. At point 14 read for X5 : X3

XVII. Unit 5 Vertical decoder

This unit consists of a "500 kHz oscillator" supplying the 250 kHz black-white squares and a "16:1 divider", which controls the vertical decoder.

The 500 kHz oscillator is an emitter coupled multivibrator TS4 - TS5.
Start and stop of the oscillator are controlled by the flip-flop IC2/2 via TS3.
The oscillator is started by the H5-25 pulse.
The front of this pulse is triggering one-shot TS1 which is adjustable by R2.
This one-shot, which gives the delayed start of the 500 kHz oscillator, is triggering one-shot TS2, supplying the set pulse to flip-flop IC2/2.

The oscillator is then running until the H37-39 pulse is applied to the reset input of the flip-flop.

The gate IC1/4 secures that the oscillator is only started in the wanted horizontal bar (V9-11).
The 500 kHz signal is applied to the 2:1 divider IC2/1, which supplies the 250 kHz black-white signal.

The 16:1 divider is dividing the V_L pulse (appears for every 21st line). Additionally the divider is supplied with an extra counting pulse V_I, which gives an extra counting pulse at the horizontal center line (selected by gate IC3/2).
The blanking signal, applied to gate IC3/3 controls the start and stop of the pulses applied to the divider.
The $\overline{\text{field}}$ pulse is setting the divider before start to secure the correct sequence of the output pulses A, B, C and D.

The A, B, C and D pulses are applied to the vertical decoders which supply the vertical picture division: the V 0-3, V 3-5, V 5-7 .... V 29-0 pulses, and the vertical gate pulses for the colour difference, the Bl/Wh circle and the center cross gates.

The "Narrow line generator", which is triggered by the vertical white lines $\overline{H_L}$, is a one-shote supplying white lines of half the width (H_L').
This signal applied to the (R-Y), (G-Y) and (B-Y) gates (unit 7) secures that the colour steps between (G-Y) = 0 and the (R-Y) respectively (B-Y) are symmetrical with respect to the vertical grid lines.

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3330 with delay unit PM 3347.
Bl/Wh monitor : e.g. PHILIPS LDH2110

The frequency of the 250 kHz generator

Connect the oscilloscope to terminal 70'.
Trigger ext. with pulse $\overline{f_H}$ (e.g. terminal 17' unit 4).
Put the oscilloscope in pos.: 2 μs/div. -
delay : $\approx$ 15 μs (5 μs x 3.00).
5 periods of 250 kHz should cover 10 cm ±0.2 cm
If not, select another value of R15 (2.7 kΩ - 5.6 kΩ)

The horizontal placing of the 250 kHz bar

Connect the monitor to BU7 - "Y-OUTPUT".
The 250 kHz bar should be placed in such a way with respect to the circle that the bar starts with ½ black in the left side and ends with ½ white block in the right side.
If not, adjust R2.

The narrow line generator

Press SK6: COLOUR DIFF.NORM.
Connect the oscilloscope to terminal 56' at unit 7.
Trigger ext. with pulse $\overline{f_H}$ (e.g. terminal 17' - unit 4).
Put the oscilloscope in pos.: 0.1 μs/div. -
delay : ≈ 11 μs (2 μs x 5.20).
The transient between +(R-Y) and (G-Y = 0) bars should be as shown in Fig. XVII-1.
If not, select another value of C5 (270 - 470 pF), until 115 ns is obtained.

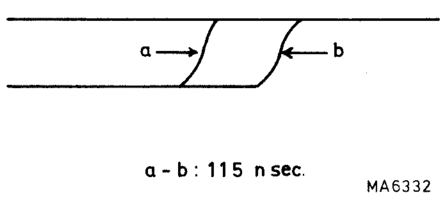
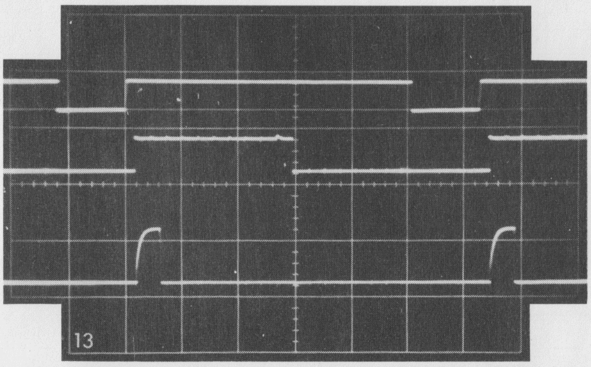
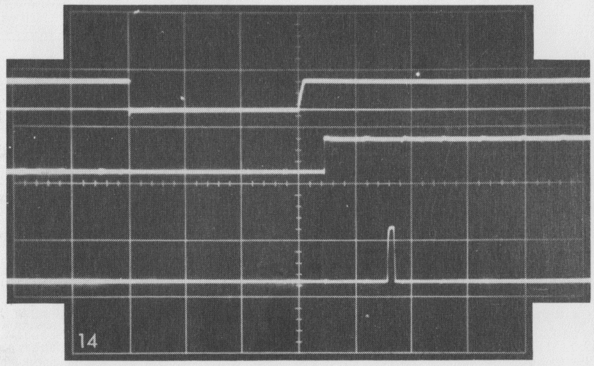


Fig. XVII-1. Pulse diagram, transient adjustment



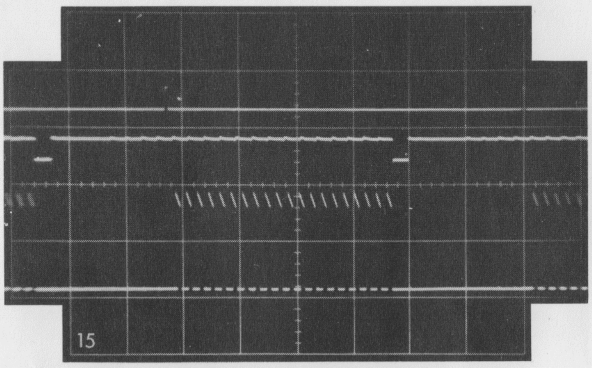
5 V/div. 10 μs/div.

Ref.: $\overline{\text{bl}}$ and H5-25



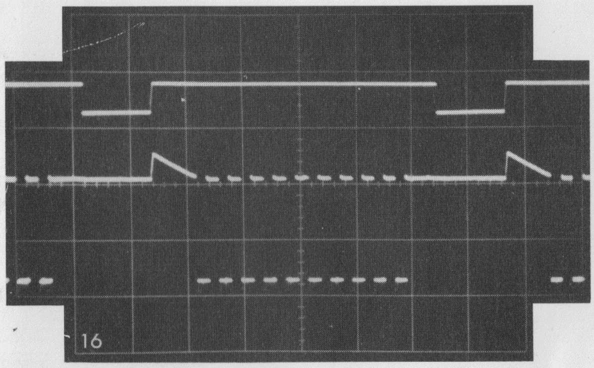
5 V/div. 4 μs/div.

Ref.: $\overline{\text{bl}}$ and H5-25



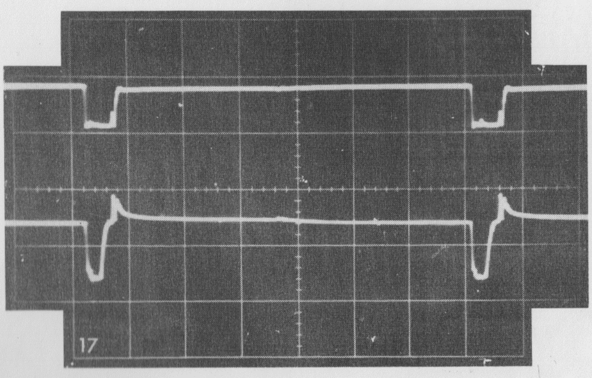
2 V/div. 10 μs/div.

Ref.: TS2c and H37-39



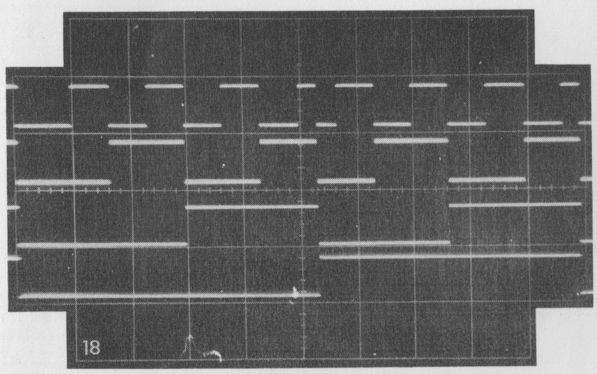
2 V/div. 10 μs/div.

Ref.: $\overline{\text{bl}}$



2 V/div. 0.4 μs/div.

Ref.: $\overline{\text{HL}}$



5 V/div. 2 ms/div.

Pulse A-B-C-D

Fig. XVII-2. Oscillograms, unit 5

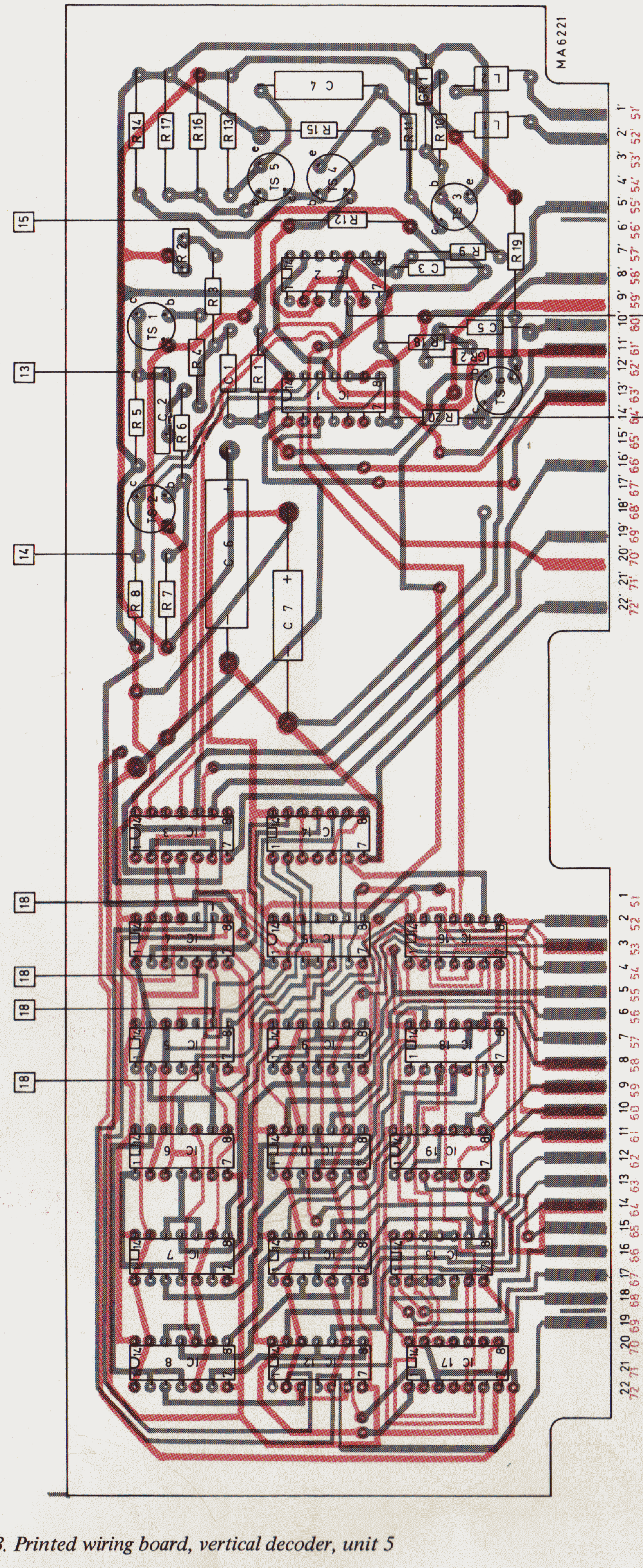


Fig. XVII-3. Printed wiring board, vertical decoder, unit 5

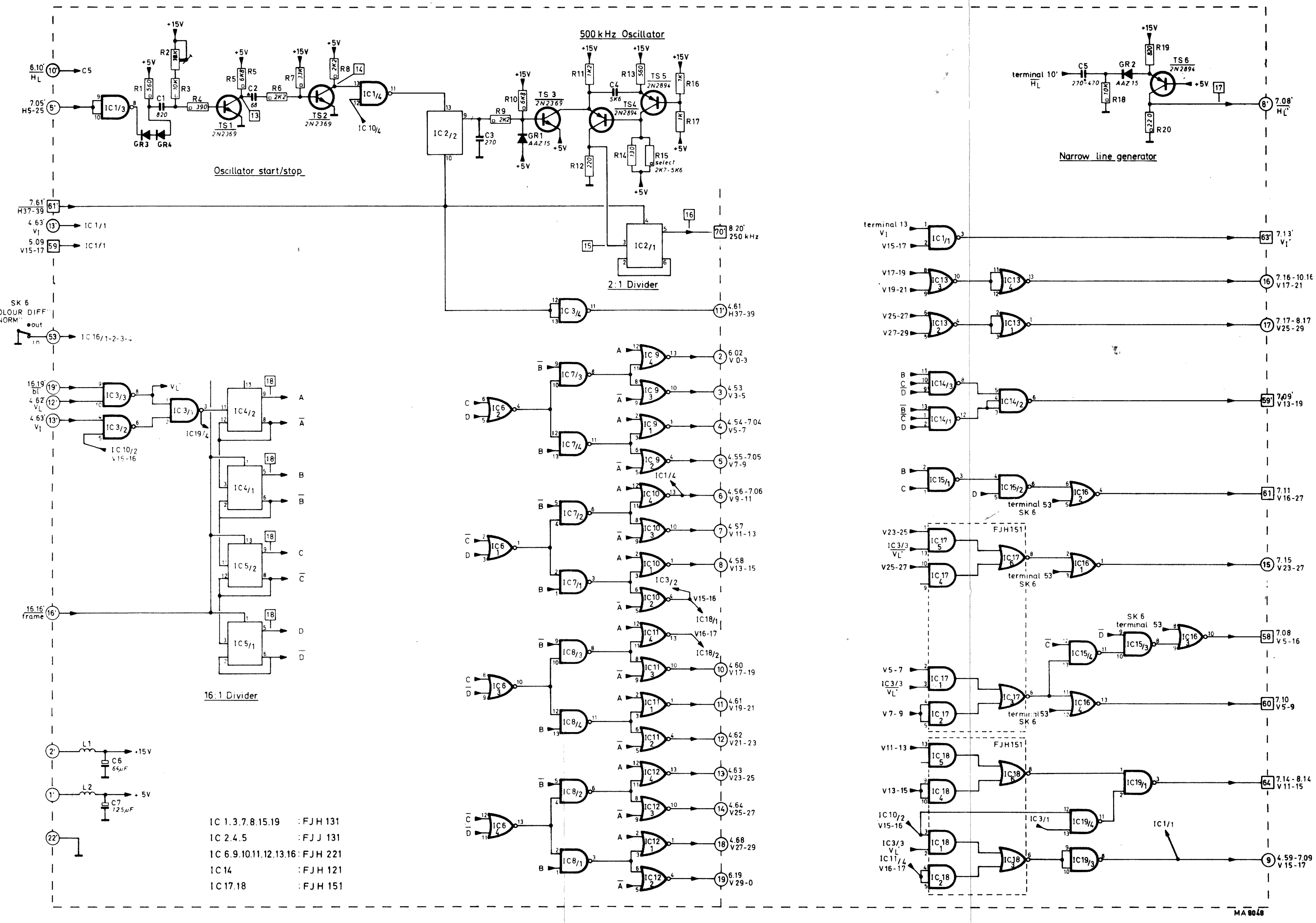


Fig. XVII-4. Circuit diagram, vertical decoder, unit 5

XVIII. Unit 6 Horizontal oscillator

This circuit consists of the horizontal oscillator with the necessary control circuits.
The horizontal oscillator is an emitter coupled multivibrator TS4 - TS5.

The frequency of the oscillator is approx. 630 kHz. The oscillator is supplying the clock pulses via the 2:1 divider IC4/2 to the "Horizontal dividers" in unit 7 as well as the vertical white lines of the raster (H_L) (via IC5), and via the 2:1 divider IC4/1 vertical bars for the top and the bottom castellations.
The start and the stop of the oscillator are controlled by the flip-flop IC2/2 (see also block diagram Fig. XVIII-1).

The line pulse $\overline{f_H}$ is triggering the one-shot oscillator TS1 – TS2.
This one-shot supplies a pulse $f_H + \Delta t$ (controlled by R6), which is setting the flip-flop at the positive step (Fig. XVIII-2b).

The 630 kHz oscillator is then started and supplies pulses to the "Horizontal divider" in unit 7.
When the horizontal divider has generated the H20-40 pulse, the "Clear generator" supplies a pulse to the flip-flop, which is stopping the oscillator (Fig. XVIII-2d + e).
The frequency of the oscillator is kept constant by means of the "frequency control circuit" (Fig. XVIII-3).

This circuit is operating as follows:

1. The frequency depends on the current applied by the current generator TS10-TS11. The current is adjusted by the setting of R41 and the mean value of the reference pulses applied to C11.
The reference pulses are generated by the flip-flop IC2/1. The clear pulse (osc. stop pulse) is setting and the line pulse ($\overline{f_H}$) is resetting the flip-flop. (Fig. XVIII-4d-f).
2. If f.inst. the oscillator frequency is too high (Fig. XVIII-4g) the clear pulse will appear earlier, and thus the reference pulse will be broader (Fig. XVIII-4f) and decrease the current to the oscillator, which will decrease the frequency.
Fig. XVIII-4i-k shows the pulses when the frequency is too low.
3. If the frequency is so low that the clear pulse will first appear after the following line pulse Fig. XVIII-5a-d, the IC2/1 will supply a very broad reference pulse (Fig. XVIII-5e), which will control the oscillator to an even lower frequency.
This is avoided by applying a clear pulse delayed by IC6/3+4 (Fig. XVIII-5f) to the Cp input of IC2/1, which then will supply a narrow pulse (Fig. XVIII-5k).

The delayed clear pulse is gated to IC2/1 via the IC7/1 (Fig. XVIII-5g-i) by means of the pulse (Fig. XVIII-5g) derived from the one-shot TS6-TS7.
This one-shot will only supply the pulse in case of very low oscillator frequency (Fig. XVIII-5l-o).

But before the reference pulses can control the frequency again the d.c. level of C11 must be restored.
This is also done by means of the pulses from the one-shot, which are clamping C11 to –10 V via IC3/3, TS8 and TS9.

This unit contains additionally the "Grey generator", which gives a signal limiting the grey background and the "Σ adder circuit".

The "Σ adder circuit" is adding the respective pulses to obtain the grid raster with the border castellations.

The adder is followed by two delay circuits to obtain full coincidence between the Σ signal and the other signals of the test patterns (see also checking and adjustment).

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g PHILIPS PM 3250.

After any adjustment in unit6, the adjustments in the units 3, 4 and 5 must be checked.

The width of the vertical gridlines

Connect the oscilloscope to terminal 20.
The width of each line should be 230 ±10 ns.
(M: version 280 ±10 ns).
If not, select another value of C6 (680 pF - 1.8 kpF), until a value is obtained as close as possible to the correct value.
Then "fine adjust" by means of selecting R22 (330 Ω - 680 Ω).

Note: The width is measured at 50 % of the peak amplitude.

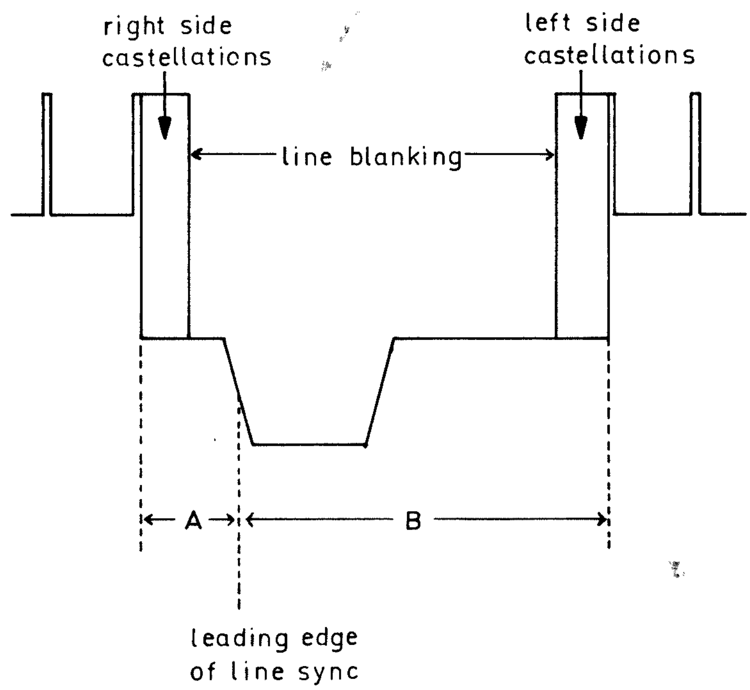
Start of the 630 kHz oscillator

Connect the oscilloscope to terminal 20.
Put the oscilloscope in pos.: 0.5 μs/div. -
delay : ≈ 66 μs (10 μs x 6.60).
The black/white castellation in the left side of the picture should have a width according to the figure on the next page.
In case of deviation, adjust R6 until the correct width is obtained.

The frequency of the 630 kHz oscillator

Connect the A amplifier of the oscilloscope to terminal 20 and the B amplifier to BU8 "Sync" input.
Trigger ext. with pulse $\overline{f_H}$ (e.g. terminal 17).
Put the oscilloscope in pos.: 0.5 μs/div. -
delay : ≈ 52 μs (10 μs x 5.20).
The black/white castellation in the right side of the picture should have a width according to the figure on the next page.
In case of deviation, adjust R41 until the correct width is obtained.
Check that the current in TS10a is equal to the current in TS10b (equal voltage across R34 and R35).
If not, the procedure given below must be followed.

1. Select C3 (0 - 47 pF) until the currents in TS10a and TS10b are equal.
2. Put R41 into its middle position.
3. Select R44 (56 Ω - 220 Ω) until the distance A in the figure below is as correct as possible.
4. Fine adjust R41 until exact timing is obtained.
5. Check that the distance B is correct (oscillator start).



Numbers of lines in the supplied **field** blanking	Position of grid related to leading edge of sync(μs) — G version		Position of grid related to leading edge of sync(μs) — M version	
	left B	right A	left B	right A
18	12.75	3.75	12.36	4.36
19	12.67	3.67	12.26	4.26
20	12.59	3.59	12.16	4.16
21	12.50	3.50	12.07	4.07
22	12.42	3.42	11.47	3.97
23	12.34	3.34	11.87	3.87
24	12.26	3.26	11.77	3.77
25	12.17	3.17	11.67	3.67

Without the first and last white line in the grid

When changing to another width of the supplied **field** blanking following other adjustments must be carried out:

