Colour pattern generator PM5534

Instruction manual

9499 493 03911
840521/02

S&I
Scientific & Industrial Equipment Division

PHILIPS

STS Jan 2023

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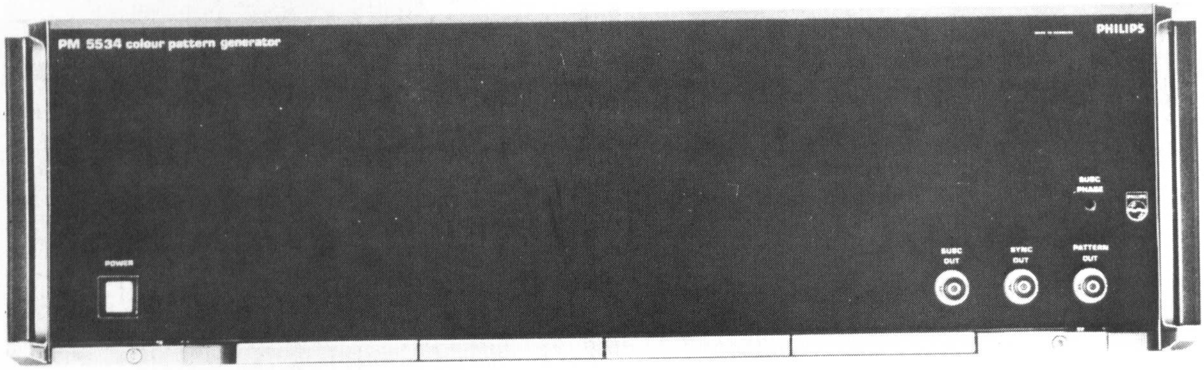

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Important

In correspondence concerning this instrument, please quote the full type and serial number as shown on the identification plate on the rear of the instrument.

Training

Courses of technical training on this, and other current PTV equipment are available either on a pre-planned basis, or to suit individual requirements.
These courses are held in English.
For details of location, time and duration of pre-planned courses, or the possibilities that exist for individually planned courses, please complete the form on the next page and return it to the Philips service organisation in your country.

Fault analysis

In the event of instrument failure, please complete the "Fault Analysis sheet" at the beginning of the "Servicing Instructions" section of this manual. After completion, please send it to the Philips service organisation in your country.

Printed in Denmark

AFTER COMPLETION, CUT ALONG DOTTED LINE AND RETURN TO THE PHILIPS SERVICE ORGANISATION IN YOUR COUNTRY.

REQUEST FOR TRAINING

Recent advances in equipment design and our commitment to the use of leading edge technology has placed increasing demands on servicing personnel world-wide. While we make every effort to ensure that our manuals reflect these advances (at the same time remaining service oriented), the need for effective and regular training has become more and more necessary. Tailor-made courses of instruction on current PTV instruments are therefore being made available to complement the information contained in our manuals. Participation will inevitably lead to reduced down-time and repair costs. If you are interested in our training program or just require information, please complete the information sheet below, and send it to the Philips service organisation in your country who will contact you and provide more detailed information for your consideration.

COMPANY NAME: ______________________

ADDRESS: ______________________

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____

We require information only: ☐

WE WOULD LIKE TRAINING ON THE FOLLOWING INSTRUMENTS:

PM ______ PM ______ PM ______ PM ______

PM ______ PM ______ PM ______ PM ______

Number of participants: ☐ (MAX. 12).

Location: ☐ ON MY OWN PREMISES.

☐ AT PHILIPS SERVICE ORGANISATION.

☐ IN COPENHAGEN.

Time available: ☐ WEEKS/DAYS.

Start date: ☐ DAY ☐ MONTH ☐ YEAR

Finish date: ☐ DAY ☐ MONTH ☐ YEAR

Type of course required: ☐ SYSTEMS/APPLICATIONS.

☐ SERVICING-FAULTFINDING.

☐ OTHER (PLEASE SPECIFY BELOW)

PLEASE SEND THIS REQUEST TO THE PHILIPS SERVICING ORGANISATION IN YOUR COUNTRY. THANK YOU.

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GENERAL INFORMATION

1. Introduction

Colour pattern generator PM 5534 is successor to the well-known PM 5544.
The pattern of the PM 5544, recognized all over the world, offers the unique feature that all important parameters of a TV set can be checked at one glance on the picture tube itself.

This test pattern has been adopted by the television authorities in more than 20 countries in all parts of the world as the test pattern to be transmitted outside the programme hours. Therefore the PM 5534 pattern has been made identical to that of the PM 5544, so that compatibility between the two instruments is assured.

By using highly integrated components and customized integrated circuits it has been possible to incorporate both a colour sync pulse generator (SPG) and a colour encoder in the PM 5534. The instrument therefore only needs a mains connection to produce the complete, encoded colour pattern.

The pattern generator can be delivered for the following colour systems:
625 lines: G/PAL, I/PAL, L/SECAM, N/PAL
525 lines: M/PAL, M/NTSC

In addition there is room for optional print cards to extend the performance of the instrument:
- text in the black bars inside the circle for transmitter and/or authority identification.
- clock generator, giving the time in hours, minutes and seconds in digital display.
- oven-controlled crystal oscillator for the SPG to keep the colour subcarrier within ± 1 Hz.
- 10 MHz input card for locking to an external frequency standard.

2. Technical data

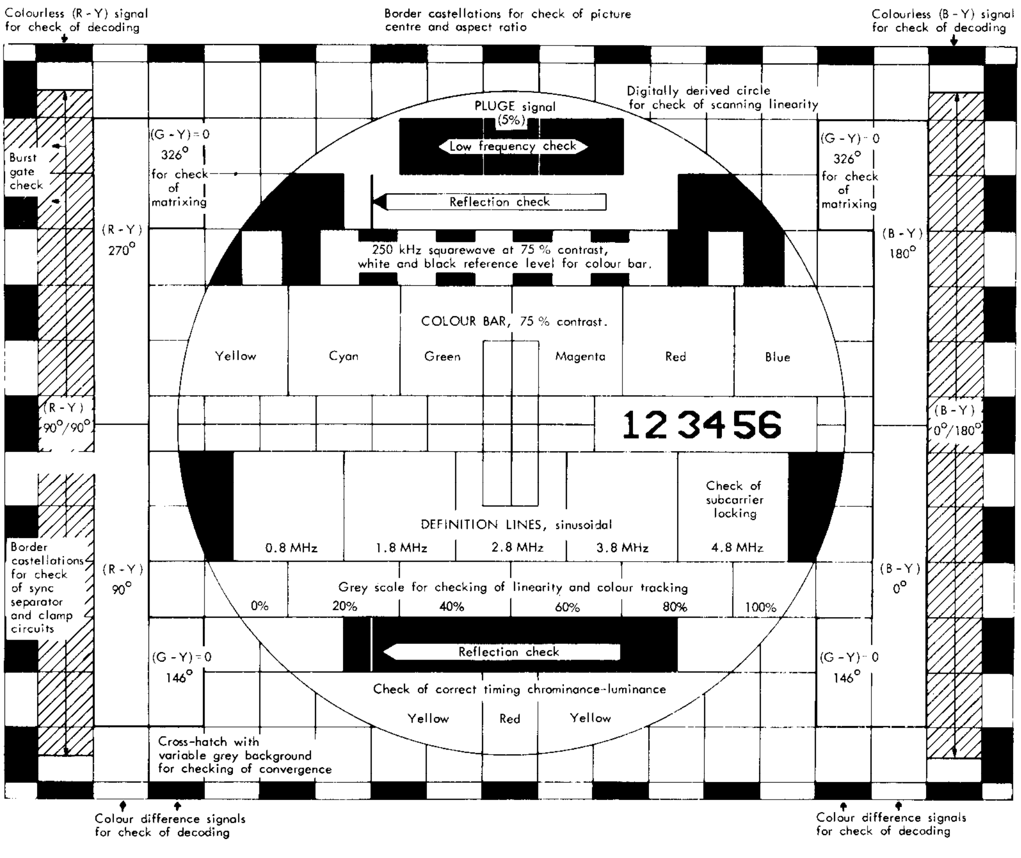
This instrument has been built and tested according to IEC publication 348 for Class I instruments and has been supplied in a safe condition. The present Manual contains instructions and warnings which should be followed by the purchaser to ensure safe operation and to keep the instrument in a safe condition.

Properties expressed in numerical values with standard tolerances are factory guaranteed. Those without tolerances are typical values.

A. System

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

B. Test pattern



SIGNALS INSIDE THE CIRCLE (from top to bottom)

1. Black rectangle (incl. a pluge signal) on white background.

Width of rectangle	:	11,3 µs
Pluge signal	:	5% below black

2. Black needle pulse on white background.

Width of needle pulse	:	225ns ± 12ns (G,I,L versions) 280ns ± 15ns (M,N versions)

3. Square wave signal.

Repetition frequency	:	250kHz
Amplitude	:	75% of white amplitude
Rise and fall time	:	100ns ± 5ns (G,I,L) 125ns ± 7ns (M,N)

4. Colour bar signal : yellow - cyan - green - magenta - red - blue.

Signal type	EBU		BBC
Saturation	100%	100%	95%
Contrast	75%	100%	75%
Set - up	0%	0%	25%

Normally the instrument is set to the Standard EBU colour bar.

M-version : 77/7,5/77/7,5 colour bar

5. Centre cross.

Width of vertical lines	:	225ns ± 12ns (G.I.L. versions) 280ns ± 15ns (M.N. versions)
Horizontal centre line	:	2 lines, one per field, reversed in sequence with lines of background (check of interlace)

A convergence cross is placed in the centre of the pattern.

6. Definition lines (Multiburst)

Frequencies	:	0.8 - 1.8 - 2.8 - 3.8 - 4.8 MHz (G-version)
		0.5 - 1.0 - 2.0 - 3.0 - 4.0 MHz (M,N-versions)
		1.5 - 2.5 - 3.5 - 4.0 - 4.5 -5.25MHz (BBC-version)
		0.8 - 1.8 - 2.8 - 1.8 - 0.8 MHz (Secam-version)
Amplitude	:	100% ± 2% (G,L,M,N)
		71.4% ± 2% (I)
Shape	:	Sinusoidal

7. Grey scale (Staircase)

Number of levels	:	6 (can be modified to 11)
Non-linearity of staircase	:	< 1%
Rise time	:	100ns ± 5ns (G,I,L version)
		125ns ± 7ns (M,N versions)

8. White needle pulse on black background

Width of needle pulse	:	225ns ± 12ns (G,I,L version)
		280ns ± 15ns (M,N versions)

9. Colour step

Colour	:	Red on yellow background
Width	:	2.6 µs
Saturation, contrast	:	As for the colour bar

10. Circle

Mode of generation	:	Digitally generated circle with Read Only Memory.
Diameter	:	88% af active picture height (625 - line versions)
		(84% for 525 - line versions)
Error of diameter	:	< 1%

SIGNALS OUTSIDE THE CIRCLE
(left hand side of the pattern).

1. Vertical bar with non-alternating R-Y signals $90^{o}/90^{o}$ and B-Y = 0.

2. Vertical bar with positive and negative R-Y signals $90^{o}/270^{o}$ and B-Y = 0.

3. Two rectangles with signals G-Y = 0 and phase $326^{o}/146^{o}$.

(right hand side of the pattern)

4. Vertical bar with line alternating B-Y signals $0^{o}/180^{o}$ and R-Y = 0. (Only of importance in the PAL system).

5. Vertical bar with positive and negative B-Y signals $0^{o}/180^{o}$ and R-Y = 0.

6. Two rectangles with signals G-Y = 0 and phase $326^{o}/146^{o}$.

All the signals from 1 to 6 have an amplitude = 48% white (G,I,L) and 52% (M) equal to the factory adjusted background level and with a phase tolerance within $\pm 1^{o}$.

Chrominance amplitude	:	0.33 Vpp (G,I version) 0.31 Vpp (M version)

BACKGROUND SIGNALS.

1. Cross hatch

Number of lines	:	14 horizontal x 18 vertical lines (equivalent to standard 14 × 19 lines pattern)
Width	:	225ns ± 12ns (G,I,L version) 280ns ± 15ns (M,N version)
Rise and fall time	:	100ns ± 5ns

2. Background level

Level	:	Adjustable within 25 to 75% of white (factory adj. to 48% for G,I,L version - 52% for M version

3. Black/white border castellations.

Rise and fall time	:	100ns ±5ns (G,I,L version) 125ns ±7ns (M,N version)

On some of the left hand castellations alternating R-Y information is superimposed for checking the burst gate of a receiver or decoder.

C. Synchronization input

Signal types	:	- Composite video - Black burst - Composite sync (subcarrier free running).
Input impedance	:	High ohmic, looped through.
Input amplitude	:	0.5 to 4Vpp.
Permissible hum	:	100%
Return loss	:	> 34 dB up to 7 MHz

D. Output signals

1. Pattern

Number of outputs	:	3
Signal type	:	Composite video signal
Video amplitude	:	700mVpp ± 1% (714mV, M-NTSC)
Sync amplitude	:	300mVpp ± 1% (286mV, M-NTSC)
Burst amplitude	:	300mVpp ± 2% (286mV, M-NTSC)
Output impedance	:	75Ω ± 1%
Return loss	:	> 34 dB up to 7 MHz
Isolation between outputs	:	> 40 dB up to 4.43 MHz
Black level	:	54mV (M-NTSC) 52.5mV (N-PAL)

2. Auxiliary

Signal	:	Cross hatch pattern (see technical data - BACKGROUND SIGNALS)
Video amplitude	:	700mV ± 3% (714mV, M-NTSC)
Sync amplitude	:	300mV ± 3% (286mV, M-NTSC)
Output impedance	:	75 Ω

3. Composite sync

Number of outputs	:	2
Amplitude	:	4Vpp ± 0.4V
Output impedance	:	75 Ω
Return loss	:	30 dB up to 4 MHz
Rise and fall time	:	200ns

4. Subcarrier

Amplitude	:	1Vpp ± 0.2V
Output impedance	:	75 Ω
Return loss	:	> 30 dB at 4.43 MHz

5. Test output - (Can be used for service work to make the pulse patterns on the circuit boards visible on a monitor).

Output impedance : 75 Ω

Rise and fall time : 100ns ± 5ns

E. Sync pulse generator

1. Colour subcarrier

Type of oscillator : Temperature Compensated Crystal Oscillator (TCXO)

	G/I - PAL	M - PAL	M - NTSC	N - PAL
Frequencies (MHz)	4.43361875	3.57561149	3.579545	3.58205625

Frequency tolerance : ± 5 Hz

2. Composite sync

	625 lines systems	525 lines systems		
	G/I/N-PAL L/SECAM	M-PAL	M-NTSC	
Line sync pulses	4.7 ± 0.2	4.77 ± 0.32	4.77 ± 0.32	µs
Front porch	1.5 ± 0.2	1.5 ± 0.2	1.7 ± 0.2	µs
Equalising pulses	2.35 ± 0.1	2.4 ± 0.15	2.4 ± 0.15	µs
Serration pulses	4.7 ± 0.2	4.45 ± 0.63	4.45 ± 0.63	µs
Number of serration pulses	5	6	6	
Number of equalising pulses	5 + 5	6 + 6	6 + 6	

3. Composite blanking

	G/I-PAL+N-PAL L-SECAM	M-NTSC M-PAL	
Line blanking duration	12.0 ± 0.3	10.95 ± 0.45	µs
Field blanking duration	25H + 12µs	20H + 11µs	

4. Colour burst

	G/I/N-PAL	M-PAL	M-NTSC	
Burst width	2.25 ± 0.23	2.5 ± 0.2	2.4 ± 0.3	μs
Burst position	5.6 ± 0.1	5.5 ± 0.2	5.5 ± 0.2	μs after line sync pulse
Burst suppression in the lines:	623 to 7	523 to 9	523 to 7	
	310 to 319	260 to 271	261 to 270	
	622 to 6	522 to 8		
	311 to 320	259 to 270		

F. Coder characteristics (PAL and NTSC)

Residual subcarrier : <0.5%

R-Y, B-Y quadrature error : $<0.5^{o}$

R-Y phase switch* error : $<0.5^{o}$

Luminance/chrominance time difference : <20ns

Colour subcarrier phase control : $>360^{o}$

* R-Y phase switching is not used in the NTSC system.

G. Coder characteristics (SECAM)

1. Chrominance subcarrier
   - f_R : 4.406250 MHz ± 2000 Hz
   - f_B ;: 4.250000 MHz ± 2000 Hz
   - Subcarrier amplitude : 23% ± 2.5% of white amplitude
   - Chrominance/luminance delay : <50ns
2. Frequency deviation
   - Δf_R nominal : 280 kHz ± 9 kHz
   - f_R maximum : +350 kHz ± 18 kHz, -506 kHz ± 25 kHz
   - f_B nominal : 230 kHz ± 7 kHz
   - f_B maximum : +506 kHz ± 25 kHz, -350 kHz ± 18 kHz
3. HF pre-emphasis (Bell filter)
   - f_0 : 4.286 MHz ± 20 kHz
   - Response : ±0.5dB from nominal
4. Blanking of subcarrier

a. During the field blanking period (with exception of the colour identification lines).

b. From the leading edge of line-blanking to 5.6μs ± 0.2μs after leading edge of sync pulse.

Suppression : >50dB

5. Colour identification lines

Line numbers	:	7 to 15 in field 1 and 3
		320 to 328 in field 2 and 4
Amplitude	:	D_R = 500mVpp ± 40mVpp
		D_B 540mVpp ± 40mVpp
Deviation	:	D_R = +350 kHz ± 18 kHz
		D_B = -350 kHz ± 18 kHz

H. Power supply

Voltage	:	230/115V ±20%
Frequency	:	48 - 65 Hz
Consumption	:	55 W at 220V

I. Temperature

The instrument works inside specification limits in the temperature range 0 - 45°C ambient when adjusted to nomimal values at 20 - 25°C.

J. Mechanical data

Width	:	6/6 module in PHILIPS universal 19'' system.
Height	:	132 mm (3units)
Depth	:	435 mm
Weight, including cabinet	:	13.6 kp.

K. Technical data PM8503

Number of text lines	:	2
Text amplitude	:	White level in the test pattern
Number of characters, top line	:	Max. 9
Number of charactors, bottom line	:	Max. 13
Characters	:	14 x 32 dot matrix

L. Technical data PM8504

Time, displayed in	:	Hours - minutes - seconds
		(0-24 or 0-12 hours)
Stand-by mode: Battery capacity	:	24 hours at fully charged battery
Oscillator accuracy	:	Keeps the time within 2 seconds for
		24 hours

3. Accessories

1 Manual 9499 493 03911

1 Mains cord

2 Extension boards, enabling measurements on the instrument during operation.

1 Hexagonal key

2 Brackets

1 75Ω BNC termination

OPTIONS available

PM 8501	Interface card
PM 8502	Oven-controlled crystal oscillator
PM 8503	Text generator
PM 8504	Clock generator
PM 8507	Test print for complete readjustment

4. Description of the block diagram

Functionally the PM 5534 can be divided into three sections, which are briefly described in this chapter.
The three sections are as listed below:

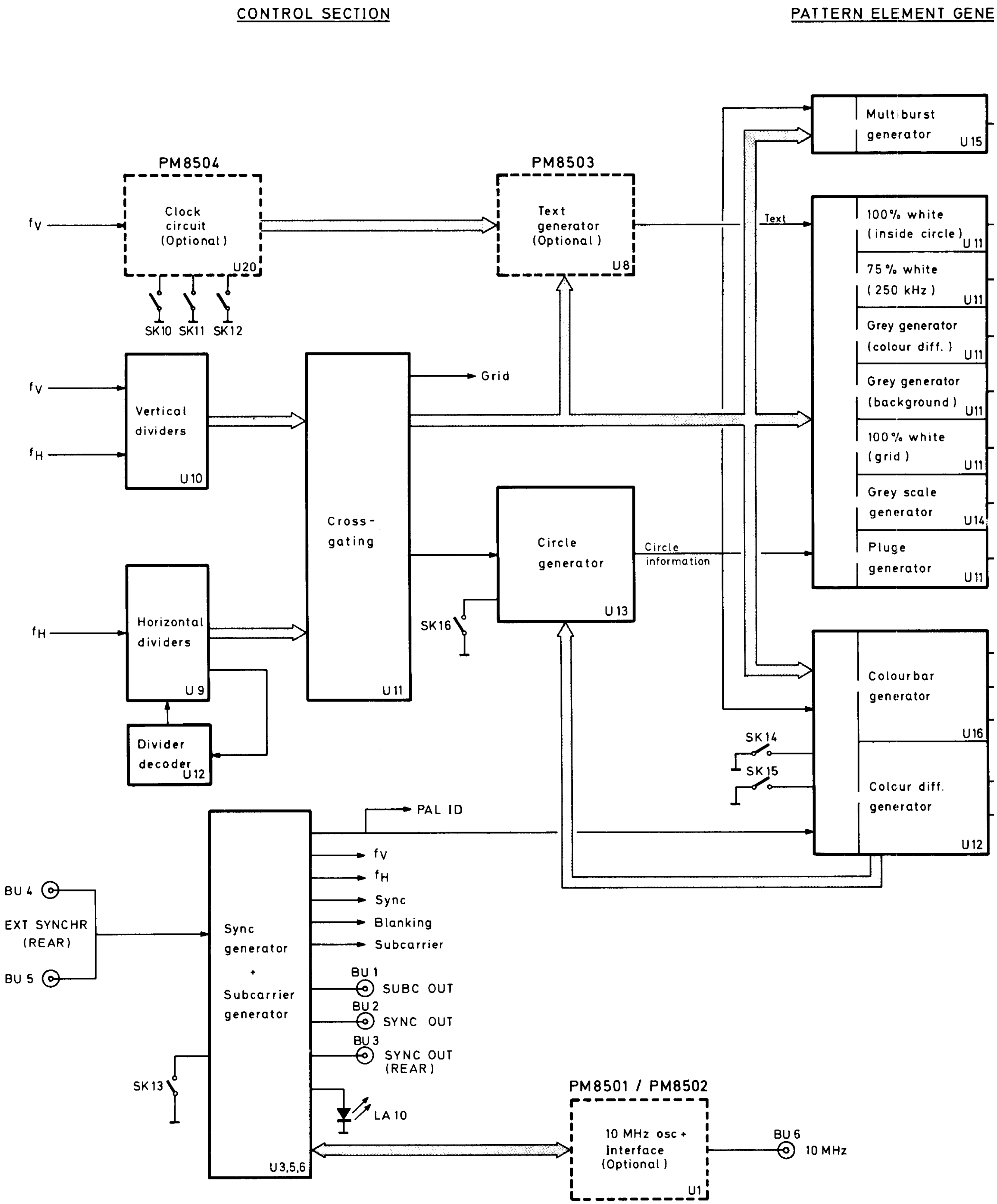
- PATTERN ELEMENT GENERATOR
- SIGNAL PROCESSING
- CONTROL SECTION

All necessary signal elements for the pattern are derived from the "PATTERN ELEMENT GENERATORS". These generators are all controlled from the "CONTROL SECTION" with pulses locked to f_H and f_V.

In addition the generators are also controlled by the circle generator, in which the circle information is electronically derived. This circle information is used to enable or disable the various generator outputs depending of whether the pattern elements should be present inside or outside the circle in the test pattern.

The various outputs are then combined in various ways; all the luminance elements except the multiburst, are mixed together and led to the output amplifiers via filters. Only the multiburst is fed directly to the output amplifiers. The colour information signals (R-Y, B-Y) are applied to the chrominance modulator where the quadrature modulation of the subcarrier takes place. When used in the SECAM system a SECAM controller for the modulator is incorporated. The chrominance output is then led to the output amplifiers.

The built-in sync pulse generator with genlock facility together with the subcarrier generator ensures that all necessary TV synchronization pulses are available.
These pulses are used partly to control the generators and partly to accomplish the output signals.
Furthermore, the sync- and subcarrier can be controlled by externally applied signals.
An external composite sync signal (standard negative) controls the sync signal.
A black burst signal or a composite video signal controls the sync signal as well as the subcarrier signal.