Unit 3 : oscillator frequency, start I and start II pulses

Unit 4 : vertical position

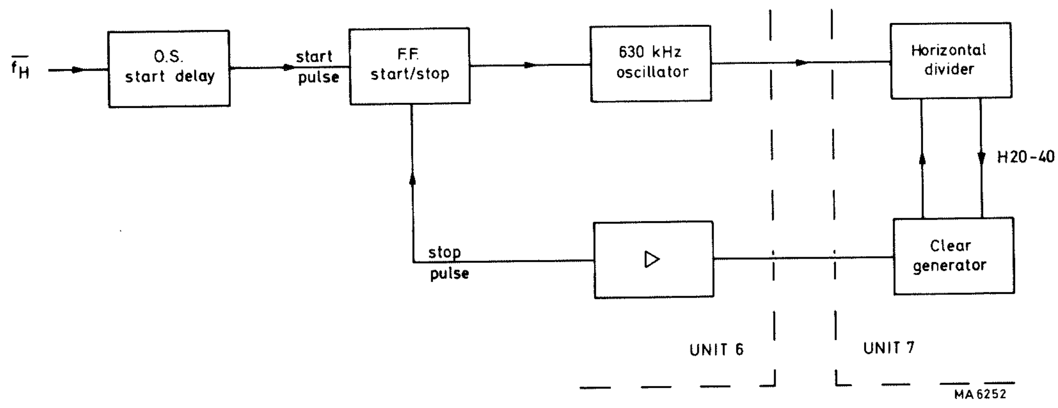


Fig. XVIII-1. Block diagram, horizontal oscillator

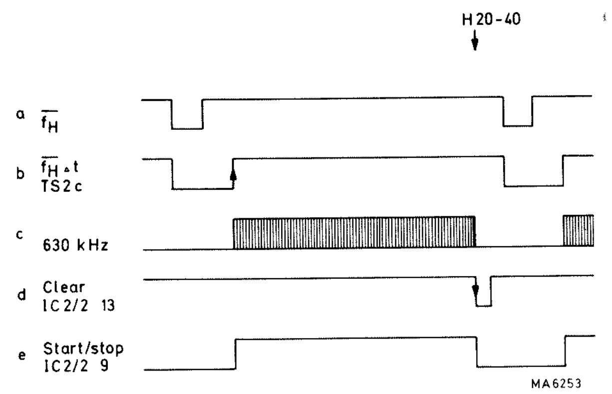


Fig. XVIII-2. Pulse diagram, start-stop pulses for horizontal oscillator

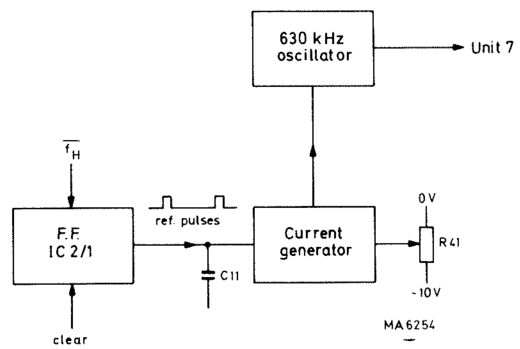


Fig. XVIII-3. Block diagram, frequency control circuit

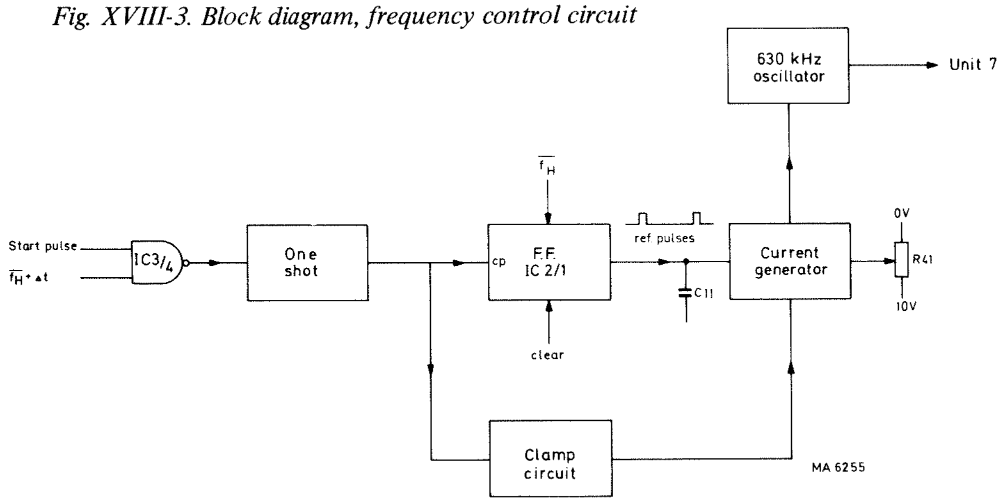


Fig. XVIII-3a. Block diagram, frequency control circuit

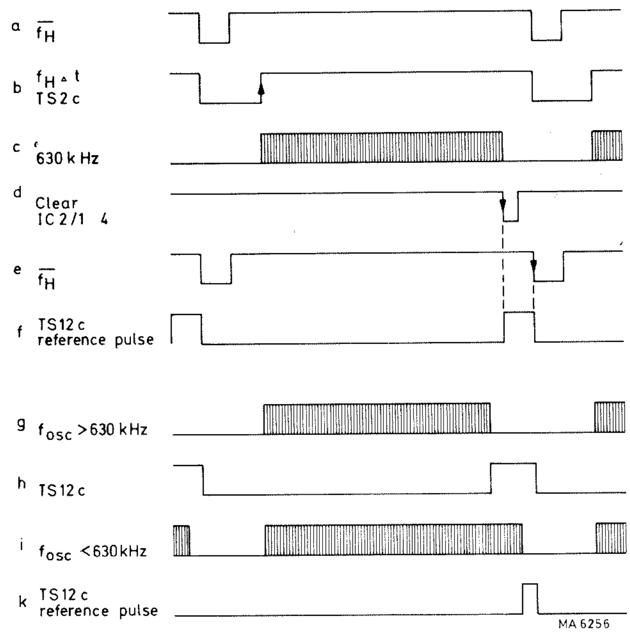


Fig. XVIII-4. Pulse diagram, frequency control pulses

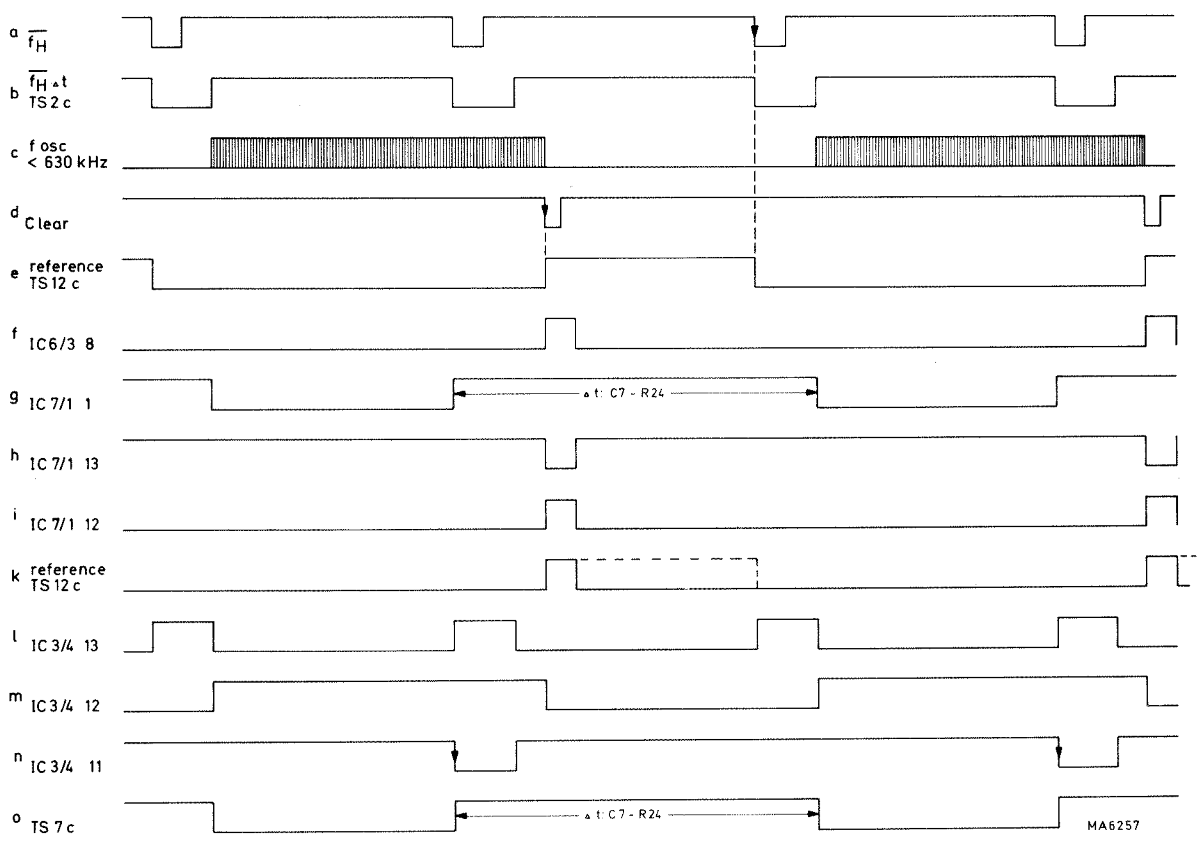
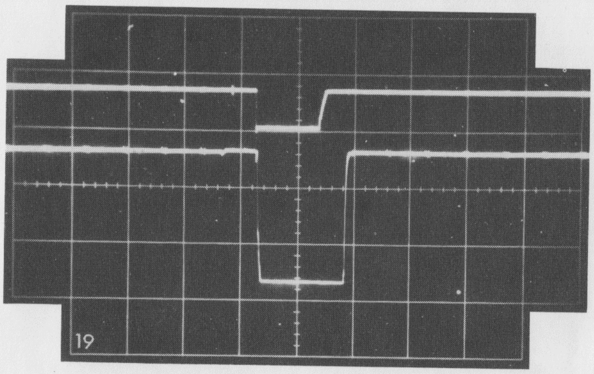
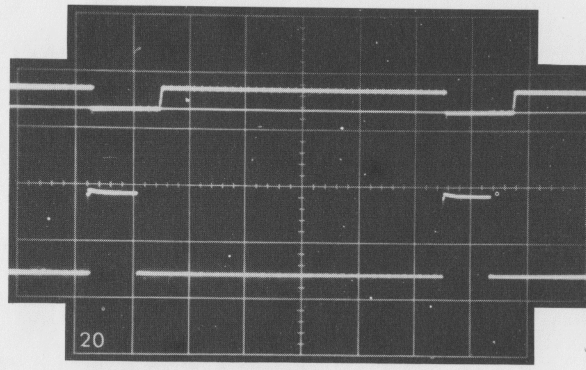


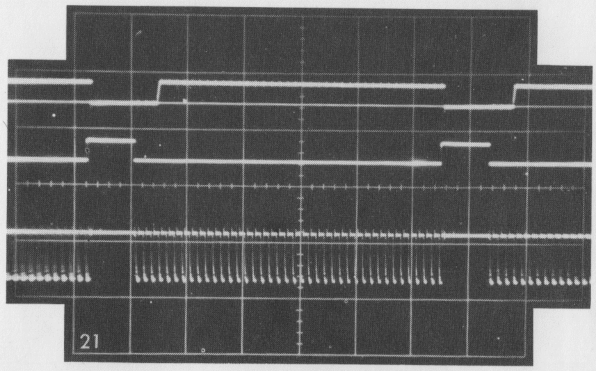
Fig. XVIII-5. Pulse diagram, frequency control pulses



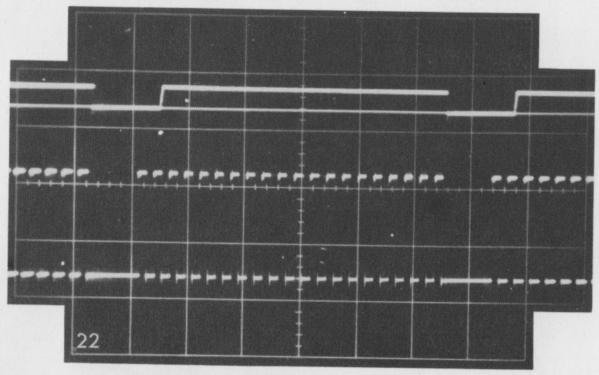
2 V/div. 4 μs/div.
Ref.: $\overline{f_H}$



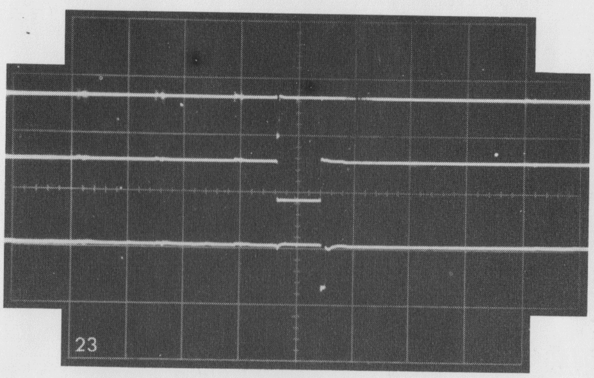
10 V/div. 10 μs/div.
Ref.: $\overline{bl}$



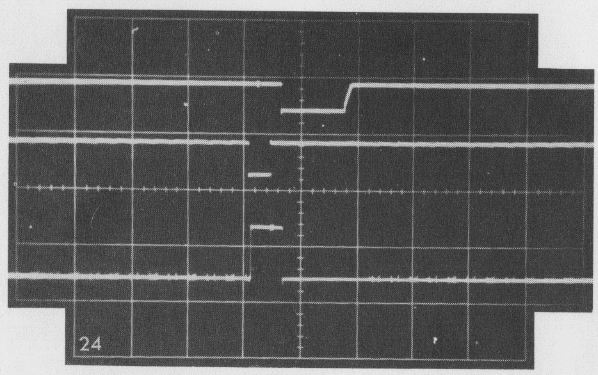
5 V/div. 10 μs/div.
Ref.: $\overline{bl}$ and TS3c



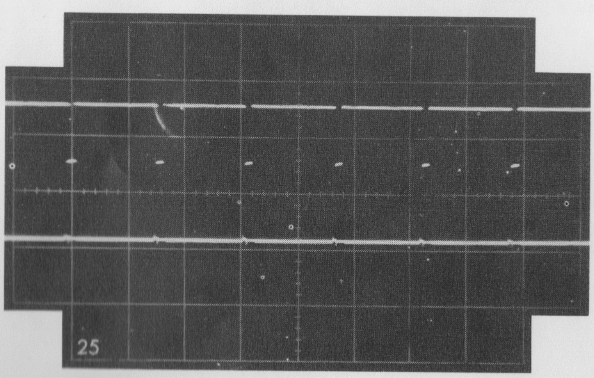
2 V/div. 10 μs/div.
Ref.: $\overline{bl}$



5 V/div. 2 μs/div.
IC6/2-5, IC6/1-3 and IC6/3-8



5 V/div. 4 μs/div.
Ref.: $\overline{f_H}$ and IC2/1-4



5 V/div. 40 μs/div.
(d.c. at –4 V)
Ref.: $\overline{f_H}$

Fig. XVIII-6. Oscillograms, unit 6

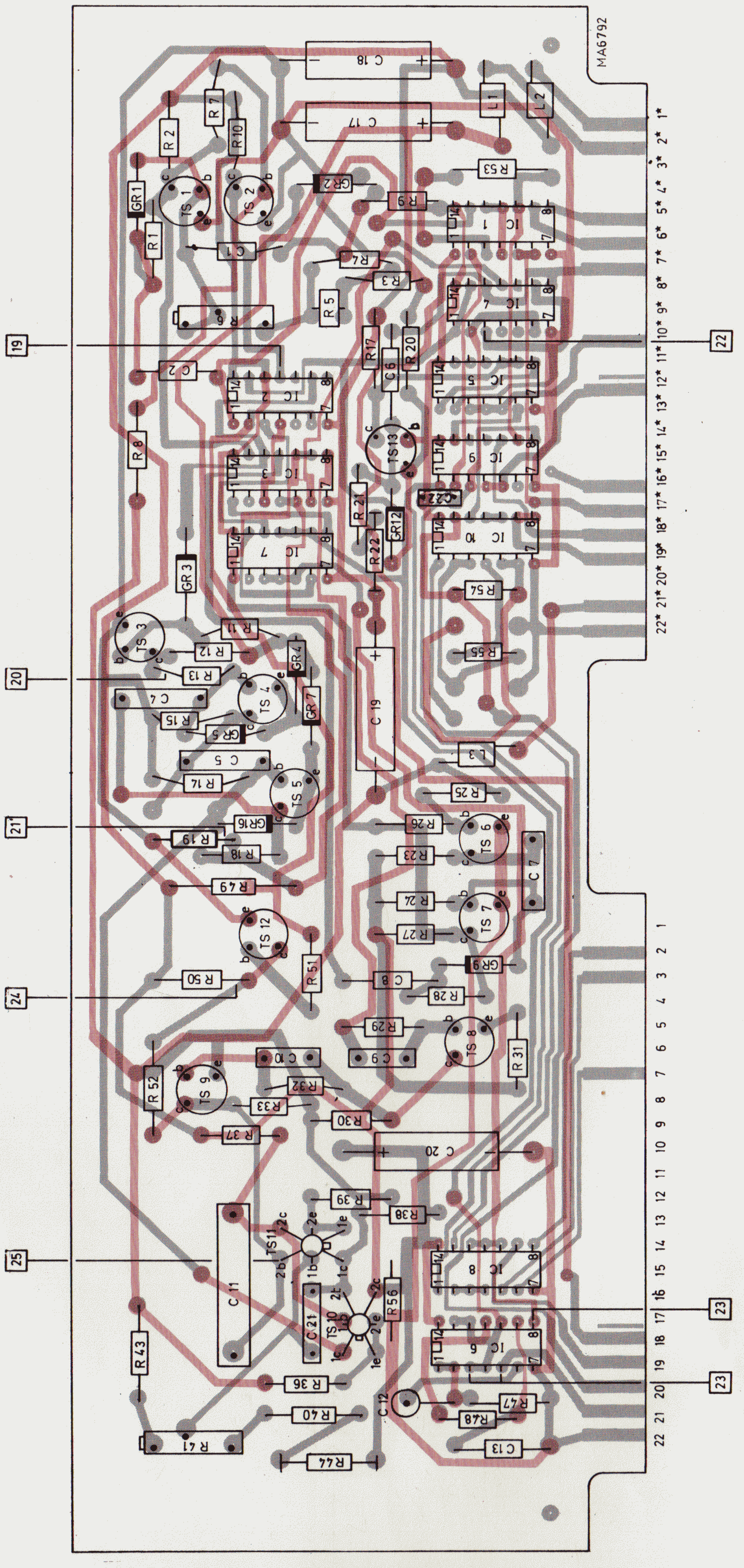


Fig. XVIII-7. Printed wiring board, horizontal oscillator, unit 6

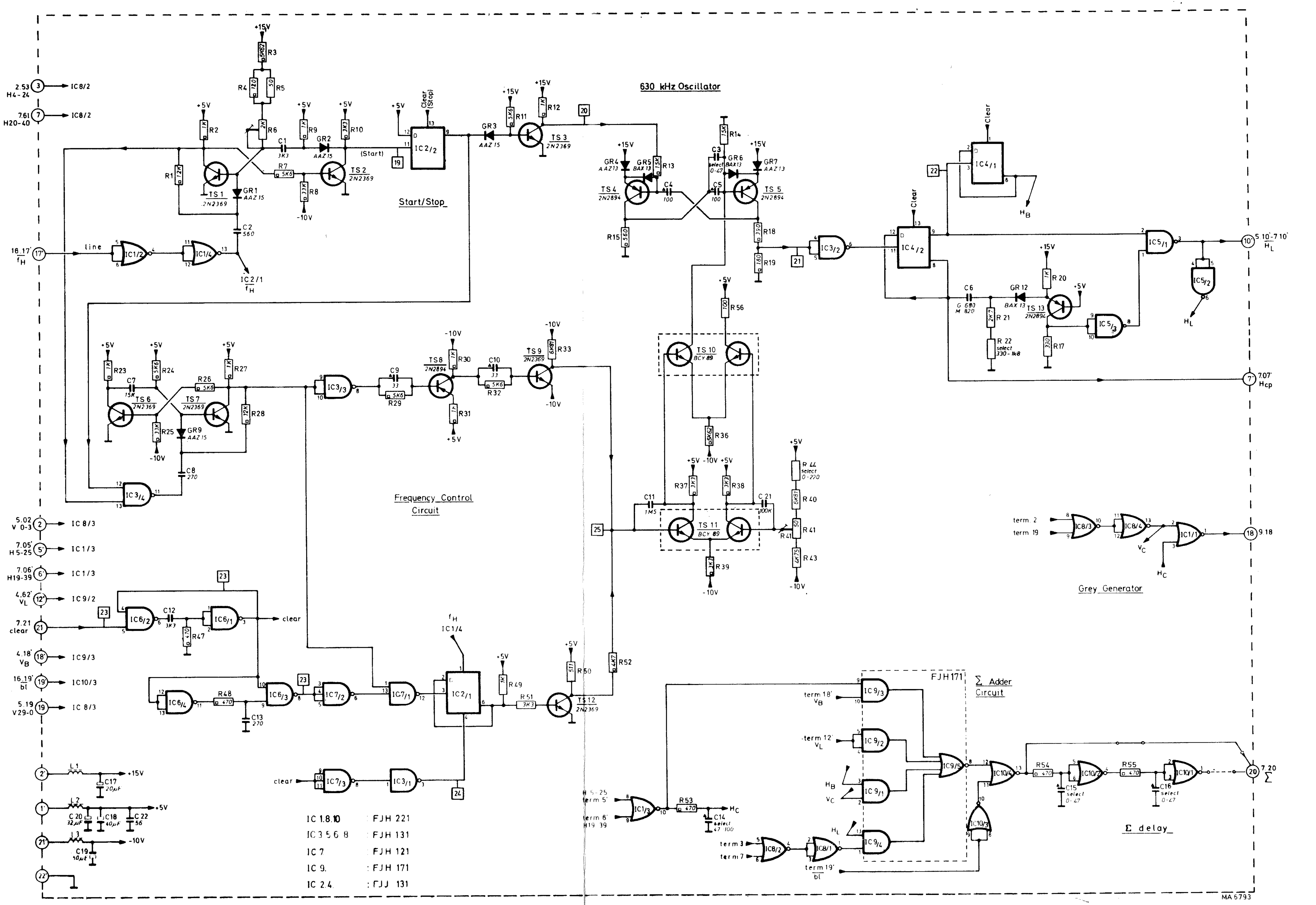


Fig. XVIII-8. Circuit diagram, horizontal oscillator (M-version), unit 6

N.B. From serie /05 a capacitor 220 μF C22 is added between IC4/1-6 and +5 V

XIX. Unit 7 Cross gate

This unit consists of the horizontal dividers supplying the horizontal basic pulses, the gate generators supplying the gate signals for the field colour information, and the gates which supply black and white information for the circle signal.

The "Horizontal dividers I and II" are Johnson counters counting the clock pulses Hcp from unit 6. The dividers are triggered by the positive steps of the pulses. As the pulses from the divider II should be started at the negative steps, the clock pulses to this divider have to be inverted by IC11/1+2. The dividers supply the pulses H1-21, H2-22, H3-23.....H20-40 (see pulse diagram for the "Horizontal dividers" Fig. XIXI-1).
The last pulse H20-40 is applied to the "Clear generator" IC12, supplying a clear pulse (Fig. XIX-2), which is used for setting of the dividers and to stop the 630 kHz oscillator in unit 6.

The gate generators, which control the above mentioned signals, are combining the pulses from the horizontal dividers with the pulses applied from the vertical decoder (unit 5).
The " Σ Gate" IC13/2 is a part of "Grey/field gate" in unit 9.
When SK6 "COLOUR DIFF.NORM." is depressed, the luminance gate signal δ is generated.
This signal is also applied to IC13/2 to make space for the colour difference signals.

Checking and adjusting

Measuring equipment:
Bl/Wh monitor : e.g PHILIPS LDH2110

The yellow-red-yellow transient

Connect the monitor to BU7 "Y-OUTPUT".
The red square in the bottom of the circle should be placed symmetrically with respect to the white vertical grid lines (Fig. XIX-3).
If not, select another value of C2 (39 - 82 pF).

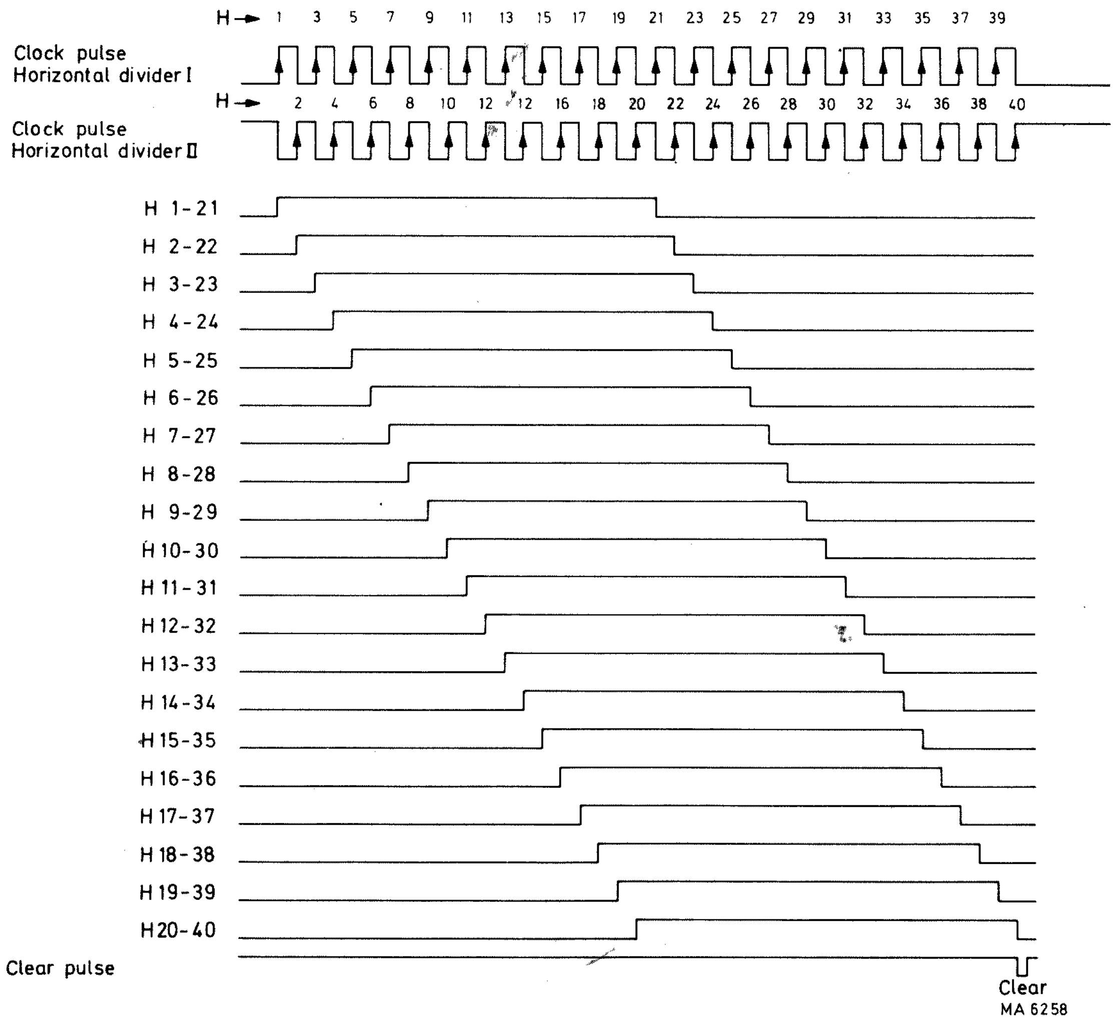


Fig. XIX-1. Pulse diagram, horizontal dividers

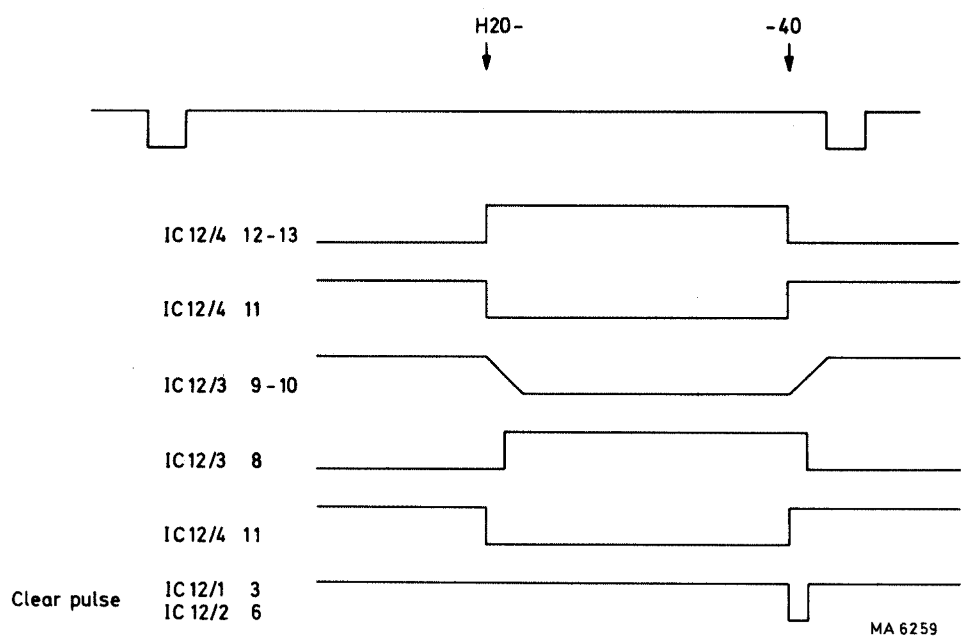


Fig. XIX-2. Pulse diagram, clear generator

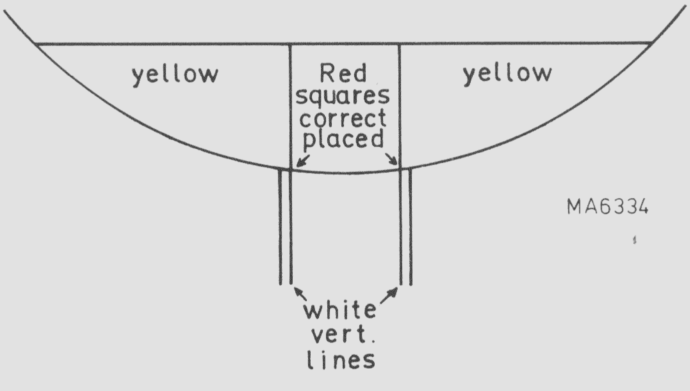
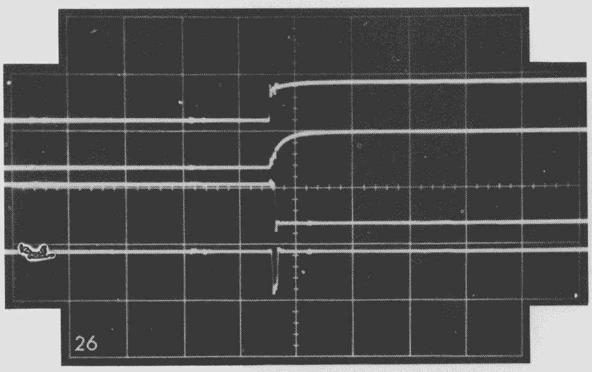


Fig. XIX-3. Survey of the yellow red yellow transient



5 V/div. 1 μs/div.

Fig. XIX-4. Oscillogram, unit 7

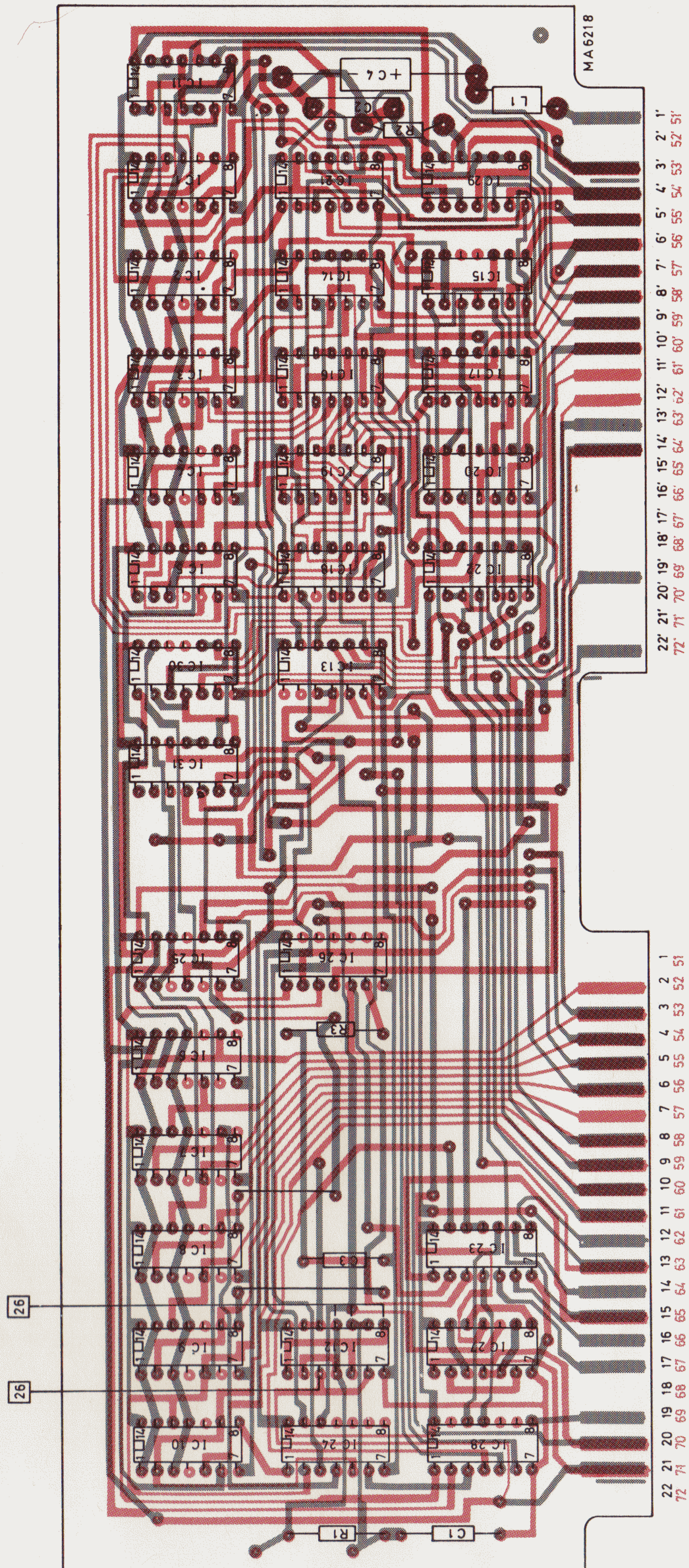


Fig. XIX-5. Printed wiring board, Cross gate, unit 7

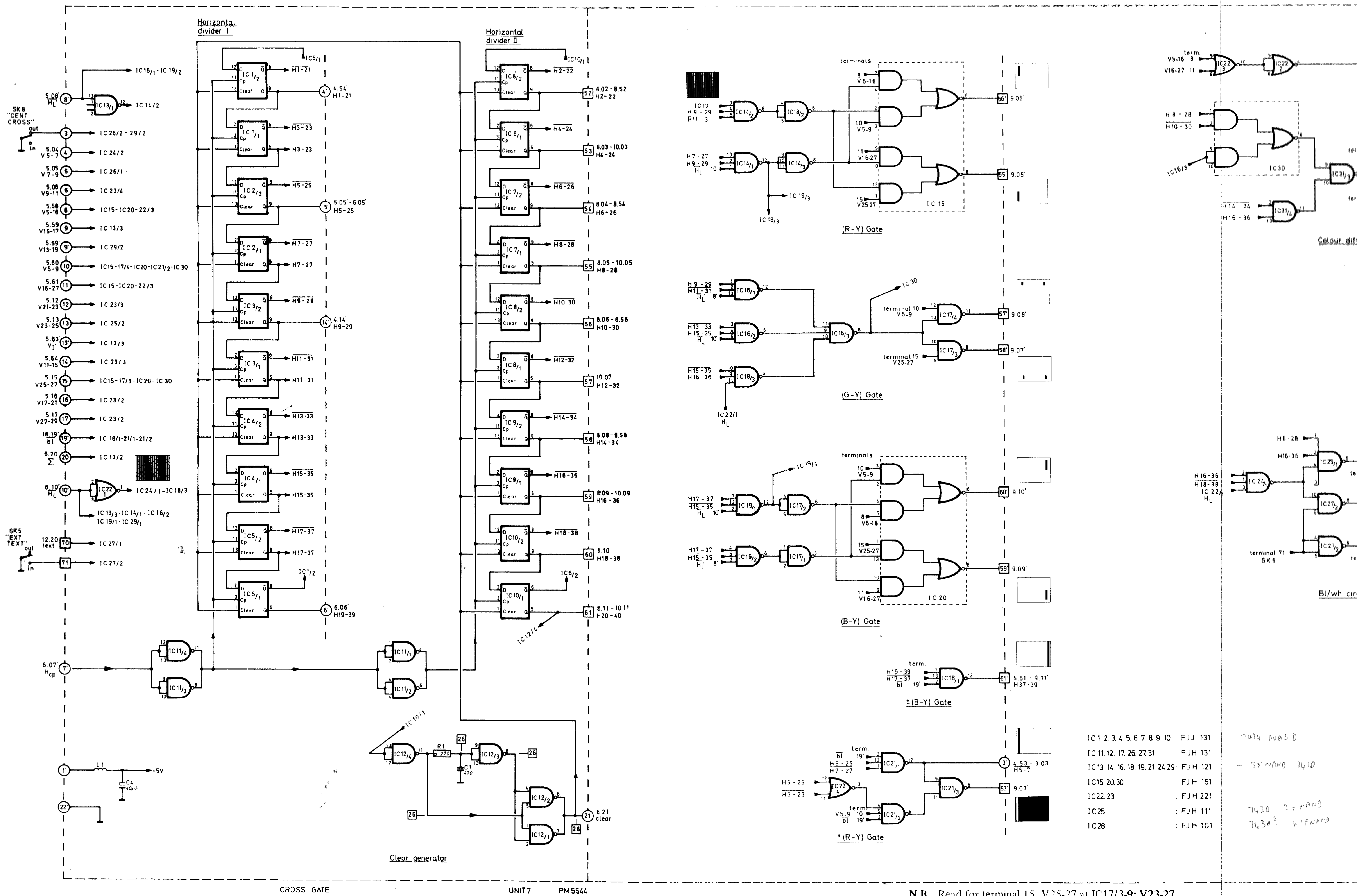
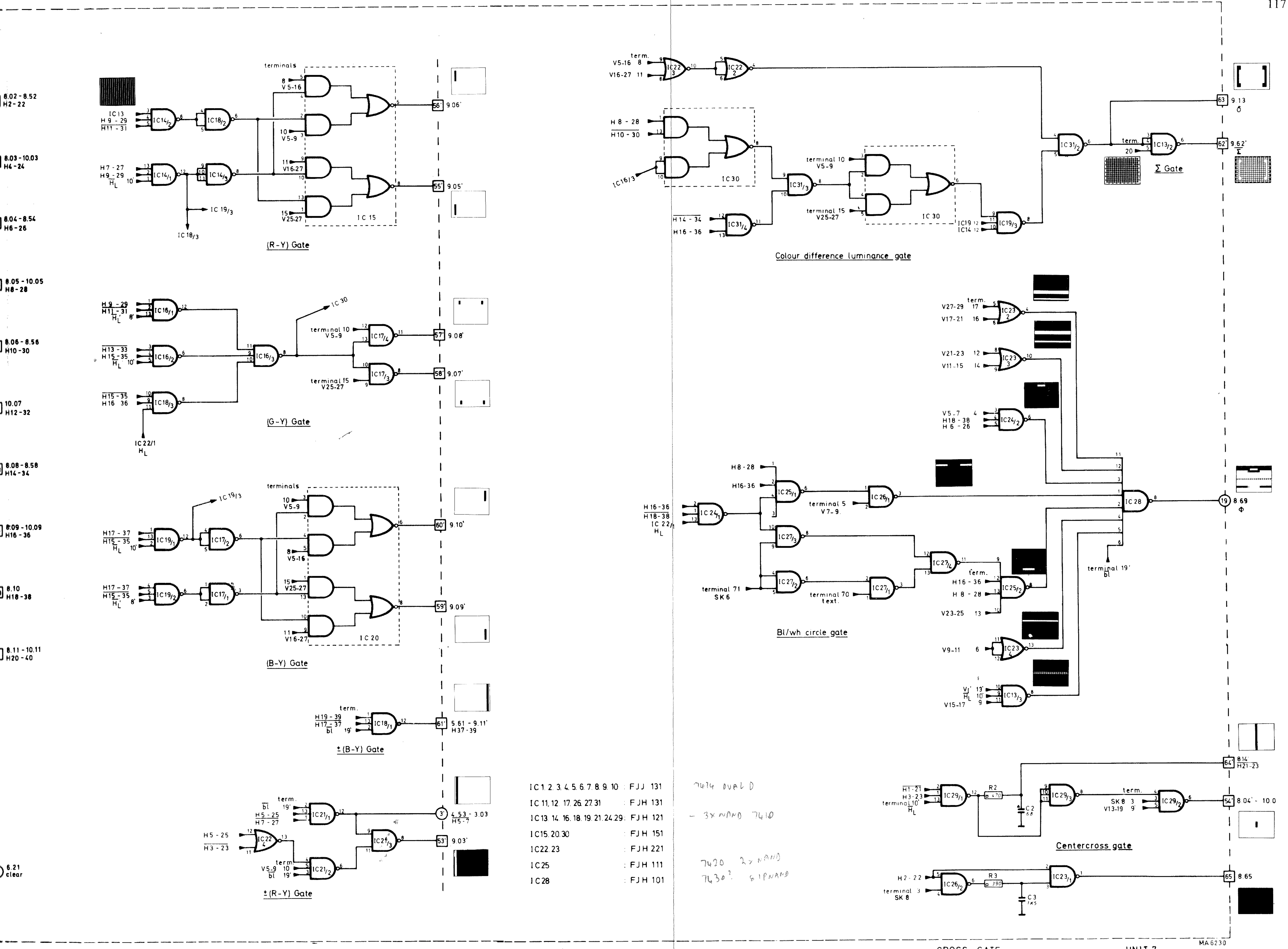


Fig. XIX-6. Circuit diagram, Cross gate, unit 7

N.B. Read for terminal 15 V25-27 at **IC17/3-9; V23-27**
Connection IC22/1-1 and IC14/1-12 to IC18/3 is omitted
Instead IC18/3-11 is connected to IC13/1.



N.B. Read for terminal 15 V25-27 at IC17/3-9; **V23-27**
Connection IC22/1-1 and IC14/1-12 to IC18/3 is omitted
Instead IC18/3-11 is connected to IC13/1.

XX. Unit 8 Circle matrix

This unit consists of:

The "Y adder" adding the signals placed inside the circle.
The "Colour gate" supplying the gate pulses for the colour bars, the colour steps and the 250 kHz blocks.
The "Staircase Generator".
The "Centercross adder".

The signals applied to the "Y adder" are as follows:

1. The Definition lines (unit 10) via TS1.
   The frequency characteristic can be adjusted by means of C11.
2. The black and white information (unit 7).
   This signal consists of all the black and white signals of the circle except the 250 kHz blocks. When SK8 "CENTER CROSS" is pressed the vertical line of the center cross (gated out by IC2/2) is added to the black white signal by IC2/1.
   The complete bl/wh signal is applied to the "Y adder" via the amplitude controlled amplifier TS2 (controlled by R21).
3. The staircase signal.
   This signal, which is applied to the "Y adder" via TS3, can be adjusted to be either a 5, 6 or 10 levels staircase (depending on the connections between the soldering tags a, b and c at the base of TS3).
   The staircase generator (f. inst. the 5 levels) is operating as follows:
   The gates, which are active in this case, are IC5/4, IC5/1, IC6/4 and IC6/2.
   The gates are supplied with respectively the $\overline{\text{H16-36}}$, $\overline{\text{H20-40}}$, H4-24 and H8-28 pulses.
   With these pulses the gates produce an output as shown in Fig. XX-1a.
   The resistors R3, R7, R11 and R15 form a voltage divider, which is controlled by the gates (Fig. XX-1c).
   Fig. XX-1b shows the resulting staircase, which is applied to TS3.
4. The colour bar luminance, the colour step luminance and the 250 kHz blocks.
   These signals are controlled by the gate pulses supplied from the IC9/2, IC1/2 and IC9/1 (see Fig. XX-2).
   The gate signals for the colour signals are obtained by combining the pulses applied to the gate groups, while the 250 kHz is generated in unit 5.
   The 250 kHz signal is applied to the colour gate in order to obtain that the contrasts of the colours and the 250 kHz are exactly the same (75 %). This is important in part of an adjustment of a receiver.

The B, G, R gate signals are applied to the "Y matrix" via TS7, TS13 and TS18.
R33, R41 and R51 are the matrix resistors.
Besides the "Y matrix" supplying the Y signal to the "Y adder"; this part of the circuit consists of the (B-Y) and (R-Y) matrix.
The (B-Y) matrix TS10 is adding the B signal (via TS9) to the -Y signal (inverted by TS8).
The (R-Y) matrix TS15 is adding the R signal (via TS14) to the -Y signal.
TS7, TS9, TS13, TS14 and TS18 are amplitude regulated amplifiers controlled by R42 (adjusted to 75 % contrast).

The Y signal from the "Y adder" and the colour difference signals are applied to the mixer stages in units 11 and 13 via the respective clamp circuits TS5, TS12 and TS17.

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3250

The B-Y matrix

Connect the oscilloscope to teminal 10'.
Trigger ext. with pulse: $\overline{\text{field}}$ (e.g. terminal 16' - unit 6).
Put the oscilloscope in pos.: 20 μs/div. -
delay : ≈ 6 ms (2 ms x 3.25).

The content of 250 kHz black/white squares should be a minimum.
If not, adjust R38.
Possible rest spikes at the signal could be removed by selecting C2 (15 - 56 pF).

The R-Y matrix

Connect the oscilloscope to terminal 11'.
Trigger ext. with pulse: $\overline{\text{field}}$ (e.g. terminal 16' - unit 6).
Put the oscilloscope in pos.: 20 μs/div. -
delay : ≈ 6 ms (2 ms x 3.25).
The content of 250 kHz black/white squares should be a minimum.
If not, adjust R48.
Possible rest spikes at the signal could be removed by selecting C4 (15 - 56 pF).

The amplitude response of tne definition lines

Connect the oscilloscope to BU7 - "Y-OUTPUT".
Trigger ext. with pulse: $\overline{\text{field}}$ (e.g. terminal 16' - unit 6).
Put the oscilloscope in pos.: 10 μs/div. -
delay : ≈ 12 ms (2 ms x 6.0).
The amplitude of the definition lines should all be at the same level.
If not, readjust C11.

Common adjustments (see Service Instructions, page 53)

1. Black/white amplitude inside the circle

Connect the oscilloscope to terminal 60.
Trigger ext. with pulse: $\overline{\text{field}}$ (e.g. terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : ≈ 15 ms (2 ms x 7.35).
Adjust by means of R21, until the amplitude of black/white inside the circle is equal to the amplitude of the staircase-signal.

2. 75 % white in the circle information

Connect the oscilloscope as under point 1.
Put delay in pos.: 6 ms (2 ms x 3.0).
Adjust by means of R42, until the amplitude of the 250 kHz signal is 75 % of the white square, just above the 250 kHz signal.

3. Clamp level in the circle

Connect the oscilloscope to terminal 4 - unit 11B.
Trigger ext. with pulse: field (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : ≈ 15 ms (2 ms x 7.35).
Adjust R54 until the black level inside the circle is equal to the black level outside the circle.

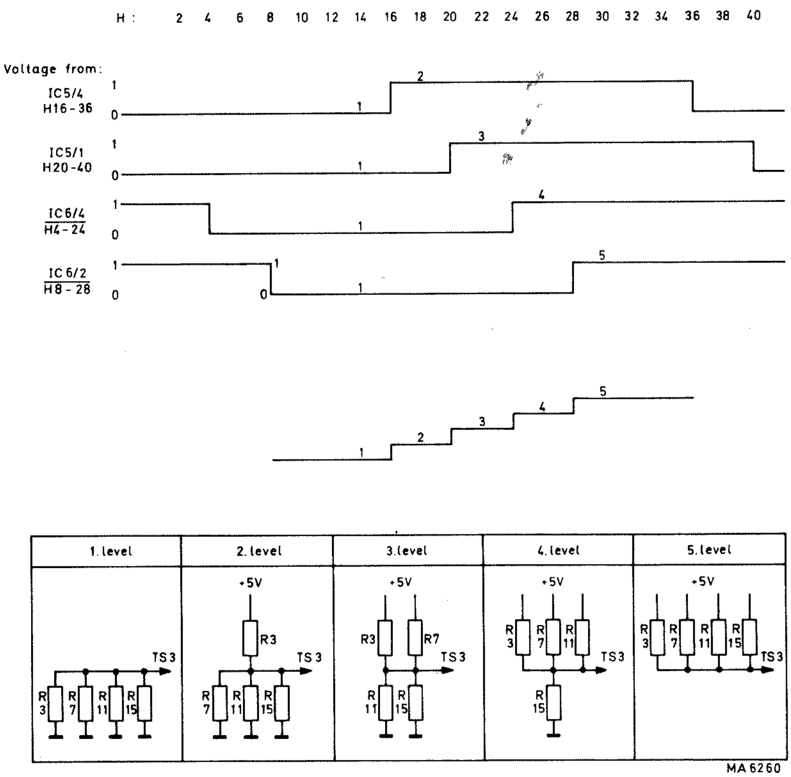


Fig. XX-1. Survey of the staircase signal

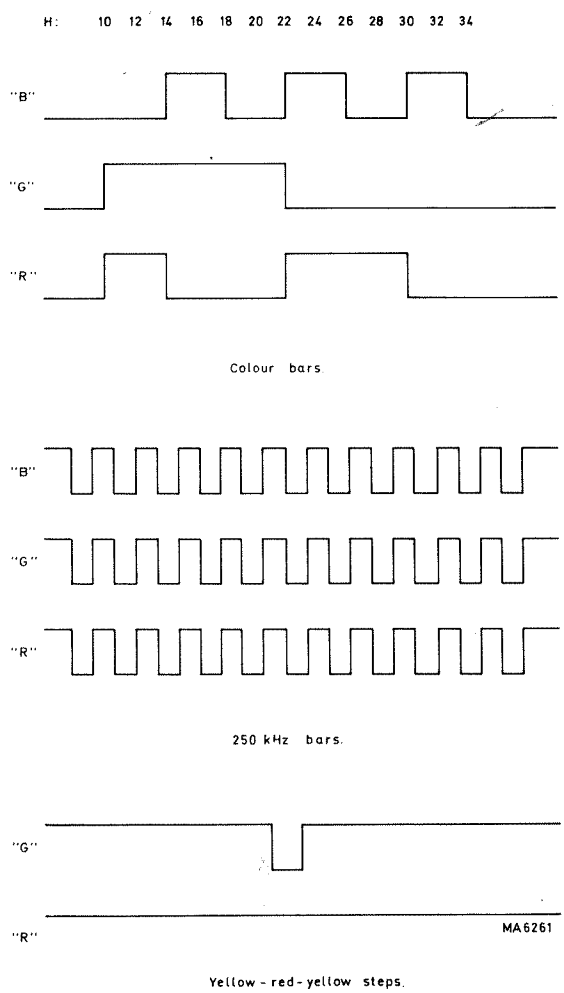
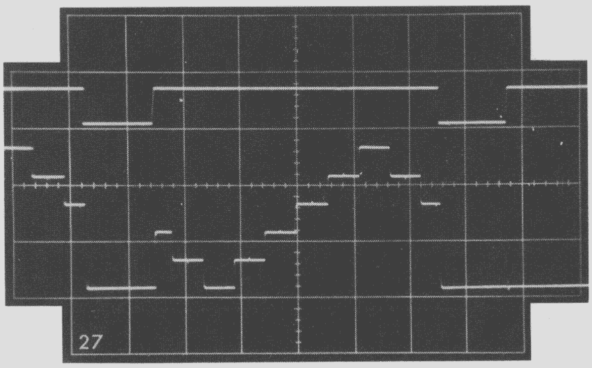
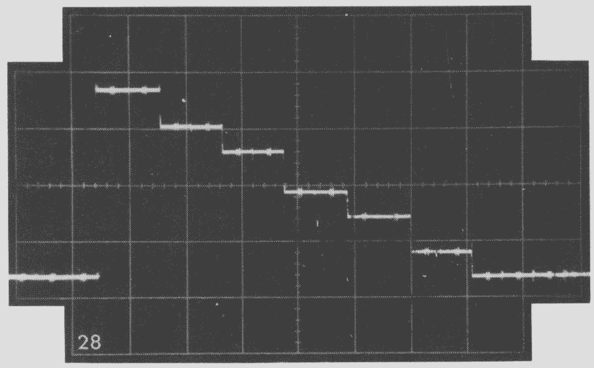


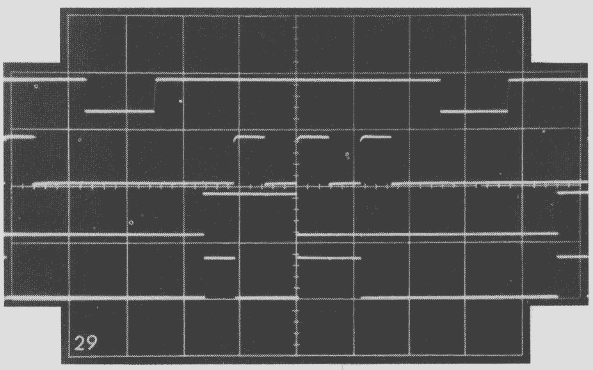
Fig. XX-2. Pulse diagram, colour bars



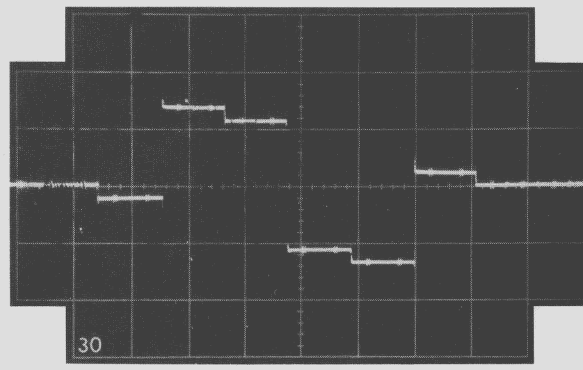
2 V/div. 10 μs/div.
Ref.: $\overline{bl}$



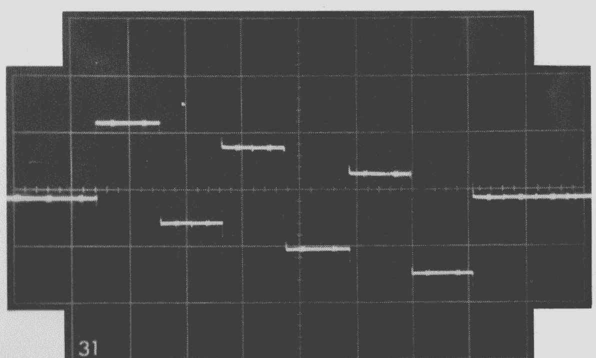
0.5 V/div. 5 μs/div.
Y



5 V/div. 10 μs/div.
(B-G-R)
Ref.: $\overline{bl}$



1 V/div. 5 μs/div.
– (R-Y)



1 V/div. 5 μs/div.
– (B-Y)

Fig. XX-3. Oscillograms. unit 8

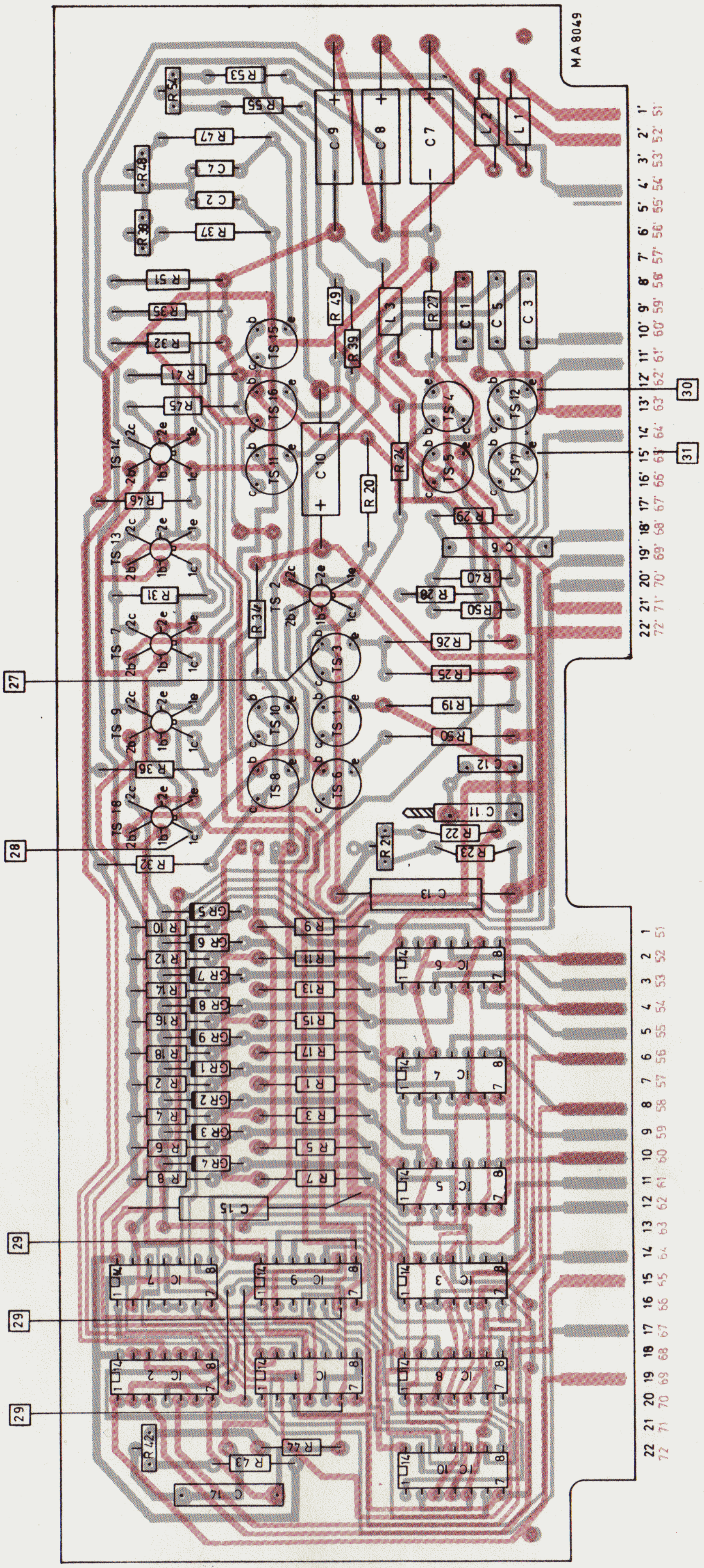


Fig. XX-4. Printed wiring board, circle matrix, unit 8

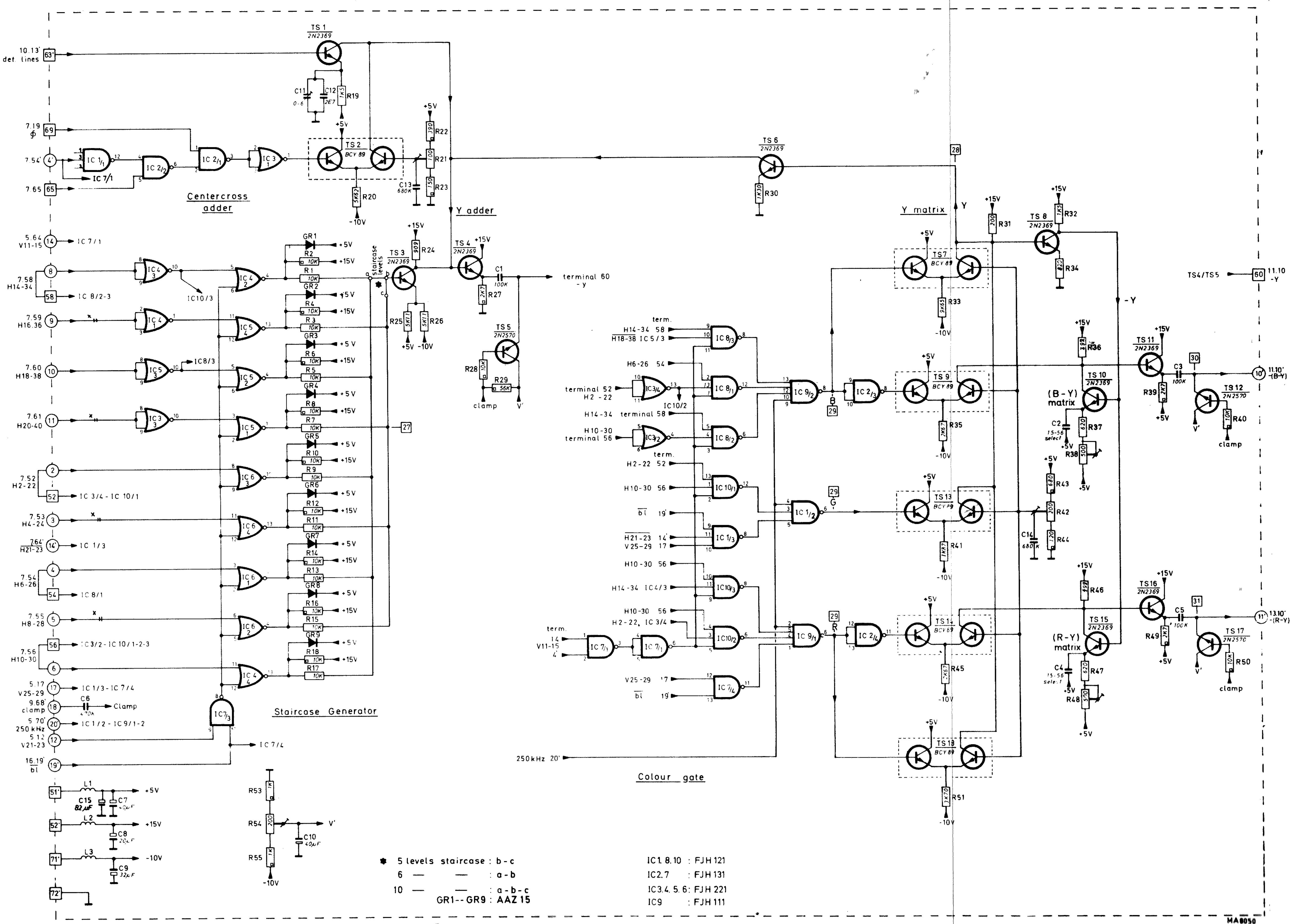


Fig. XX-5. Circuit diagram, circle matrix, unit 8

N.B. For 5-step staircase disconnect leads marked with XX.

XXI. Unit 9 Grid matrix

This unit consists of the generators for the colour information outside the circle, the luminance circuits for the background and the above mentioned colour signals.