CONTROL SECTION
PATTERN ELEMENT GENE
PM8504
Clock circuit (Optional)
U20
SK10 SK11 SK12
PM8503
Text generator (Optional)
U8
Text
Multiburst generator
U15
100% white (inside circle)
U11
75% white (250 kHz)
U11
Grey generator (colour diff.)
U11
Grey generator (background)
U11
100% white (grid)
U11
Grey scale generator
U14
Pluge generator
U11
Vertical dividers
U10
Cross-gating
U11
Grid
Circle generator
U13
Circle information
SK16
Horizontal dividers
U9
Divider decoder
U12
Colourbar generator
U16
SK14
SK15
Colour diff. generator
U12
PAL ID
Sync generator + Subcarrier generator
U3,5,6
BU 4
EXT SYNCHR (REAR)
BU 5
Sync
Blanking
Subcarrier
BU 1
SUBC OUT
BU 2
SYNC OUT
BU 3
SYNC OUT (REAR)
SK13
LA 10
PM8501 / PM8502
10 MHz osc + Interface (Optional)
U1
BU 6
10 MHz

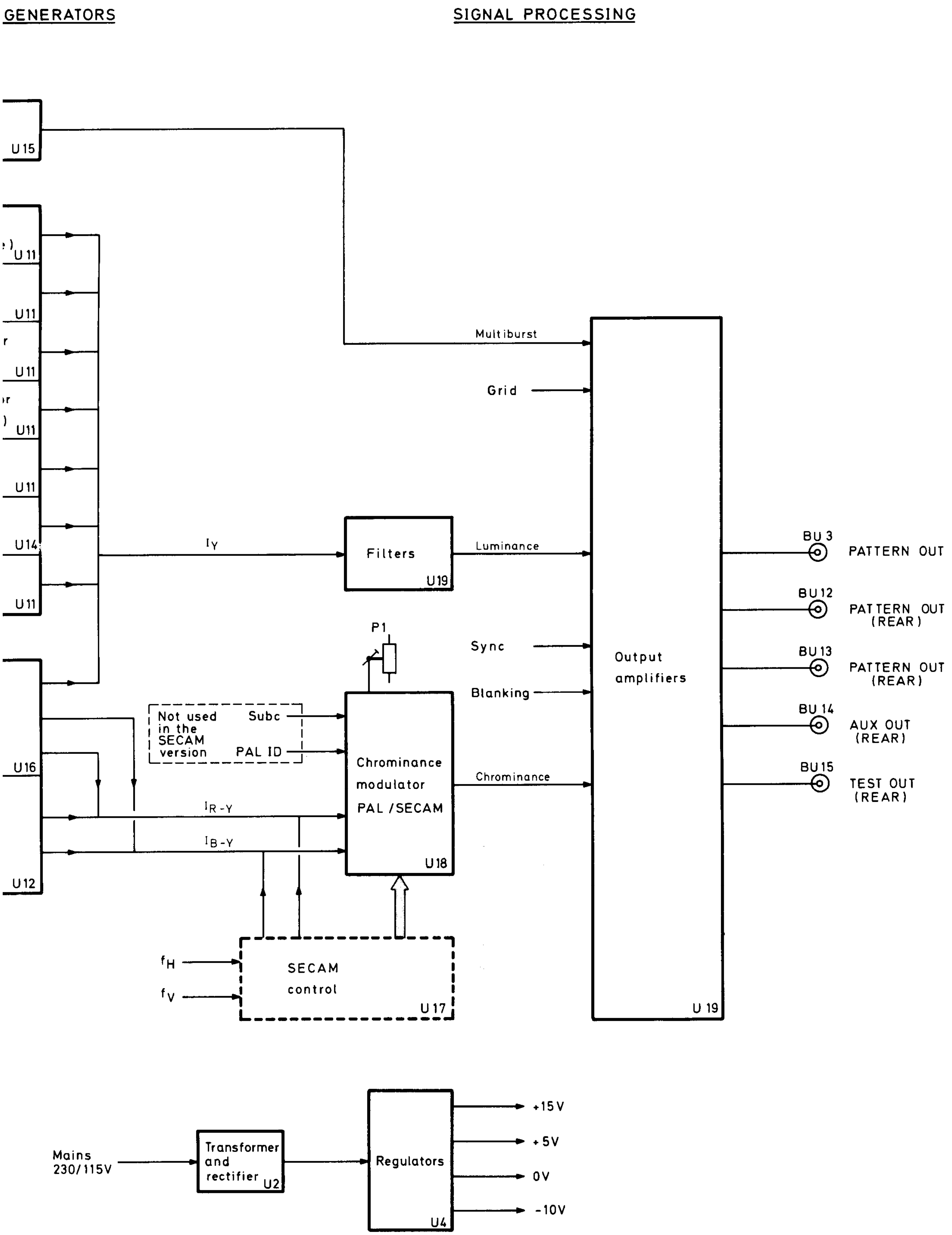


Fig. 4-1 Block diagram

OPERATING INSTRUCTIONS

5. Survey of controls and sockets

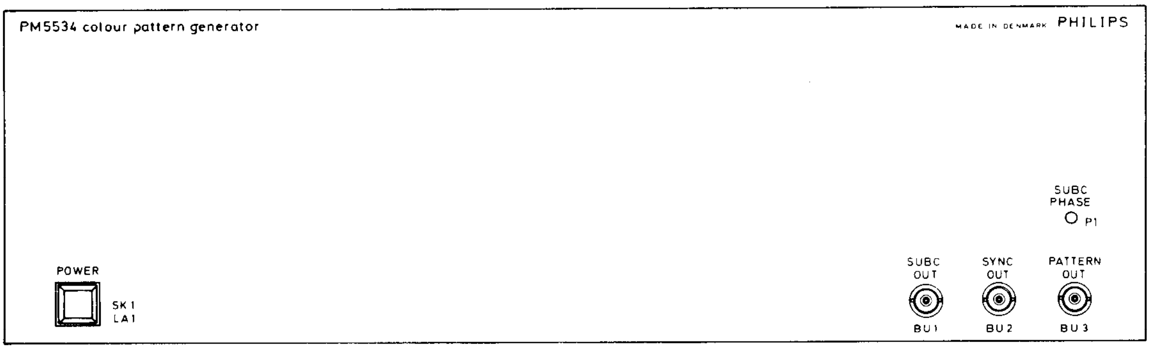


Fig. 5-1 Front of the instrument

SK1/LA1	"POWER" The mains are switched on (the lamp lights up) when the pushbutton is pressed.
BU1	"SUBC OUT" Colour subcarrier signal output (BNC connector - 75Ω). Not functioning in L-version
BU2	"SYNC OUT" Composite sync signal output (BNC connector - 75Ω)
BU3	"PATTERN OUT" Composite video signal output (BNC connector - 75Ω)
P1	"SUBC PHASE" Screwdriver control for the colour subcarrier phase Not functioning in L-version

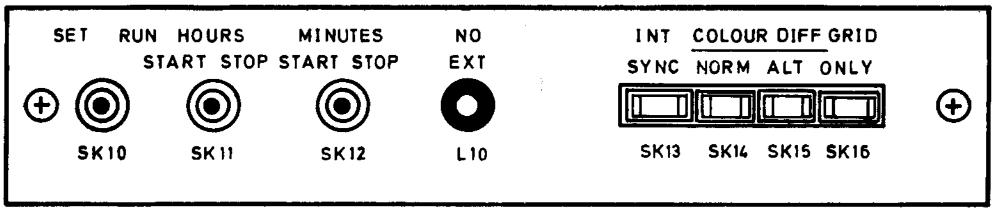


Fig. 5-2 Front of the control panel

SK10	"SET" "RUN" Clock command switch
SK11	"HOURS" Time set, hours
SK12	"MINUTES" Time set, minutes
L10	"NO EXT" Lights if external sync is missing (only when SK13 is released)
SK13	"INT SYNC" Sync mode selector
SK14	"COLOUR DIFF-NORM" When pressed the two colour difference fields next to the circle are removed.
SK15	"COLOUR DIFF-ALT" When pressed the two alternating colour difference fields at the sides of the picture are removed.
<u>Important</u>	SK15 must always be kept depressed in the SECAM version.
SK16	"GRID ONLY" When depressed all circle information is removed from the pattern.

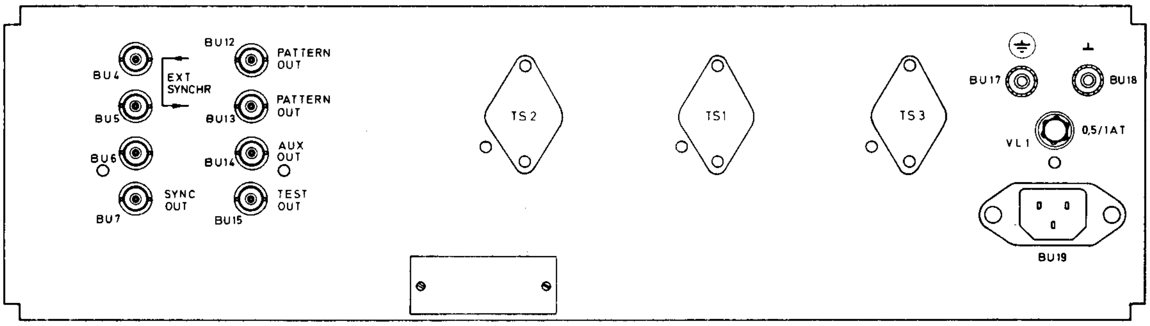


Fig. 5-3 Rear of the instrument

BU4/BU5	"EXT SYNCHR" Looped through sync input (BNC connectors - high ohmic)
BU6	10 MHz Input/output (optional) (BNC connector - high ohmic)
BU7	"SYNC OUT" Composite sync output (BNC connector - 75Ω)
BU12/BU13	"PATTERN OUT" 2 composite video signal outputs (BNC connectors - 75Ω)
BU14	"AUX OUT" Cross hatch pattern output (BNC connector - 75Ω)
BU15	"TEST OUT" Can be used for service work to make the pulse patterns on the printed circuit boards visible on a monitor (BNC connector - 75Ω)
BU17	"⏚" Protective earth (chassis)
BU18	"⊥" Electrical neutral
BU19	Power connection
VL1	Fuse: 230V - 0.5AT 115V - 1AT

6. Directions for use

A. Installation

Before any other connection is made, the protective earth terminal should be connected to a protective conductor (see section EARTHING).

MAINS ADJUSTMENT AND FUSE

The PM 5534 is powered directly from the mains supply. It is capable of operating on either 115 or 230V, 48 to 65 Hz. Prior to shipment from the factory, each instrument is wired for 230V, unless otherwise specified when ordered. Before inserting the mains plug into the mains socket, make sure that the instrument is set to the local mains voltage.
Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse-holders should be avoided.
It is recommended that fuse replacement and setting of the instrument's mains supply is done by a skilled person who is aware of the hazard involved.

MAINS (BU19): 230V ac ± 20% (115V ± 20%)

The instrument can be used with mains voltage of 115V and 230V a.c.
Before using a new instrument check the adjustment.
If the mains adjustment of the instrument has to be changed unscrew the transformer-connection cover and resolder the connections to the primary windings of the supply transformer as shown in the figures below:

EARTHING

Before the instrument is switched on, it should be connected to a protective earth conductor in one of the following ways:

- via the protective earth terminal BU17
- via the three-core mains cable. In this case the mains plug has to be inserted into a socket outlet provided with a protective earth contact. The protective action should not be ignored by the use of an extension cord without protective conductor. Replacing the mains plug is at the users own risk. After replacing a mains plug, a high-voltage test in accordance with IEC Publication 348 is strongly recommended.

WARNING:

- Any interruption of the protective conductor inside or outside the instrument or disconnection of the protective earth terminal is likely to make the instrument dangerous.
- Intentional interruption is prohibited.
- When an instrument is brought from the cold into a warm environment, condensation may cause a hazardous condition. Therefore, make sure that the earthing requirements are strictly adhered to.

B. Operating the instrument

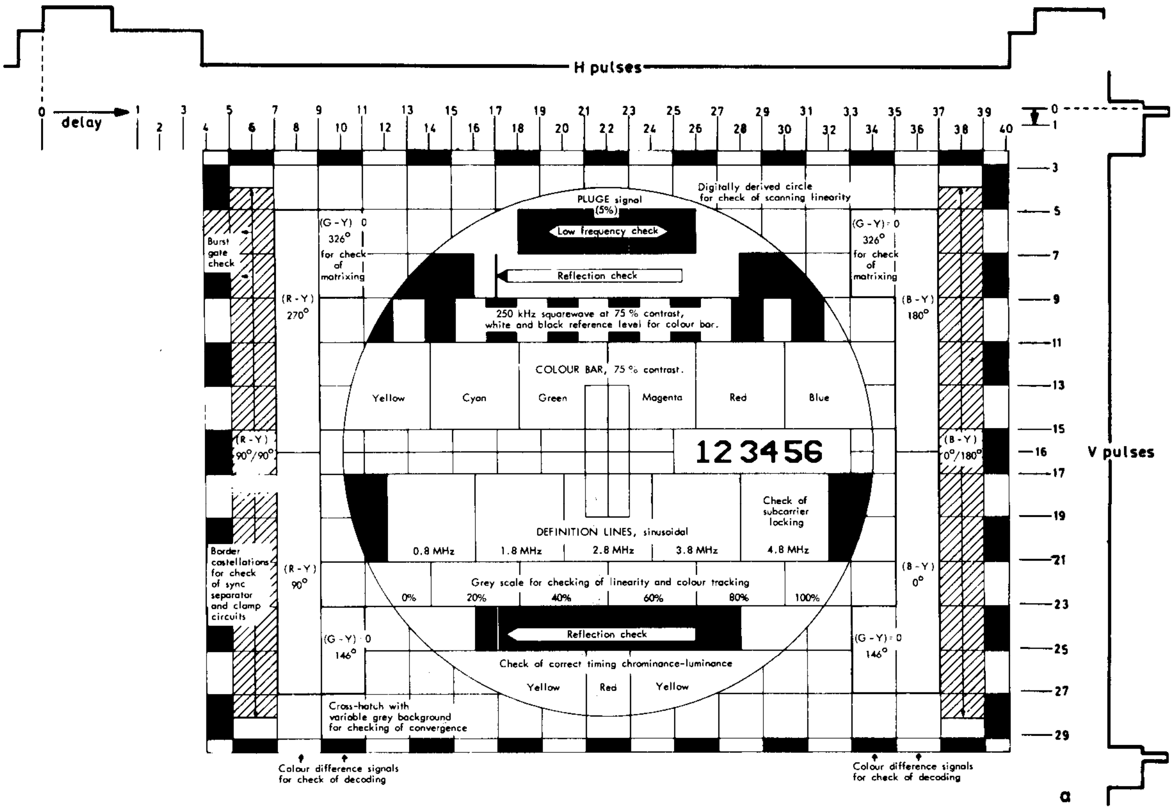


Fig. 6-1 Pattern composition

The basic pattern outside the circle consists of a cross-hatch surrounded by border castellations. This pattern is obtained when the switches SK14, SK15, and SK16 (see fig. 6-2) are depressed.

Two vertical bars with colour difference signals are present beside the circle when the switch SK14 (see fig. 6-2) is released.
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)).
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)).
The inner blocks represent the ((G-Y)=0)-phases, the upper ones produce a signal of 326°, the lower ones of 146°.
Outside these two coloured areas two more vertical bars are added to the pattern when SK15 (see fig. 6-2) is released.
These two bars, only of importance for PAL, contain alternating B-Y and non-alternating R-Y signals and they should remain colourless, provided the colour decoder of the TV set/monitor is correctly aligned.

When SK16 (see fig. 6-2) is released a circle is also incorporated in the pattern. Inside this circle various black/white steps, rectangles, needle pulses, a colour bar, and a colour step are present.
The circle itself is used, because the eye is very sensitive to any deviation from the exact circle. Only a TV-set with good horizontal and vertical linearity can reproduce a circle in an acceptable way, thus the circle allows in fact an extra, sensitive way of checking the geometric linearity.
The circle is generated by means of digital circuitry, which is controlled by a PROM (Programmable Read Only Memory). The PROM contains information about the shape of the circle. In practice this means that any visible distortion of the circle can be allocated fully to the TV-set under test.

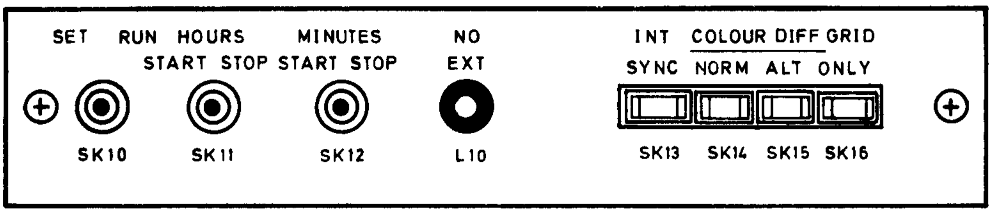


Fig. 6-2 Control panel

How to start the instrument.

Depress SK13.
Release SK14, SK15 and SK16 for standard picture.

If the instrument is to be externally synchronized a composite signal should be applied to BU4 (BU5 terminated with 75Ω) and SK13 released.
L10 indicates missing ext. sync when SK13 is released.

In the SECAM version SK15 has to be depressed.

Time setting.

Switch SK10 shortly to position SET.
The minutes are then set by SK12 and hours by SK11. The seconds will display 00 and are not adjustable.
The time display should be set one or two minutes ahead of actual time. At the exact moment switch SK10 to RUN to start the clock.

Fault-finding.

The instrument is provided with a test input on unit 19 pin 112 for digital signals.
A monitor on TEST OUT displays the signal.

C. The pattern of the PM5534

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 function check of a receiver just installed.
The following procedure for visual inspection is meant as an 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 of 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

Adjustable at any value between 25 - 75% of black-to-white level it is usually set to approx. 48% of white level (52% for M-versions).
To a certain extent it provides an impression of the purity of the 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 castellation covers each 3.5% of the vertical scanning; on a screen with the usual over-scanning they will be partly visible. The cross hatch raster has an aspect ratio of 3:4, and as most receivers have a display area of this aspect ratio it is usual for the side castellations just to disappear from 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. Superimposed on a few of the left hand castellation some (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 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 (3:4).

5. Black rectangle in the top areas of the circle

Similar to the one of test cards "C" and "F".
It provides cheking of the low-frequency response. Poor response shows as streaking to the right from the edges of this rectangle. Pluge signal in centre makes provision for correct brightness adjustment. Pluge field should just not be seen when correctly adjusted.

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 distributions 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.
By switching off the red and green gun the saturation control can be adjusted until no difference in brightness is visible between the blue blocks of the colour bar and those of the 250 kHz square wave.
Check for red and green gun.
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. Horizontal 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 very effective checking of the interlacing.
Any faulty interlacing appears as a deviating thickness of this horizontal white line, compared to the other horizontal white lines.
The white crosses provide a check of the convergence in the central area of the picture.
The white centre cross shows faults in the static convergence of the picture and indicates the centre of the picture as well.

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, for L-version 0.8 - 1.8 - 2.8 - 1.8 - 0.8)
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 cubcarrier (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 typically show a pattern moving downwards.

11. Greyscale steps

Six rectangles of 0% - 20% - 40% - 60% - 80% - 100% video amplitude. The number of rectangles can be increased to eleven.
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 part 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

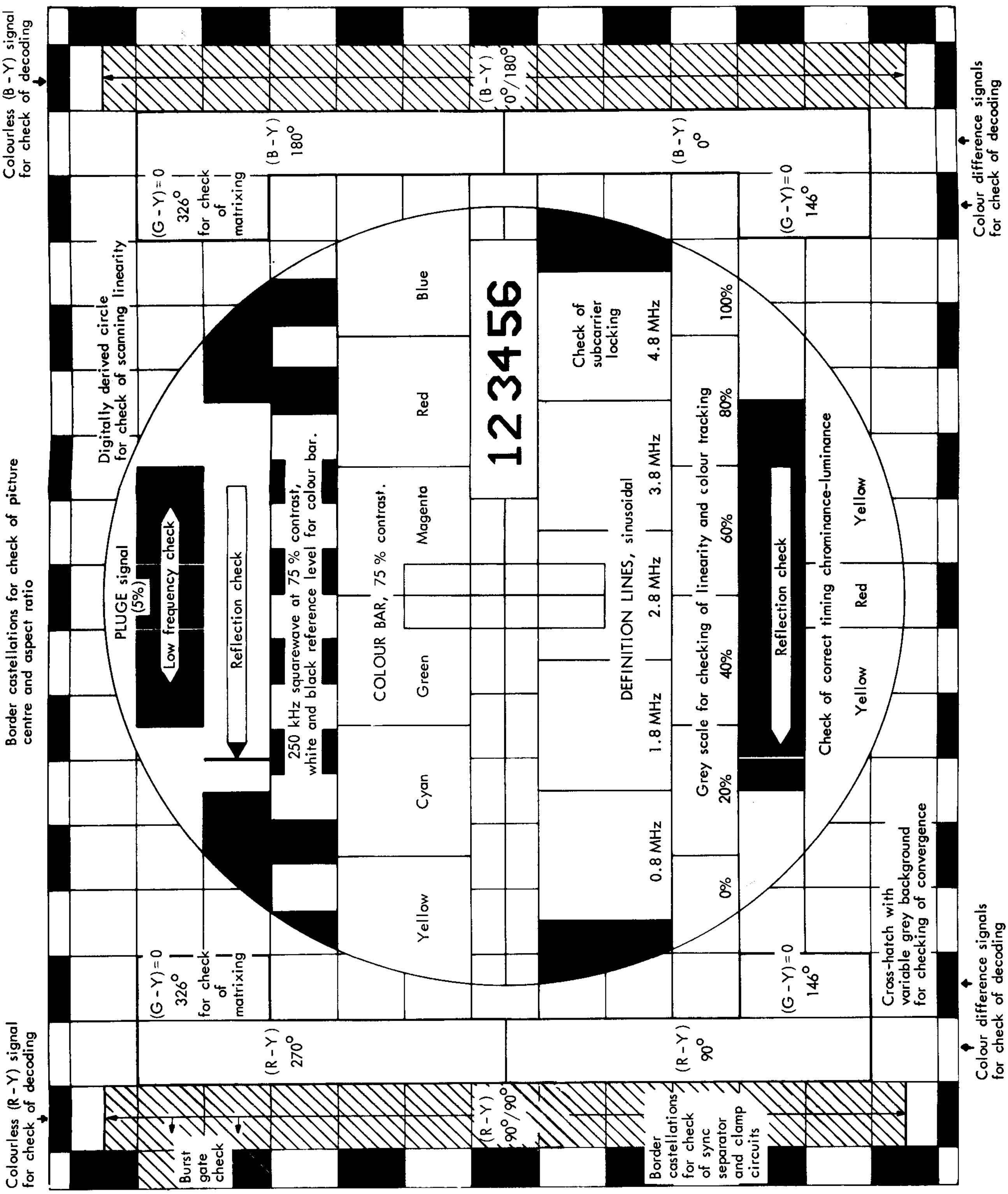
Next to the circle on each side fields with colour difference information are present.
To prevent non-linear distortion in the transmission path from having a different influence on the various signals, they have a constant luminance as well as a constant chrominance amplitude. Their lay-out and phasing may be derived from the figure in section "Operating the PM 5534".
They serve to indicate the proper function of the main circuit 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 regarding 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 (3rd block from the left).
    It should 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)
  - Carry 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.
  - While 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.



Colourless (B - Y) signal for check of decoding
Border castellations for check of picture centre and aspect ratio
Colourless (R - Y) signal for check of decoding
Colour difference signals for check of decoding
Colour difference signals for check of decoding
Digitally derived circle for check of scanning linearity
(G - Y) = 0
326°
for check of matrixing
(B - Y)
180°
(B - Y)
0°/180°
(B - Y)
0°
(G - Y) = 0
146°
(R - Y)
270°
(R - Y)
90°/90°
(R - Y)
90°
PLUGE signal (5%)
Low frequency check
Reflection check
250 kHz squarewave at 75 % contrast, white and black reference level for colour bar.
COLOUR BAR, 75 % contrast.
Yellow
Cyan
Green
Magenta
Red
Blue
123456
Check of subcarrier locking
DEFINITION LINES, sinusoidal
0.8 MHz
1.8 MHz
2.8 MHz
3.8 MHz
4.8 MHz
Grey scale for checking of linearity and colour tracking
0%
20%
40%
60%
80%
100%
Reflection check
Check of correct timing chrominance-luminance
Yellow
Red
Yellow
Cross-hatch with variable grey background for checking of convergence
Burst gate check
Border castellations for check of sync separator and clamp circuits

FAULT ANALYSIS REPORT

To aid us in maintaining our records and in our continuing efforts to improve instrument reliability and the quality of the servicing manuals, we kindly request that you complete this fault-analysis report if the instrument requires repair and/or adjustment.

INSTRUMENT TYPE NO.: PM____________ SERIAL NO.:

ESTIMATED USAGE: HRS/YR

COMPANY NAME:

HOW MANY INSTRUMENTS OF THIS TYPE DOES YOUR COMPANY USE ?:

Please give a short description of the fault/symptoms:

What was the cause ? (Failed component, mis-adjustment etc).:

TIME TAKEN TO REPAIR/ADJUST : HRS.

When fault-finding/making adjustments, did you find the manual:

- ☐ EXCELLENT ?
- ☐ VERY GOOD ?
- ☐ GOOD ?
- ☐ ADEQUATE ?
- ☐ POOR ?
- ☐ VERY POOR ?

Do you have any suggestions that you think would improve future servicing manuals

Does your company/organisation normally:

- ☐ REPAIR SELF.
- ☐ SEND INSTRUMENT TO PHILIPS SERVICE.

Have you any other suggestions/complaints.

PLEASE SEND THIS REPORT TO THE PHILIPS SERVICING ORGANISATION IN YOUR COUNTRY. THANK YOU.

AFTER COMPLETION, CUT ALONG DOTTED LINE AND RETURN TO THE PHILIPS SERVICE ORGANISATION IN YOUR COUNTRY.

SERVICE INSTRUCTIONS

7. Disassembling and wiring diagram

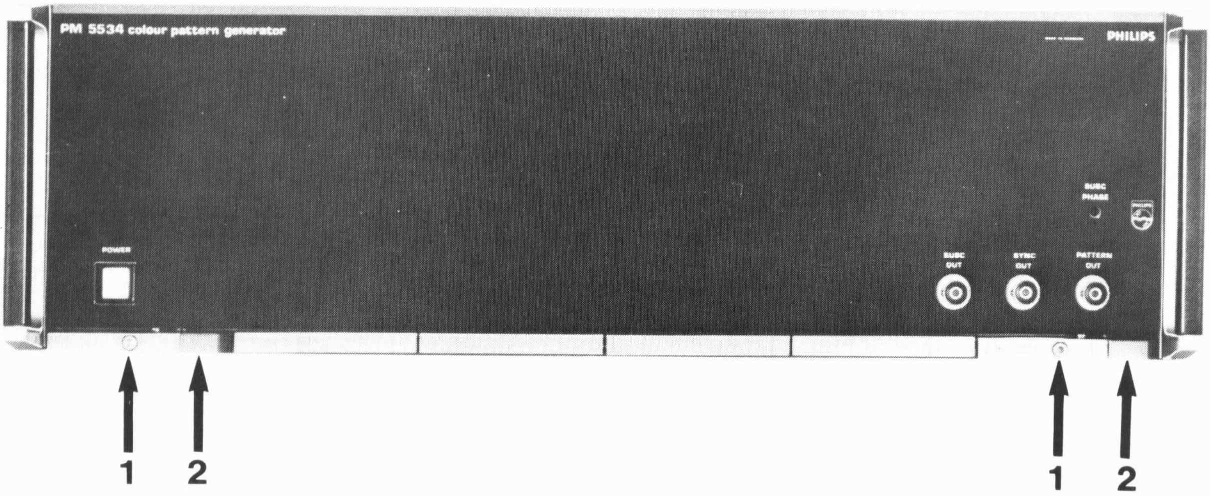


Fig. A

1. Removing the cabinet
   - After having removed the 2 transportation screws each side of the cabinet, loosen the hexagonal-head screws 1 fig.A and turn the two locking bracket 2 outwards.
   - Pull out the chassis from the cabinet.

<u>Taking out print cards for repair.</u>

Before taking out a print card it is necessary to remove the print support bracket. This is done by removing four 3 $^{m}/m$ screws, one on each side wall and two on the top. Extension boards are provided to make it easy to carry out measurements on the instrument during operation.

Replacement of printed circuit boards.

Normally service cards for replacement will be supplied as G-PAL or M-NTSC versions. When dealing with versions differing from these, minor modifications might have to be carried out prior to installation. See survey on next page.
Coding of p.c.b.'s should be carried out according to the component location drawings.

Options.

When PM 8501 or PM 8502 is mounted the 10 MHz oscillator on unit 5 is automatically switched off by the option in order to enable the supply of a substitute 10 MHz.
When mounting the text generator PM 8503 and the clock generator PM 8504, the pattern has to be modified:
Before mounting PM 85o3 the white needle pulse should be removed by means of the switch SW1 on unit 11.
Before mounting PM 8504 the clock area should be disposed by means of the switch SW2 on unit 11.

	BBC-PAL	I-PAL	N-PAL	M-PAL	M-NTSC	L-SECAM
UNIT 3 Service print to be ordered as TCXO L4 Change	-/G 8.8672MHz L4/G	-/G 8.8672MHz L4/G	/N-PAL 7.1641125MHz L4/M	/M-PAL 7.151223MHz L4/M C27 to be fed from Term. 17	/M-NTSC 7.159090MHZ L4/M	not in L-version
UNIT 5 Service print to be ordered as	-/G	-/G	-/G + subunit.	-/M	-/M	-/G
UNIT 6 Change				R32=8.2kΩ		
UNIT 9 Change				R16=6.19kΩ	R16=6.19kΩ	R16=7.5kΩ
UNIT 11 Service print to be ordered as	-/G	-/G	-/M	-/M	-/M	-/G
UNIT 13 Service print to be ordered as Change	-/G	-/G	-/G	-/M	-/M	-/G C3=100pF
UNIT 15 Service print to be ordered as Change	-/I	-/G	-/M	-/M	-/M	-/G R21=20.0kΩ R22= 10kΩ R23=47.5kΩ R24= 20kΩ Label:4008 108 85860 C39=39p, R137=1K
UNIT 16 Change			R67=39kΩ Cut IC2.12 and connect R72 to IC2.2			Cut term. 104
UNIT 18 Service print to be ordered as	-/G	-/G	-/M	-/M	-/M	-/L
UNIT 19 Service print to be ordered as	-/G	-/G	-/M	-/M	-/M	-/G

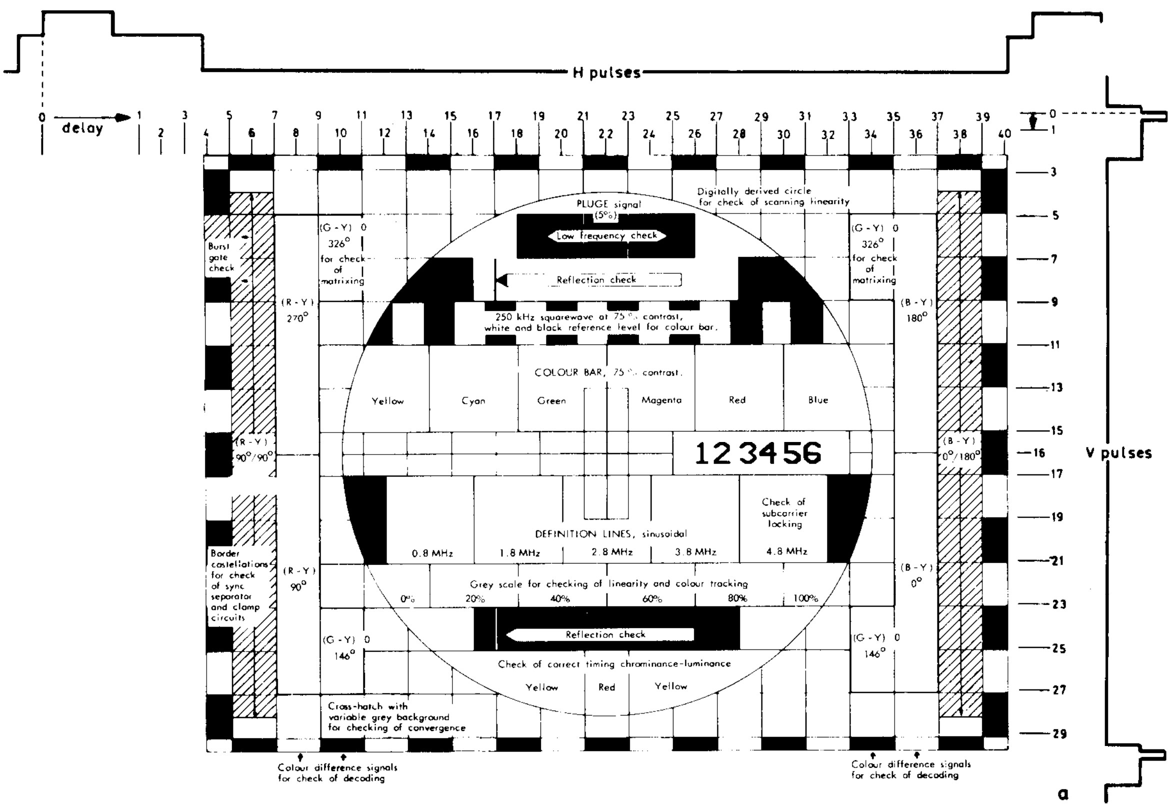
Modifications and ordering of service p.c.b.'s

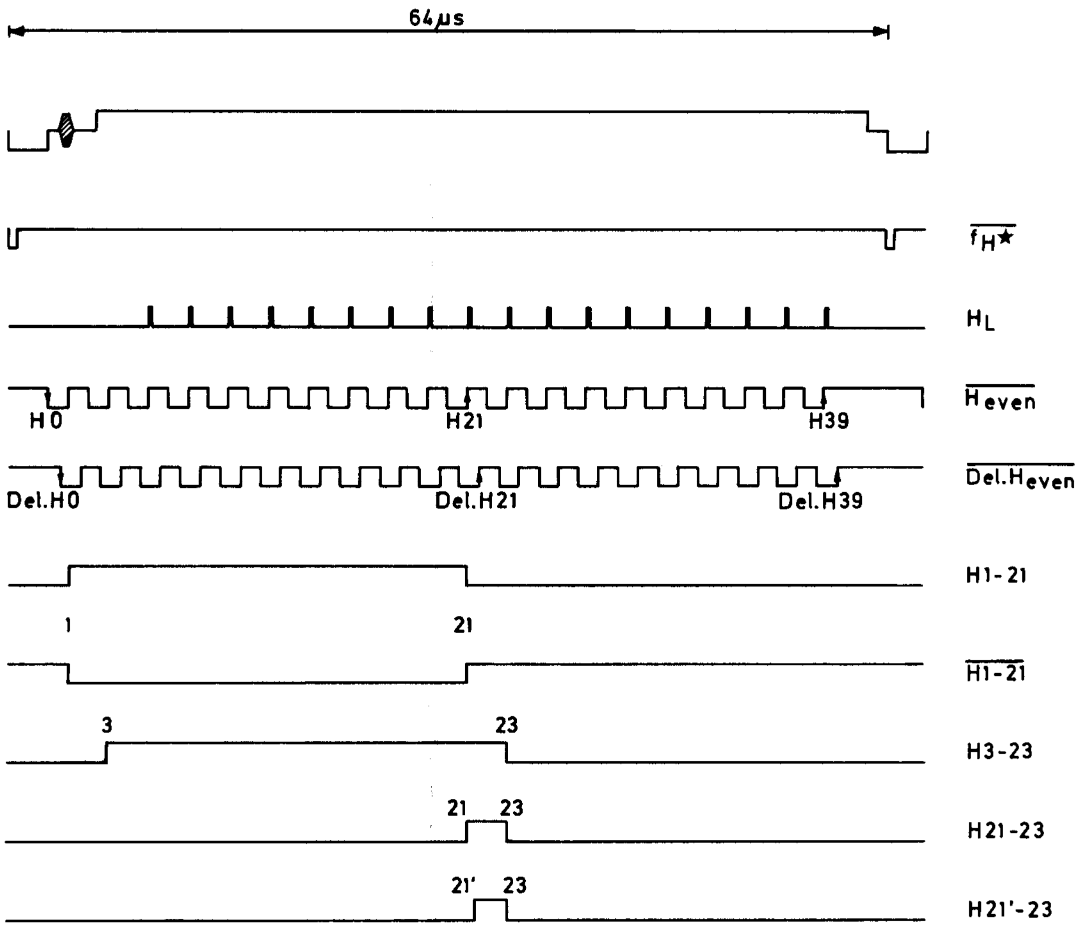
2. How to read the pulses in the diagrams.

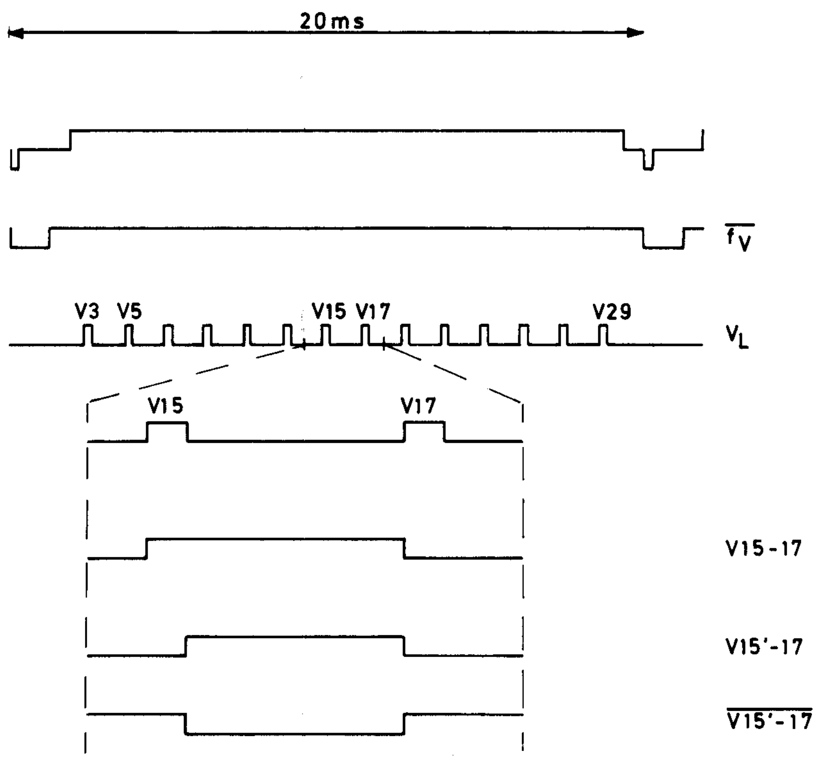
All signals in the generator are built up by pulses which can, with few exceptions, be located from a coordination system consisting of the grid raster.
The pulses are indicated by the letter "H" or "V" followed by two figures.
The "H" pulses are pulses which occur with the line frequency.
The "V" pulses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

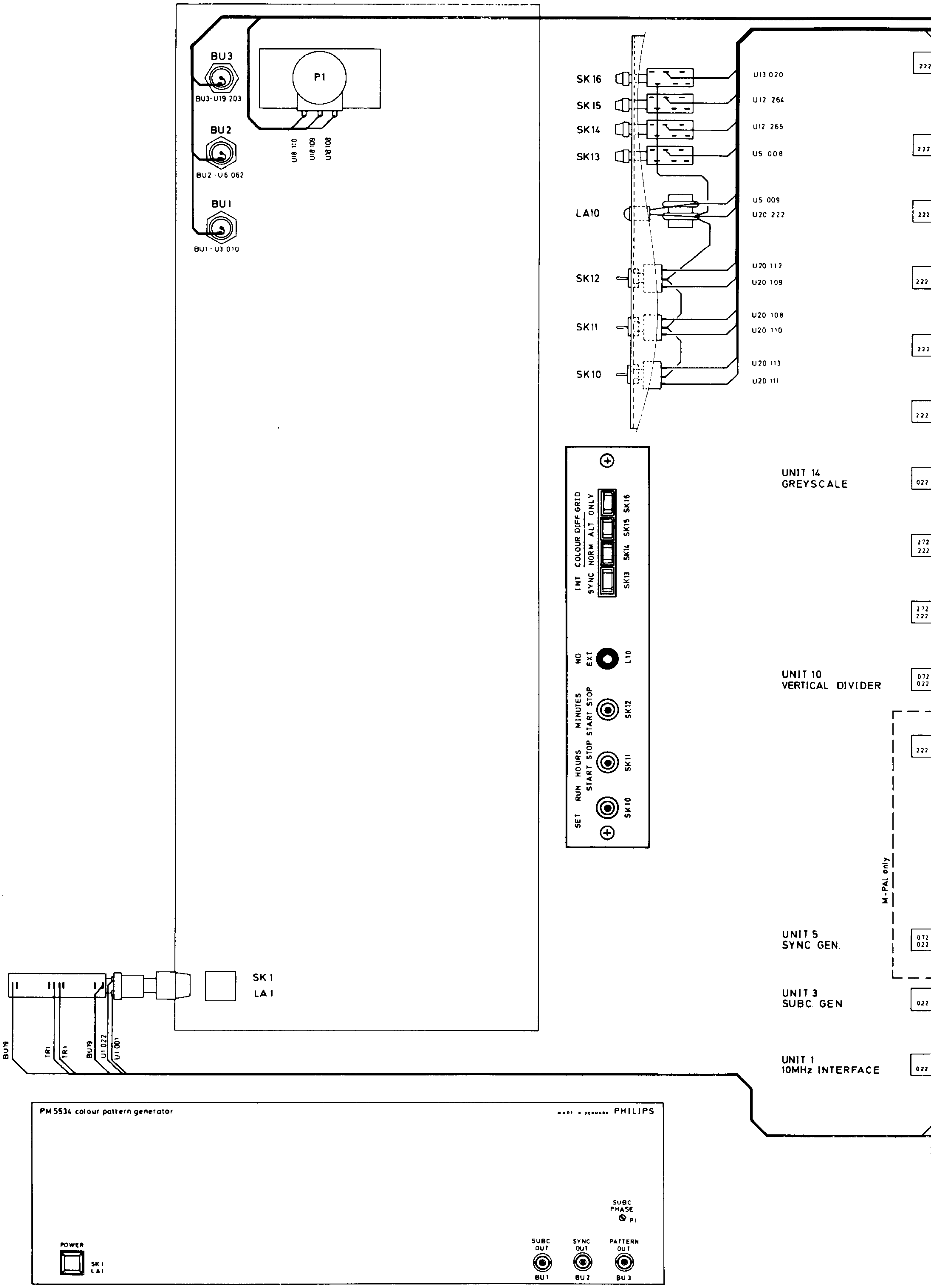
EXAMPLES:

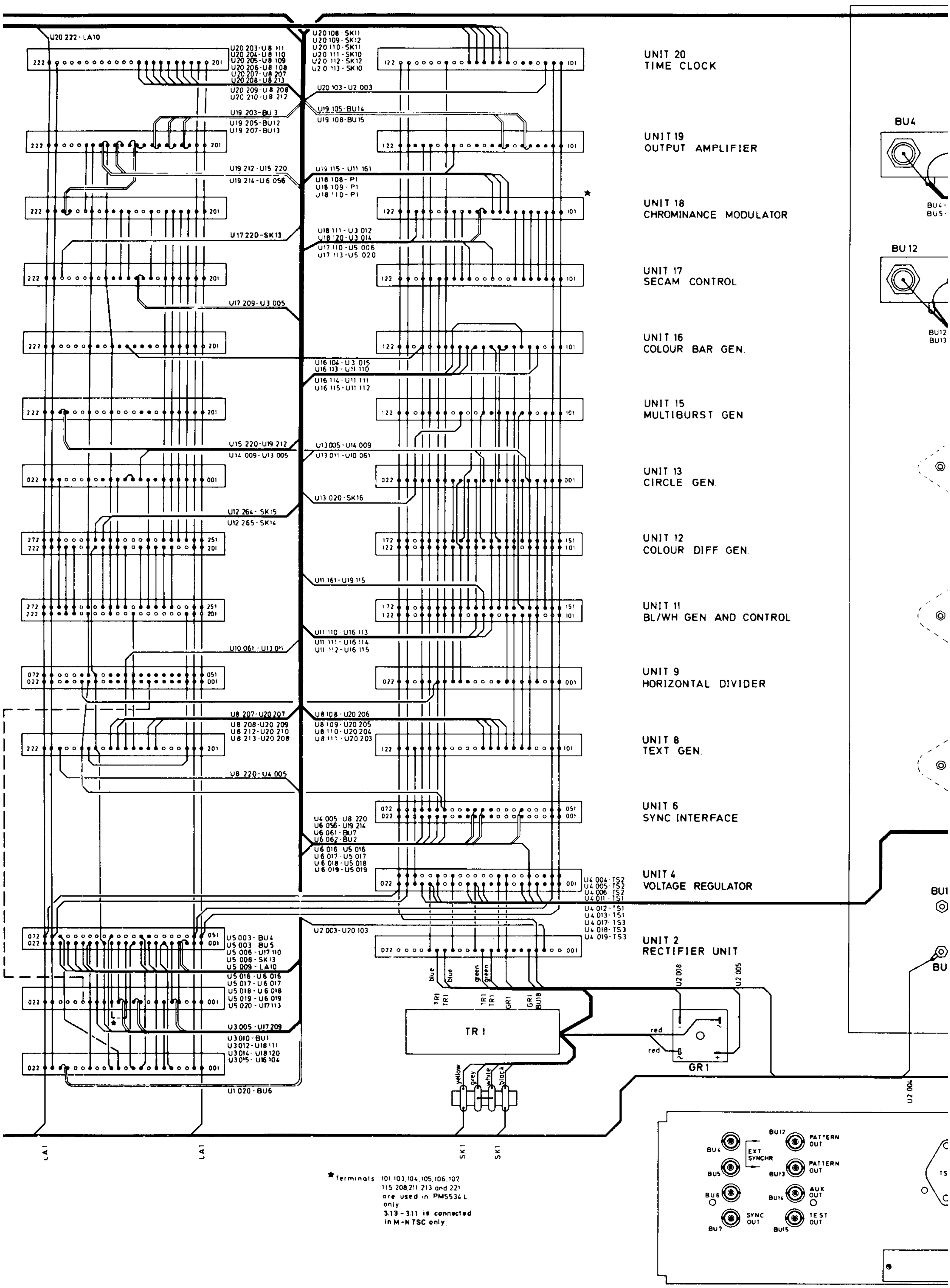
H1-21:
This is a positive going pulse between H1 and H21.
$\overline{\text{H1-21}}$:
This is the same pulse as H1-21 but inverted.
If the pulse $\overline{\text{H1-21}}$ is applied to a NAND gate together with the pulse H3-23, the output of the NAND gate will supply a new pulse: $\overline{\text{H21-23}}$.
Some complex signals are additionally supplied with a symbol e.g. Σ, ϕ.
These pictures can be found in the generator by means of a monitor and the built-in "test output amplifier".
$\overline{\text{Del. H}_{\text{even}}}$ is a timing pulse for the vertical white lines delayed approximately 300 ns (Y-delay).
H21'-23 is a pulse where H21 has been delayed the width of a white line.