The colour information is controlled by the gate signals applied to the transistors TS1 - TS6 and TS9 - TS14 (see the figures in the diagram).
These transistors operate in principle as small digital-analog converters, the outputs of which depend on the emitter resistance.
The (R-Y) and (B-Y) ALT signals are supplied by respectively TS5-TS6 and TS13-TS14 (positive phase by TS5 and TS14 and inverted by TS6 and TS13).
When SK7 "ALT" is pressed, IC4/3 and IC2/2 will let the $f_H/2$ signal (f_H divided by 2 by the binary divider IC3/1) pass on to the IC1/4, IC2/4 and IC2/1, IC4/4, which in turn will open for TS5, TS14 and TS6, TS13.
TS7 and TS15 are buffers which supply the signal to the mixer stages in units 11 and 13 via the clamping circuits TS8 and TS16.

The luminance of the grey background is dependent on the current in the transistors TS20 - TS21.
TS21 is a constant current generator controlled by the potentiometer R1 "GREY VALUE" on the front plate.
The left side of the transistor TS20 is supplied with signals which should be suppressed in the grey background, as these signals have a deviating luminance value.

The signals are:

1. The frame of the border castellations. This signal is applied via IC5/1+2+4.
2. The area of the colour difference signals (when SK6 "COLOUR DIFF.NORM." is activated). This signal is also applied via IC5/1+2+4.
3. The circle area (when SK2 "GRID ONLY" is released) and the grid. These signals are applied via IC6/1+4 and IC5/4.

The luminances of the colour difference signals depend on the current in TS23.

The background luminance, the grid signal (within or without the circle) and the colour difference luminance are added across R37-R49 and applied to the mixer circuits in unit 11 via TS24 and the clamping circuit TS25.

Checking and adjusting

For adjustments in this unit see section: Common adjustments.(see Service Instructions, page 53)

4. Black/white amplitude outside the circle

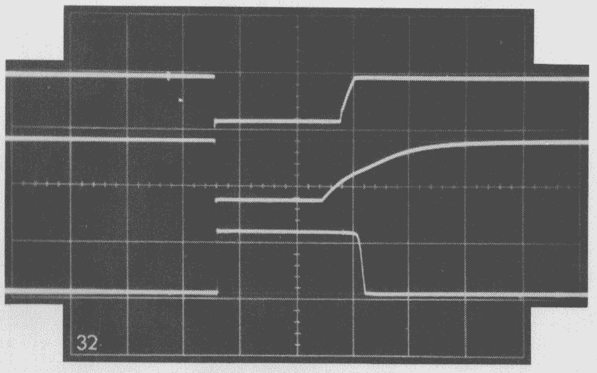
The oscilloscope should be put into the same position and connected to the same terminal as under point 3.
Adjust R49 until the amplitude of the Y signal outside the circle is equal to the amplitude of the staircase inside the circle.

5. R-Y amplitude outside the circle

Connect the oscilloscope to terminal 11' - unit 8.
Adjust the sensitivity of the oscilloscope until the R-Y content inside the circle has an amplitude of 2.7 $V_{p\text{-}p}$.
Connect the oscilloscope to terminal 55' (unit 9).
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Adjust R46 until the R-Y signal outside the circle has an amplitude of 1.38 $V_{p\text{-}p}$.

6. B-Y amplitude outside the circle

Connect the oscilloscope to terminal 10' - unit 8.
Adjust the sensitivity of the oscilloscope until the B-Y content inside the circle has an amplitude of 2.7 $V_{p\text{-}p}$.
Connect the oscilloscope to terminal 56' (unit 9).
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Adjust R47 until the B-Y signal outside the circle has an amplitude of 1.94 $V_{p\text{-}p}$.



5 V/div. 2 µs/div.
Ref.: $\overline{f_H}$

Fig. XXI-1. Oscillogram, unit 9

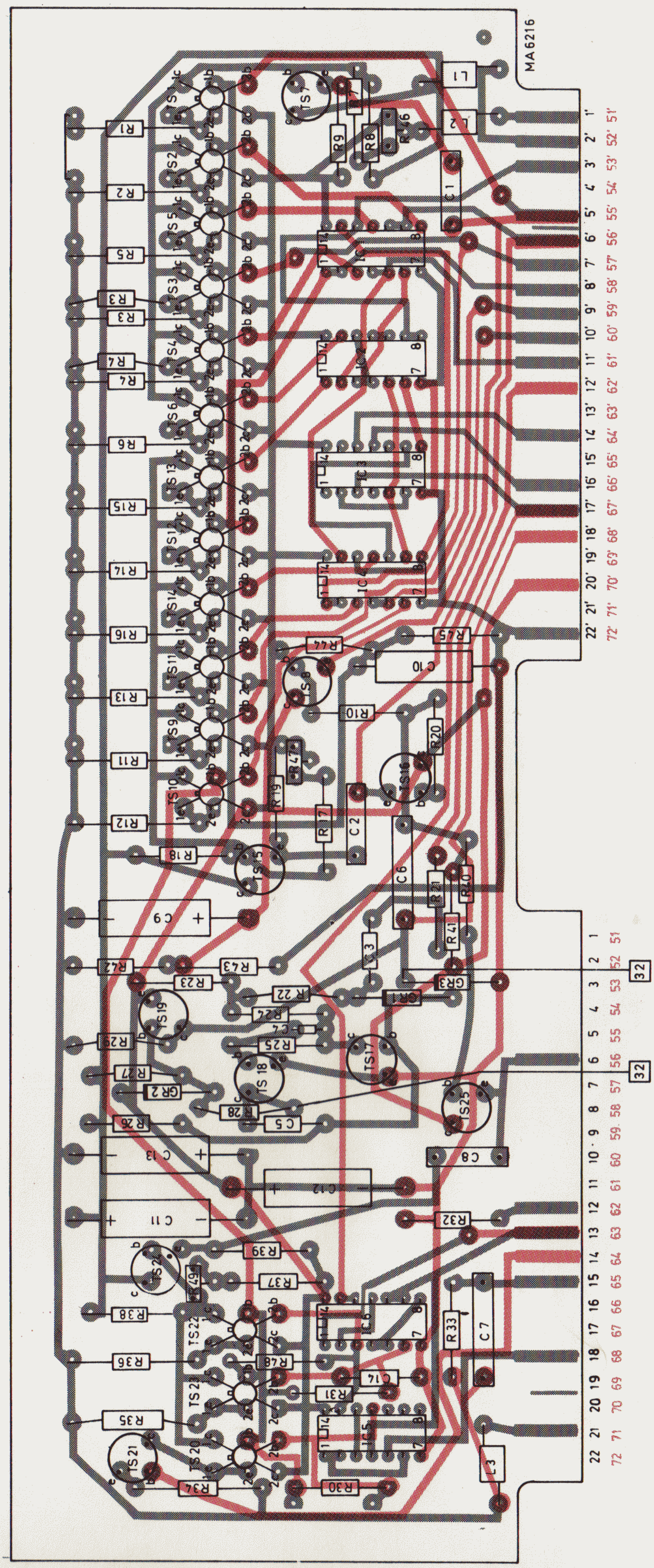
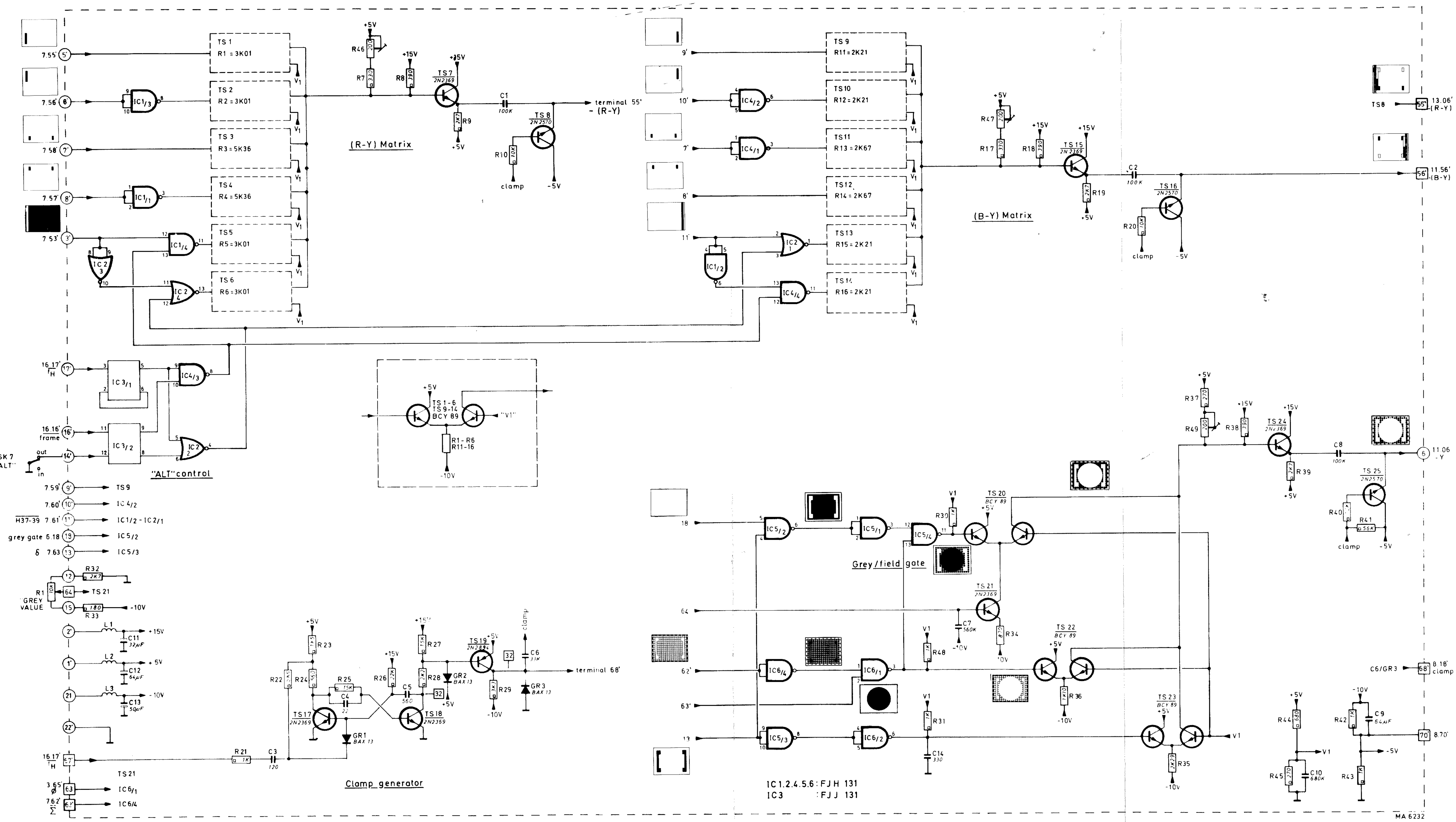


Fig. XXI-2. Printed wiring board, Grid matrix, unit 9



N.B. All matrix resistors R1-6, R11-16, 35, 36 changed to 1/4 %
R7 and R17 changed to 332 Ω, 1 %
R8 and R18 changed to 392 Ω, 1 %
From /05-version onwards C10 changed to 150 μF, 6.3 V

Fig. XXI-3. Circuit diagram, Grid matrix, unit 9

XXII. Unit 10 Definition lines

This unit consists of a triangular wave generator, which supplies the definition lines via the "Sine shaper". The frequency of the oscillator is controlled by the "Frequency control" circuit.

The triangular wave generator

The working principle of the triangular wave generator can be explained with the aid of the simplified diagram Fig. XXII-1.
Capacitor C1 is alternately charged, positively via TS4 and negatively via TS6.

To secure a linear charging of C1 and thus a correct triangular wave signal, the charging is controlled by two constant current generators:

TS4 which control the positive charging and
TS9-11 which controls the negative charging.

The on and off switching of TS4 and TS6 respectively is controlled by the tunnel diode GR1 in connection with the feedback circuit (TS12, TS14-18), which for the sake of simplificity here is drawn by one transistor.

The working principle is as follows:
Supposing the capacitor C1 becomes positively charged via TS4, the current through TS12, TS14-18 will increase and thus the current through the tunnel diode GR1.
Due to the characteristic of the tunnel diode (Fig. XXII-2) the voltage across the diode will follow the curve up to point A.

With increasing current through the diode (> 10 mA) the voltage across the diode will suddenly jump from point A to B.
This voltage jump is sufficient to drive TS6 into saturation.

TS5 and consequently TS4 are then cut-off, capacitor C1 will then be charged in negative direction via TS6.

After a certain time, depending on the current through TS9-TS11, the voltage of C1 becomes so low that the current through the tunnel diode decreases to point C (Fig. XXII-2).

With further current decrease the voltage across the diode will jump from point C to point D.

When the voltage of C2 corresponds to point D the transistor TS6 will be cut-off.

The current will then pass through TS5, so that TS4 is driven into saturation, and according to this C1 will be charged in positive direction.

As the tunnel diode GR1 needs a rather heavy current and the charging of C1 is very small, the sensing of the voltage across C1 must take place via the amplifier TS15, TS16, TS14 and TS12, having a very high input impedance.

The tuning of the generator occurs by controlling the current through transistor TS10.

As the generator should supply definition lines in the steps 0.8 - 1.8 - 2.8 - 3.8 - 4.8 MHz (0.5 - 1 -2 - 3 - 4 in the M-version) the control voltage to TS10 should be a staircase voltage with levels adapted to the wanted frequencies.

This staircase is generated by the "Frequency control" circuit.
The frequency control circuit (IC1/1+2+3+4 and IC2/1+2) is supplied with the pulses H16-36, H4-24, H8-28 and H20-40 generated in unit 7.

With these pulses the gates will give an output as shown in Fig. XXII-3).

The resistors R2, R4, R6 and R8 are a voltage divider, which is controlled by the gates (Fig. XXII-3c).

Fig. XXII-3b shows the resulting staircase, which is applied to the "Triangular wave generator" via TS8.

The staircase generator and the triangular wave generator are controlled by a start/stop circuit IC2/4 and IC3/1.

This circuit, which is supplied with the gate pulses H12-32 and V17-21, secures that the generators can only operate within the stipulated area.

The sine shaper

The function of the sine shaper is shown in Fig. XXII-4. The diodes GR2 - GR7 are connected to different levels above and below the average value of the supplied triangular wave.

When the triangular wave voltage passes this diode combination, diodes GR2 - GR4 will form the positive half of the sine shape and GR5 - GR7 the negative one.

The diodes GR2 and GR7, which shape the top and the bottom of the sine wave, draw a relative high current.

For that reason the voltage levels of these diodes are stabilized by means of the transistors TS19 and TS20.

The signal of the definition lines is applied to the "Y-adder" in unit 8 via TS24.
The transistor TS23 is additionally used for suppressing a part of the definition lines to make space for the center cross (SK8 "CENTER CROSS" pressed).

The gate signal for this suppression is obtained by supplying the gate signal for the center cross to the IC3/2 together with the gate signal for the definition lines (see the figure in the circuit diagram).

The black level of the suppressed area can be adjusted (see operating the PM 5544) with R56, which controls the current in TS22-TS23.

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3250
Bl/Wh monitor : e.g PHILIPS LDH2110

The level of the centercross

Connect the monitor to BU7 "Y-OUTPUT".
The black level of the lower part of the centercross should be equal to that of the upper part.
If not, readjust R56.

In case of incorrect sineshape or frequency all the adjustments in this unit must be carried out in accordance with the sequence given below.

1. Triangle amplitude

Connect the oscilloscope to the emitter TS13.
Trigger ext. with pulse: $\overline{f_H}$ (e.g. terminal 67' - unit 9).
Put the oscilloscope in pos.: 0.5 μs/div. -
delay : ≈ 15 μs (5 μs x 3.00).
Adjust R34 until the max. amplitude is obtained.
Select R28, until the amplitude is: 4.6 - 5.0 V_{p-p}.

2. D.C. bias of the tunneldiode GR1

Connect the oscilloscope to terminal 13'.
Put the oscilloscope into the same position as under point 1.
Adjust R34 until the bottom of the pulse just touches the 0 line (see Fig. XXII-5).

3. Triangle symmetry

Connect the oscilloscope to emitter TS13.
Trigger ext. with pulse: $\overline{f_H}$ (e.g. terminal 67' - unit 9).
Put the oscilloscope in pos.: 0.2 μs/div. -
delay : ≈ 15 μs (5 μs x 3.00).
Adjust R9 until a proper symmetrical triangle shape is obtained.

4. Sinewave amplitude

Connect the oscilloscope to terminal 4 - unit 11B.
Trigger ext. with pulse: $\overline{f_H}$ (e.g. terminal 67' - unit 9).
Put the oscilloscope in pos.: 0.2 μs/div. -
delay : ≈ 15 μs (5 μs x 3.00).
Adjust R50 until the sinewave amplitude is equal to the amplitude of black/white in the video signal. (measured at BU7 "Y-OUTPUT").

5. Adjusting 0.8 MHz (M-version: 0.5 MHz)

Connect the oscilloscope to terminal 13'.
Trigger ext. with pulse: $\overline{f_H}$ (e.g. terminal 67' - unit 9).
Put the oscilloscope in pos.: 0.5 μs/div. x 2
(M-version: 0.2 μs/div.)
delay : ≈ 15 μs (5 μs x 3.00).
Adjust R24 in such a way that 2 sinewaves of 0.8 MHz cover 10 divisions on the screen of the oscilloscope. (M-version: 1 sinewave).

6. Adjusting 4.8 MHz (M-version: 4 MHz)

Connect and trigger the oscilloscope according to point 5.
Put the oscilloscope in pos.: 0.5 μs/div. x 2
(M-version: 0.2 μs/div.)
delay : ≈ 40 μs (5 μs x 7.90).
Adjust C4 in such a way that 12 sinewaves of 4.8 MHz cover 10 divisions on the screen of the oscilloscope. (M-version: 8 sinewaves).

Repeat the points 5 and 6

7. Checking the other frequencies (G version)

Connect the oscilloscope according to point 5.
Put the oscilloscope in pos.: 0.5 μs/div. x 2
Check that the following frequencies cover 10 div. ±0.5 div.:

At 1.8 MHz = 4.5 sinewaves
2.8 MHz = 7.0 sinewaves
3.8 MHz = 9.5 sinewaves

8. Checking the other frequencies (M-version)

Connect the oscilloscope according to point 5.
Put the oscilloscope in pos.: 0.2 μs/div.
Check that the following frequencies cover 10 div. ±0.5 div.:

At 1 MHz = 2 sinewaves
2 MHz = 4 sinewaves
3 MHz = 6 sinewaves

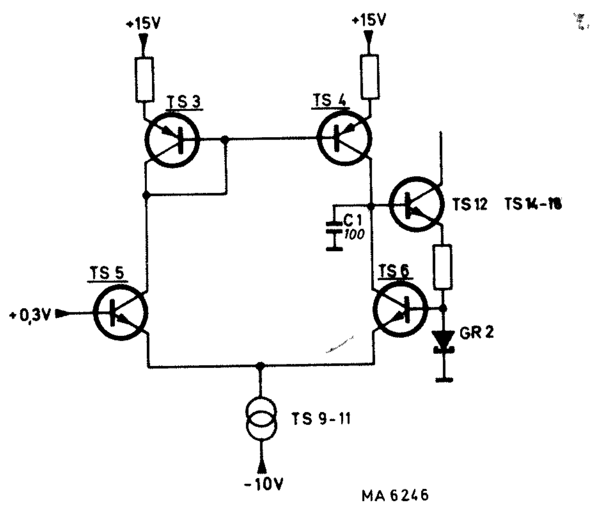


Fig. XXII-1. Simplified block diagram, triangular wave generator

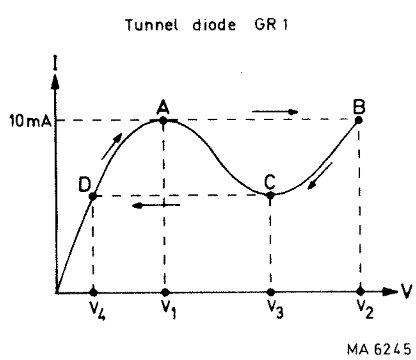


Fig. XXII-2. Characteristic of tunnel diode

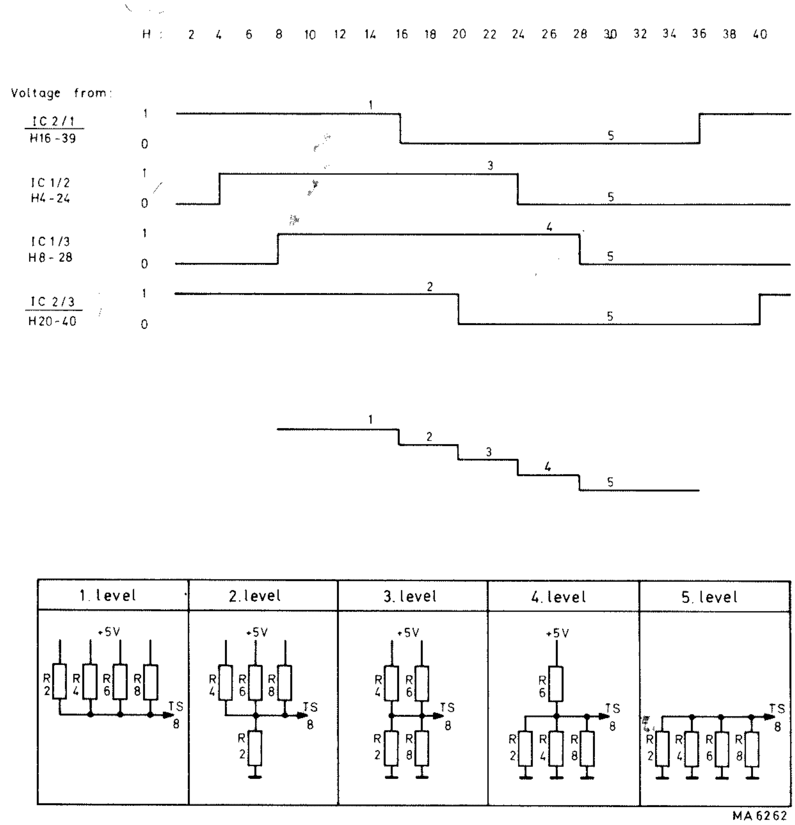


Fig. XXII-3. Pulse diagram, staircase

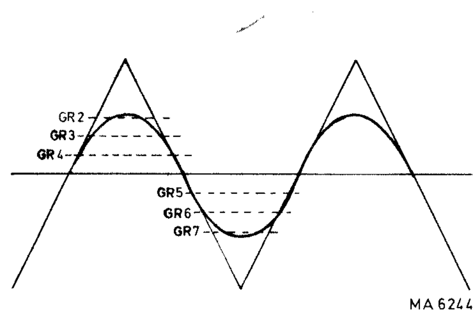


Fig. XXII-4. Pulse diagram, sine shaper

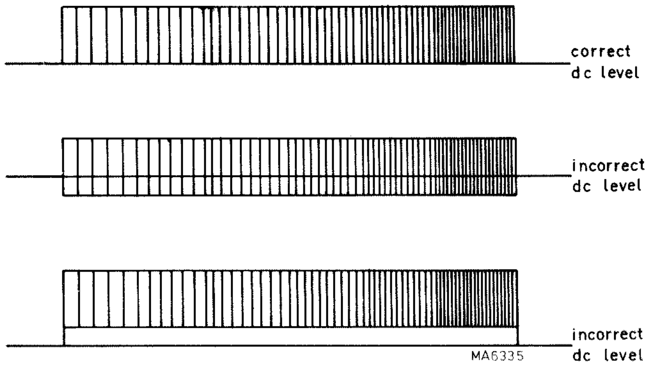
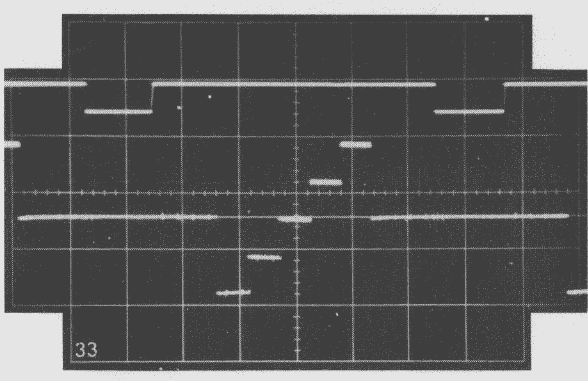
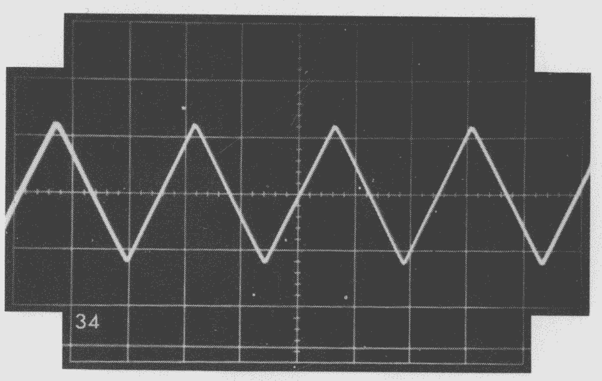


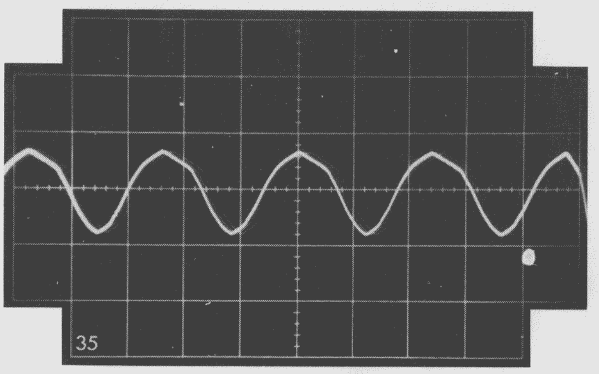
Fig. XXII-5. d.c. level, definition lines



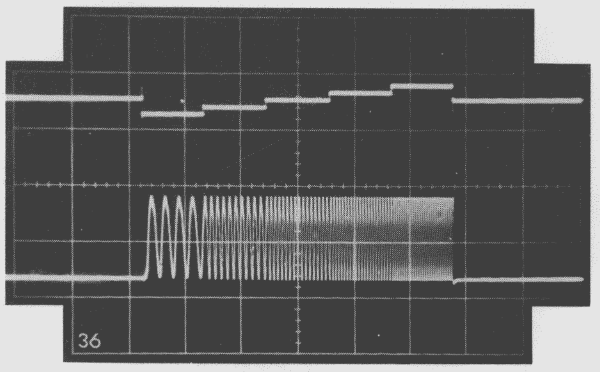
1 V/div. 10 μs/div.
Ref.: $\overline{\text{bl}}$



2 V/div. 0.5 μs/div.



2 V/div. 0.5 μs/div.



2 V/div. 5 μs/div.

Fig. XXII-6. Oscillograms, unit 10

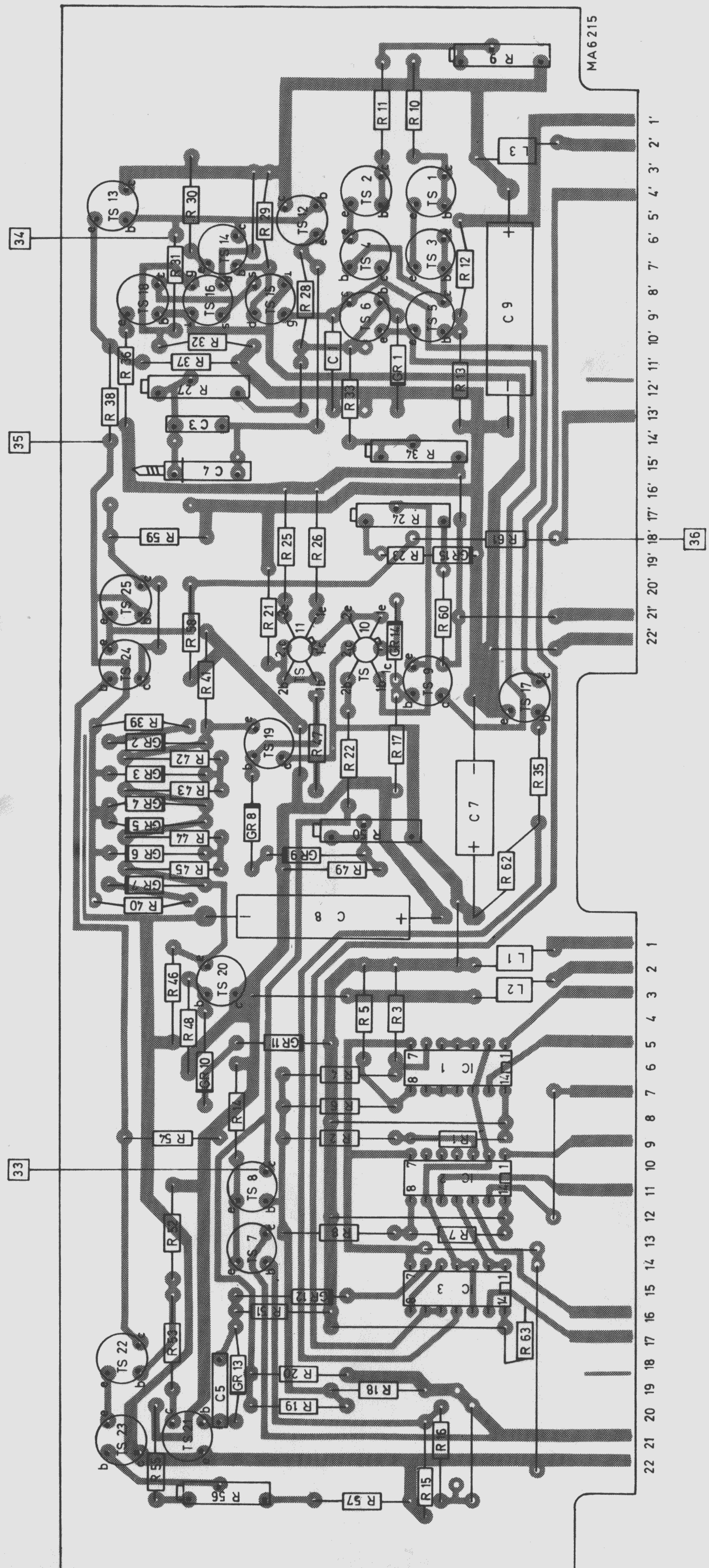
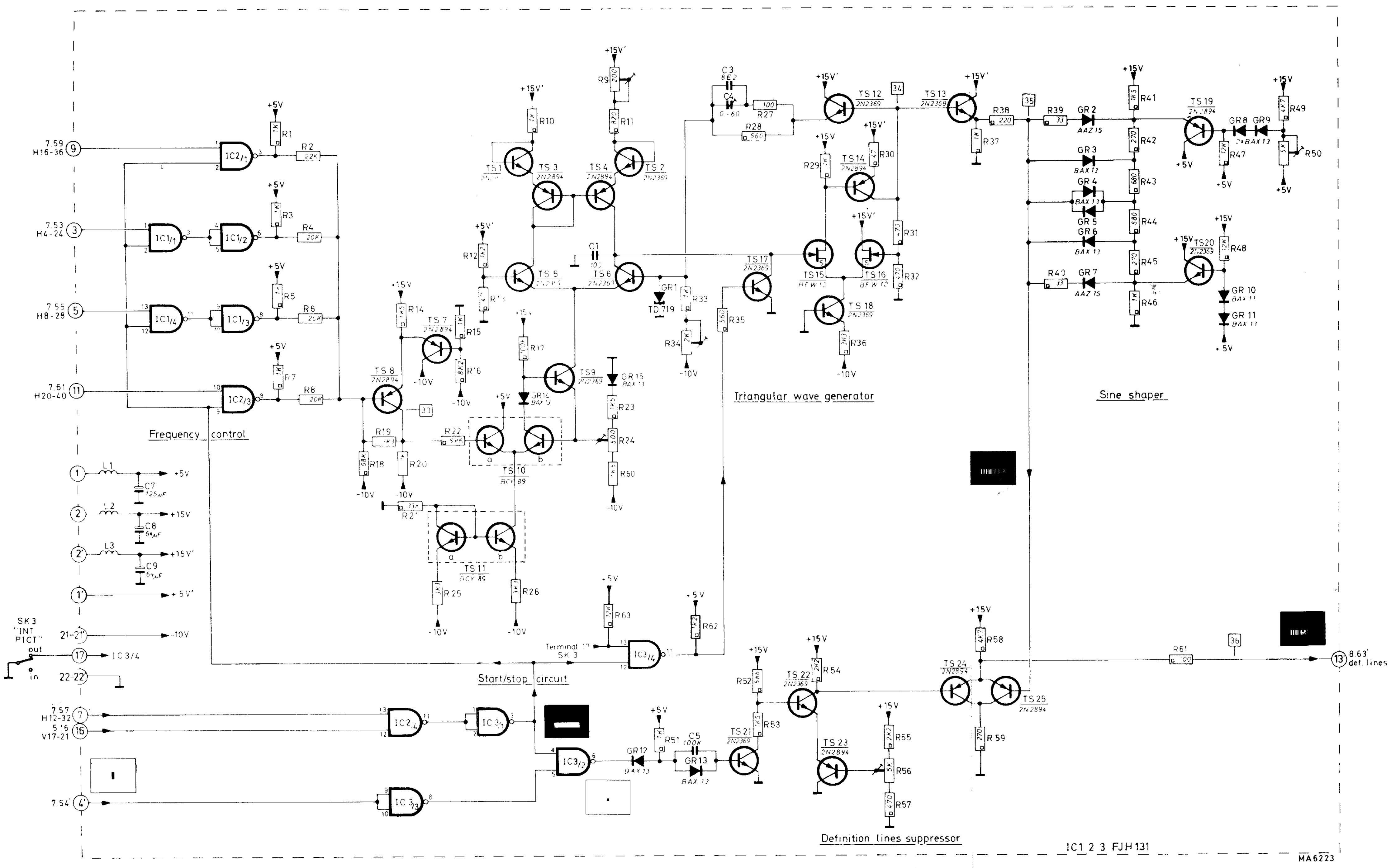


Fig. XXII-7. Printed wiring board, definition lines, unit 10



Erratum:

In M version = R2 = 47 kΩ
R8 = 22 kΩ
R16 = 5.6 kΩ

C3 is omitted
R20 = 1,2 kΩ
R24 = 200 Ω
R60 = 1,82 kΩ 1 %
R56 = 1 kΩ
From serie /05 C4 = 0 - 12 pF

Fig. XXII-8. Circuit diagram, definition lines, unit 10

XXIII. Unit 11A Video mixer (B-Y) Unit 11B Video mixer (Y) Unit 13A Video mixer (R-Y)

These three video mixers are identical, for the sake of simplicity only video mixer (B-Y) is described.
The video mixers are adding the circle contents to the grid contents (except when SK2 "GRID ONLY" is pressed).
The different signals are applied to the 3 input amplifiers TS7 - TS12.
The signal with the circle content (applied to terminal 10') can be substituted by an externally applied signal (via terminal 14') by means of the switch SK4 "EXT.PICT."

When SK4 is released, TS5b and TS6a are cut-off. The internally generated circle signal will then be applied to the "Mixer" (TS2) via TS6b.
When SK4 is pressed, TS5a and TS6b are cut-off, and the externally applied circle signal is applied to the "Mixer" via TS5b.
The grid information is gated together with the circle information in the "Mixer".
The circle gate signal ϕ controls TS1 and TS2 in such a way, that TS1 is open for the grid signal outside the circle, and TS2 is open for the circle information.
The mixer supplies the complete (B-Y) information to the output amplifier via TS3.

Common adjustments (see Service Instructions, page 53)

7. D.c. levels in mixers (B-Y), (Y) and (R-Y)

Connect the oscilloscope to terminal 4' (for (Y) terminal 4)
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 10 μs/div. -
delay : $\approx$ 14 ms (2 ms x 7.00).
Disconnect the wires to the terminals 6 and 14 on the contact blocks.
Connect the terminals 6' and 14' to terminal 10 (for (Y) terminals 6 and 14).
Select R29 - R30 and R31 in such a way that black is at the same level inside as well as outside the circle.
The levels could be compared by pressing:
1. SK2 "GRID ONLY" - SK3 "INT PICT" resp.
2. SK2 "GRID ONLY" - SK4 "EXT PICT" resp.

Resolder the wires after the adjustments.

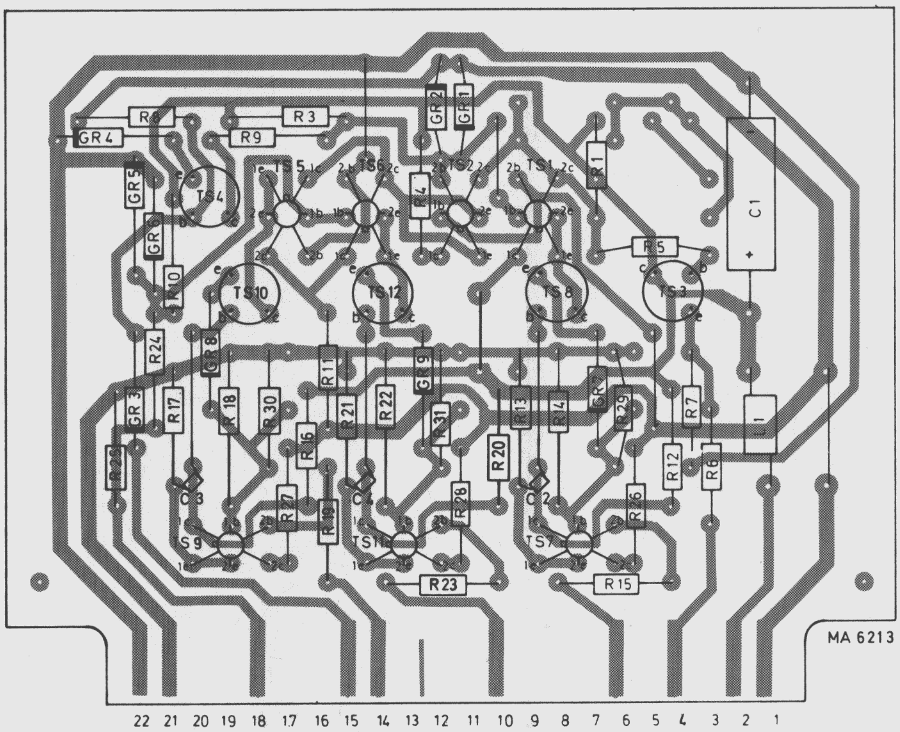


Fig. XXIII-1. Printed wiring board, video mixer, unit 11A, 11B and 13A

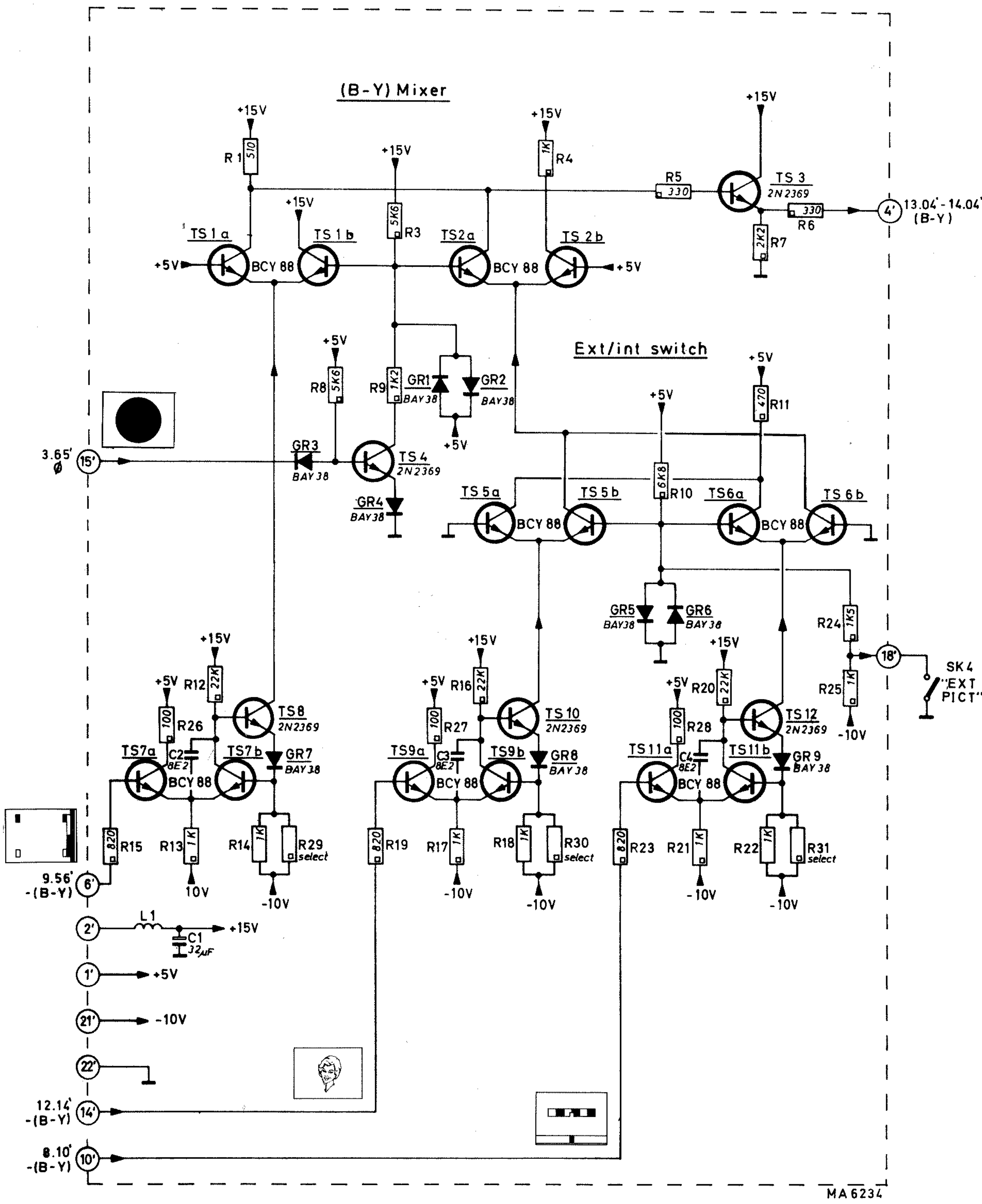


Fig. XXIII-2. Circuit diagram, video mixer (B-Y), unit 11A

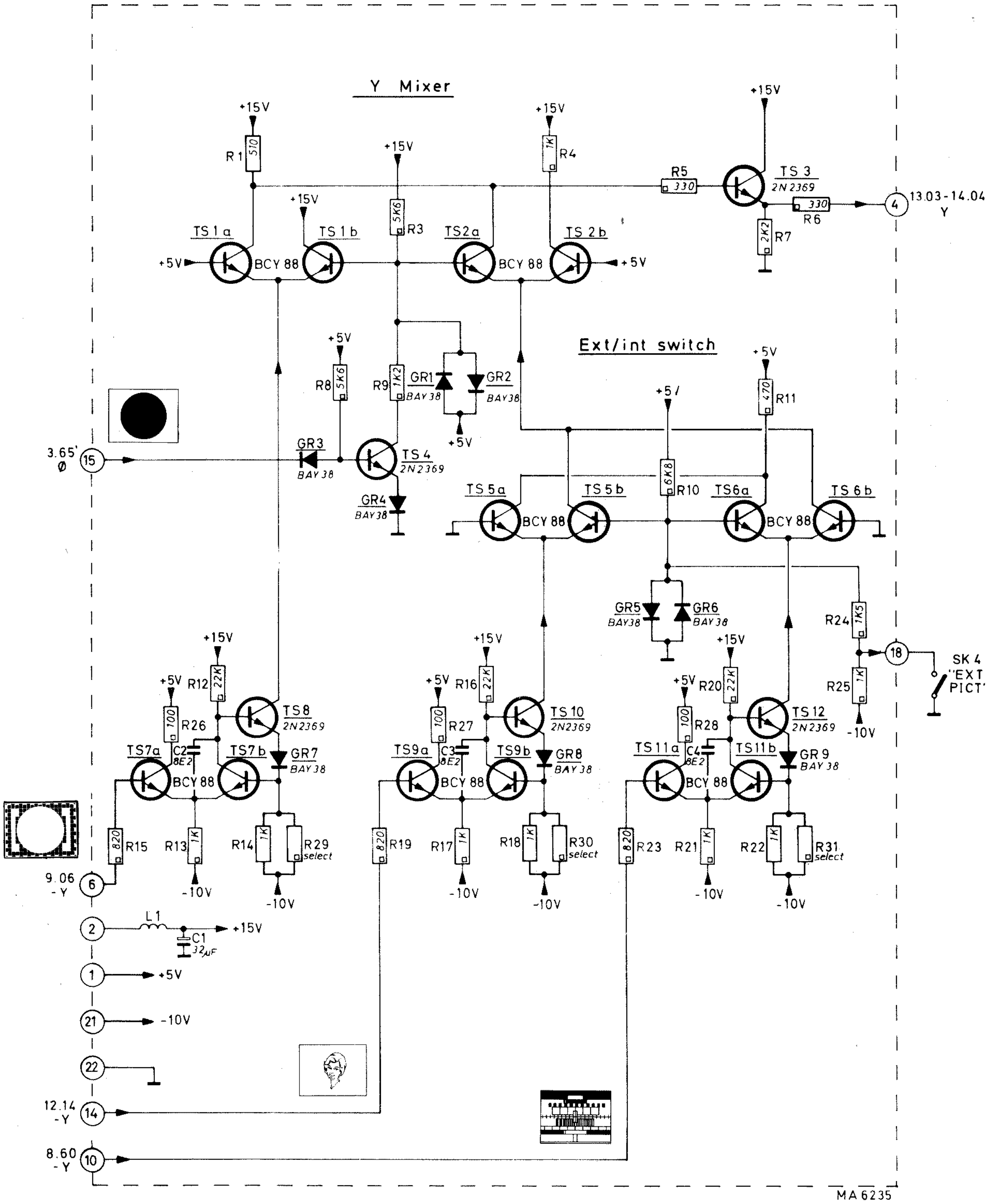


Fig. XXIII-3. Circuit diagram, video mixer (Y), unit 11B

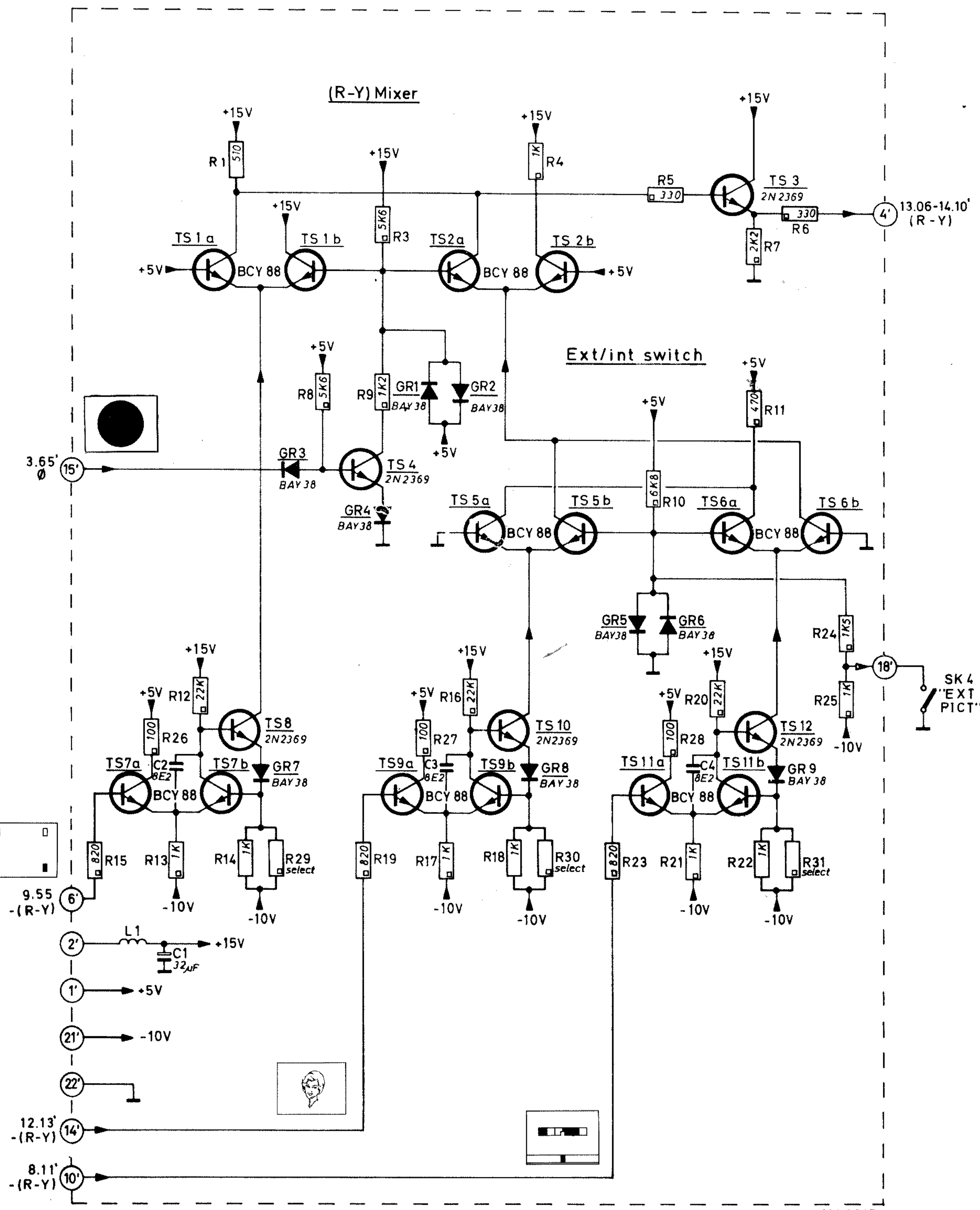


Fig. XXIII-4. Circuit diagram, video mixer (R-Y), unit 13A

XXIV. Unit 12 Video input

This unit consists of the input circuits for the external circle signals.
The input signal for the circle information should be applied as R, G and B signals.
The R, G and B signals are applied to the Y matrix (R1, R2 and R3), to the (R-Y) matrix (R14, R15 and R16) and to the (B-Y) matrix (R27, R28 and R29).

After matrixing, the signals are applied to the mixer stages (units 11 and 13) via the clamping circuits TS3, TS6 and TS9.

The "Text input" supplies externally generated text to the lower black field in the circle.
TS11 should be operated on-off by the input signal (the sensitivity is adjusted by R39).

The "Text inverters" TS12 and TS13 supply the text signal inverted and not inverted via the switch SK9 (mounted on the printplate).
By operating the switch, the text can always be obtained as white letters on black back ground independent of the phase of the applied signal.

Common adjustments (see Service Instructions, page 53)

For adjustments of the points 8 ... 14 supply R.G.B. signals from eg. PHILIPS PM 5552 to BU9 - 14 and 19.
Terminate with 75 Ω.
The saturation of the supplied signal should be 100 % (= 0.7 V).

8. Y-amplitude

Connect the oscilloscope to terminal 60 - unit 8.
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : ≈14 ms (2 ms x 7.00).
Note the amplitude of the bl/wh staircase in the "INT.PICT." (approx. 1.8 $V_{p\text{-}p}$).

Connect the oscilloscope to terminal 14 (unit 12).
Adjust R7 until the amplitude (of the ext. bar signal) is equal to that of the staircase (approx. 1.8 $V_{p\text{-}p}$).

9. R-Y matrix

Connect the oscilloscope to terminal 13'.
Adjust R15 until R-Y = 0 in the white bar.

10. R-Y amplitude

Connect the oscilloscope to terminal 11' - unit 8.
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : ≈ 8 ms (2 ms x 4.00).
Adjust the sensitivity of the oscilloscope until the R-Y content inside the circle has an amplitude of 2.7 $V_{p\text{-}p}$.
Connect the oscilloscope to terminal 13'.
Adjust R20 until the R-Y amplitude of the bar is 3.6 $V_{p\text{-}p}$.

11. B-Y matrix

Connect the oscilloscope to terminal 14'.
Adjust R28 until B-Y = 0 in the white bar.

12. B-Y amplitude

Connect the oscilloscope to terminal 10' - unit 8.
Trigger ext. with pulse: field (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/ div. -
delay : ≈ 8 ms (2 ms x 4.00).
Adjust the sensitivity of the oscilloscope until the B-Y content inside the circle has an amplitude of 2.7 $V_{p\text{-}p}$.
Connect the oscilloscope to terminal 14'.
Adjust R33 until the B-Y amplitude of the bar is 3.6 $V_{p\text{-}p}$.

13. Y clamp

Connect the oscilloscope to terminal 6 - (unit 9).
Note the d.c. level of the negative pulses (approx. - 5 V).
Connect the oscilloscope to terminal 14 (unit 12).
Adjust R12 until the black bar of the ext. signal is at the same d.c. level as that of terminal 6 - unit 9.

14. R-Y/B-Y clamp

Connect the oscilloscope to terminal 6 - (unit 9).
Note the d.c. level of the negative pulses (approx. - 5 V).
Connect the oscilloscope to terminal 13' (unit 12).
Adjust R25 until the d.c. level in the line sync period is at the same level as that of terminal 6 - unit 9.

15. Text input

Connect the monitor to BU7 - "Y-OUTPUT".
Supply BU4 "TEXT INPUT" with "B" signal from PM 5552.
Terminate BU5 with 3 x 75 Ω in parallel. (The input amplitude is now 350 $mV_{p\text{-}p}$).
Press SK3 "INT.PICT." and SK5 "EXT.TEXT".
Release SK9 on unit 12.
Put R39 into its complete right position.
Adjust R39 by turning to the left until the vertical bars are just visible in the test area.

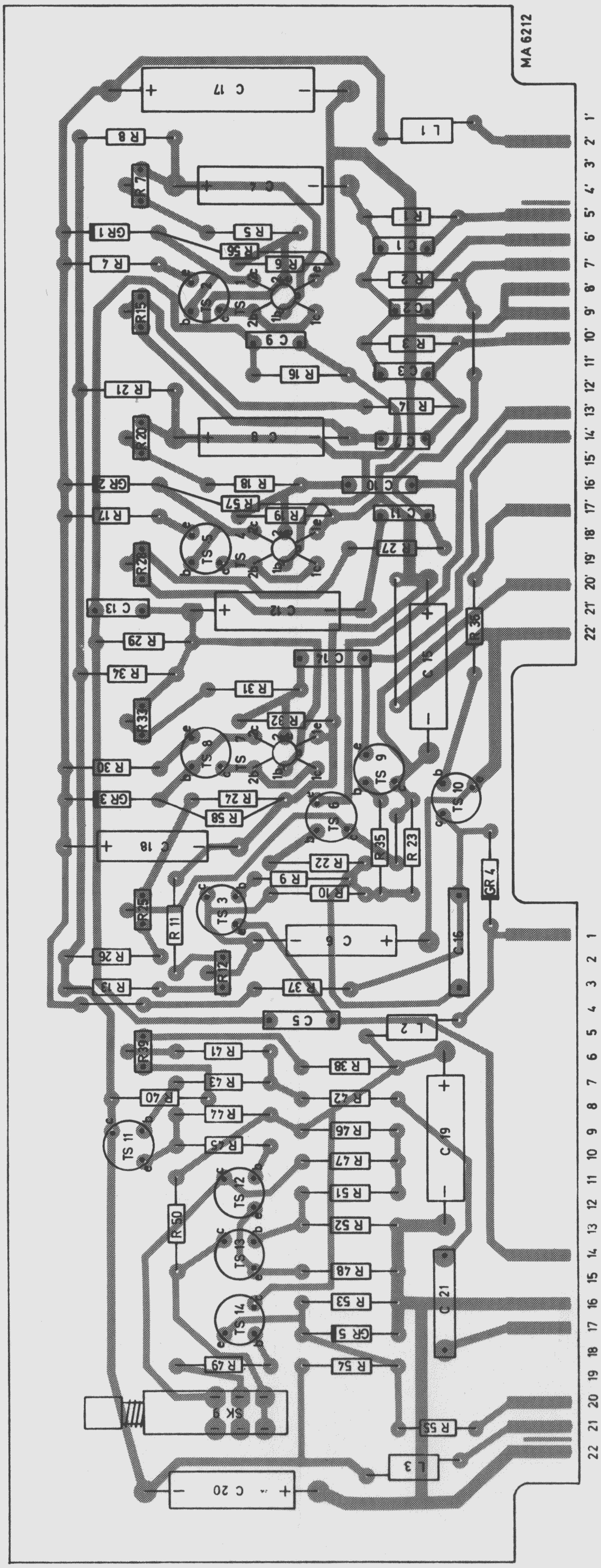
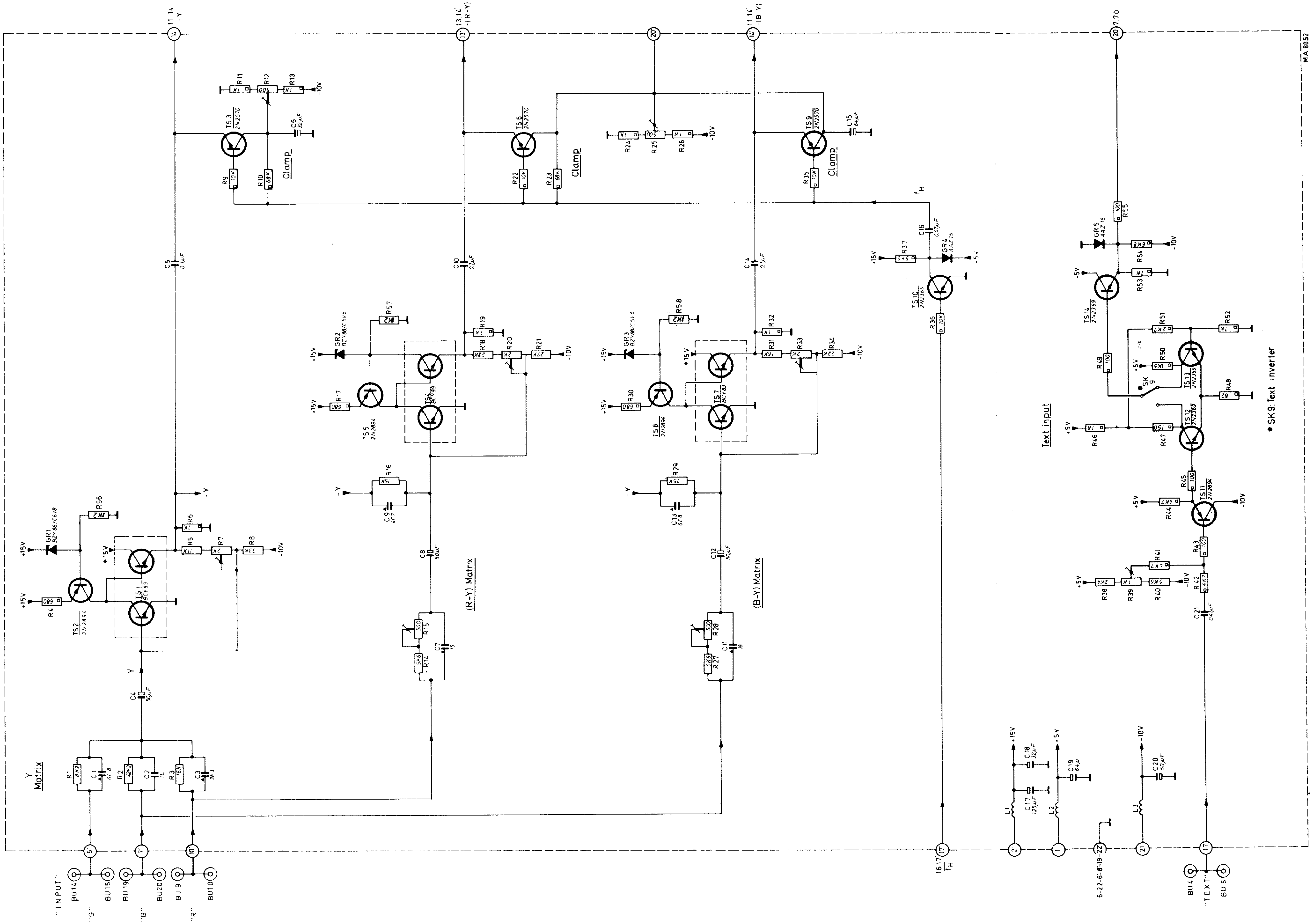


Fig. XXIV-1. Printed wiring board, video input, unit 12



N.B. From /05 version R28 and R15 changed to 1 kΩ

Fig. XXIV-2. Circuit diagram, video input, unit 12

XXV. Unit 13B R-G-B matrix

This unit consist of the matrix system for the R-G-B signals.
The R-Y and B-Y signals are applied to the matrix via the amplifiers TS4-TS5 and TS7-TS8, which supply the signals inverted and not inverted to satisfy the matrix system.