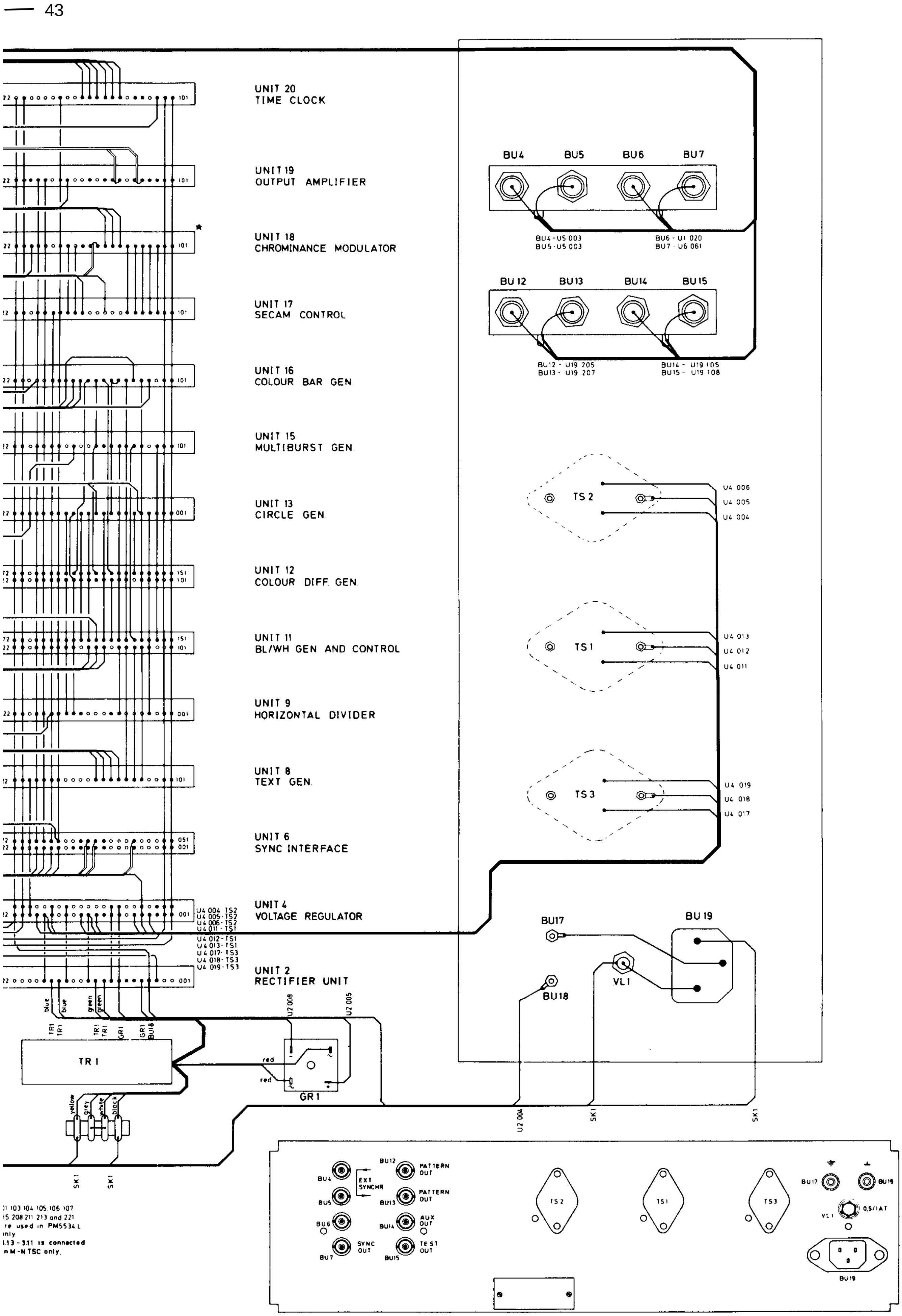

64µs
$\overline{f_{H}\star}$
H_L
$\overline{H_{even}}$
H0
H21
H39
$\overline{Del.H_{even}}$
Del.H0
Del.H21
Del.H39
H1-21
1
21
$\overline{H1-21}$
3
23
H3-23
21
23
H21-23
21'
23
H21'-23


20ms
$\overline{f_V}$
V3
V5
V15
V17
V29
V_L
V15
V17
V15-17
V15'-17
$\overline{V15'-17}$


BU3
BU3-U19 203
BU2
BU2-U6 062
BU1
BU1-U3 010
P1
U8 110
U8 109
U8 108
SK 16
SK 15
SK 14
SK 13
LA10
SK12
SK11
SK10
U13 020
U12 264
U12 265
U5 008
U5 009
U20 222
U20 112
U20 109
U20 108
U20 110
U20 113
U20 111
INT SYNC
COLOUR NORM
DIFF ALT
GRID ONLY
NO EXT
MINUTES START STOP
HOURS START STOP
SET RUN
UNIT 14 GREYSCALE
UNIT 10 VERTICAL DIVIDER
M-PAL only
UNIT 5 SYNC GEN.
UNIT 3 SUBC. GEN
UNIT 1 10MHz INTERFACE
SK 1
LA 1
BU19
TR1
U1 022
U1 001
PM5534 colour pattern generator
MADE IN DENMARK PHILIPS
SUBC PHASE
POWER
SUBC OUT
SYNC OUT
PATTERN OUT
BU1
BU2
BU3



★ Terminals 101,103,104,105,106,107, 115,208,211,213 and 221 are used in PM5534 L only
3.13 - 3.11 is connected in M-NTSC only.



)1 103 104 105 106 107
15 208 211 213 and 221
re used in PM5534 L
only
3.13 - 3.11 is connected
n M-NTSC only.

Fig. 7-1 Wiring diagram

8. Unit 1 PM8501 and PM8502 (optional)

L-version:
NOTE: If unit 1 is mounted, SW1 on unit 17 should be disconnected.

PM8501 Interface card is an optional circuit to the pattern generators PM 5534 and PM 5537.
The interface card allows the pattern generators to be controlled by an externally applied 10 MHz reference signal.
This may be required for these applications of the test pattern: when the frequency standard is to control a built-in clock generator or when the colour subcarrier is to be locked to the frequency standard.
When a clock generator and a text generator are built-in the local time as well as two text lines can be displayed in the test pattern.

Technical data:

PM 8501

Input level	:	0.1V_{rms} to 2V_{rms}
Input impedance	:	75Ω ±1%

PM8502 Oven-controlled crystal oscillator is the above mentioned circuit PM 8501 with a built-in 10 MHz crystal oscillator similar to the oscillator used in PHILIPS precision counters.
PM 8502 improves the colour subcarrier accuracy of PM 5534 and PM 5537 to be better than ±1 Hz. Normally the subcarrier accuracy is ±5 Hz.

Technical data:

PM 8502 (Can only be used in G, I and N-versions of PM 5534 and PM 5537).
(In L-version also, if a unit 3/G is fitted).

Frequency	:	10.000 000 MHz
Accuracy	:	better than ±1Hz (on subcarrier).
Stability	:	better than 3 x 10^{-8}
Ageing	:	<1 x 10^{-7}/month
Output level (at BU6)	:	approx. 0.1V_{rms}
Output impedance	:	75Ω

Circuit description

PM 8501 consists in principle of a 10 MHz reference control and a crash lock circuit.

The function of the 10 MHz reference control is as follows:
A 10 MHz signal, applied to BU6, passes via SW1a, TS1 and TS2 to IC1 where it will be divided by two.
At the same time part of the signal from TS2, rectified with GR1 and GR2, generates a positive voltage on C5. This voltage causes a base current in TS3, which means that the collector level is low. Consequently, the resetting of IC1 is cancelled and transistor TS5 is saturated.
Transistor TS5 is part of the control system, which allows the entire pattern generator to use the 5 MHz output from PM 8501 as frequency standard. The sync lock input level, terminal 007, determines the circuit mode:

- Low level means locked, and the 5 MHz signal is present at the output terminal 010.
- High level means unlocked, and the crash lock signal is available at terminal 012.

The crash lock circuit consists of two flip-flops, a mode switch, and an output gate. With the switch SW2 in position "CRASH LOCK" and with high sync lock level (unlocked) a negative going pulse is present at terminal 012. This pulse width is equal to the time difference between the inputs "vertical drive" and "ext vertical drive".
The presence of the crash lock pulse at terminal 012 forces the sync generator to lock to the next field.
When locked to the field, the generator needs approximately 300ms to lock the line frequency as well.

In the "SLOW LOCK" mode, the sync generator is locked within 7 seconds.

PM 8502 is similar to PM 8501 with the only exception that a 10 MHz oven-controlled crystal oscillator PM 9690 is mounted on the printed circuit board.
At the same time SW1 is set to position "LOCAL" which means that the internally generated 10 MHz is now led to BU6 too.
The 10 MHz signal at BU6 can then be used as a frequency standard for other equipment as well.
The function of the circuit is described above.

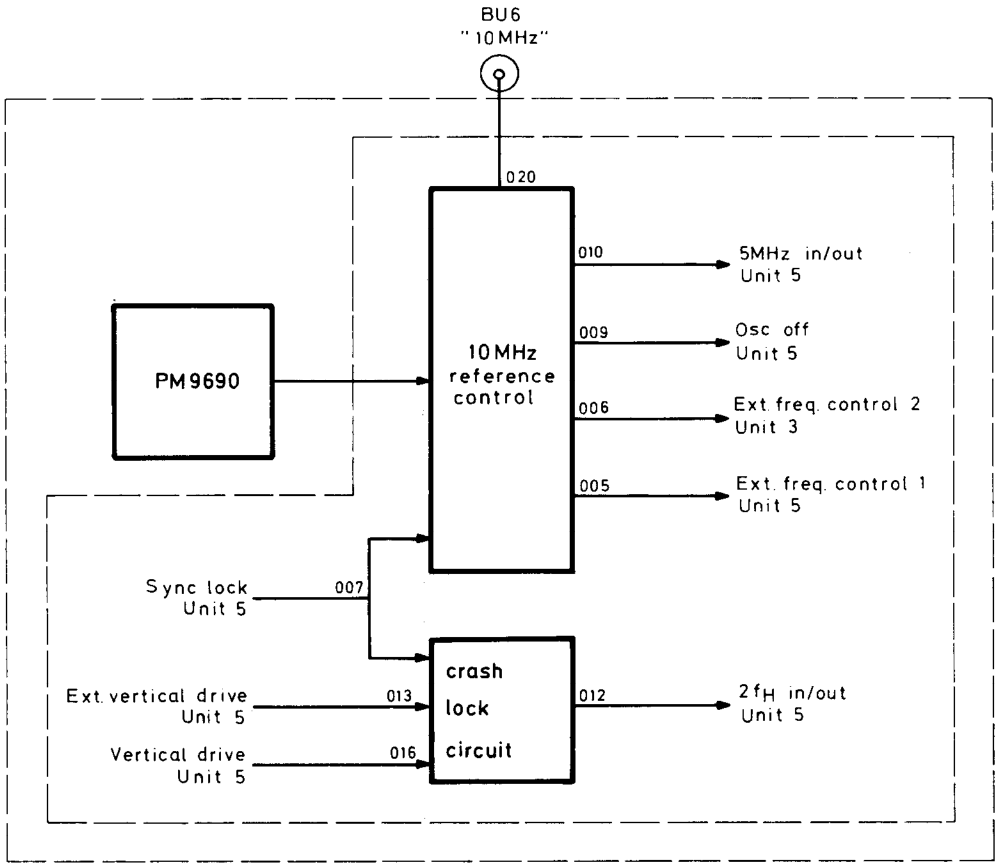


Fig. 8-1 Block diagram

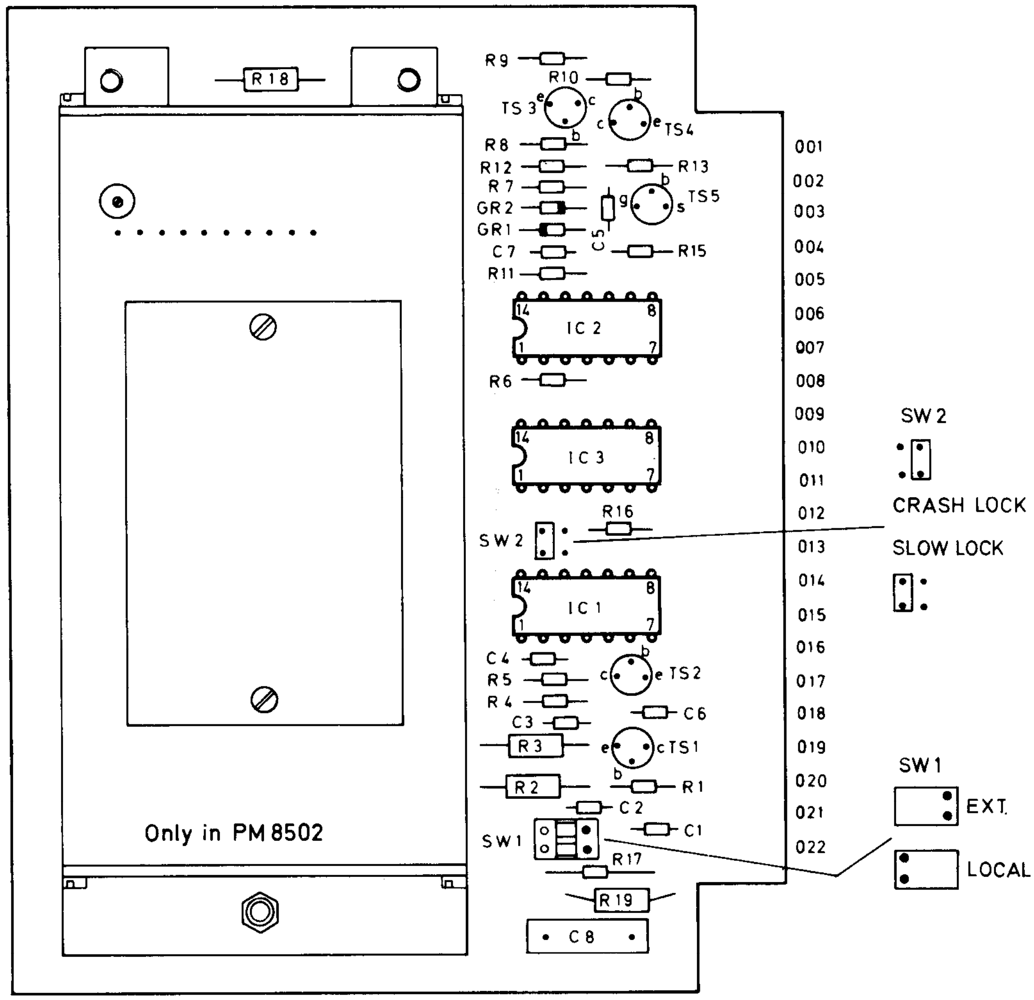
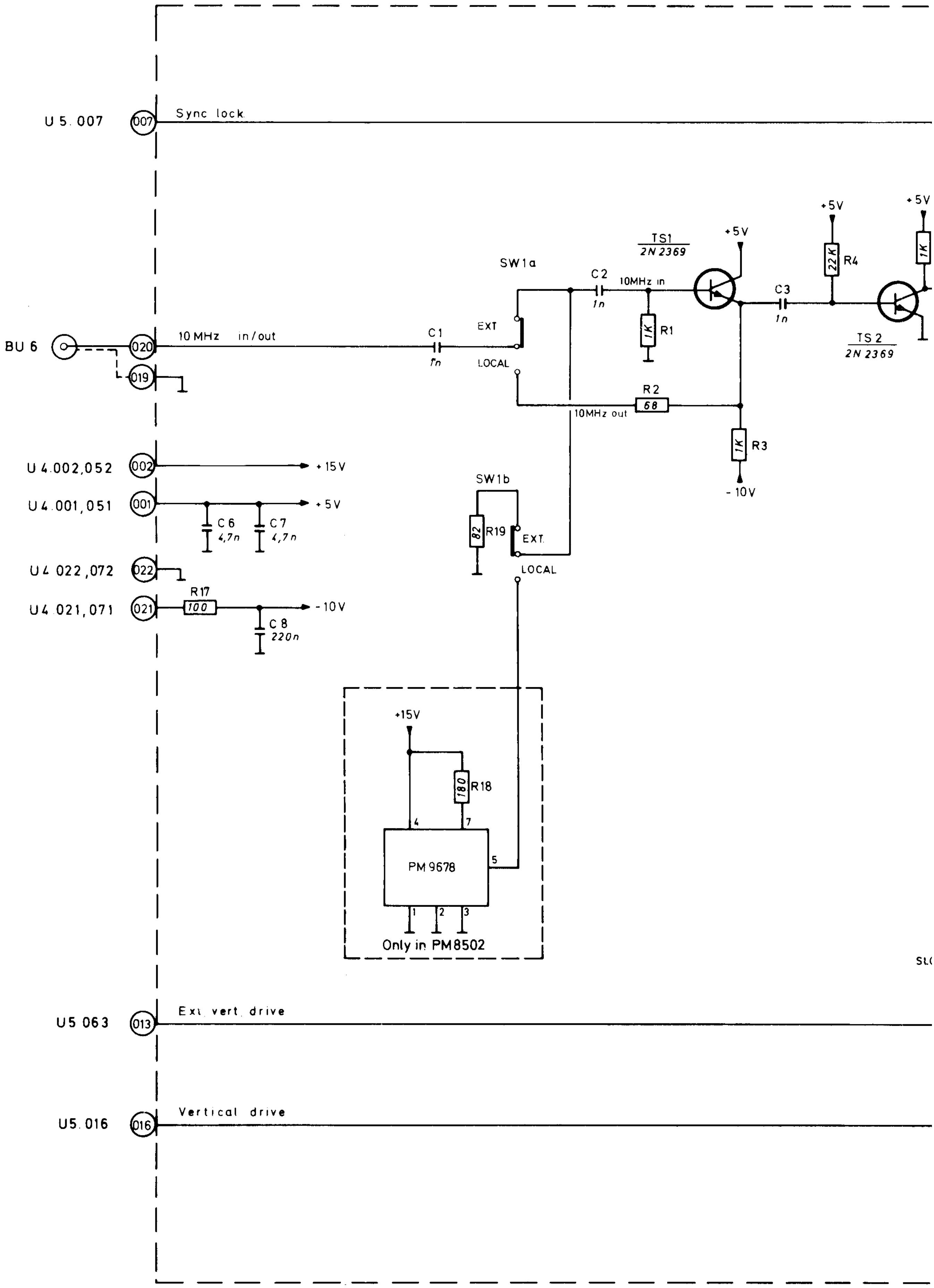


Fig. 8-2 Component location, 10 MHz interface, unit 1.


U 5. 007
007
Sync lock
BU 6
020
019
10 MHz in / out
C1
1n
EXT
LOCAL
SW1a
C2
1n
10MHz in
R1
1K
TS1
2N 2369
+5V
C3
1n
R2
68
10MHz out
R3
1K
-10V
+5V
R4
22K
+5V
1K
TS 2
2N 2369
U 4.002,052
002
+15V
U 4.001,051
001
+5V
C6
4,7n
C7
4,7n
U 4.022,072
022
U 4.021,071
021
R17
100
-10V
C 8
220n
SW1b
82
R19
EXT.
LOCAL
+15V
180
R18
4
7
PM 9678
5
1
2
3
Only in PM8502
U5 063
013
Ext. vert. drive
U5. 016
016
Vertical drive

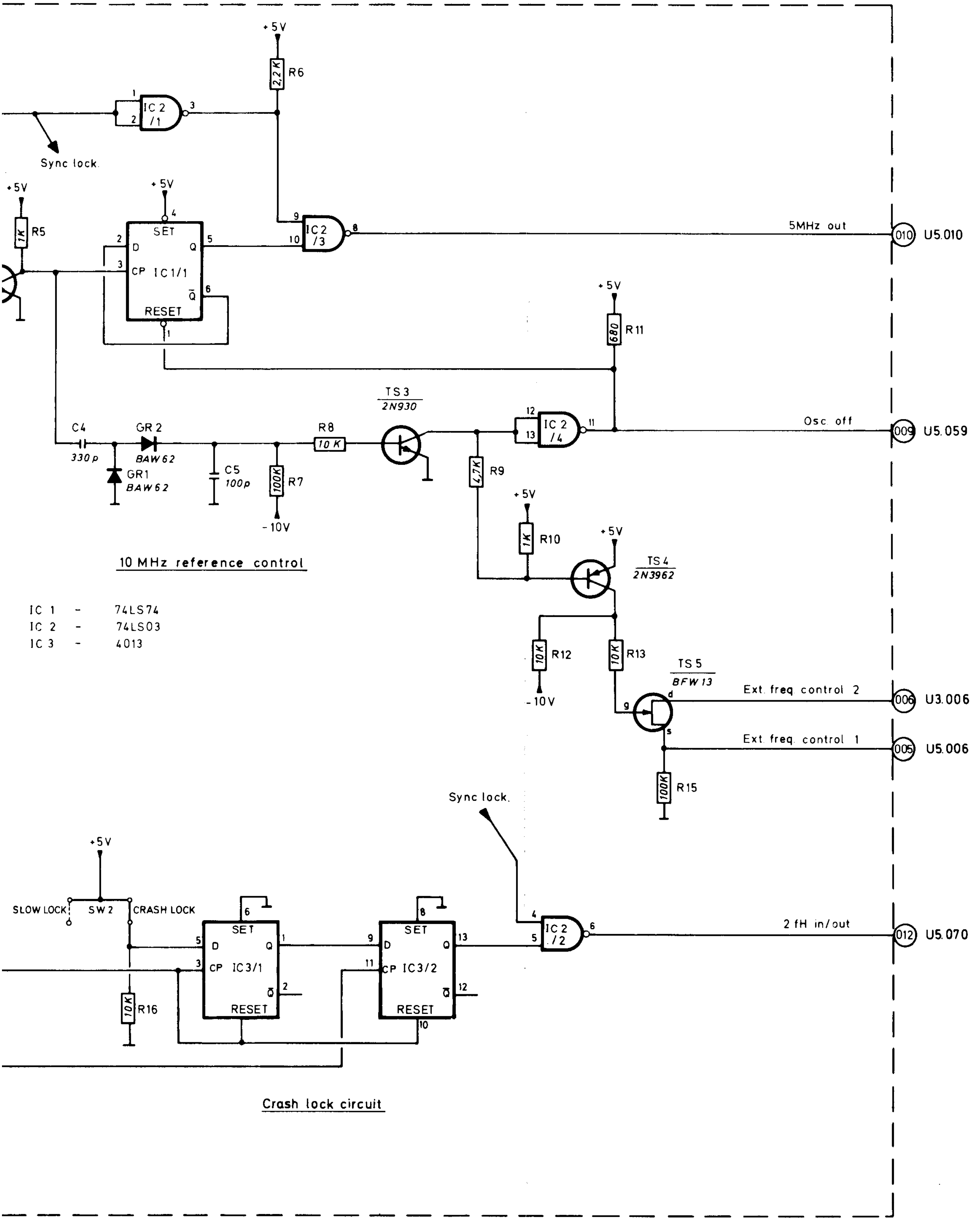


Fig. 8-3 Circuit diagram, 10MHz interface, unit 1

9. Unit 2+4 Rectifier + Voltage regulator

These units comprise three voltage regulators with associated rectifier circuits. The current capability of the three regulators is extended by separate series transistors, which are mounted at the rear of the instrument.

The current limit circuits in unit 2 are interacting, i.e. a short circuit of any of the three voltages causes a switch off of all three voltages. These circuits can if necessary be disconnected while servicing the power supply. This can be done by removing the jumpers A, B and C.

The opto-coupler circuit IC1 delivers the clock pulse to the time clock unit, where it is used when line mode is selected.

Circuit description

Regulator + 15V

The output from TR1 is rectified and smoothed by the rectifier bridge GR1 and the capacitor C1 respectively. The unregulated d.c. voltage across C1 is applied to the series transistor TS1 and the regulator circuit IC1.

The regulator circuit IC1 contains an error amplifier and a voltage reference amplifier. The stable reference voltage (about 7V) is available at IC1.6 and is fed to the error amplifier via R1.
The error amplifier compares the reference voltage at IC1.5 with the voltage at IC1.4.
This voltage is obtained with the voltage divider R2 - R4. R3 is adjustable for setting of the output voltage. The error voltage at IC1.10 is regulating the series transistor TS1 by controlling the base current.

IC1 is provided with a current limiter which is controlled by TS1. When current is drawn from IC1.3, the base current to the series transistor decreases, and thereby the output voltage U decreases. This in turn causes a decrease in the current limit level and a "fold back" characteristic is obtained.

Condition for shut down:

$$I \cdot R_s > 0.7V + U \cdot \frac{R6}{R6 + R5}$$

I = Output current
U = Output voltage
R_s = Sensor resistor, R7 in parallel with R8

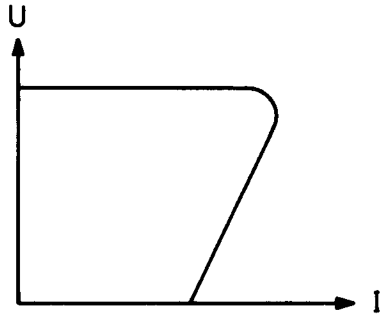


Fig. 9-1 Current limiter characteristic.

A short circuit of any of the three voltages will switch off the +15V, and all three voltages will disappear. The overload protection circuits can if necessary be disconnected while servicing the power supply. This can be done by removing the jumpers A, B and C.

Regulator + 5V

The regulator works in the same way as the +15V regulator but with the following exceptions: As the output voltage is less than the reference voltage at IC2.6, the error amplifier must be provided with a divided reference voltage. This performed with R9 - R11. R10 is adjustable for setting of the output voltage.
The working voltage at IC1.12 is obtained from the +15V circuits.

Regulator – 10V

The regulator works in the same way as the +15V regulator but with the changes necessary to obtain a negative output voltage, i.e. points grounded in the +15V regulator are now at -10V potential etc.
The difference in the overload protection circuit is necessary to make it compatible with the circuits in the +15V and +5V regulators.

Checking and adjusting

Measuring equipment:

Digital voltmeter : e.g. PHILIPS PM 2422

Oscilloscope : e.g. PHILIPS PM 5540X

+ 15V supply

Connect the voltmeter to terminal 2 (earth at terminal 22).
The voltage should be +15V ±2mV
If not, readjust the voltage with the potentiometer R3.

+ 5V supply

Connect the voltmeter to terminal 1 (earth at terminal 22).
The voltage should be +5V ±2mV
If not, readjust the voltage with the potentiometer R10.

– 10V supply

Connect the voltmeter to terminal 21 (earth at terminal 22).
The voltage should be -10V ±2mV
If not, readjust the voltage with the potentiometer R24.

Ripple voltage

Connect the oscilloscope to terminals 2, 1 and 21 respectively.
The 100Hz ripple voltage must not exceed 2mVpp.

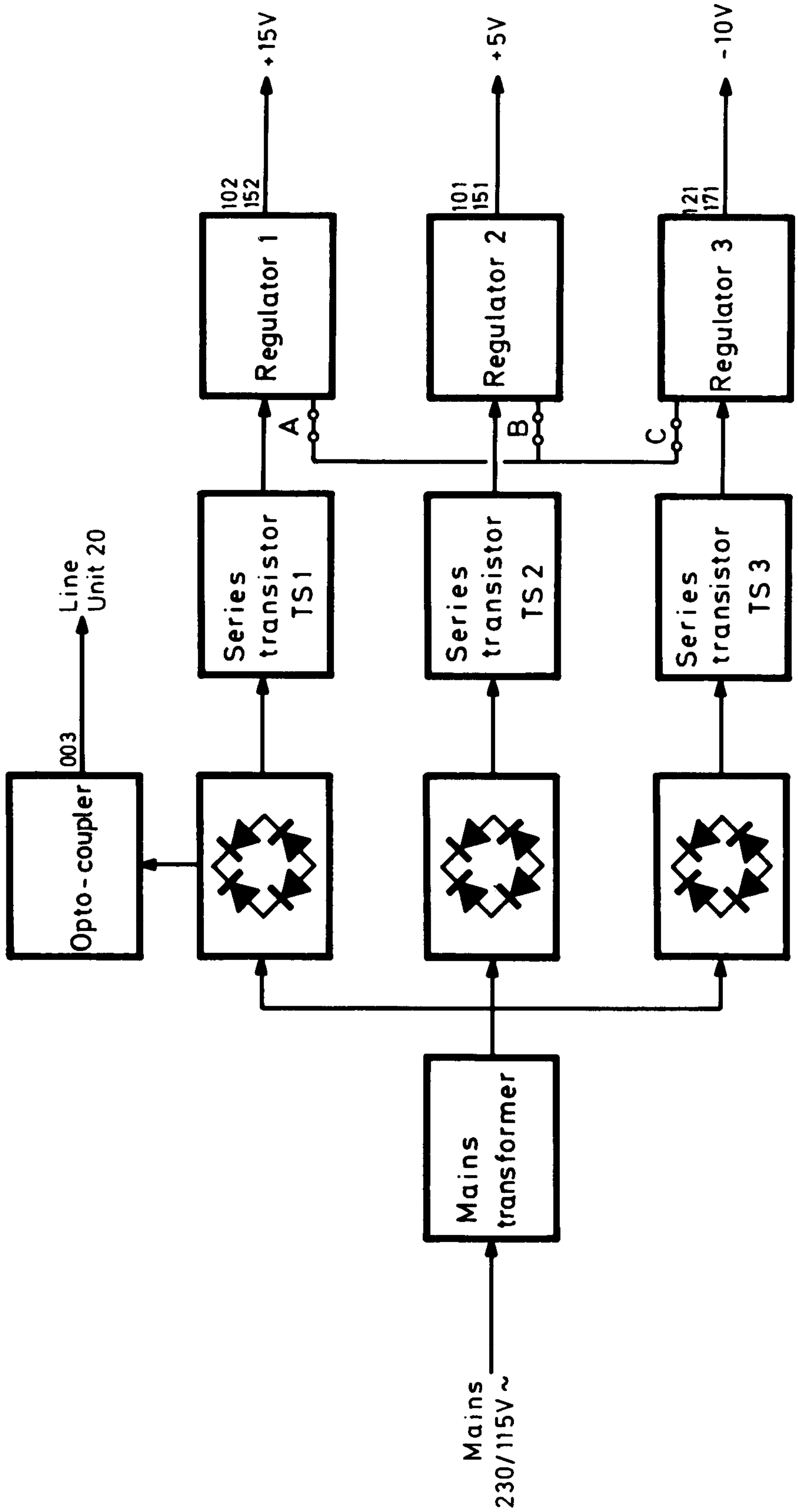


Fig. 9-2 Block diagram, rectifier + voltage regulator, unit 2 + 4

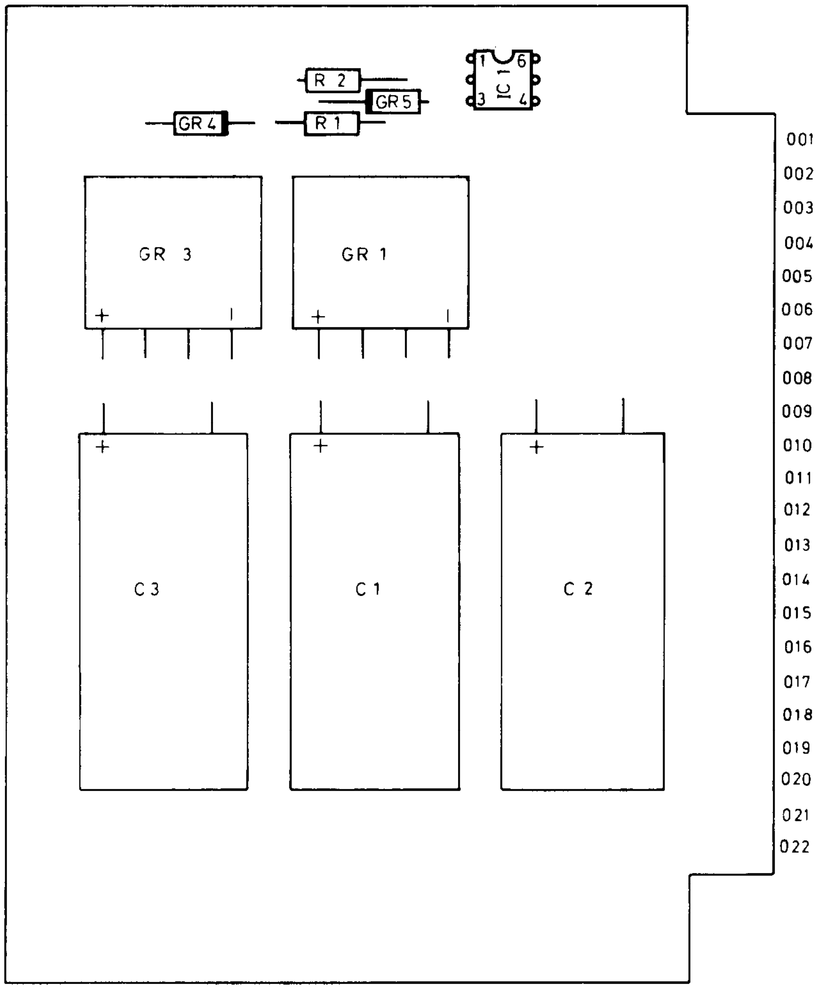


Fig. 9-3 Component location, rectifier, unit 2

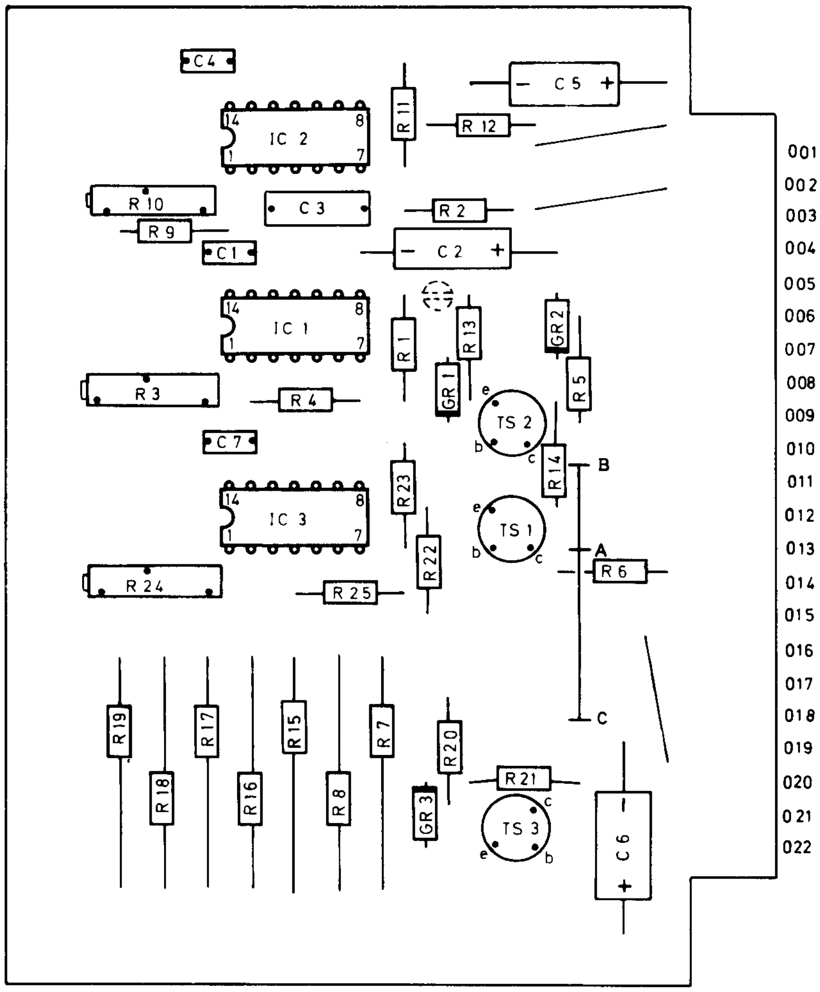
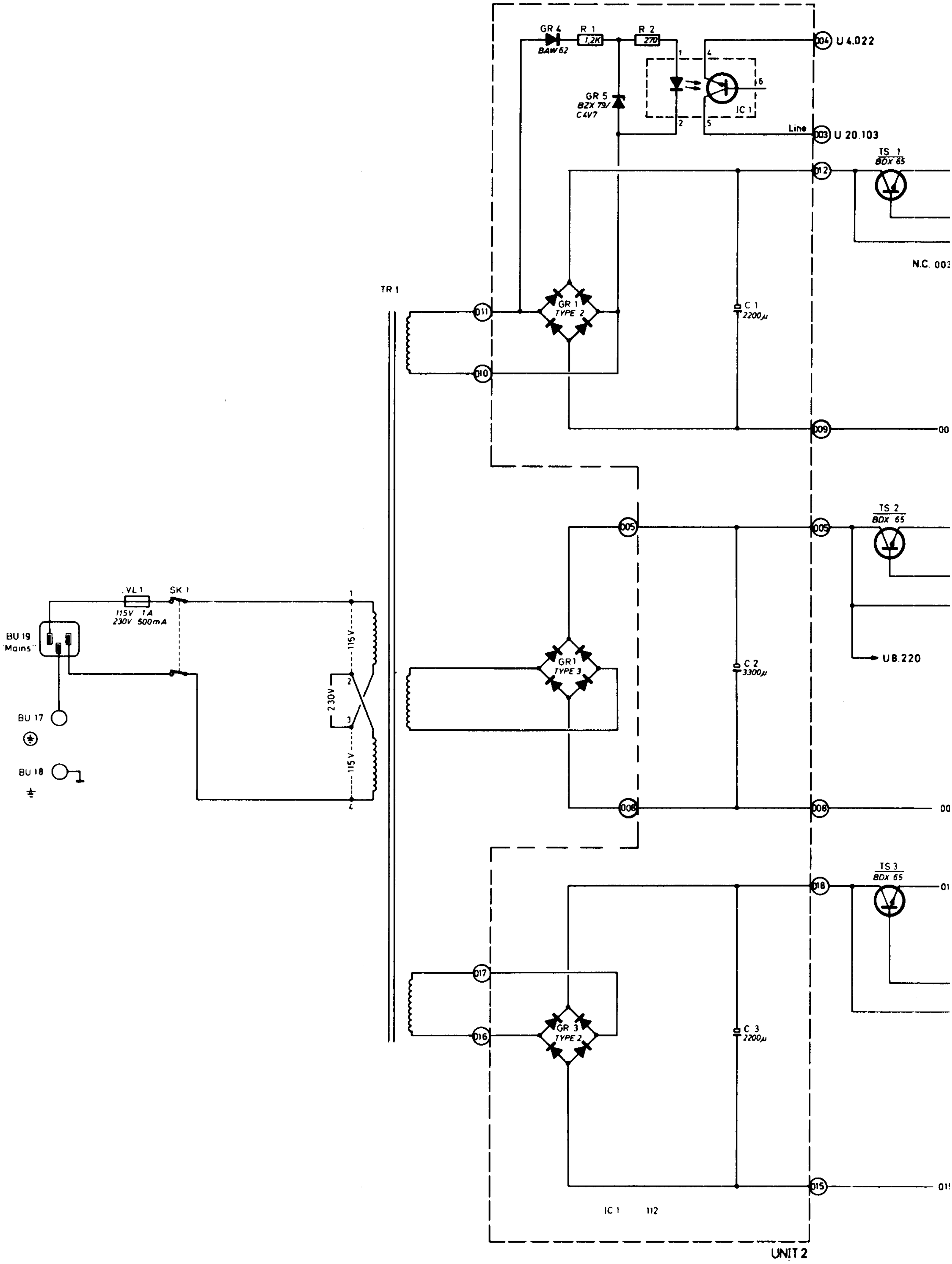


Fig. 9-4 Component location, voltage regulator, unit 4


GR 4
BAW 62
R 1
1,2K
R 2
270
GR 5
BZX 79/
C4V7
IC 1
Line
U 4.022
U 20.103
TS 1
BDX 65
N.C. 003
TR 1
GR 1
TYPE 2
C 1
2200μ
TS 2
BDX 65
UB.220
GR 1
TYPE 3
C 2
3300μ
VL 1
SK 1
115V 1A
230V 500mA
BU 19
"Mains"
BU 17
BU 18
115 V
230 V
115 V
TS 3
BDX 65
GR 3
TYPE 2
C 3
2200μ
IC 1 112
UNIT 2

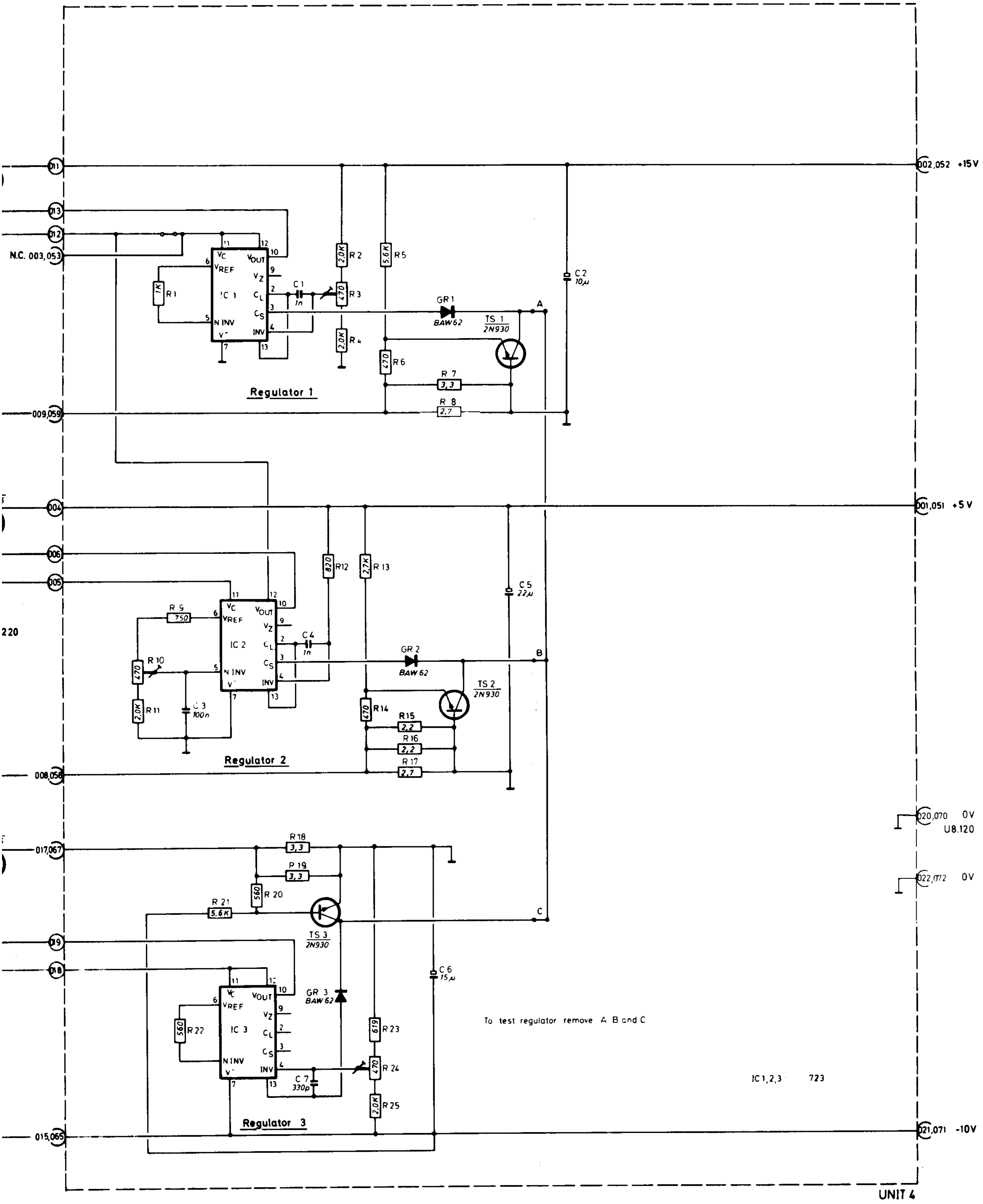


Fig. 9-5 Circuit diagram, rectifier + voltage regulator, unit 2 + 4

10. Unit 3 Subcarrier generator

This unit produces the colour subcarrier by means of a Temperature Compensated X-tal Oscillator, which is corrected by some control circuits. This unit is not mounted in /L-version (secam system).

Circuit description

The "Oscillator" consists of a TCXO, of twice the subcarrier frequency. The output of this is buffered by TS13 and shaped by TS14. Then the 8 MHz signal is divided by two in IC6/2 and is passed to the "Limiter" stage TS15 to TS17, where the sinusoidal shaping of the signal takes place.
The "Limiter" stage is followed by two amplifiers, "Output amplifier 1" and "Output amplifier 2", where "Output amplifier 1" provides the subcarrier signal to the "SUBC OUT" connector BU1 on the front, while "Output amplifier 2" provides the subcarrier to be used internally.

In order to lock the "Oscillator" to an external chroma signal a "Demodulator" and some burst control circuits are present.
When an external composite sync signal is applied to the instrument and the sync mode selector SK13 is released, a "high" level at terminal 7, Sync lock, indicates the presence of the sync, while at terminal 5, the applied chroma signal is added to the input amplifier.
In the burst key periods, this chroma signal has access to the "Limiter" and the "Burst detector" via the "Input amplifier" and the "Burst gate".
The "Limiter" output is then applied to the "X+" input at the "Demodulator" IC2, which continuously has the internal subcarrier signal connected to its "Y+" input.
These two signals are compared by means of IC2, and the phase difference is amplified by IC3. Via TS8 the output has access to the hold capacitor C15 every second line.
TS8 performs the gate part of the "Sample and hold" circuit TS7, TS8, C15, in which the sampling intervals are controlled by the PAL identification pulses at terminal 14. The voltage of C15 is, via the "Low-pass and amplifier" IC4 and the switch TS12, passed over to the "TCXO" to correct the subcarrier frequency.
The switch TS12 is "ON", only when a chroma signal is detected by the "Burst detector" and at the same time the sync lock level at terminal 7 is "high".
The PAL identification phase of the chroma signal is sensed at the "Demodulator", pin 6, and this phase information is via IC7 applied to the "PAL identification phase detector", where it is compared to the vertical drive pulse coming from the sync generator unit. In case of improper phasing a positive PAL identification reset pulse is applied to the sync generator unit, via terminal 13, and this pulse causes the PAL identification pulse to be "high" as long as the PAL identification reset pulse remains "high".

Checking and adjusting

Measuring equipment	:
Oscilloscope	: e.g. PHILIPS PM 3240X
Frequency counter	: e.g. PHILIPS PM 6610
Video test signal generator	: e.g. PHILIPS PM 5570

Subcarrier frequency

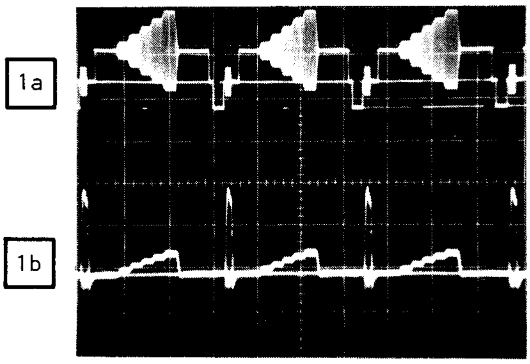
Connect the frequency counter to BU1 "SUBC OUT" and press the switch SK13 "INT SYNC". The frequency should be within ±5Hz. If necessary, readjust by means of C19.

Subcarrier amplitude

Connect the oscilloscope to BU1 "SUBC OUT" and terminate with 75 ohms.
The amplitude should be 1Vpp ±50mV.
If not, then readjust the coil L4.

Residual subcarrier

Apply a chroma staircase signal to BU4 "EXT SYNCHR" and connect the oscilloscope to BU4 as well as to 2 on this unit. Release the switch SK13 "INT SYNC". The residual subcarrier should be at its minimum as shown in fig. 10-1. If not, then readjust with the potentiometer R17.



a. BU4 0.5V/div. 20µs/div.

b. TP2 2.0V/div. 20µs/div.

Fig. 10-1 Residual subcarrier

Phase lock

Apply an external sync signal to BU4 and release SK13. Connect an oscilloscope (DC-input) to 3 and turn R24 fully clockwise. Disconnect and reconnect the external sync signal.

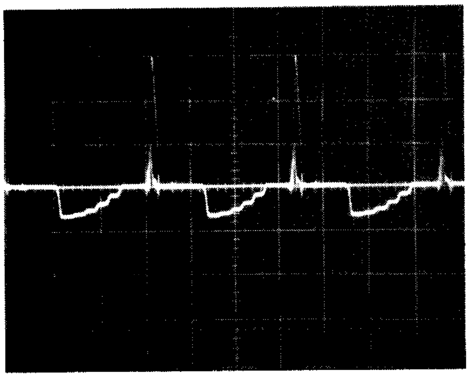
Adjust R24 and note the DC level where locking takes place.

Repeat with R24 adjusted from the opposite end.

Leave R24 in the mid-position between the two locking positions.

Phase lock

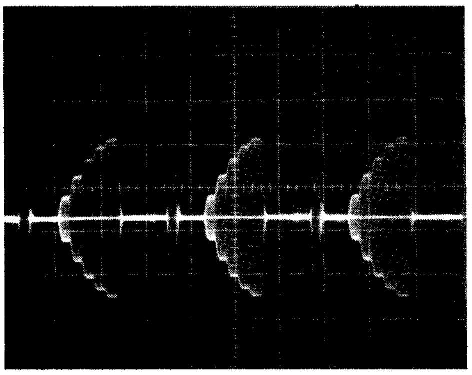
2b



2.0V/div. 20µs/div.

- phase lock

2b



2V/div. 20µs/div.