The Y signal is applied to the matrix via the inverter TS1-TS2.

Common adjustments (see Service Instructions, page 53)

16. G-matrix

Connect the oscilloscope to terminal 10.
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : $\approx$ 8 ms (2 ms x 4.00).
Press SK3 "INT.PICT."
Adjust R6 until G = 0 in the magenta, red and blue bars.

17. R-matrix

Connect the oscilloscope to terminal 4.
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : $\approx$ 8 ms (2 ms x 4.00).
Press SK3 "INT.PICT."
Adjust R19, until R = 0 in the cyan green and blue bars.

18. B-matrix

Connect the oscilloscope to terminal 9.
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 20 μs/div. -
delay : $\approx$ 8 ms (2 ms x 4.00).
Press SK3 "INT.PICT."
Adjust R32, until B = 0 in the yellow green and red bars.

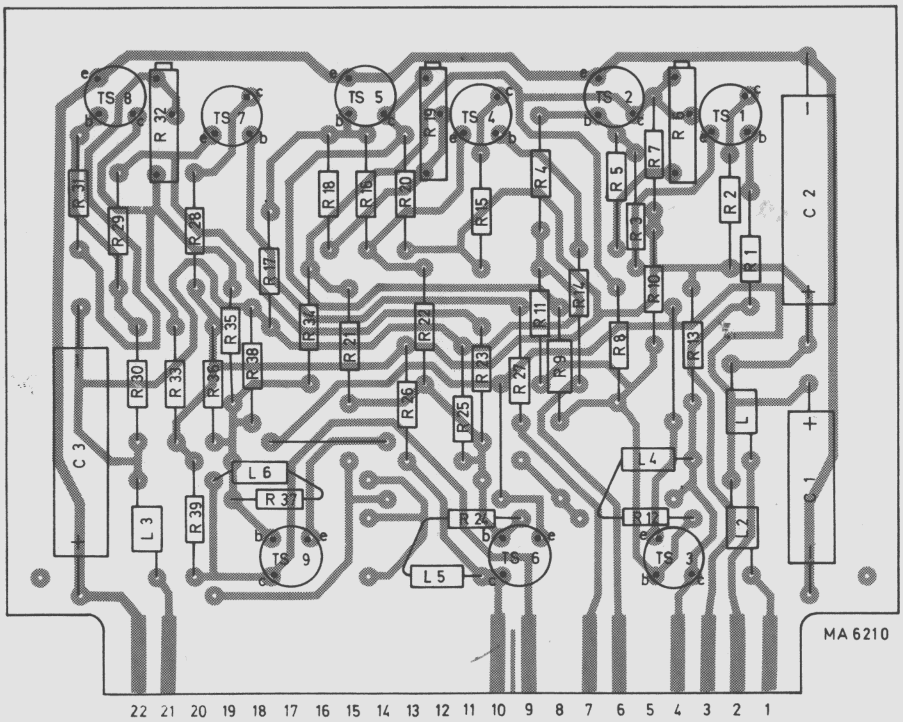


Fig. XXV-1. Printed wiring board, R-G-B matrix, unit 13B

MOD TO STOP RINGING AND OVERSHOOTS

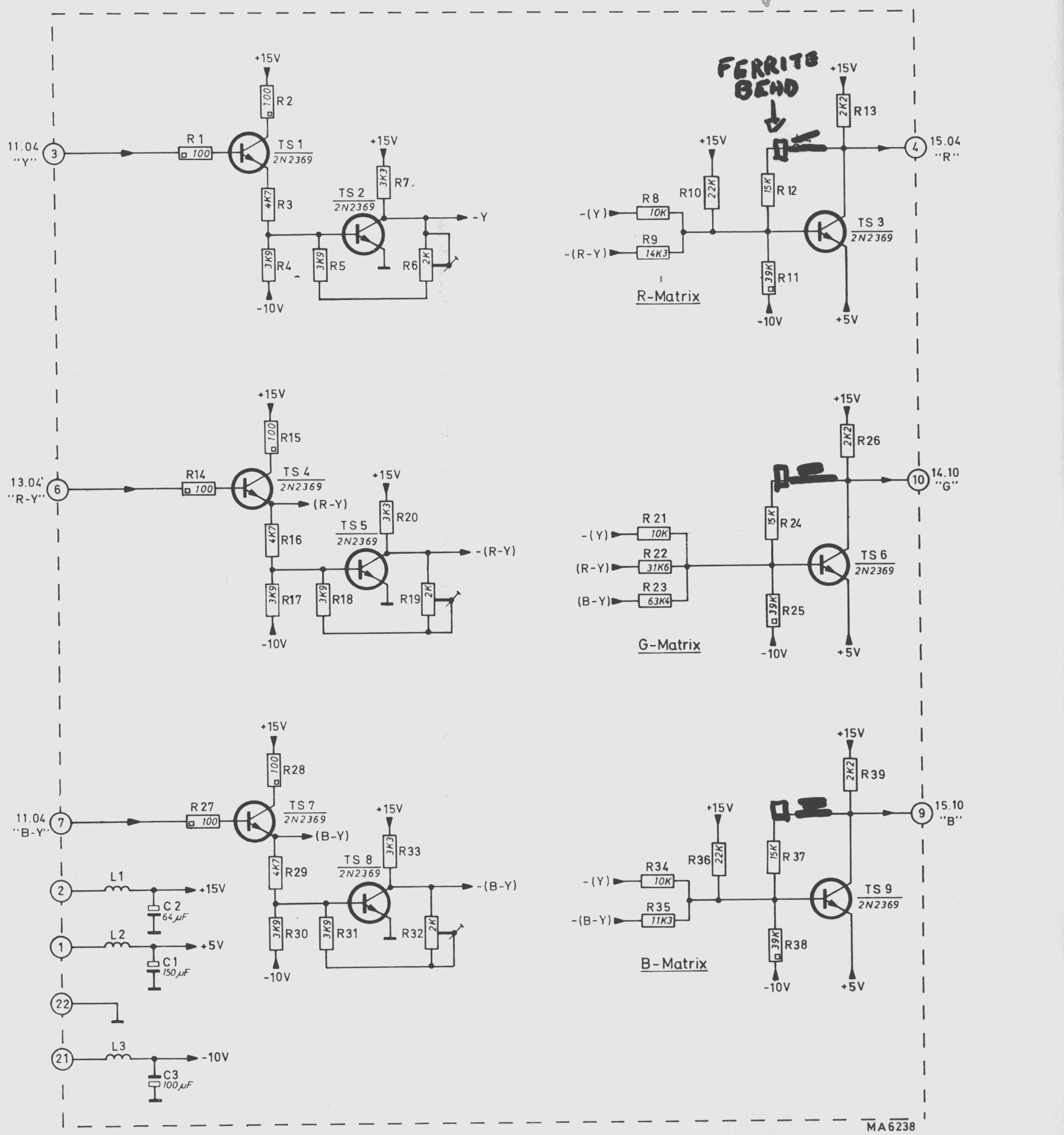


Fig. XXV-2. Circuit diagram, R-G-B matrix, unit 13B

XXVI. Unit 14A Output amplifier (B-Y) and (R-Y)
Unit 14B Output amplifier, Y and G
Unit 15B Output amplifier, R and B

These output amplifiers are identical, for the sake of simplicity only output amplifier (B-Y) is described.

The output amplifiers are push-pull amplifiers supplied with a heavy negative feed-back. (Junction R12, R13 to TS2 in the (B-Y) amplifier).
Due to this negative feed-back the output impedance is very low ($\approx 0\ \Omega$) which means, that the impedance of the signal applied to the output connectors, is only controlled by the output resistors (f. inst. R14 and R15).

The output voltage is nominal 0.7 V_{p-p}, but can be changed to 1 V_{p-p} (see the modification section d).

Common adjustments (see Service Instructions, page 53)

When using PM 5544 in connection with PM 5554 the points 19-20 and 21 of the adjustment should be carried out according to chapter VII-C page 53.

19. B-Y amplitude

Connect the oscilloscope to terminal 5' ("BU3").
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Terminate BU3 with 75 Ω.
Adjust R1, until the B-Y amplitude is 1.05 V_{p-p}.

20. R-Y amplitude

Connect the oscilloscope to terminal 11' ("BU2").
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Terminate BU2 with 75 Ω.
Adjust R16 until the R-Y amplitude is 1.05 V_{p-p}.

21. Y-amplitude

Connect the oscilloscope to terminal 5 ("BU1").
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Terminate BU1 with 75 Ω.
Adjust R1 until the Y amplitude is 0.70 V_{p-p}.

22. G-amplitude

Connect the oscilloscope to terminal 14 ("BU11").
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Terminate BU11 with 75 Ω.
Adjust R16 until the G-amplitude is 0.70 $V_{p\text{-}p}$.

23. R-amplitude

Connect the oscilloscope to terminal 8 ("BU6").
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Terminate BU6 with 75 Ω.
Adjust R1 until the R amplitude is 0.70 $V_{p\text{-}p}$.

24. B-amplitude

Connect the oscilloscope to terminal 14 ("BU16").
Trigger ext. with pulse: $\overline{\text{field}}$ (terminal 16' - unit 16).
Put the oscilloscope in pos.: 2 ms/div.
Terminate BU16 with 75 Ω.
Adjust R16 until the B-amplitude is 0.70 $V_{p\text{-}p}$.

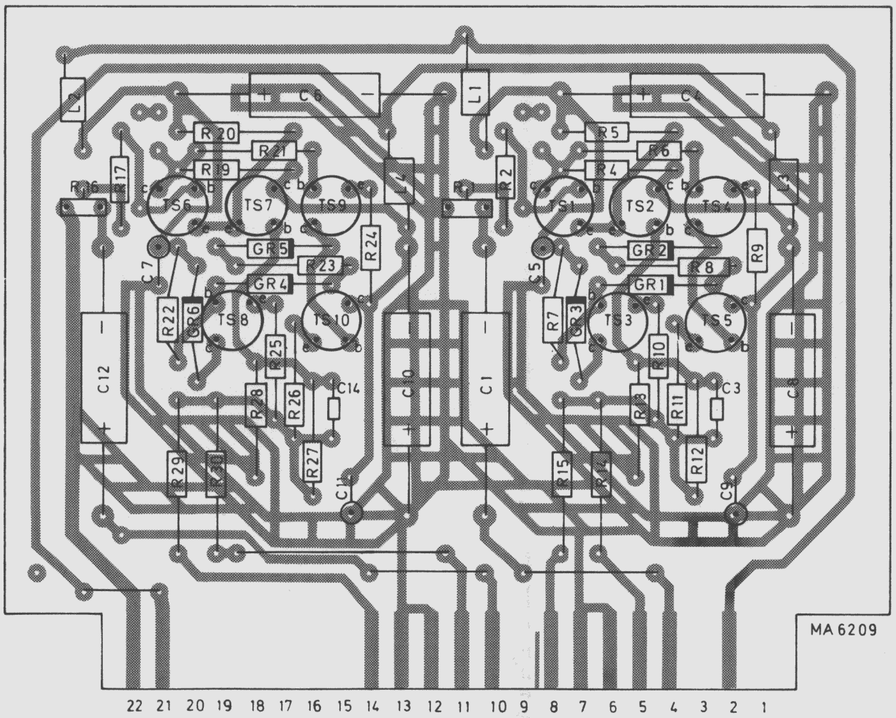


Fig. XXVI-1. Printed wiring board, output amplifier, units 14A, 14B and 15B

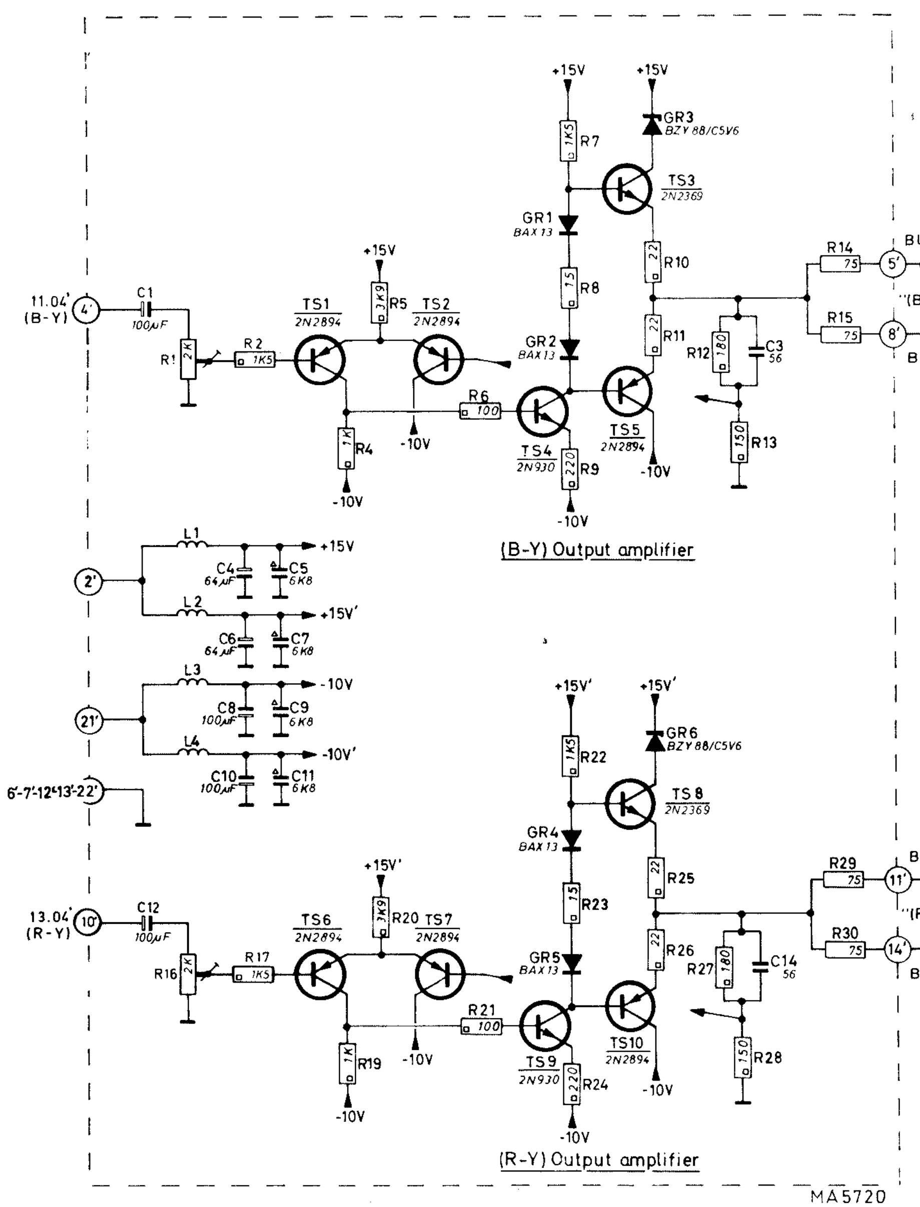


Fig. XXVI-2. Circuit diagram, output amplifier, unit 14A

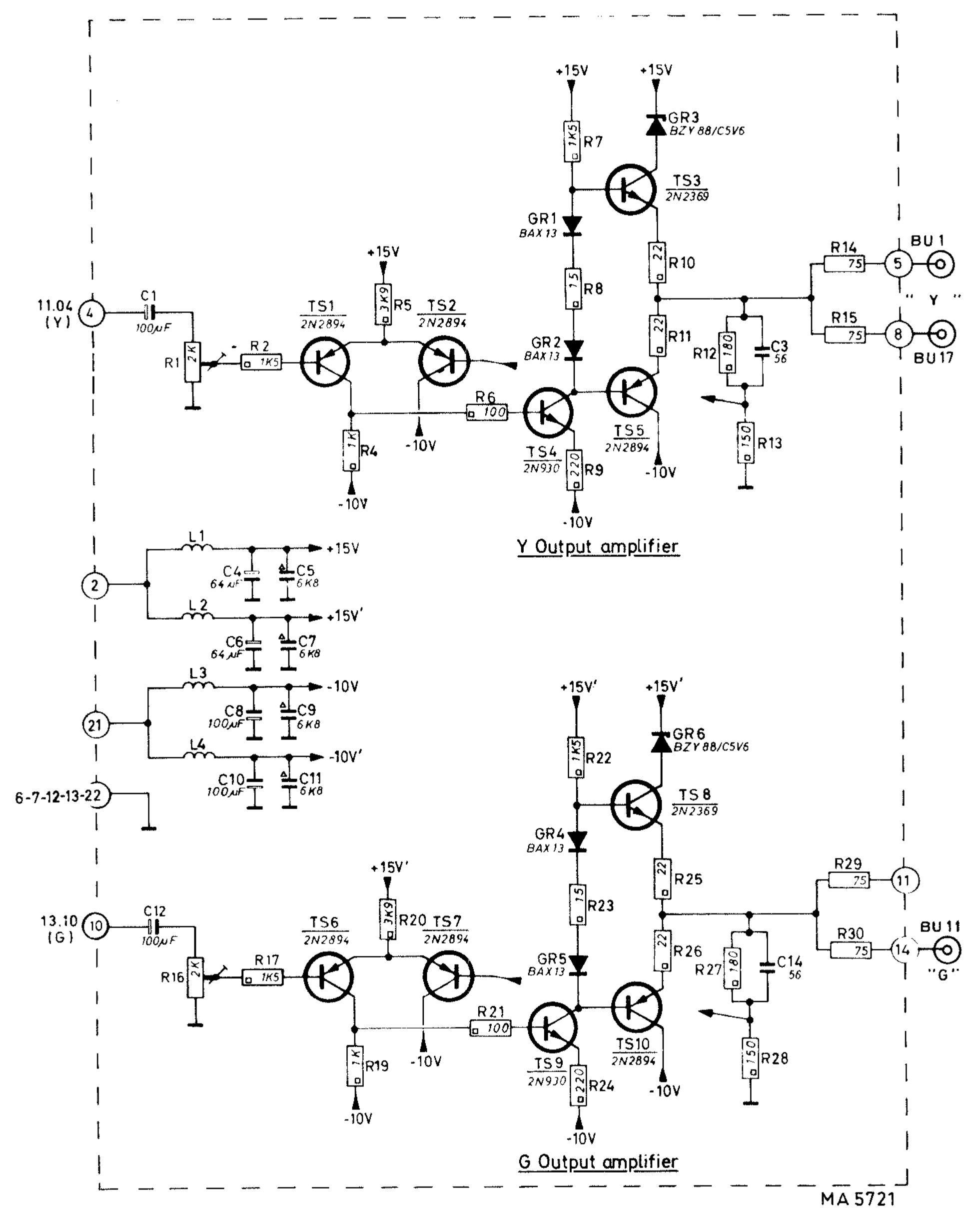


Fig. XXVI-3. Circuit diagram, output amplifier, unit 14B

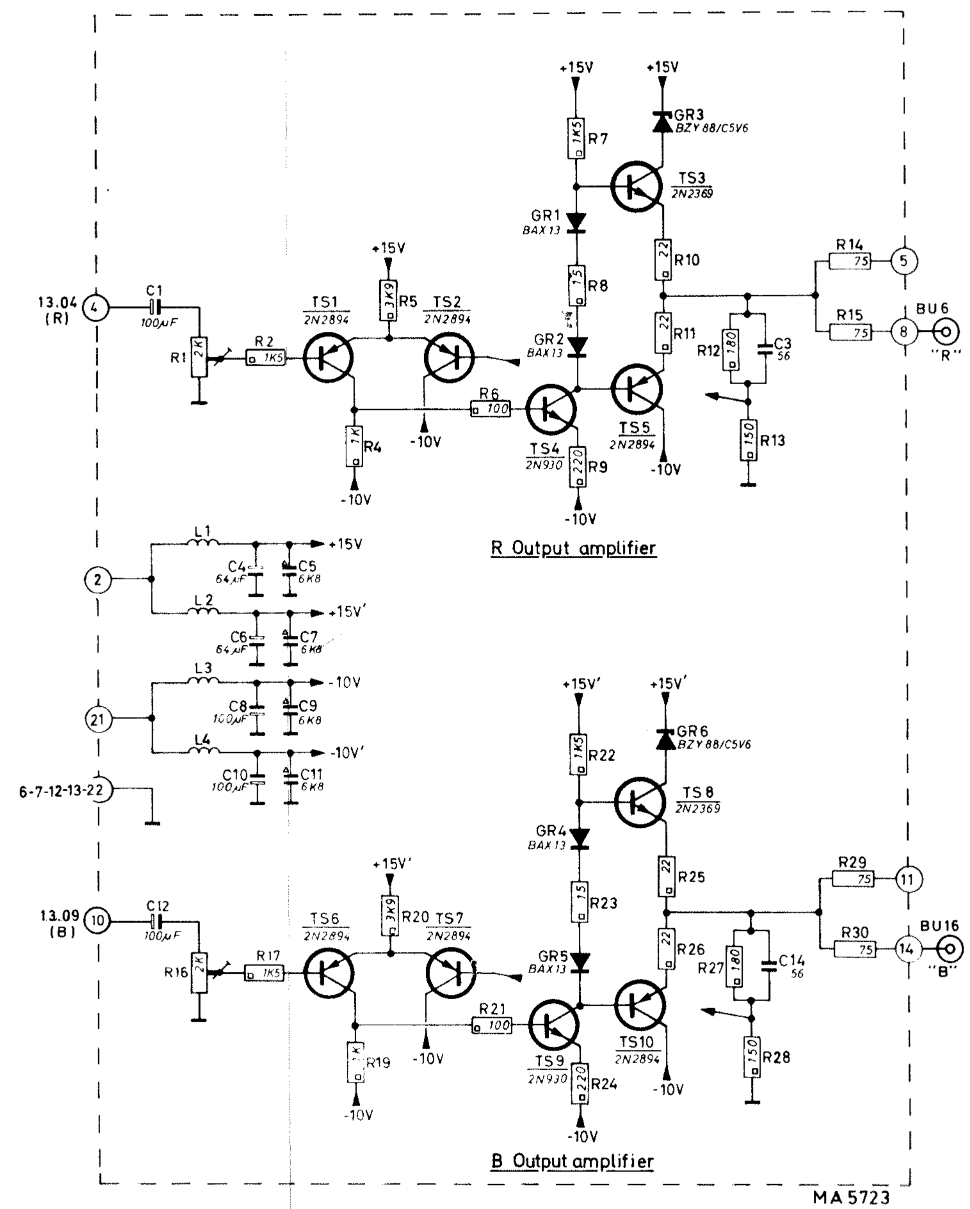


Fig. XXVI-4. Circuit diagram, output amplifier, unit 15B

XXVII. Unit 15A Test output amplifier

This amplifier is a special service amplifier added to promote the service-ability of the instrument (see operating instructions).

The signal to be measured is applied to TS1 via the gate GR1 - GR2.

TS1 is an on-off operated amplifier (positive inputs: on, negative inputs: off).
The tested signals is via an inverter IC1/1 applied to the "Blanking adder". By means of internal soldering a positive or a negative phase of the signal can be chosen.

From the blanking adder the signal is applied, via TS2, to the "Sync. adder" and subsequently to the output connector (BU21 "X").

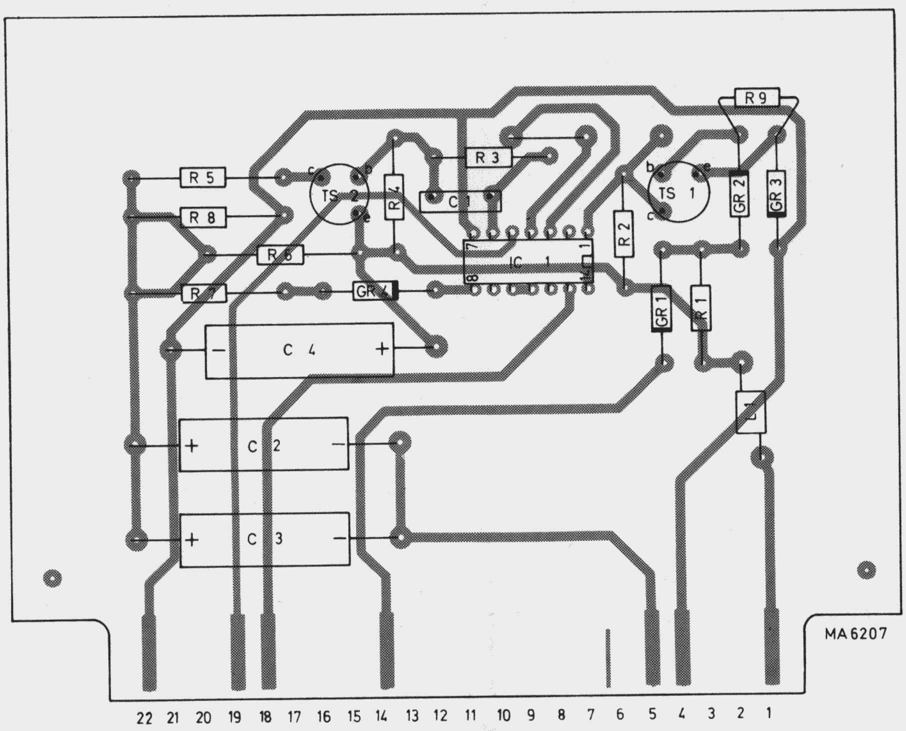


Fig. XXVII-1. Printed wiring board, test output amplifier, unit 15A

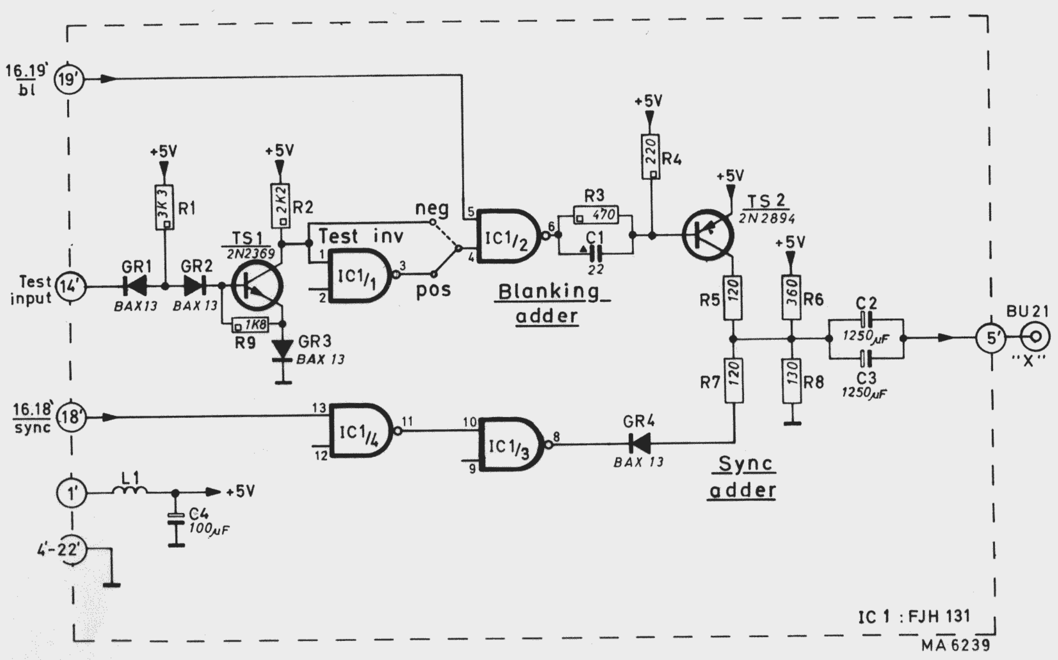


Fig. XXVII-2. Circuit diagram, test output amplifier, unit 15A

XXVIII. Unit 16 Sync. regenerator

This unit consists of two input circuits for:

Composite sync. signal (with line- and field pulse separators).
Blanking signal.