Fig. 10-2 Phase lock

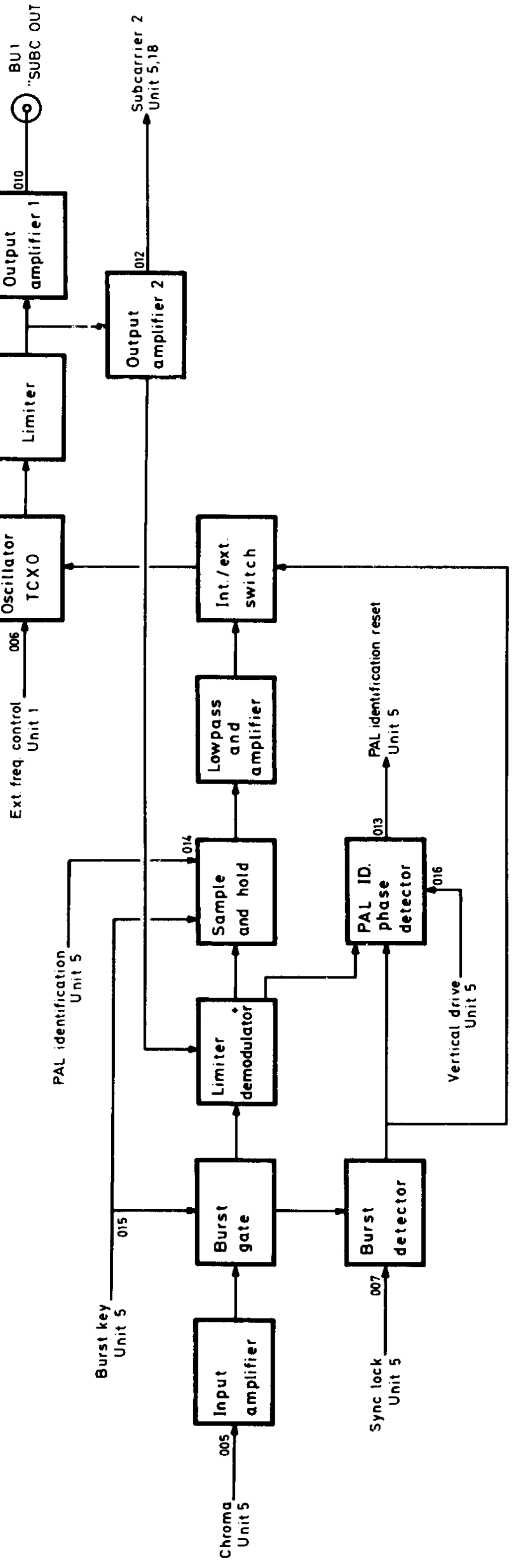


Fig. 10-3 Block diagram, subc. generator, unit 3

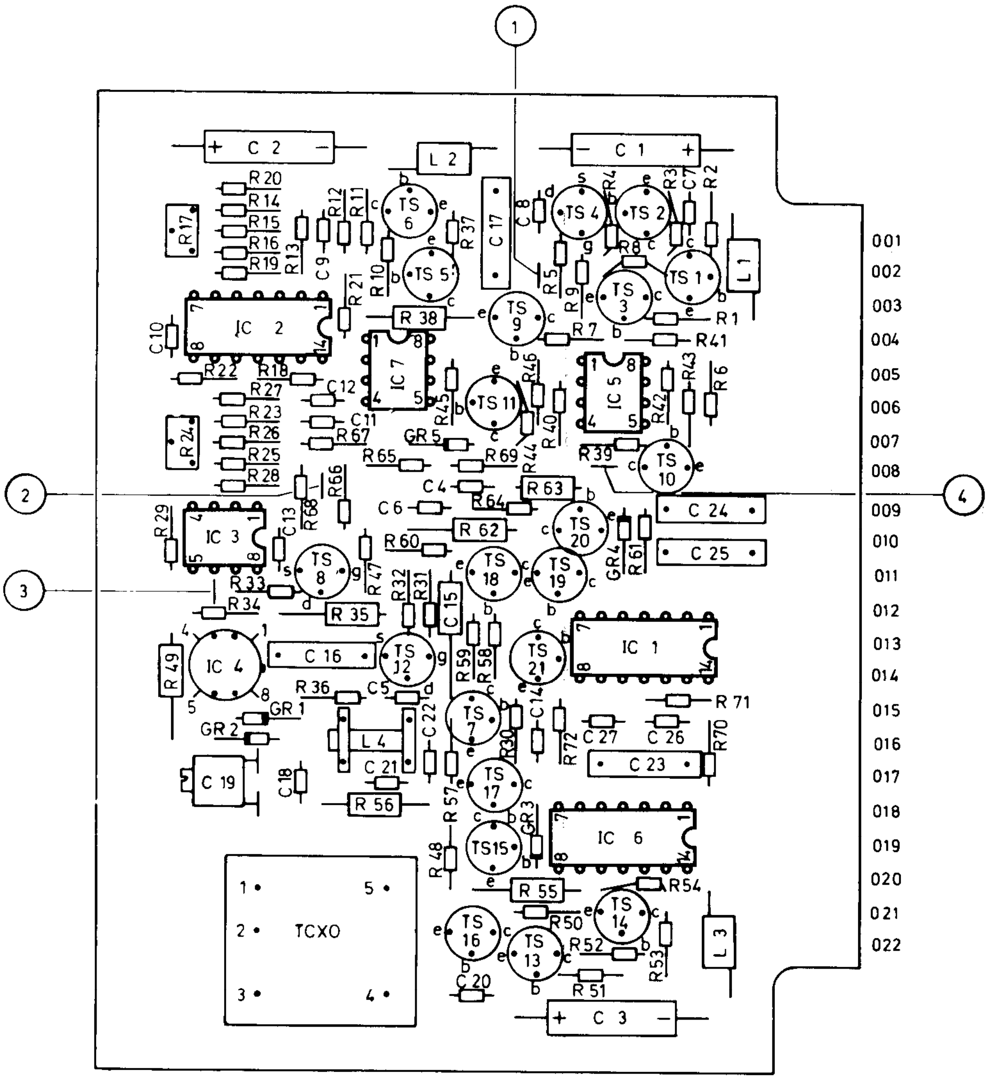
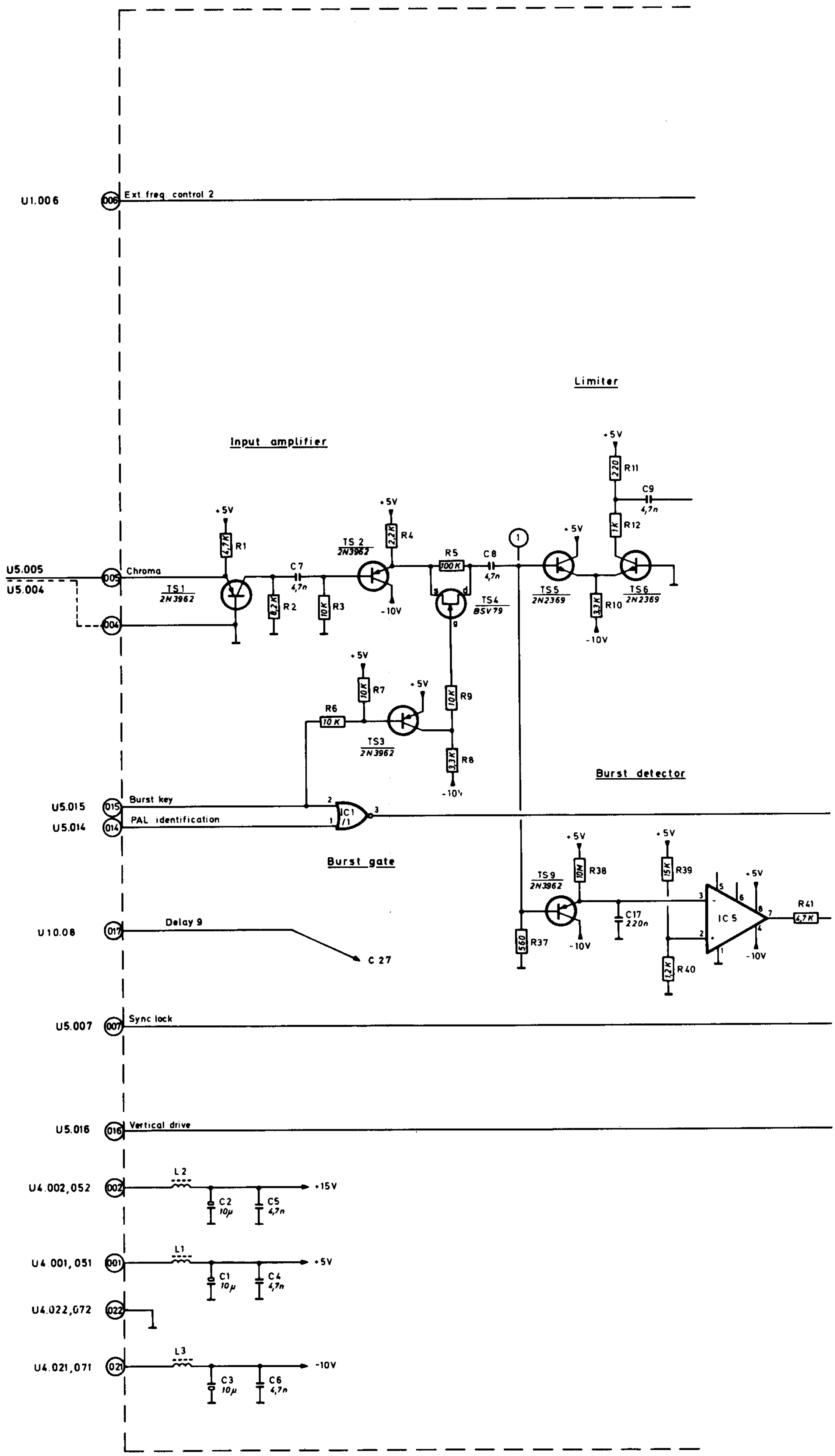
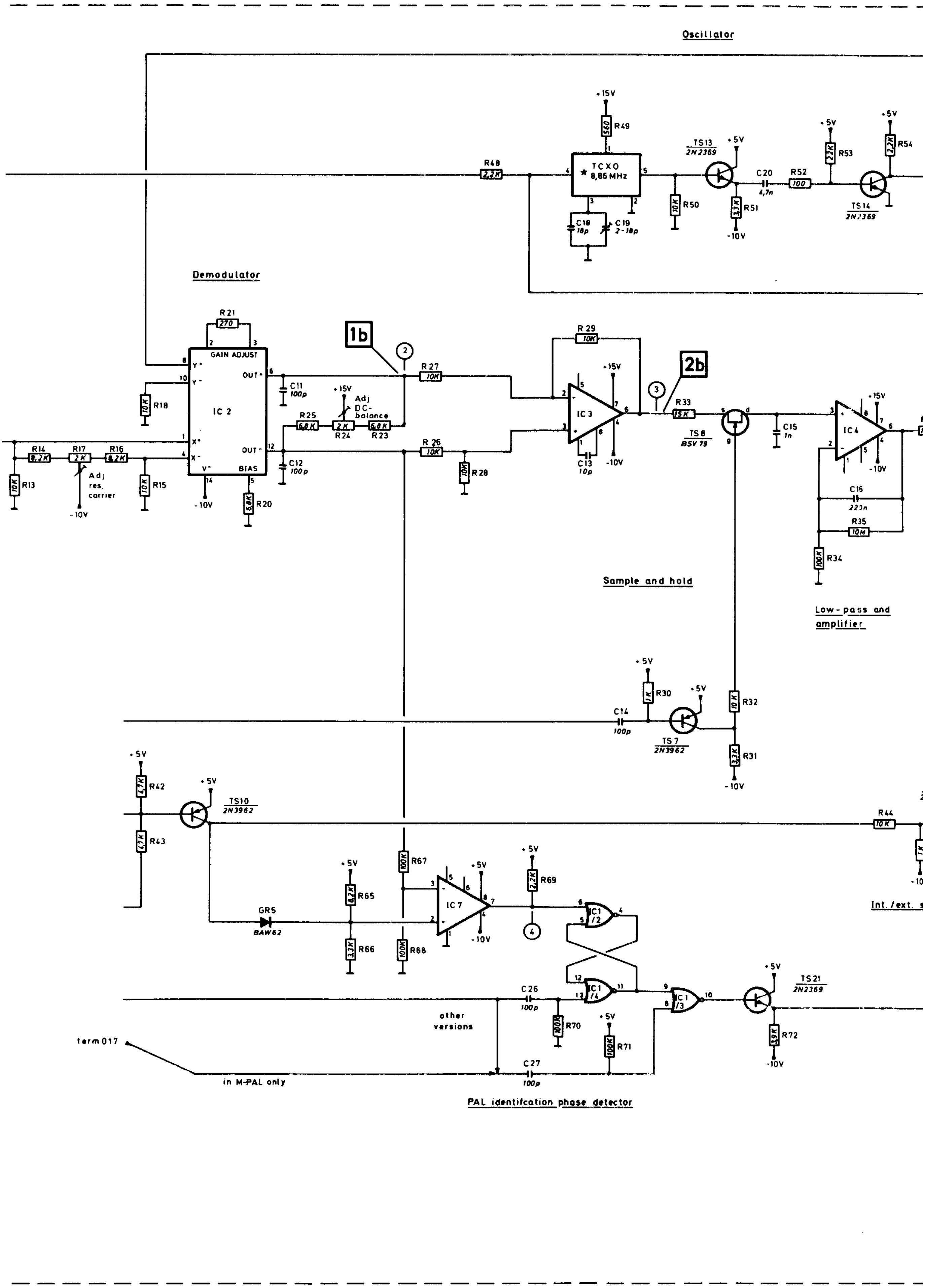


Fig. 10-4 Component location, subc. generator, unit 3


U1.006
Ext. freq. control 2
Limiter
Input amplifier
+5V
R1
4,7K
U5.005
U5.004
Chroma
TS1
2N3962
C7
4,7n
R2
8,2K
R3
10K
TS 2
2N3962
R4
2,2K
-10V
R5
100K
C8
4,7n
TS4
BSV79
TS5
2N2369
TS6
2N2369
R10
3,3K
R11
220
R12
1K
C9
4,7n
R6
10K
R7
10K
TS3
2N3962
R9
10K
R8
3,3K
Burst detector
U5.015
U5.014
Burst key
PAL identification
IC1
Burst gate
TS9
2N3962
R38
10M
R39
15K
R37
560
C17
220n
IC 5
R40
12K
R41
4,7K
U10.08
Delay 9
C 27
U5.007
Sync lock
U5.016
Vertical drive
U4.002,052
L 2
C2
10µ
C5
4,7n
+15V
U4.001,051
L1
C1
10µ
C4
4,7n
+5V
U4.022,072
U4.021,071
L3
C3
10µ
C6
4,7n
-10V


Oscillator
TCXO
8,86 MHz
TS13
2N2369
TS14
2N2369
Demodulator
GAIN ADJUST
IC 2
1b
2b
IC 3
IC 4
TS8
BSV 79
Adj
res.
carrier
Adj
DC-
balance
Sample and hold
Low-pass and
amplifier
TS7
2N3962
TS10
2N3962
GR5
BAW62
IC 7
TS21
2N2369
other
versions
term 017
in M-PAL only
PAL identifcation phase detector

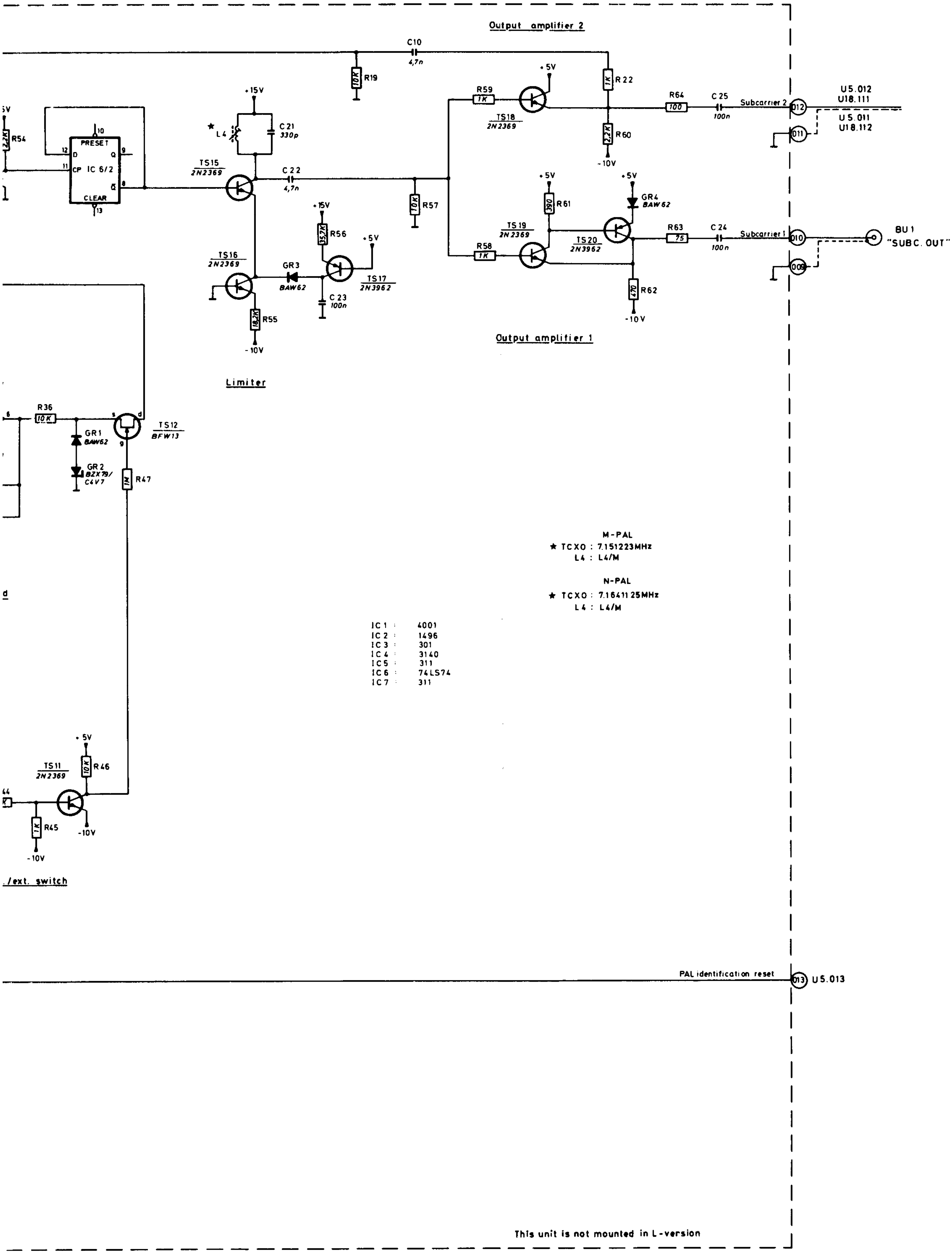


Fig. 10-5 Circuit diagram, subc. generator, unit 3 /G/I/N-PAL/M-PAL

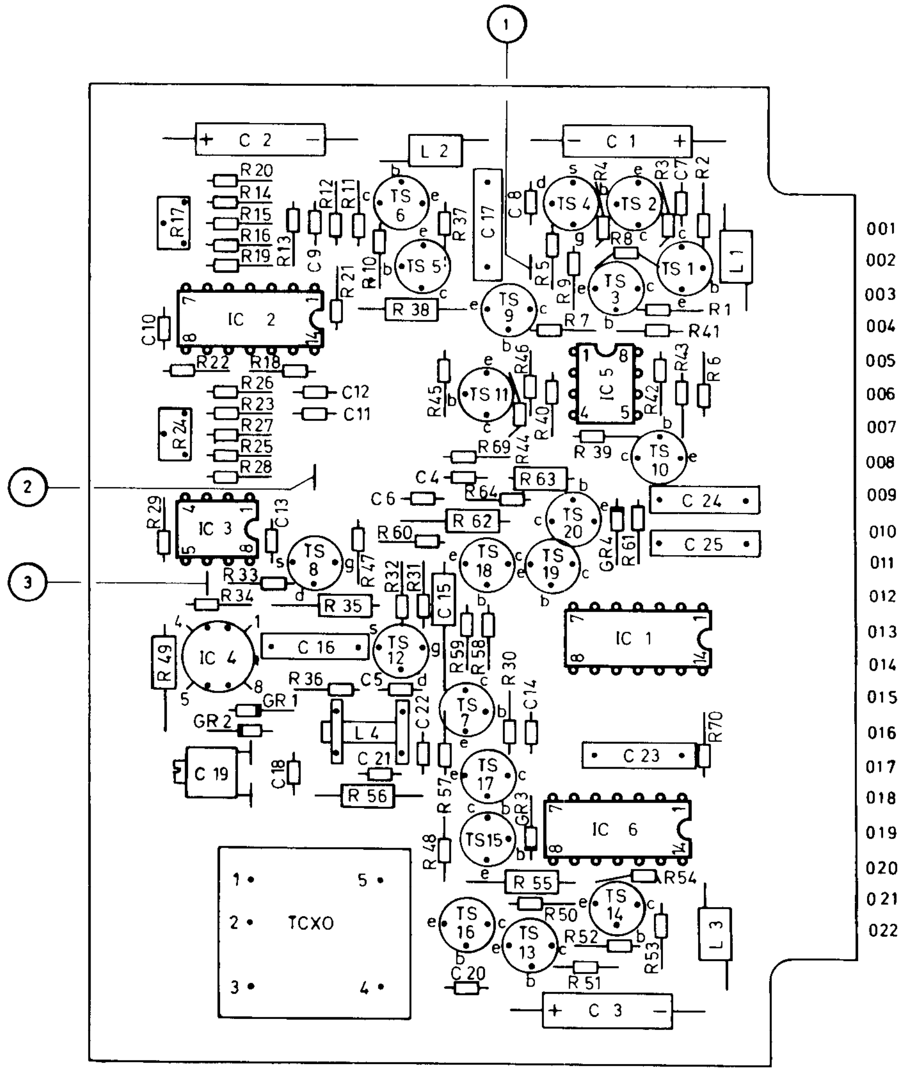
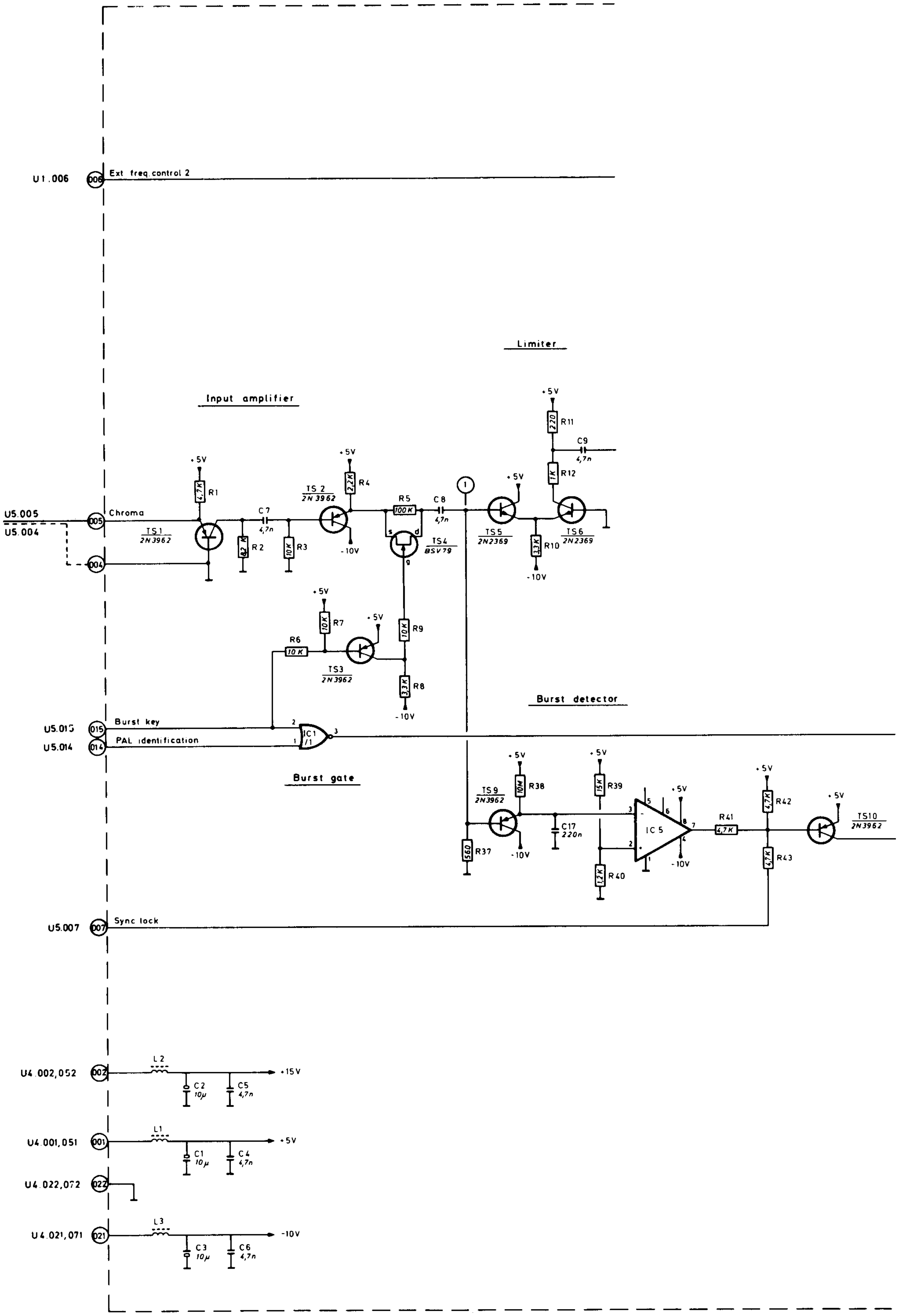
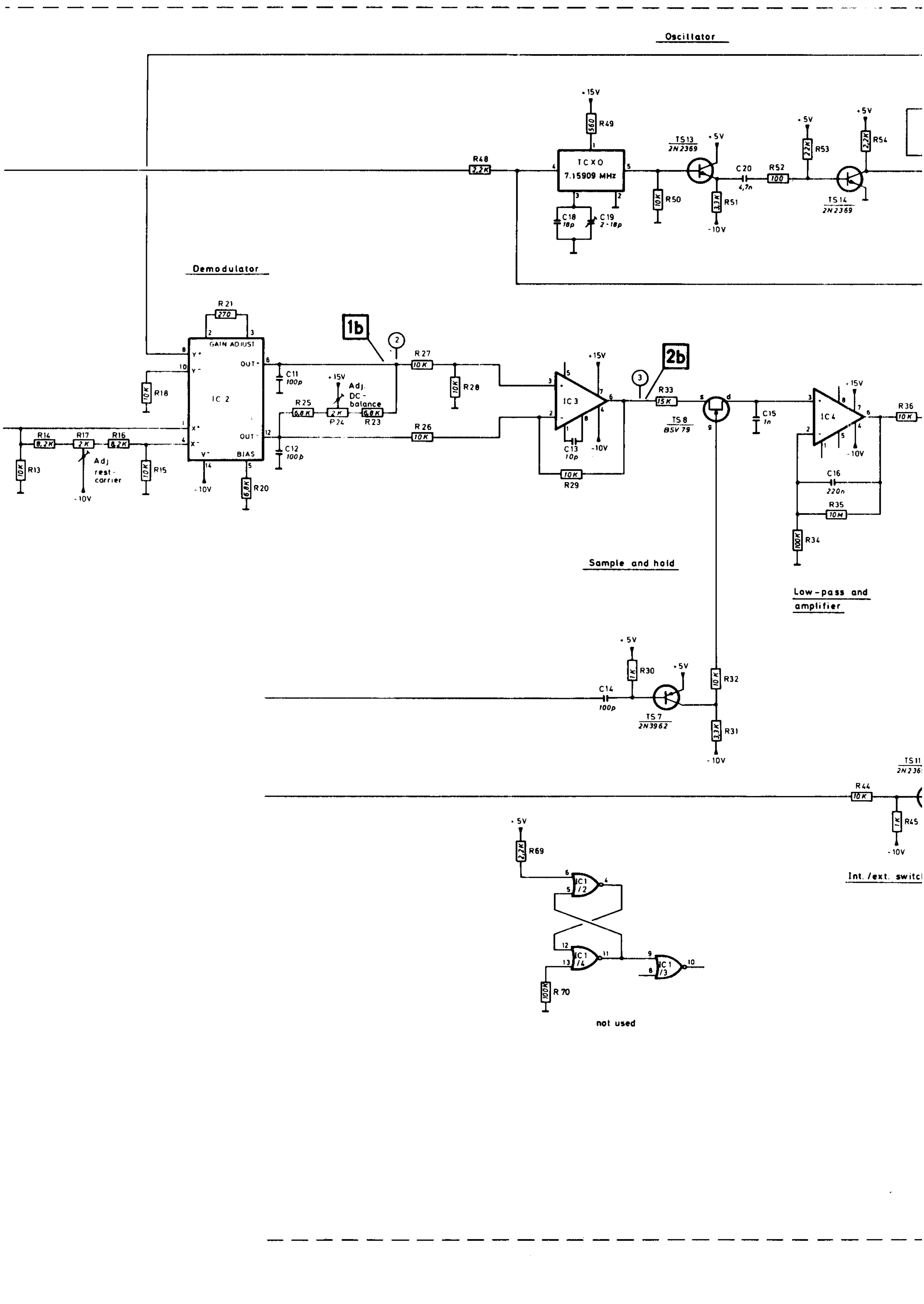


Fig. 10-6 Component location, subc. generator, unit 3/M/NTSC


U1.006
Ext. freq. control 2
Limiter
Input amplifier
U5.005
U5.004
Chroma
TS1 2N3962
TS2 2N3962
TS3 2N3962
TS4 BSV79
TS5 2N2369
TS6 2N2369
TS9 2N3962
TS10 2N3962
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12
C7 4,7n
C8 4,7n
C9 4,7n
Burst detector
U5.015
U5.014
Burst key
PAL identification
IC1
Burst gate
R37 R38 R39 R40 R41 R42 R43
C17 220n
IC5
U5.007
Sync lock
U4.002,052
U4.001,051
U4.022,072
U4.021,071
L1 L2 L3
C1 10µ
C2 10µ
C3 10µ
C4 4,7n
C5 4,7n
C6 4,7n
+15V
+5V
-10V



Oscillator
TCXO
7.15909 MHz
R48
R49
R50
R51
R52
R53
R54
C18
C19
C20
TS13
2N2369
TS14
2N2369
Demodulator
R21
GAIN ADJUST
IC 2
BIAS
1b
2b
R27
R28
R25
R23
P24
Adj. DC-balance
R26
C11
C12
R13
R14
R15
R16
R17
R18
R20
Adj rest-carrier
IC 3
C13
R29
R33
TS 8
BSV 79
C15
IC 4
R36
C16
R35
R34
Sample and hold
Low-pass and amplifier
R30
C14
TS 7
2N3962
R32
R31
R44
R45
TS11
Int. /ext. switc
R69
R 70
IC1 /2
IC1 /4
IC1 /3
not used

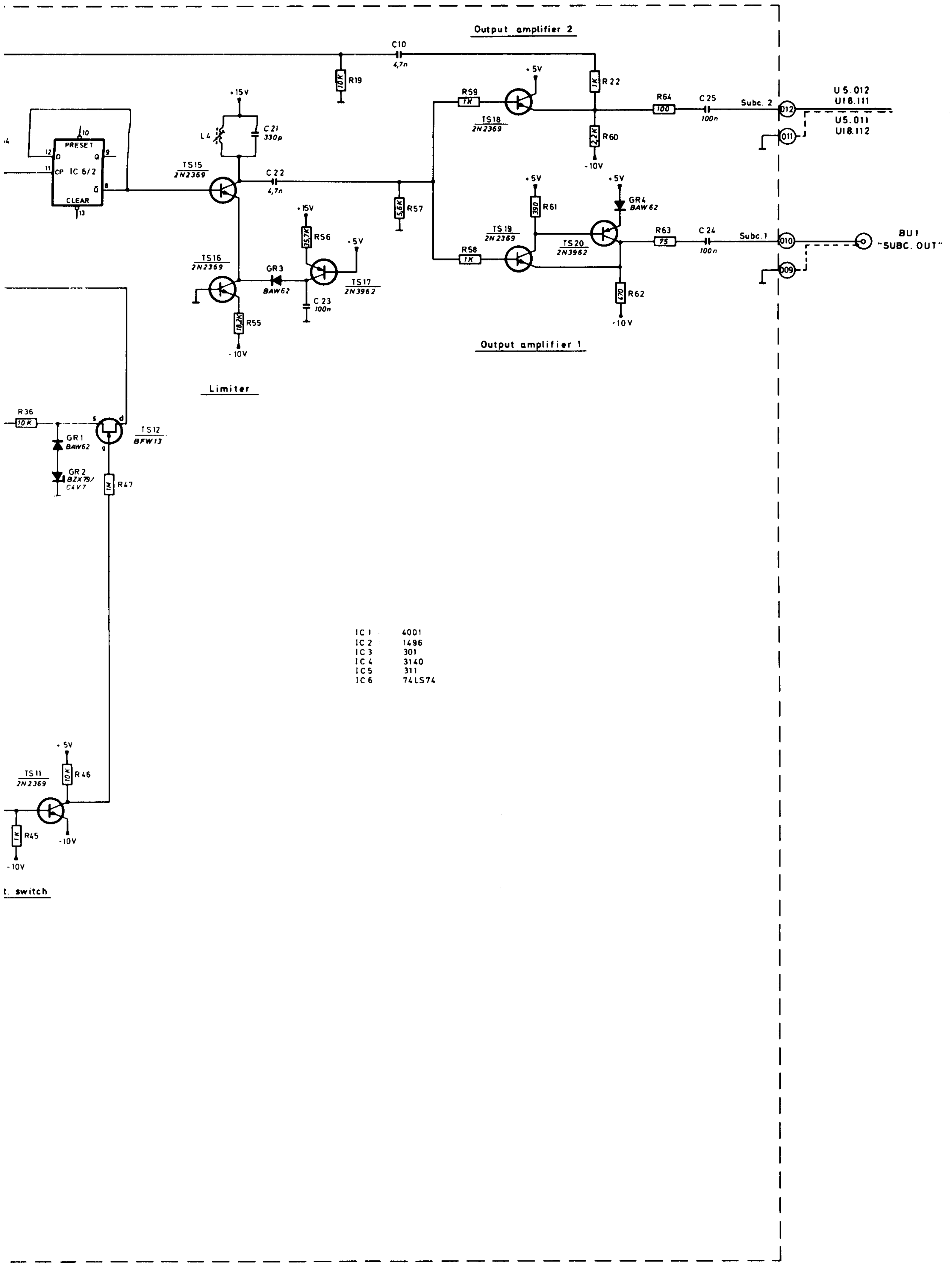


Fig. 10-7 Circuit diagram, subc. generator, unit 3 /M-NTSC

11. Unit 5 Sync generator

Functional description of OQ5502 and OQ5506

Essentially, the Sync generator is based on two integrated-circuits - IC8 (OQ5506) and IC9 (OQ5502). The complete sync pulse generation functions are derived from IC8, while phase-locking is achieved by IC9. The other two basic requirements of the generator are the $160f_H$ clocking oscillator and the high-stability colour subcarrier oscillator, unit 3. In view of the fundamental importance of these two integrated circuits in the sync pulse generator, a short description of the input/output functions, together with some internal circuit operation description to block diagram level is given, before proceeding with the description of the detailed circuit operation. The functions present on each pin are shown, followed by a summary of the functions and their uses in the circuit and, finally, block diagrams of the principle circuit loops are given and described.

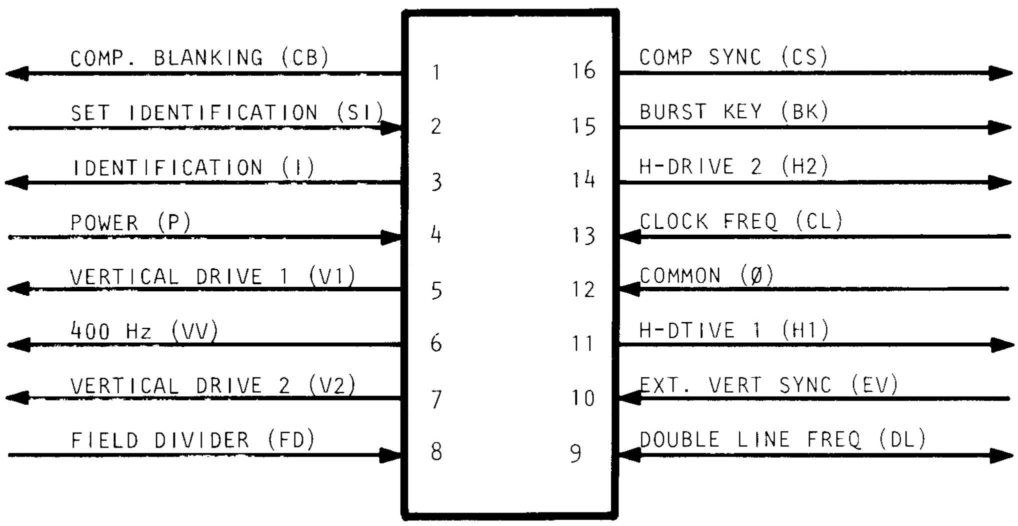


Fig. 11-1 Pulse generator OQ5506 pin connections

<u>Pin Functions</u>

Pin 1 - Composite Blanking output.

Pin 2 - Set Identification input. When this input is high, the PAL identification output of pin 3 is also high. With logical 0 at this pin, the input is inactive.

Pin 3 - PAL Identification output or Standard Switch input. For EIA/NTSC operation the PAL pulse is not used. Therefore link SW2 is set to connect this pin to common and link SW1 set to connect pin 8 to open-circuit (i.e. 525 line mode), the IC functions as an EIA/NTSC standard generator. A truth table showing the strapping for the various standards is given below.

Pin 3 (Link SW2)	Pin 8 (Link SW1)	Standard
Not to common	Common	CCIR/PAL, PAL(N)
Not to common	Not to common	PAL (M)
Common	Not to common	EIA/NTSC

Pin 4 - Power input.

Pin 5 - Vertical Drive 1 output.

Pin 6 - 400 Hz/360 Hz input/output. The 400 Hz signal is required for use in the Phase Lock circuit IC9, in order to obtain the subcarrier-to-line frequency relationship for the CCIR/PAL standards. This pin is also input with the V-Drive 1 output from pin 5, via a transistor in IC9, to determine the phase relationship of the vertical drive to the external vertical sync pulse.

Pin 7 - Vertical Drive 2.

Pin 8 - Frame Divider input of the logic level at this input switches the vertical divider count. With logic 1 set by link SW1, the IC operates as a 525 line divider with a vertical frequency of 60 Hz. With this pin low, it operates as a 625 line divider with a vertical frequency of 50 Hz.

Pin 9 - Double Line frequency (suppress input). The vertical divider in the IC is driven by double line frequency pulses. As the normal vertical sync lock takes up to a maximum of about 6-7 seconds to operate, a crash lock facility is required for VCR systems, etc. This is achieved by suppressing the double line frequency pulses to stop the counter for the necessary period, thus introducing a fast "crash" lock operation. The stop period of the counter is determined by the phase relationship between the internal V1 drive and the external (reference) vertical sync pulses offered at pin 10 of the IC. When crash lock has been carried out, the counter is re-started and the slowlock operation is resumed (i.e. without visible disturbance on the local TV picture).

Pin 10 - External Vertical Synchronization input. This reference is input to execute the slow locking of the generator V-Drive phase to the reference source as well as to produce the crash lock operation as mentioned for Pin 9.

Pin 11 - Horizontal Drive 1 output. The H-Drive on this pin occurs on the line sync.

Pin 12 - Common (ground).

Pin 13 - Clock input. This must always be 160 times the line frequency of the TV standard being used (i.e. 2.5 MHz for CCIR/PAL and PAL(N); 2.517482 MHz for EIA/NTSC and PAL(M).

Pin 14 - Horizontal Drive 2 output. The H-Drive on this pin occurs on the line blanking.

Pin 15 - Burst Key output.

Pin 16 - Composite Sync output.

A simplified block diagram of IC8 is given in Fig. 11-2.

The 160 fH is input to a ÷160 line divider which generates lines (fH) and double line (2 fH) frequency outputs, with the 2 fH output being used to drive the switchable 525/625 lines frame divider which generates the vertical frequency pulse. The line and vertical frequency pulses, together with the PAL Identity pulse (where relevant) are then input to the logic and processing circuit for the generation of the required output pulses.
As the 160 fH clock pulses are controlled in phase by an output from the phase-lock circuit IC9, the line frequency output pulses from the 160 fH line divider are locked in phase to the line sync of the external composite sync signal. Thus, as there is a fixed relationship between the line and vertical frequencies, it follows that the vertical pulses output from the frame divider must be of the same frequency as the vertical sync pulses in the external composite sync signal. However, the phase relationship of the vertical sync pulses is arbitrary so that phasing of these pulses must be carried out in IC8 to achieve lock.

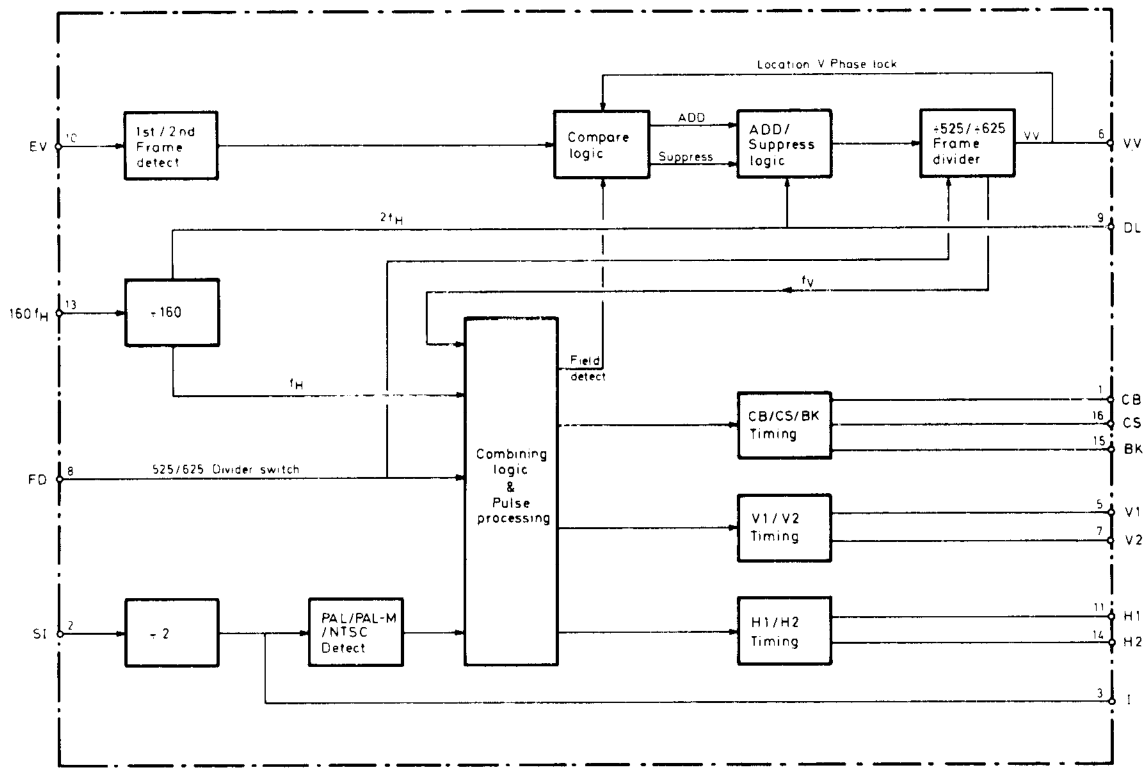


Fig. 11-2 Simplified block diagram of IC 8.

In this circuit, a slow vertical lock system has been chosen, thus providing an almost invisible lock while, at the same time, being very insensitive to any disturbances in the external vertical sync signal. Because of the interlacing of two fields in the television picture, the number of lines is odd so that to obtain an invisible lock requires that the interlace is maintained and phase locking achieved slowly by changing the number of lines per picture. This is done by adding or suppressing pulses in the 2 fH drive to the frame divider on every second frame until the phasing of the vertical sync pulses is correct to within half a line. Thus, by adding or suppressing two pulses in the drive to the frame divider, this becomes a quasi-627 or quasi-623 divided respectively. When phase lock is achieved, a STOP command is sent to the ADD/ SUPPRESS circuit so that normal 625/525 line division is resumed. This slow locking system results in a maximum locking time of approximately 6.25 seconds. However, the system disturbances in the external composite sync signal cause the minimum distortion of the vertical drive pulses because a line can only be added or suppressed at one time in a frame. Loss of external vert. sync pulses will have no effect so that the vertical phase lock will remain correct.
Crash lock is achieved by grounding pin 9 so that the double-line frequency 2 fH drive is suppressed and the frame divider is stopped.

The phase-lock circuit IC9 establishes the relationship between the subcarrier and line frequencies, as well as it provides processing of the external composite sync signal and comparison of the sync phasing.

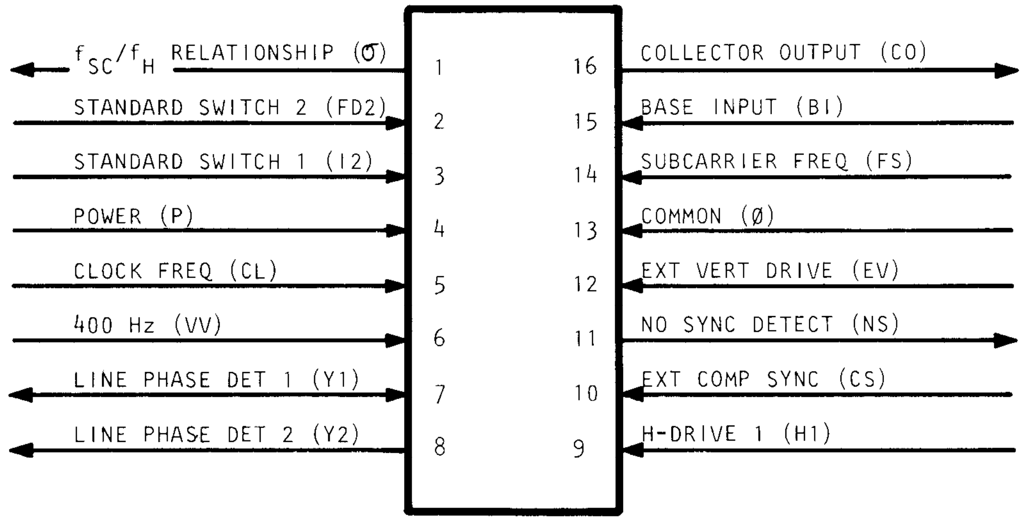


Fig. 11-3 IC9 Phase lock circuit 0Q5502 pin connections.

Pin Functions

Pin 1 - Relationship between subcarrier and Line frequencies output σ. Depending on the television system in use, there is a standard relationship between the subcarrier and line frequencies. The result of the comparison between f_H and f_S is output at pin 1. This output is fed, via a lowpass filter, to tune the clock oscillator thus ensuring that this standard relationship is maintained. This facility is used when no external sync is present.

Pin 2,3 - Standard switch inputs. The states of these inputs are determined by the setting of links SW5/SW6 and SW3/SW4 (logic 1 or 0). Note that logical 1 corresponds to a voltage greater than +2V d.c. and logical 0 to 0V (positive logic). The television standards and line frequency/subcarrier relationship ($f_H = f_S/K$) for the various link positions are shown in the table below.

Pin 2 (SW5/SW6)	Pin 3 (SW3/SW4)	TV Standard	$f_H = f_S/K$
0	1	CCIR/PAL	$f_{H1} = f_{S1}/283,7516$
1	1	PAL(M)	$f_{H2} = f_{S2}/227,25$
1	0	EIA/NTSC	$f_{H3} = f_{S3}/227,25$
0	0	PAL(N) VCR lock	$f_{H4} = f_{S4}/229,2516$

f_{S1} = 4 433 618,75 Hz	f_{H1} = 15 625 Hz
f_{S2} = 3 575 611,49 Hz	f_{H2} = 15 734,265 Hz
f_{S3} = 3 579 545 HZ	f_{H3} = 15 734,265 Hz
f_{S4} = 3 582 056,25 Hz	f_{H4} = 15 625 Hz

Pin 4 - Power input.

Pin 5 - Clock input. This clock frequency is 160 f_H as required for IC8 and is derived from the same X-tal oscillator.

Pin 6 - $8f_V$ input (VV). This is a 400 Hz signal received from IC8 which is used in CCIR/PAL as well as in PAL(N) TV-systems, where it is required to generate the 25 Hz offset in the subcarrier frequency. When operating in PAL(M) or EIA/NTSC modes, pin 6 is inactive.

Pin 7,8 - Y1, Y2 Line Phase Detector Outputs 1 + 2. The line pulses which are derived from the processing of the external composite sync (ECS) signal are compared in phase with the internal line pulses (H1) from IC8 signals representing their relationship Y1, Y2 which appear on Pins 7,8. These signals are passed via lowpass filters and appear as d.c. voltages at the inputs of op. amplifier IC10, the output of which is used to tune the clocking oscillator in such a sense as to cancel any phasing error so that the d.c. voltages at the op. amplifier inputs are equal. The phasing is then correct to within $\pm$50 nanoseconds.