The pulses delivered by a TV-pulse generator are quite accurately specified as regards pulse amplitude and pulse shape. But they may often be considerably distorted by the cable distribution network due to reflections, wrong terminations, cable losses, hum etc...
Fig. XXVIII-1a+b show some examples of typical distortions.
These disturbances of the pulses must be suppressed to ensure a proper operation. Therefore the sync. and blanking input circuits are provided with special circuits for eliminating the distortions.

Input circuit for composite sync. signal

The composite sync. signal is applied to TS1-TS2 via terminal 8.
GR1 and GR2 limit the input signal to 15 $V_{p\text{-}p}$.
The bias of TS1 is chosen so that only the centre part (the undistorted part, see Fig. XXVIII-1c) of the pulse makes the transistor conducting.
The pulse across the emitter resistor R4 will then appear with the correct shape.
In order to eliminate hum from the signal a keyed clamping circuit is introduced. This is formed by TS3 operating on-off by means of sync. pulses which are applied to the base of TS4.

At each sync. pulse the base voltage to TS4 will be clamped via R8/C4 to a d.c. level being automatically adjusted to half the pulse voltage. In this way the reaction of possible hum in the signal is eliminated. From TS4 the sync. signal is applied via TS5 to the line- and field separator and via TS10 to the test output amplifier (unit 15).

The line separator IC1/1 and TS12 are supplied with negatively going sync. pulses.
TS12 is normally "on", but for each sync. pulse the IC1/1 will supply a positive jump to the base of TS12, which will drive TS12 into "off" position for a period controlled by C11/R31.
The connection from junction R32/R33 to the gate input keeps the gate closed until TS12 is conducting again and prevents in this way the pulse generating from being disturbed in the field period.

The field generators IC1/2+3 and TS15 - TS16 are also supplied with negatively going sync. pulses (Fig. XXVIII-2a).
From IC1/3 the pulses (Fig. XXVIII-2b) are applied to IC1/2 and the one shot TS15.
The pulses of TS15 (Fig. XXVIII-2c) are also applied to IC1/2, which will open for only the broad pulses of the one shot (Fig. XXVIII-2d), (it is the only moment when both inputs of IC1/2 are positive).
The first pulse of the broad pulses (Fig. XXVIII-2d) is triggering the one-shot TS16 which supplies the field pulse.
The feed-back from TS17 to TS16 prevents spurious from triggering the one-shot outside the field blanking time.

Input circuit for blanking signal

Via terminal 6' the blanking signal is applied to the amplifier TS6 - TS9 corresponding to the same amplifier in the sync. input.
Here the distorted part of the pulse and the possible hum voltage are also cut-off.

As this sync. regenerator is common for several instruments the unit is supplied with circuits which are not used here, f. inst. the circuit TS11 and the gates controlled by the terminals 11', 13', 14' and 15'.

Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. PHILIPS PM 3250

The sync. pulse

Connect the A amplifier of the oscilloscope to terminal 8'.
Connect the B amplier to terminal 18'.
These two signals should be of the same width.
The voltage of terminal 18' should be approx. 5 V_{p-p}.

The $\overline{f_H}$ pulse

Connect the oscilloscope to terminal 17'.
The width of the $\overline{f_H}$ pulse should be 4.7 μs ±10 %.
The voltage should be approx. 5 V_{p-p}.

The $\overline{\text{field}}$ pulse

Connect the oscilloscope to terminal 16'.
The width of the $\overline{\text{field}}$ pulse should be 500 - 600 μs.
The voltage should be approx. 5 V_{p-p}.

The $\overline{\text{bl}}$ pulse

Connect the A amplifier of the oscilloscope to terminal 6'.
Connect the B amplifier to terminal 19'.
These two signals should be of the same width.
The voltage of terminal 19' should be approx. 5 V_{p-p}.

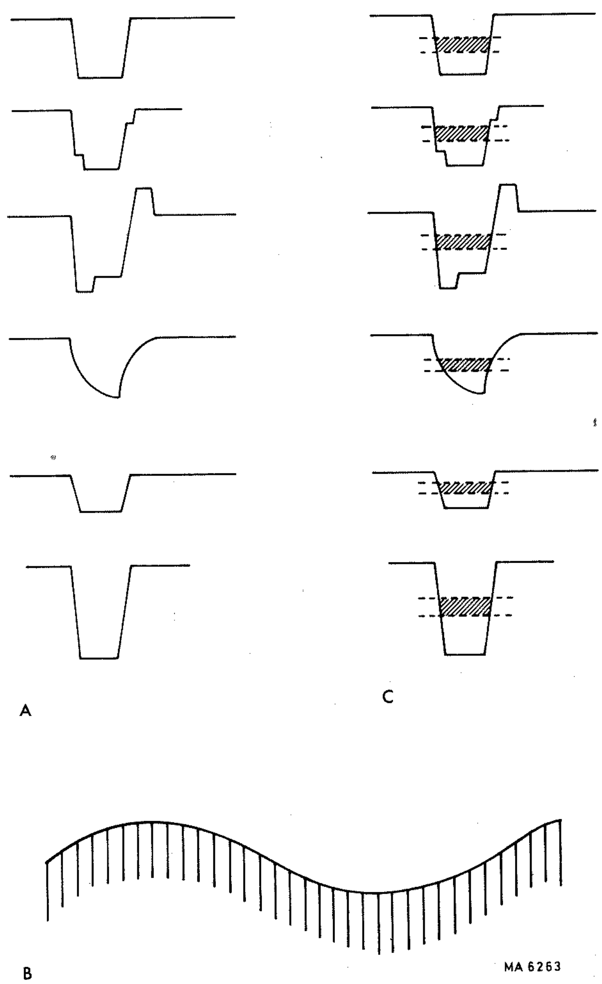


Fig. XXVIII-1. Pulse diagram of typical distortion

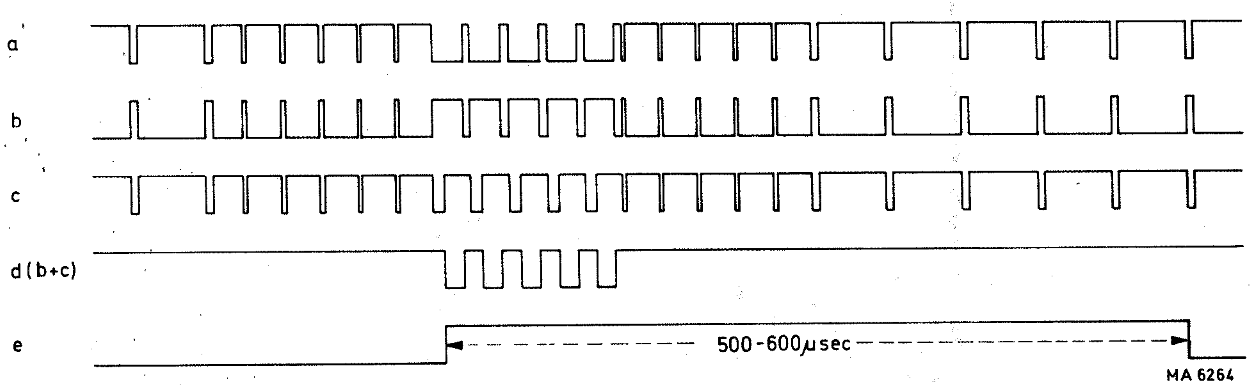


Fig. XXVIII-2. Pulse diagram, field blanking

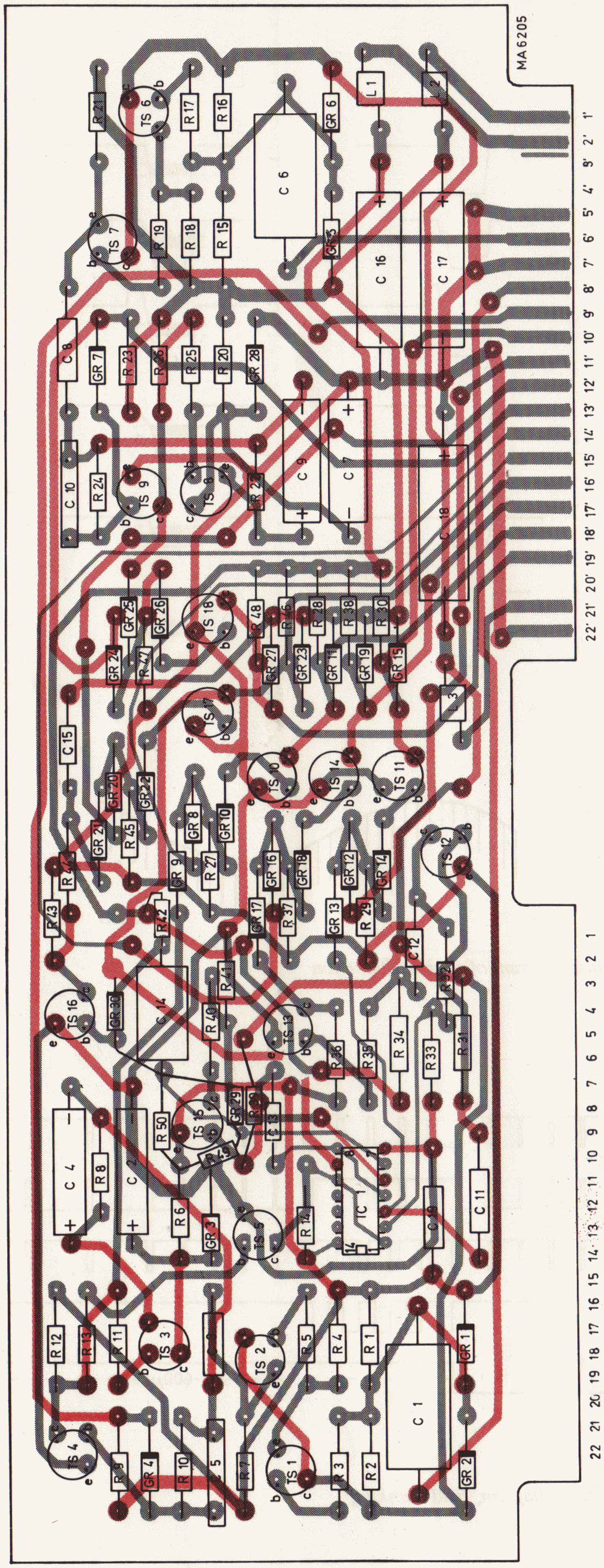


Fig. XXVIII-3. Printed wiring board, Sync. regenerator, unit 16

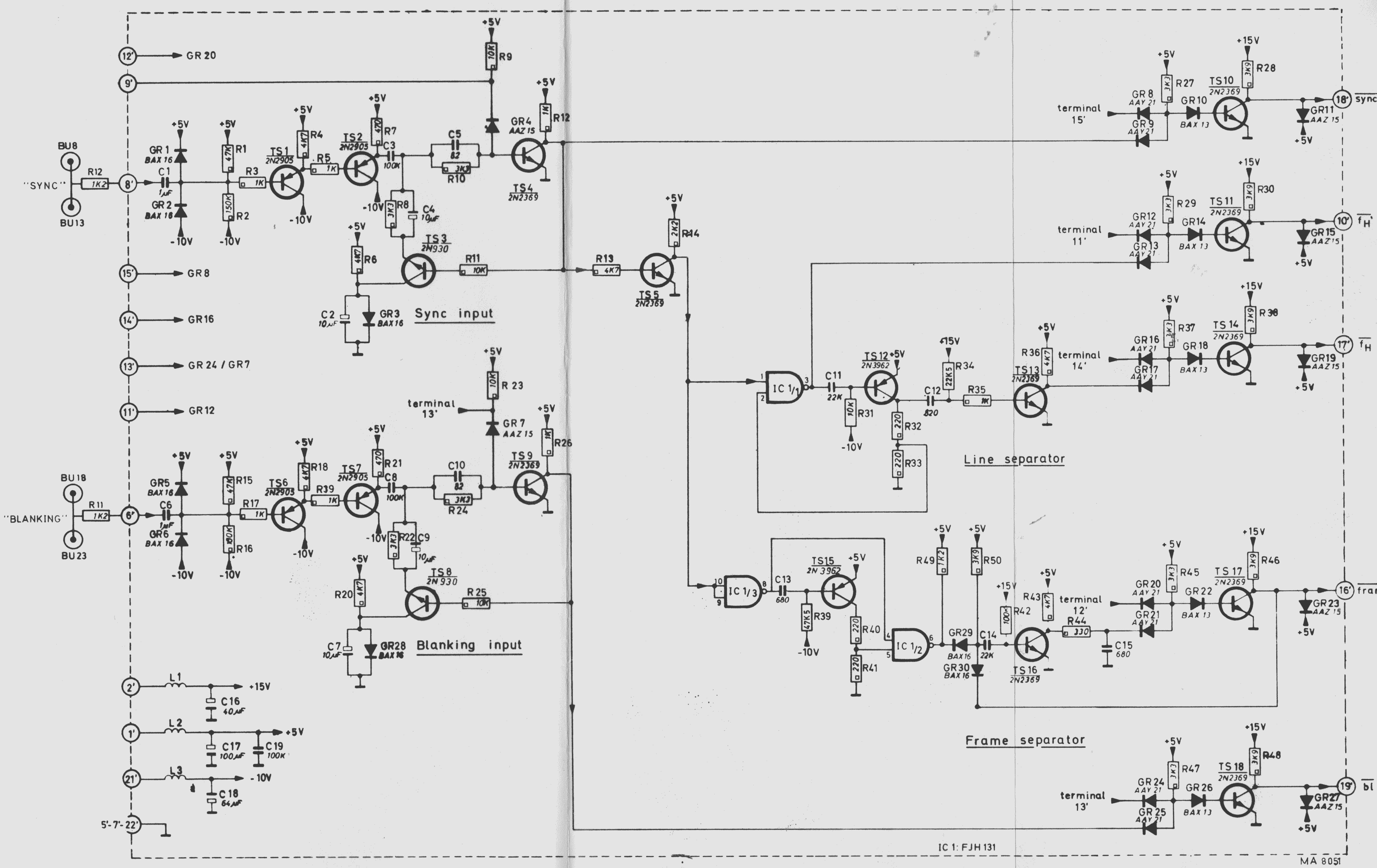


Fig. XXVIII-4. Circuit diagram, Sync. regenerator, unit 16

XXIX. Unit 18 Current gate

This unit is added to the PM 5544 in order to decrease the power consumption of the text generator.
The unit controls the current to a part of the text generator and supplies only current during the text areas (upper and lower bar V5-7 and V23-25).

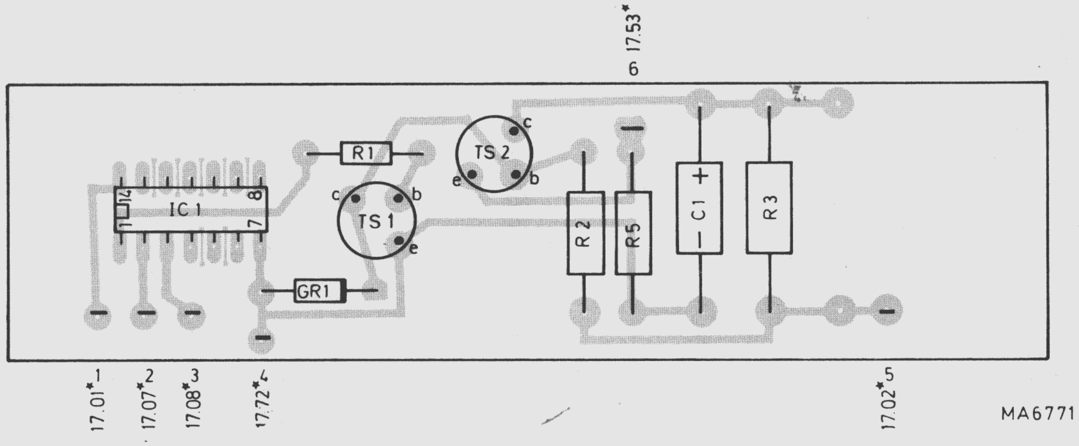


Fig. XXIX-1. Printed wiring board current gate

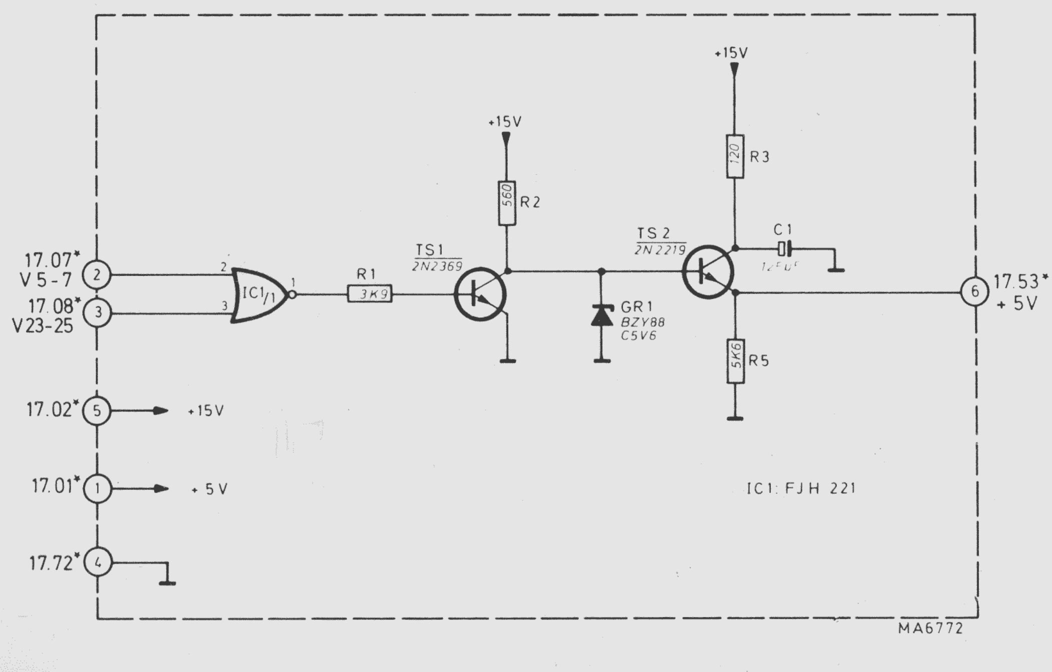


Fig. XXIX-2. Circuit diagram current gate

XXX. General information on integrated circuits

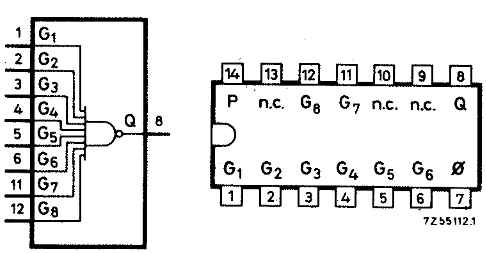
FJ family

standard temperature range

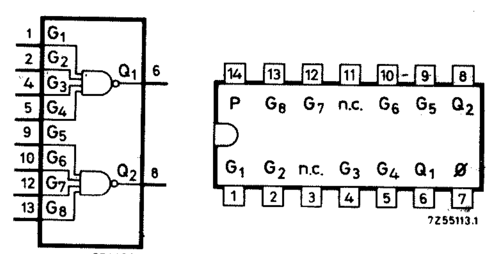
The FJ family of TTL silicon monolithic integrated circuits is designed for medium speed digital equipment in computing, telecommunication, instrumentation and control.

Features of the FJ family: * high-fan-out* low power consumption (typ. 10 mW for standard gates) *high logic swing* low output impedance *short circuit protection *high capacitance drive capability* high noise margin (typ. 1.0 V for standard gates) * comprehensive range of circuits, including NAND gates, AND-OR-NOT, gate expanders, flip-flops and complex-function devices * it corresponds to the 74Nseries TTL.
For more specified information on integrated circuits see "PHILIPS DATA HANDBOOK" published by "ELCOMA".

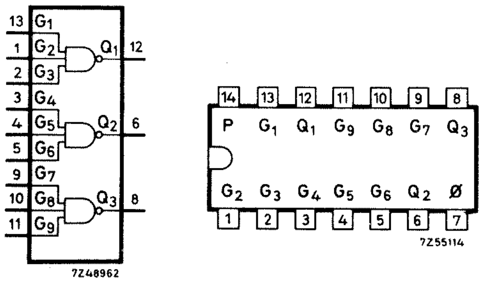
NAND GATES



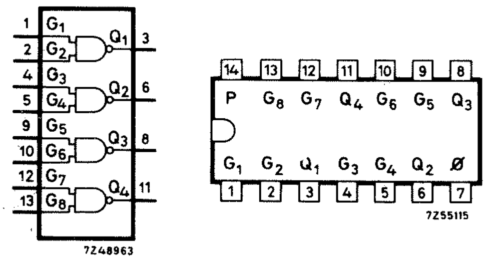
FJH101 7430



FJH111 7420

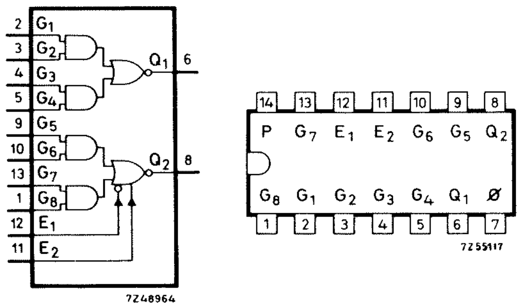


FJH121 7410



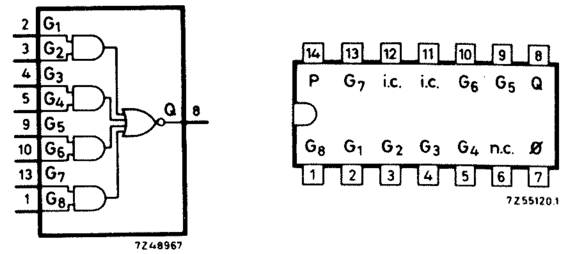
FJH131 7400

DUAL AND-OR-NOT GATE



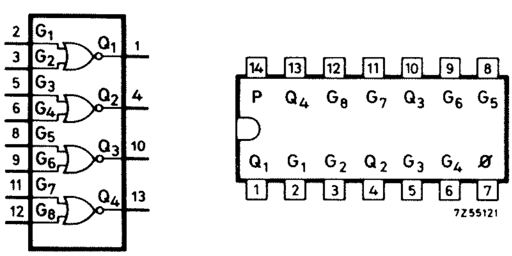
FJH151 7450 AOI

2+2+2+2 INPUT AND-OR-NOT GA



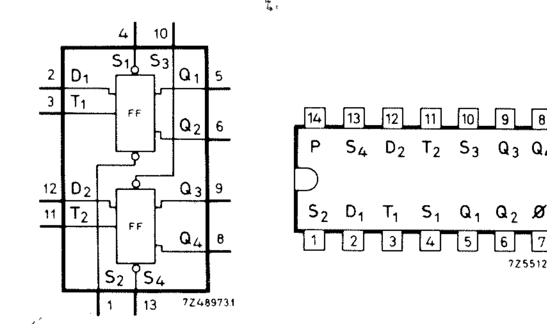
FJH181 7454 AOI

QUADRUPLE 2-INPUT NOR GATE



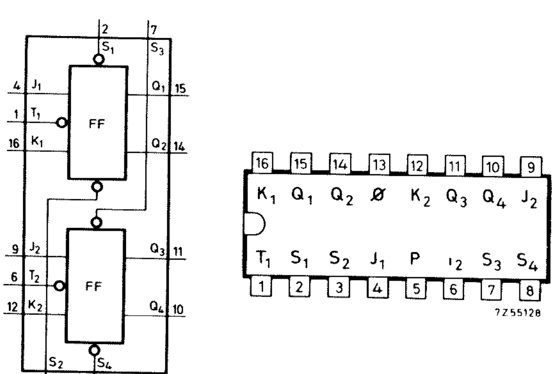
FJH221 7402

DUAL D-TYPE EDGE-TRIGGERED FLIP-FLOP



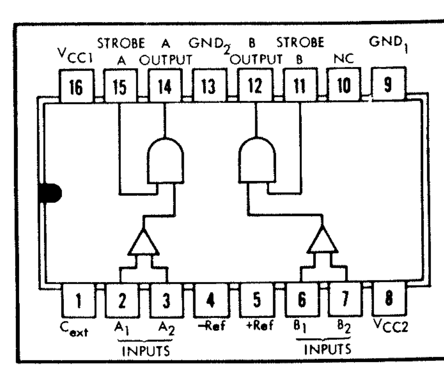
FJJ131 7474

DUAL JK MASTER-SLAVE FLIP-FLOP



FJJ191 7476

SENSE AMPLIFIER



SN7525N

XXXI. Access to and replacement of parts

A. Removing the chassis (see Fig. XXXI-1)

1. Loosen the two screws "A"
2. Turn the two locking brackets "B" forward
3. Pull out the chassis

B. Removing the textplate

1. Remove the chassis as indicated in section "A"
2. Remove the screws underside of the loding brackets "B"
3. Remove the fixing nut which holds the mains switch
4. Remove ornamental strip
5. The textplate can be removed

Now the push button switch, potentiometer ect. are accessible.

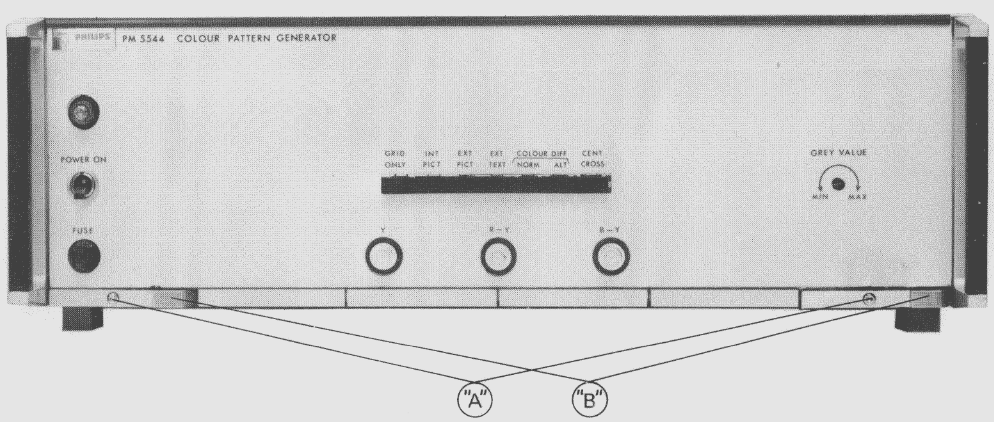


Fig. XXXI-1. Front of the instrument

XXXII. Maintenance

A. Switches

Should the switches cease to function properly due to dirty contacts, they should be treated with switch oil (see list of mechanical parts).
This oil has both cleaning and lubricating properties.
After using this oil, the switch should be operated a few times.

B. Cabinet

The P.V.C. coated cabinet can be cleaned with soap and water (first remove chassis, chapter XXXI.)
If necessary, a fine scouring detergent can be used.

XXXIII. List of mechanical parts

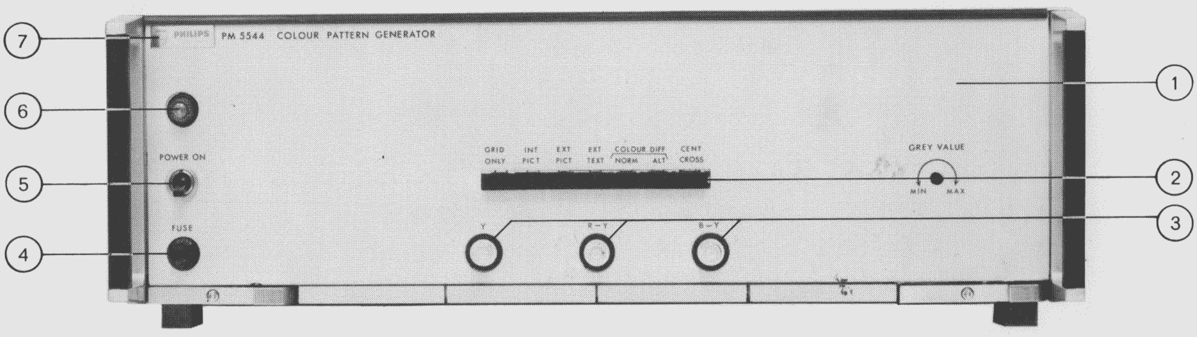


Fig. XXXIII-1. Front of the instrument

Item	Description	Quantity	Ordering number
1	Textplate	1	4822 455 70102
2	Push-button switch	1	4822 276 70048
3	BNC socket	3	4822 276 10004
4	Fuse holder	1	4822 256 40039
5	Mains switch	1	4822 277 10226
6	Lampholder	1	4822 255 10078
7	Badge	1	4822 459 10086

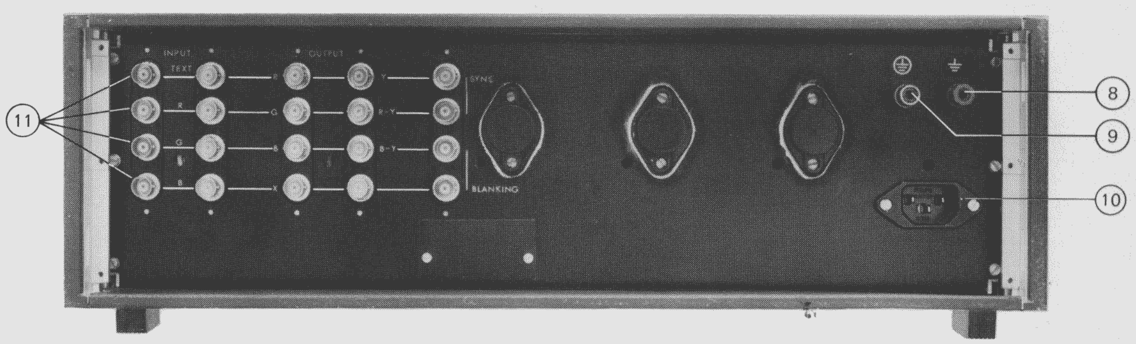


Fig. XXXIII-2. Rear of the instrument

Item	Description	Quantity	Ordering number
8	Earth connector (chassis)	1	4822 290 40011
9	Earth connector (electrical)	1	4822 290 40012
10	Mains socket	1	4822 265 30066
11	BNC socket (3-pole)	20	4822 267 10004
	Mains flex (3-pole)	1	4822 321 10071
	BNC connector (cable part)	10	4822 265 10003
	Terminating plug (75 Ω)	6	4822 263 60033
	Connector plate	5	4822 466 90687
	Fuse 230 V/500 mA (delayed action)	1	4822 253 30017
	Fuse 115 V/1000 mA (delayed action)	1	4822 253 30021
	Coaxial cable (75 Ω)		4822 320 10028
	10 cc of switch oil		4822 390 10007

XXXIV. List of electrical parts

This parts list does not contain multi-purpose and standard parts. These components are indicated in the circuit diagram by means of identification marks. The specification can be derived from the survey below.

Diese Ersatzteilliste enthält keine Universal- und Standard-Teile. Diese sind im jeweiligen Prinzipschaltbild mit Kennzeichnungen versehen. Die Spezifikation kann aus nachstehender Übersicht abgeleitet werden.

In deze stuklijst zijn geen universele en standaardonderdelen opgenomen. Deze componenten zijn in het principeschema met een merkteken aangegeven. De specificatie van deze merktekens is hieronder vermeld.

La présente liste ne contient pas des pièces universelles et standard. Celles-ci ont été repérées dans le schéma de principe. Leurs specifications sont indiquées ci-dessous.

Esta lista de componentes no comprende componentes universales ni standard. Estos componentes están provistos en el esquema de principio de una marca. El significado de estas marcas se indica a continuación.

Carbon resistor E24 series Kohleschichtwiderstand, Reihe E24 Koolweerstand E24 reeks Résistance au carbone, série E24 Resistencia de carbón, serie E24	0,125 W 5%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	1 W ≦ 2,2 MΩ, 5% > 2,2 MΩ, 10%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	0,25 W ≦ 1 MΩ, 5% > 1 MΩ, 10%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	2 W 5%
Carbon resistor E24 series Kohleschichtwiderstand, Reihe E24 Koolweerstand E24 reeks Résistance au carbone, série E24 Resistencia de carbón, serie E24	0,5 W ≦ 5 MΩ, 1% > 5 ≦ 10 MΩ, 2% > 10 MΩ, 5%
Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	0,4 – 1,8 W 0,5%
Carbon resistor E12 series Kohleschichtwiderstand, Reihe E12 Koolweerstand E12 reeks Résistance au carbone, série E12 Resistencia de carbón, serie E12	0,5 W ≦ 1,5MΩ, 5% > 1,5MΩ, 10%
Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	5,5 W ≦ 200 Ω, 10% > 200 Ω, 5%
Wire-wound resistor Drahtwiderstand Draadgewonden weerstand Résistance bobinée Resistencia bobinada	10 W 5%
Tubular ceramic capacitor Rohrkondensator Keramische kondensator, buistype Condensateur céramique tubulaire Condensador cerámico tubular	500 V
Polyester capacitor Polyesterkondensator Polyesterkondensator Condensateur au polyester Condensador polyester	400 V
Tubular ceramic capacitor Rohrkondensator Keramische kondensator, buistype Condensateur céramique tubulaire Condensador cerámico tubular	700 V
Flat-foil polyester capacitor Miniatur-Polyesterkondensator (flach) Platte miniatuur polyesterkondensator Condensateur au polyester, type plat Condensador polyester, tipo de placas planas	250 V
Ceramic capacitor, "pin-up" Keramikkondensator "Pin-up" (Perltyp) Keramische kondensator "Pin-up" type Condensateur céramique, type perle Condensador cerámico, versión "colgable"	500 V
Paper capacitor Papierkondensator Papierkondensator Condensateur au papier Condensador de papel	1000 V
"Microplate" ceramic capacitor Miniatur-Scheibenkondensator "Microplate" keramische kondensator Condensateur céramique "microplate" Condensador cerámico "microplaca"	30 V
Wire-wound trimmer Drahttrimmer Draadgewonden trimmer Trimmer à fil Trimmer bobinado	
Mica capacitor Glimmerkondensator Micakondensator Condensateur au mica Condensador de mica	500 V
Tubular ceramic trimmer Rohrtrimmer Buisvormige keramische trimmer Trimmer céramique tubulaire Trimmer cerámico tubular	

For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.
Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.
Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.
Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS.
Para piezas universales y standard consulte el Catálogo de Servicio PHILIPS.

Printpanels

Unit	Quantity	Description	Print number	Ordering number
1	1	Voltage regulator	4008 108 75120	5322 216 60153
2 (G version)	1	Memory	4008 108 75130	5322 216 60154
2 (M version)	1	Memory	4008 108 76400	5322 212 84001
3	1	Circle register	4008 108 75140	5322 216 60155
4 (G version)	1	Vertical divider	4008 108 75150	5322 216 60156
5	1	Vertical decoder	4008 108 75160	5322 216 60157
6	1	Horizontal oscillator	4008 108 76541	5322 212 84002
7	1	Cross gate	4008 108 75180	5322 216 60159
8	1	Circle matrix	4008 108 75190	5322 216 60161
9	1	Grid matrix	4008 108 75200	5322 216 60162
10 (G version)	1	Definition lines	4008 108 75210	5322 216 60163
11A	1	Video mixer (B-Y)	4008 108 75220	5322 216 60164
11B	1	Video mixer (Y)	4008 108 75220	5322 216 60164
12	1	Video input	4008 108 75230	5322 216 60165
13A	1	Video mixer (R-Y)	4008 108 75220	5322 216 60164
13B	1	R-G-B matrix	4008 108 75240	5322 216 60166
14A	1	Output amplifier	4008 108 75250	5322 216 60167
14B	1	Output amplifier	4008 108 75250	5322 216 60167
15A	1	Test amplifier	4008 108 75260	5322 216 60168
15B	1	Output amplifier	4008 108 75250	5322 216 60167
16	1	Sync. regenerator	4008 108 75370	5322 216 60169
	1	Rectifier unit	4008 108 75380	5322 216 60171
17	1	Extension board	4008 108 75570	5322 466 10216
	1	Extension board	4008 108 76310	5322 466 10216
18	1	Current gate	4008 108 77270	5322 212 84011

Semiconductors

Type	Ordering number	Type	Ordering number
2N930	5322 130 40051	AAY21	5322 130 30087
2N2297	5322 130 40131	AAZ15	5322 130 30229
2N2369	5322 130 40407	AEY27	5322 130 30017
2N2570	5322 130 40181	BAX13	5322 130 40182
2N2894	5322 130 40018	BAX16	5322 130 30273
2N2905	5322 130 40444	BY164	5322 130 30414
2N3055	5322 130 40132	BZY88/C5V1	5322 130 30284
BCY88	5322 130 30187	BZY88/C5V6	5322 130 30193
BCY89	5322 130 30188	BZY88/C6V8	5322 130 30079
BFW10 (pair)	5322 130 40179	BZY88/C7V5	5322 130 30287
BFY55	5322 130 40323		
2N3962	5322 130 40373		

Integrated circuits

Type	Ordering number
FJH 101	5322 209 80106
FJH 111	5322 209 80024
FJH 121	5322 209 80062
FJH 131	5322 209 80023
FJH 151	5322 209 80125
FJH 181	5322 209 80131
FJH 221	5322 209 80128
FJJ 131	5322 209 80065
FJJ 191	5322 209 80127
SN 7525 N	5322 209 80129

Diagram number	Description	Value		Watt/Volt		Ordering number
R1	Potentiometer	10	kΩ			5322 103 20094
Unit 1						
C1	Capacitor	1	kpF			5322 120 21107
C7	Electrolytic capacitor	8	μF	40 V		5322 124 10083
C8	Electrolytic capacitor	20	μF	16 V		5322 124 10008
C9	Electrolytic capacitor	40	μF	6.4 V		5322 124 10011
C10	Electrolytic capacitor	32	μF	10 V		5322 124 10062
R1	Resistor	1.5	Ω	10 %	1 W	5322 113 60092
R6, R32	Resistor	2.21	kΩ	1 %		5322 116 50532
R8	Resistor	1.10	kΩ	1 %		5322 116 50518
R12, R24, R34	Resistor	1.82	kΩ	1 %		5322 116 50781
R13	Resistor	20	kΩ	1 %		5322 116 50332
R17, R35	Resistor	15.0	kΩ	1 %		5322 116 50663
R23	Resistor	0.56	Ω	10 %	1 W	5322 113 60094
R25	Resistor	33.2	kΩ	1 %		5322 116 50416
R28	Resistor	100	kΩ	1 %		5322 116 50746
R29	Resistor	3.3	kΩ	1 %		5322 116 50404
R33	Resistor	1.8	Ω	10 %	1 W	5322 113 60073
R11	Resistor	1.2	Ω	10 %		4822 113 50078
Unit 2						
	Sub memory assy					5322 216 60181
L1, L2	Coil					5322 158 10052
C1 ... C4	Capacitor	150	pF			5322 122 30002
C5	Electrolytic capacitor	56	μF	16 V		5322 124 10068
R27	Resistor	3.3	Ω	10 %	1 W	5322 113 60072
C6	Electrolytic capacitor	220	μF	10 V		4822 124 20573
Unit 3						
L1...L3	Coil					5322 158 10052
C4, C5	Capacitor	180	pF	16 V		5322 121 50416
C6	Electrolytic capacitor	20	μF	16 V		5322 124 10008
C7	Electrolytic capacitor	40	μF	6.4 V		5322 124 10011
C8	Electrolytic capacitor	32	μF	10 V		5322 124 10062
R5	Resistor	182	Ω	1 %		5322 116 50754
Unit 4						
L1, L2	Coil					5322 158 10052
C1	Capacitor	15	kpF			5322 121 40301
C2	Capacitor	3.3	kpF	1 %		5322 121 50085
C3	Capacitor	1.5	kpF	1 %		5322 121 50432
C4, C6...C9	Capacitor	220	pF	1 %		5322 121 50371
C5	Capacitor	120	pF	1 %		5322 121 50439
C10, C11	Capacitor	1	kpF	2 %		5322 122 30027
C12	Capacitor	680	pF	1 %		5322 121 50367
C13	Electrolytic capacitor	82	μF	6.4 V		5322 124 20384
C14	Electrolytic capacitor	0.1	μF	100 V		5322 124 40146
C15	Electrolytic capacitor	33	μF	10 V		5322 124 10062
R4	Potentiometer	50	kΩ			5322 100 10079
R15, R21, R28	Potentiometer	10	kΩ			5322 100 10035
C06	Electrolytic capacitor	22	μF	6.3 V		5322 124 24033
C07	Electrolytic capacitor	10	μF	10 V		5322 124 24008

Diagram number	Description	Value	Watt/Volt	Ordering number
Unit 5				
L1, L2	Coil			5322 158 10052
C1	Capacitor	820 pF		5322 121 50368
C2	Capacitor	68 pF		5322 120 11076
C3	Capacitor	270 pF		5322 121 50409
C4	Capacitor	5.6 kpF		5322 121 50373
C5	Capacitor	390 pF		4822 121 50418
C6	Electrolytic capacitor	68 μF	16 V	5322 124 10016
C7	Electrolytic capacitor	125 μF	6.4 V	5322 124 10074
R2	Potentiometer	10 kΩ		5322 100 10035
R11	Resistor	1.21 kΩ	1 %	5322 116 50099
R12	Resistor	227 Ω	1 %	5322 116 50435
R13	Resistor	562 Ω	1 %	5322 116 50662
R14	Resistor	130 Ω	1 %	5322 116 50085
R16, R17	Resistor	1.00 kΩ	1 %	5322 116 50573
R19	Resistor	825 Ω	1 %	5322 116 50764
Unit 6				
L1, L2, L3	Coil			5322 158 10052
C1, C12	Capacitor	3.3 kpF		5322 121 50085
C2	Capacitor	560 pF		5322 121 50061
C7	Capacitor	15 kpF		5322 121 40301
C8, C13	Capacitor	270 pF		5322 121 30409
C11	Capacitor	1.5 μF		5322 121 40227
C17	Electrolytic capacitor	20 μF	16 V	5322 124 10153
C18	Electrolytic capacitor	40 μF	6.4 V	5322 124 10011
C19	Electrolytic capacitor	50 μF	10 V	5322 124 10068
C20	Electrolytic capacitor	32 μF	10 V	5322 124 10062
R5	Resistor	50 μ	PTC	5322 116 40007
R6	Potentiometer	2 kΩ		5322 103 10135
R40	Resistor	10 kΩ	1 %	5322 116 50748
R41	Potentiometer	500 kΩ		5322 103 10052
R43	Resistor	12.1 kΩ	1 %	5322 116 50572
Unit 7				
L1	Coil			5322 158 10052
C1	Capacitor	470 pF		5322 121 50413
C3	Capacitor	1.5 kpF		5322 121 50432
C4	Electrolytic capacitor	40 μF	6.4 V	5322 124 10011
Unit 8				
L1, L2, L3	Coil			5322 158 10052
C1, C3, C5	Capacitor	100 kpF		5322 121 40059
C6	Capacitor	470 kpF		5322 121 40175
C7, C10	Electrolytic capacitor	40 μF	6.4 V	5322 124 10011
C8	Electrolytic capacitor	20 μF	20 V	5322 124 10153
C9	Electrolytic capacitor	32 μF	10 V	5322 124 10062
C11	Capacitor	0.6 pF		5322 125 60067
C12	Capacitor	2.7 pF		5322 120 10038
C13, C14	Capacitor	680 kpF		5322 121 40233
R1, R3, R5, R7, R9 R11, R13, R15, R17	Resistor	10 kΩ	1 %	5322 116 50748
R18	Resistor	1.50 kΩ	1 %	5322 116 50293
R20	Resistor	5.62 kΩ	1/4 %	5322 116 50885

Diagram number	Description	Value	Watt/Volt	Ordering number
R21	Potentiometer	100 Ω		5322 100 10073
R24	Resistor	909 Ω	1/4 %	5322 116 50765
R25, 26	Resistor	5.11 kΩ	1/4 %	5322 116 50762
R30	Resistor	1.30 kΩ	1/4 %	5322 116 50878
R31	Resistor	200 Ω	1/4 %	5322 116 50267
R32	Resistor	1.50 kΩ	1 %	5322 116 50293
R33	Resistor	9650 Ω	1/4 %	5322 116 50618
R34	Resistor	825 Ω	1 %	5322 116 50764
R35	Resistor	2.67 kΩ	1/4 %	5322 116 50867
R36	Resistor	499 Ω	1/4 %	5322 116 50847
R37	Resistor	619 Ω	1/4 %	5322 116 50584
R38	Potentiometer	500 Ω		5322 100 10038
R41	Resistor	1870 Ω	1/4 %	5322 116 50472
R42	Potentiometer	200 Ω		5322 100 10019
R45	Resistor	2.67 kΩ	1/4 %	5322 116 50867
R46	Resistor	392 Ω	1/4 %	5322 116 50287
R47	Resistor	619 Ω	1/4 %	5322 116 50584
R48	Potentiometer	500 Ω		5322 100 10038
R51	Resistor	3920 Ω	1/4 %	5322 116 50882
R52	Resistor	59.0 kΩ	1/4 %	5322 116 50886
R54	Potentiometer	200 Ω		5322 100 10019
Unit 9				
L1, L2, L3	Coil			5322 158 10052
C1, C2, C8	Capacitor	100 kpF		5322 121 40059
C3	Capacitor	120 pF		5322 121 50404
C4	Capacitor	22 pF		5322 122 30022
C5	Capacitor	560 pF		5322 121 50491
C6	Capacitor	330 kpF		5322 121 40257
C7, C10	Capacitor	680 kpF		5322 121 40233
C9, C12	Electrolytic capacitor	64 μF	6.4 V	5322 124 10016
C11	Electrolytic capacitor	32 μF	16 V	5322 124 10062
C13	Electrolytic capacitor	50 μF	10 V	5322 124 10068
C14	Capacitor	330 pF		5322 121 50369
R1, R2, R5, R6	Resistor	3.01 kΩ	1/4 %	5322 116 50806
R3, R4	Resistor	5.36 kΩ	1/4 %	5322 116 50884
R7-17	Resistor	332 Ω	1 %	5322 116 50788
R8-18	Resistor	392 Ω	1 %	5322 116 54006
R11, R12, R15, R16	Resistor	2.21 kΩ	1/4 %	5322 116 50532
R13, R14	Resistor	2.67 kΩ	1/4 %	5322 116 50867
R34	Resistor	825 Ω	1 %	5322 116 50764
R35	Resistor	2.29 kΩ	1/4 %	5322 116 50227
R36	Resistor	1.10 kΩ	1/4 %	5322 116 50844
R46, R47, R49	Potentiometer	200 Ω		5322 100 10019
Unit 10				
L1, L2, L3	Coil			5322 158 10052
C1	Capacitor	100 pF		5322 121 50411
C4	Trimmer	0-12 pF		5322 125 60033
C5	Capacitor	100 kpF		5322 121 40059
C7	Electrolytic capacitor	125 μF	6.4 V	5322 124 10074
C8, C9	Electrolytic capacitor	64 μF	16 V	5322 124 10016
R2, R4, R6, R8	Resistor	20.0 kΩ	1 %	5322 116 50332
R9, R27	Potentiometer	200 Ω		5322 103 10118
R19, R25, R26	Resistor	3.32 kΩ	1 %	5322 116 50404
R20	Resistor	1.00 kΩ	1 %	5322 116 50573

Diagram number	Description	Value		Watt/Volt		Ordering number
R24	Potentiometer	500	Ω			5322 103 10052
R34	Potentiometer	2	kΩ			5322 103 10135
R50, R56	Potentiometer	5	kΩ			5322 103 10049
R60	Resistor	1.82	kΩ	1	%	5322 116 50781
Unit 11A, Unit 11B and Unit 13A						
L2	Coil					5322 158 10052
C1	Electrolytic capacitor	32	μF	16	V	5322 124 10148
C2-C4	Capacitor	8.2	pF			5322 122 40009
R1	Resistor	511	Ω	1	%	5322 116 50659
R14, R18, R22	Resistor	1.00	kΩ	1	%	5322 116 50573
Unit 12						
L1, L2, L3	Coil					5322 158 10052
C2	Capacitor	1	pF			5322 122 30104
C4, C8, C12, C20	Electrolytic capacitor	50	μF	10	V	5322 124 10068
C5, C10, C14	Capacitor	0.1	μF			5322 121 40059
C6, 18	Electrolytic capacitor	32	μF	16	V	5322 124 10148
C15, C19	Electrolytic capacitor	64	μF	16	V	5322 124 10016
C16, C21	Capacitor	0.47	μF			5322 121 40175
C17	Electrolytic capacitor	125	μF			5322 124 10076
R1	Resistor	8.16	kΩ	1/4	%	5322 116 50888
R2	Resistor	42.2	kΩ	1/4	%	5322 116 50883
R3	Resistor	16	kΩ	1/4	%	5322 116 50881
R5	Resistor	11.0	kΩ	1	%	5322 116 50445
R7, R20, R33	Potentiometer	2	kΩ			5322 100 10029
R8	Resistor	33.2	kΩ	1	%	5322 116 50482
R12, R15, R25, R28	Potentiometer	500	Ω			5322 100 10038
R14, R27, R40	Resistor	5.62	kΩ	1	%	5322 116 50853
R16, R29	Resistor	15.0	kΩ	1	%	5322 116 50663
R18	Resistor	20	kΩ	1	%	5322 116 50332
R21	Resistor	27.4	kΩ	1	%	5322 116 50559
R31	Resistor	16.2	kΩ	1	%	5322 116 50593
R34	Resistor	22.1	kΩ	1	%	5322 116 50648
R38	Resistor	2.43	kΩ	1	%	5322 116 50248
R39	Potentiometer	1	kΩ			5322 100 10038
Unit 13B						
L1,L2, L3	Coil					5322 158 10052
L4, L5, L6	Coil	330	μH			5322 158 10307
C1	Electrolytic capacitor	64	μF	6.4	V	5322 124 10016
C2	Electrolytic capacitor	64	μF	16	V	5322 124 10016
C3	Electrolytic capacitor	100	μF	10	V	5322 124 10012
R3, R16, R29	Resistor	4.75	kΩ	1	%	5322 116 50385
R4, R5, R17, R18, R30, R31	Resistor	3.92	kΩ	1	%	5322 116 50103
R6, R19, R32	Potentiometer	2	kΩ			5322 103 10135
R7, R20, R33	Resistor	3.32	kΩ	1	%	5322 116 50404
R8, R21, R34	Resistor	10.0	kΩ	1	%	5322 116 50463
R9	Resistor	14.3	kΩ	1/4	%	5322 116 50879
R10, R36	Resistor	22.1	kΩ	1	%	5322 116 50648
R12, R24, R37	Resistor	15	kΩ	1	%	5322 116 50539
R13, R26, R39	Resistor	2.21	kΩ	1	%	5322 116 50532
R22	Resistor	31.6	kΩ	1/4	%	5322 116 50421

Diagram number	Description	Value	Watt/Volt	Ordering number
R23	Resistor	63.4 kΩ	1/4 %	5322 116 50887
R35	Resistor	11.3 kΩ	1/4 %	5322 116 50877
Unit 14A, Unit 14B and Unit 15B				
L1...L4	Coil			5322 158 10052
C1, C8, C10, C12	Electrolytic capacitor	100 μF	10 V	5322 124 10012
C3, C14	Capacitor	56 pF		5322 122 30116
C4, C6	Electrolytic capacitor	64 μF	16 V	5322 124 10016
C5, C7, C9, C11	Capacitor	6.8 kpF		5322 120 21129
R1, R16	Potentiometer	2 kΩ		5322 100 10029
R14, R15, R29, R30	Resistor	75.0 Ω	1 %	5322 116 50001
Unit 15A				
L1	Coil			5322 158 10052
C2, C3	Electrolytic capacitor	1250 μF	4 V	5322 124 20509
C4	Electrolytic capacitor	100 μF	10 V	5322 124 10012
R5, R7	Resistor	121 Ω	1 %	5322 116 50003
R6	Resistor	365 Ω	1 %	5322 116 50529
R8	Resistor	130 Ω	1 %	5322 116 50085
R9	Resistor	1.8 kΩ	1 %	5322 116 50781
Unit 16				
L1, L2, L3	Coil			5322 158 10052
C1, C6	Capacitor	1 μF		5322 121 40176
C3, C8, C19	Capacitor	100 kpF		5322 121 40036
C5, C10	Capacitor	82 pF		5322 120 10078
C11, C14	Capacitor	22 kpF		5322 121 50287
C12	Capacitor	820 pF		5322 121 50368
C13, C15	Capacitor	680 pF		5322 121 50367
C2, C4, C7, C9	Electrolytic capacitor	10 μF	16 V	5322 124 10004
C16	Electrolytic capacitor	40 μF	25 V	5322 124 10108
C17	Electrolytic capacitor	100 μF	10 V	5322 124 10012
C18	Electrolytic capacitor	64 μF	16 V	5322 124 10016
R31	Resistor	10.0 kΩ	1 %	5322 116 50748
R34	Resistor	22.1 kΩ	1 %	5322 116 50648
R36	Resistor	47.5 kΩ	1 %	5322 116 50391
R42	Resistor	100 kΩ	1 %	5322 116 50244
R49	Resistor	1.3 kΩ	1 %	5322 116 50526
R50	Resistor	3.9 kΩ	1 %	5322 116 50103
Unit 17				
C1, C3	Electrolytic capacitor	1250 μF	40 V	5322 124 30069
C2	Electrolytic capacitor	2500 μF	25 V	5322 124 30009

QUALITY REPORTING

CODING SYSTEM FOR FAILURE DESCRIPTION

The following information is meant for Philips service workshops only and serves as a guide for exact reporting of service repairs and maintenance routines on the workshop charts.
For full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for Test and Measuring Instruments).

LOCATION

Unit number
e.g. 000A or 0001 (for unit A or 1; not 00UA or 00U1)

or: Type number of an accessory (only if delivered with the equipment)
e.g. 9051 or 9532 (for PM 9051 or PM 9532)

or: Unknown/Not applicable
0000

CATEGORY

0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

COMPONENT/SEQUENCE NUMBER

Enter the identification as used in the circuit diagram, e.g.:

GR1003	Diode GR1003
TS0023	Transistor TS23
IC0101	Integrated circuit IC101
R0....	Resistor, potentiometer
C0....	Capacitor, variable capacitor
B0....	Tube, valve
LA....	Lamp
VL...	Fuse
SK....	Switch
BU....	Connector, socket, terminal
T0....	Transformer
L0....	Coil
X0....	Crystal
CB....	Circuit block
RE....	Relay
ME....	Meter, indicator
BA....	Battery
TR....	Chopper

Parts not identified in the circuit diagram:

990000	Unknown/Not a[illegible]
990001	Cabinet or rack [illegible]blem, grip, rail, graticule, e[illegible]
990002	Knob (incl. dial knob, cap, etc.)
990003	Probe (only if attached to instrument)
990004	Leads and associated plugs
990005	Holder (valve, transistor, fuse, board, etc.)
990006	Complete unit (p.w. board, h.t. unit, etc.)
990007	Accessory (only those without type number)
990008	Documentation (manual, supplement, etc.)
990009	Foreign object
990099	Miscellaneous

Sales and service all over the world

Argentina: Philips Argentina S.A., Cassila Correo 3479, Buenos Aires; tel. T.E. 70, 7741 al 7749

Australia: Philips Electrical Pty Ltd., Philips House, 69-79 Clarence Street, Box 2703 G.P.O., Sydney; tel. 2.0223

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Ned. Antillen: N.V. Philips Antillana, Postbus 523, Willemstad; tel. Curaçao 36222-35464

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