Pin 9 - Internal Horizontal Drive H1 Input. As the leading edge of the H1 Drive Signal coincides very closely to the leading edge of the composite sync signal at pin 16 of IC8, it is not processed in IC9.

Pin 10 - External Composite Sync Input. This signal is derived from an external (C)VBS or Black Burst signal.

Pin 11 - No Sync Detector Output. This detector senses only the presence, or absence, of the external composite sync signal and so it functions as a dropout detector. When composite sync is present at pin 10, the level at pin 11 is logical zero (0V) and the 160 f_H oscillator is controlled by the output of the line phase detector at pins 7, 8. Should there be no external composite sync input at pin 10, the level at pin 11 changes to logical one approximately 7 µsec after the imaginary leading edge of the missing composite sync pulse. This logical one output switches TS11, TS12 so that the voltage-controlled 160 f_H oscillator is tuned by the subcarrier/line frequency relationship output from pin 1.

When the next composite sync pulse appears at pin 10 after a drop-out, the level at pin 11 switches to logical zero after a maximum delay of 16 µsec so that TS11, TS12 are switched to return control of the 160 f_H oscillator to the line phase detector.

Pin 12 - External Vertical Drive Output. This signal is derived from the external composite sync input and is passed to IC8 as reference where the generator V-Drive phase is locked to it.

Pin 13 - Common.

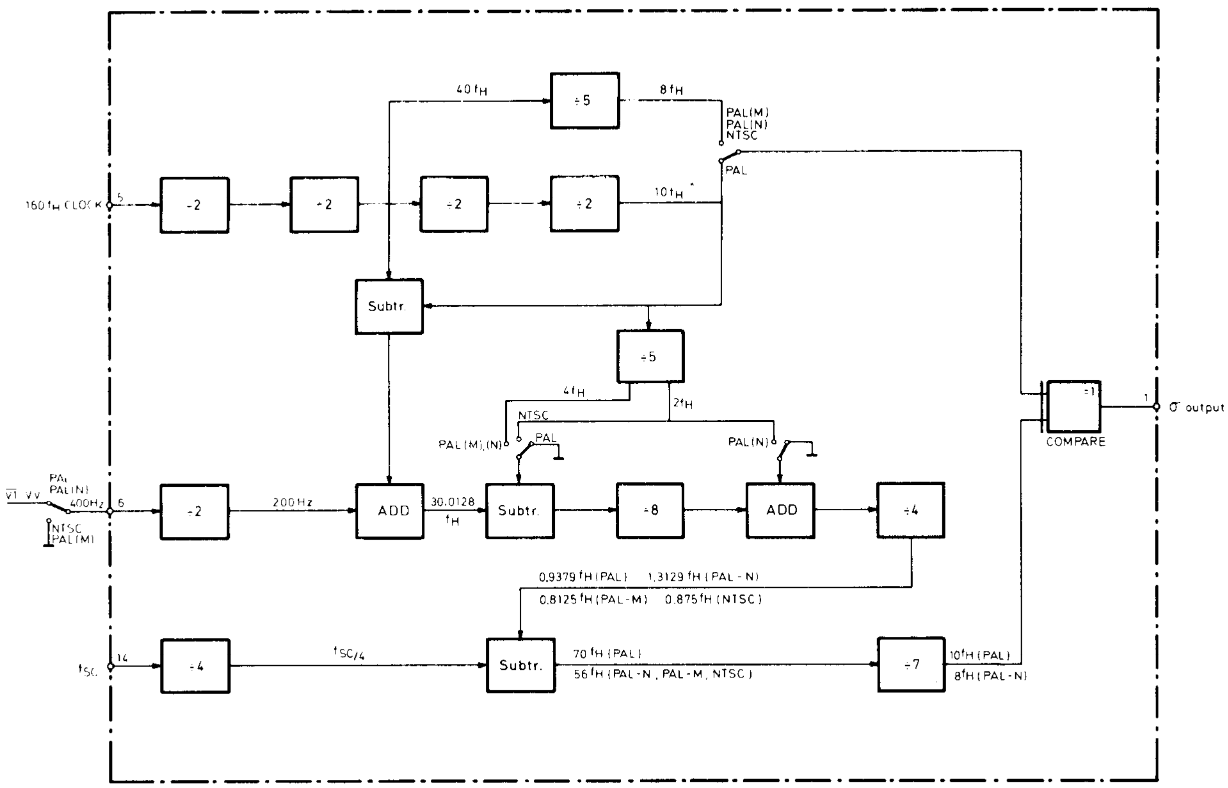
Pin 14 - Subcarrier Frequency Input. This signal is used to establish the relationship between subcarrier and line frequencies.

Pin 15,16- Transistor Stage. The base input is on pin 15 and the collector output at pin 16. This stage is input with the V-Drive 1 signal so that the output is V. As the 400 Hz $8f_V$ signal VV from IC8 is also present on this line, the product V.VV is generated for use in IC8 in the PAL system.

Two principal functions are carried out by IC9 which are described separately:
- The calculation of the subcarrier/line frequency relationship.
- Processing of the external composite sync signal (ECS) and the comparison of reference and internal line sync phases.

Subcarrier/Line Frequency Relationship

A block diagram showing the method of establishing this relationship is given in Figure 11-4.



f_{SC}CCIR/PAL	:	4433618,75 Hz	f_HCCIR/PAL	:	15625 Hz
f_{SC}PAL (M)	:	3575611,49 Hz	f_HPAL (M)	:	15734,265 Hz
f_{SC}EiA/NTSC	:	3579545,0 Hz	f_HEIA/NTSC	:	15734,265 Hz
f_{SC}PAL (N)	:	3582056,25 Hz	f_HPAL (N)	:	15625 Hz

Fig. 11-4 Subcarrier/Line frequency relationship.

Basically the circuit is input with subcarrier frequency from the subcarrier oscillator and 160 f_H from the clocking oscillator. These two outputs are offered to an Exclusive-OR gate which acts as a comparator so that, if the two outputs are in phase, the output level of the signal will be logical zero. The Phase Lock Loop principle is illustrated in figure 11-5.

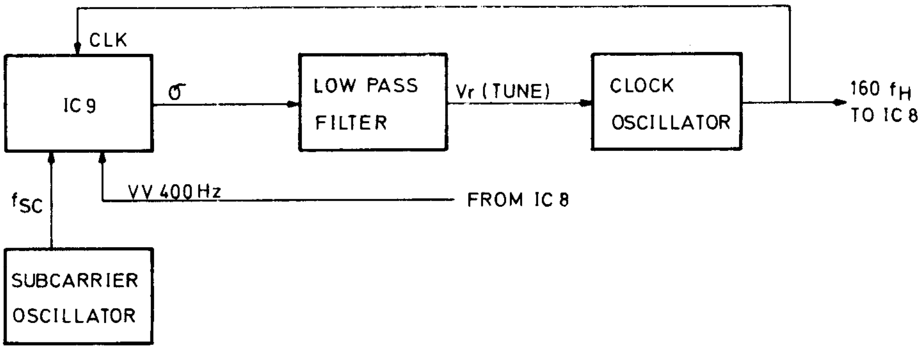


Fig. 11-5 Phase lock loop principle.

ECS Processing and Line Phase Comparison

The 160 f_H input to IC9 is first divided by eight, to provide a 20 f_H clock signal for the line counter. This counter divides by 20 and is reset by the leading edge of the External Composite Sync signal. The pulse period of the clock is 3.2 µs so that the counter period is 64 µs between ECS resets. Thus, provided the systems are locked, phase equality of the ECS signal and the line counter output will always be within 3.2 µs.

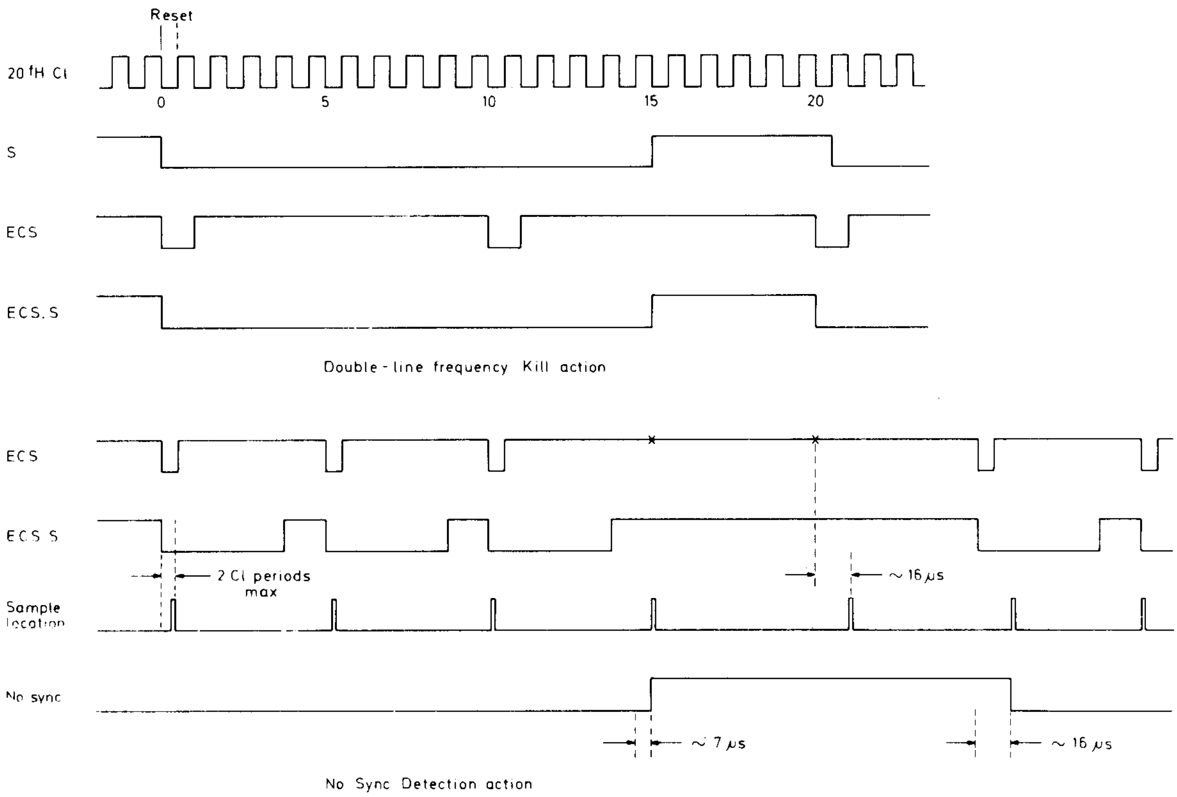


Fig. 11-6 Sync pulse processing in IC9.

After 15 clock pulse periods, the line counter outputs a signal to set a "dead-end" flip-flop output to logical one. This flip-flop 'S' will return to output a logical zero only if a reset occurs due to an ECS signal (i.e. it will remain high during ECS drop-out periods). The signal from the flip-flop is offered to the line phase comparator (the product eliminates the delay introduced by the flip-flop switching back to logical zero).

The NO SYNC detector in IC9 detects the absence of an ECS line pulse after a maximum of two clock pulse periods (i.e. approximately 7 μs) . By sampling the two-clock pulse periods in the ECS.S signal following every start of the line counter (i.e. not following a reset from the ECS signal), drop-outs can be detected quickly. When the NO SYNC (NS) signal becomes logical one, sampling of the 'S' information takes place 16 μs after the start of the line counter. This delay is necessary as the phase comparator in C9 must deliver the correct phasing information following possible drift of the oscillator during drop-out periods. Idealised waveforms showing the switching of the ECS Processing are given in figure 11-6.

Line Phase Comparison is achieved by an Early-Late detector. The product signal ECS.S is input to the comparator and forms the reference information to which the local signal H-Drive 1 from pulse generator IC8 is locked.

The principle of the Early-Late Detector is illustrated by the first waveform diagram of Fig. 11-7. The leading edge of the ECS.S. (reference) waveform drives the Y1 output and the leading edge of the local H1 signal drives the Y2 output
When both Y1 and Y2 signals are at logical zero, both lines are switched back to logical one. Thus the trailing edges of the Y1 and Y2 pulses are always coincident and the difference in pulse widths (duty cycles) provides a measure of the phase error between the reference and the local signals.

The outputs of the Y1 and Y2 channels are fed to lowpass filters R70/C28 and R69/R74/C27 where they are integrated to provide d.c. levels at the inputs of op. amplifier IC10. With a phase error present, as shown in the diagram, the op. amplifier inputs will be unbalanced so that this will produce a control output voltage to tune the 160 f_H oscillator until the error is cancelled and equilibrium is established at the inputs. Thus Y1 and Y2 pulses will have the same duty cycle and the leading edge of the H1 signal will coincide precisely with that of the ECS.S reference signal. Due to the high open-loop gain of op. amplifier IC10, very small phase differences will produce the full control voltage range, thus ensuring very fast response with an accuracy of ±100 nanoseconds.

When drop-outs occur in the ECS.S. reference signal this is detected so that the NO SYNC detector produces an output to the switches TS11, TS12. Thus, during these periods, the control voltage for the 160 f_H oscillator is derived from the Sub-carrier/Line Frequency Relationship from pin 1.

The second waveform diagram of Fig. 11-7 demonstrates the method of detecting the External Vertical Sync Pulse for use in IC8. The level of the ECS signal is detected twice per half-line. The first detection occurs 6,5 µs after the start of the line counter and the second a further 6,5 µs later. From detectors 1 and 2 pulses the signal EV1 and EV2 are derived and, thence, the product signal $\overline{EV1}.\ \overline{EV2}$ provides a suitable EV output to IC8. Double detection of the ECS signal is required for applications involving VCR-locking.

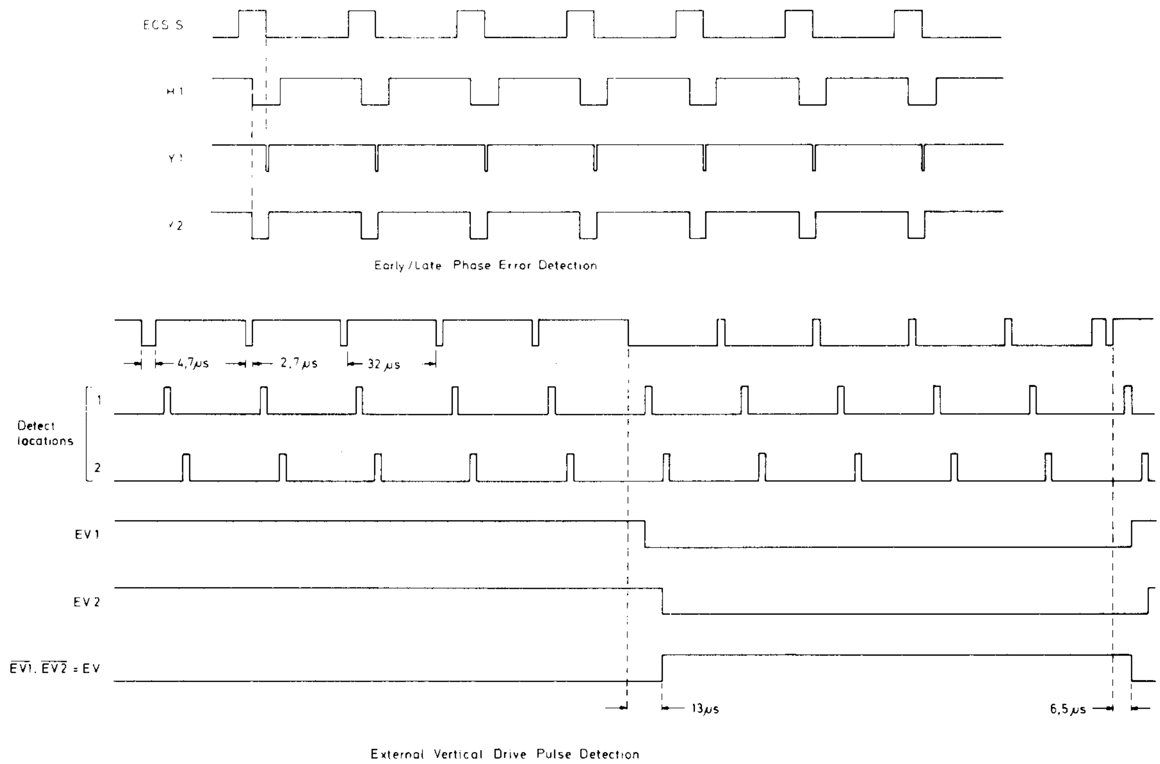


Fig. 11-7 External vertical drive pulse detection.

Circuit description

As mentioned in the functional description of OQ5506 and OQ5502, the entire sync and phase-locking are carried out by these IC's, which have two basic requirements: A clock oscillator and a colour subcarrier.

The "10MHz oscillator" on this unit is a X-tal oscillator, which is controlled by the dc output level of IC10.
The 10MHz signal is then divided by two in IC7/2, and the so derived 5MHz signal is passed on to unit 18, via terminal 10, as well as to another divide by two system IC7/1. The resulting 2.5MHz - equal to $160f_H$ - is applied to IC8 and IC9 to drive the entire sync generator.

The colour subcarrier, derived from unit 3, is via terminal 12 passed on to the "Genlock" circuit IC9, pin 14, in which it is used to established the relationship between subcarrier and line frequencies.

When a composite sync signal or a black burst signal is applied to the looped-through "SYNCHR IN" input, this signal has access to the "Buffer" stage TS1 via terminal 3.
The output from TS1 is now processed by four circuits. First the chroma contents of the signal is removed by the "Chroma take-out" circuit L3, C9 and is passed along to the "Subcarrier generator" unit 3. Then the TS1 output is also used to initiate the "Clamp pulse generator" IC3, IC2/1, IC4/2, provided that no field sync information is present. The clamp pulse is positioned at the back porch on each line outside the field sync period.
The TS1 output is via TS4 applied to IC5, where the black level of the signal is clamped to zero by the clamp pulse (via TS5). The signal is then amplified by IC5 and passed on to IC6 as well as to TS6, TS7, which is a negative sync peak detector. The "Sync level detector" output is, reduced to 50% by R29, R30, fed to IC6.
The resulting output of IC6 is a sync signal sliced at 50% of the sync peak level and this signal is led to the "Genlock" circuit IC9.

In order to remove hum from the incoming sync signal (via TS1), the dc level of C10 is compared to zero by IC1 in the "Hum remover". The output of IC1 is followed by a one-shot generator IC2/2 where, depending on the hum polarity, C10 + R10 is connected either to +5V (through TS2) or to - 10V via R11, thus compensating the hum.

Checking and adjusting

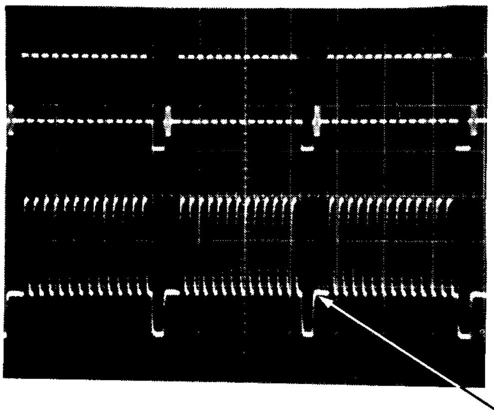
Measuring equipment	:	
Digital voltmeter	:	e.g. PHILIPS PM 2522
Oscilloscope	:	e.g. PHILIPS PM 3240X
Video signal generator	:	e.g. PHILIPS PM 5570

Chroma take-out

Apply a correct video signal to BU4 "EXT SYNCHR" and obtain $\boxed{1}$ and $\boxed{2}$. The chroma content of $\boxed{2}$ should be adjusted to a minimum during the burst period by means of L3.

BU4 $\boxed{1}$

TP3 $\boxed{2}$



1.	0.5V/div	20µs/div	min chroma
2.	1.0V/div	20µs/div	

Fig. 11-8 Chroma take-out.

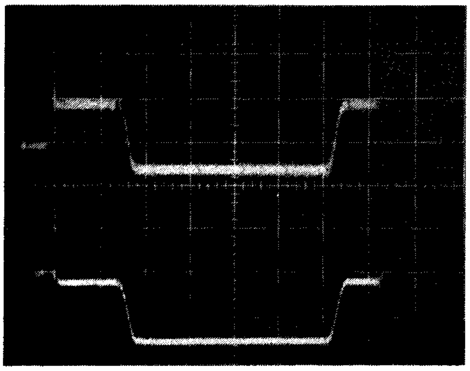
Genlock check

Apply a correct video signal to BU4 "EXT SYNCHR" and release SK13.
Check by means of the voltage that the voltage at IC10, pin 6 is 2.8V $\pm$0.5V.
If necessary, then readjust the coil L4 in the 10 MHz oscillator.

Genlock timing

Apply a correct video signal to BU4 "EXT SYNCHR" with the switch SK13 released.
Connect the oscilloscope terminated with 75ohms to BU5 "EXT SYNCHR" and to BU13 "PATTERN OUT" respectively.
The timing difference between the two leading edges of the sync pulses should be less than 100ns. If not readjust with the potentiometer R76.

BU5



BU13

BU5	0.2V/div.	10µs, delayed: 1µs
BU13	0.2V/div.	10µs, delayed: 1µs

Fig. 11-9 Genlock timing

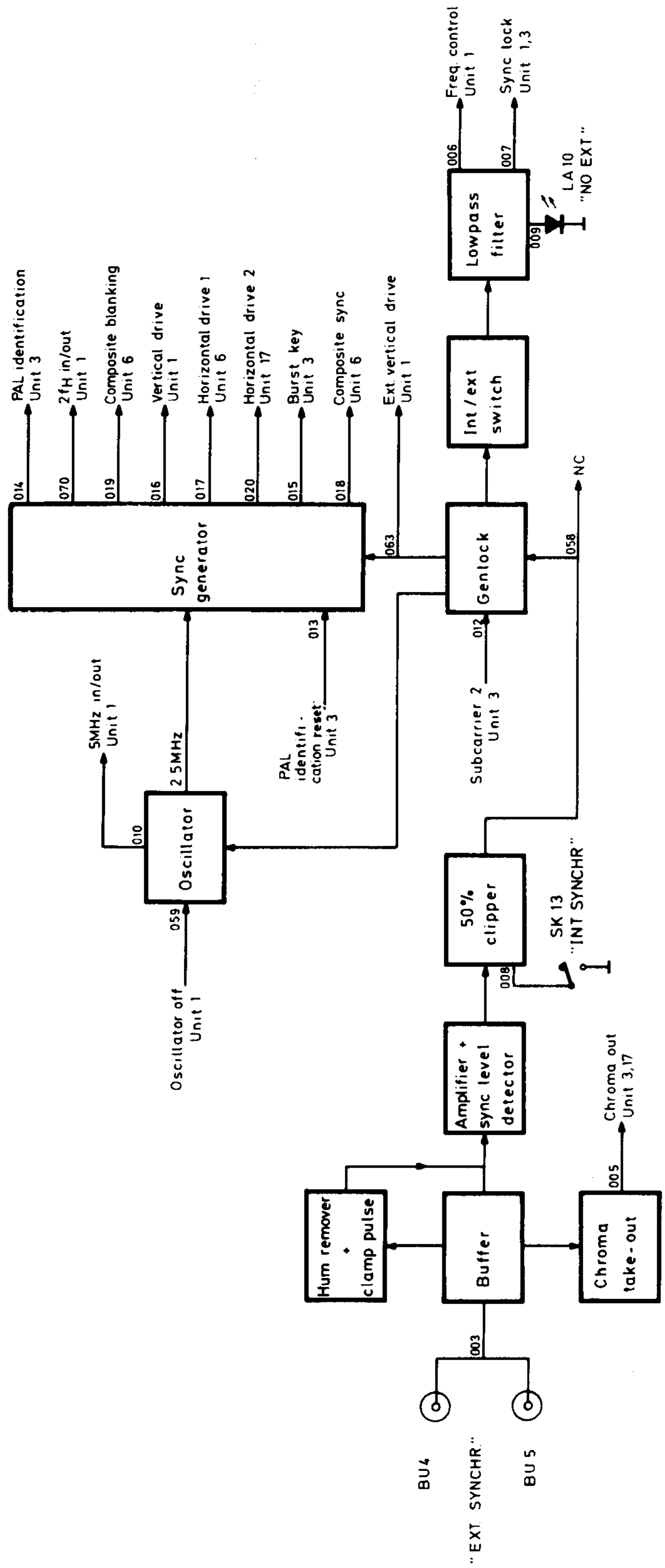
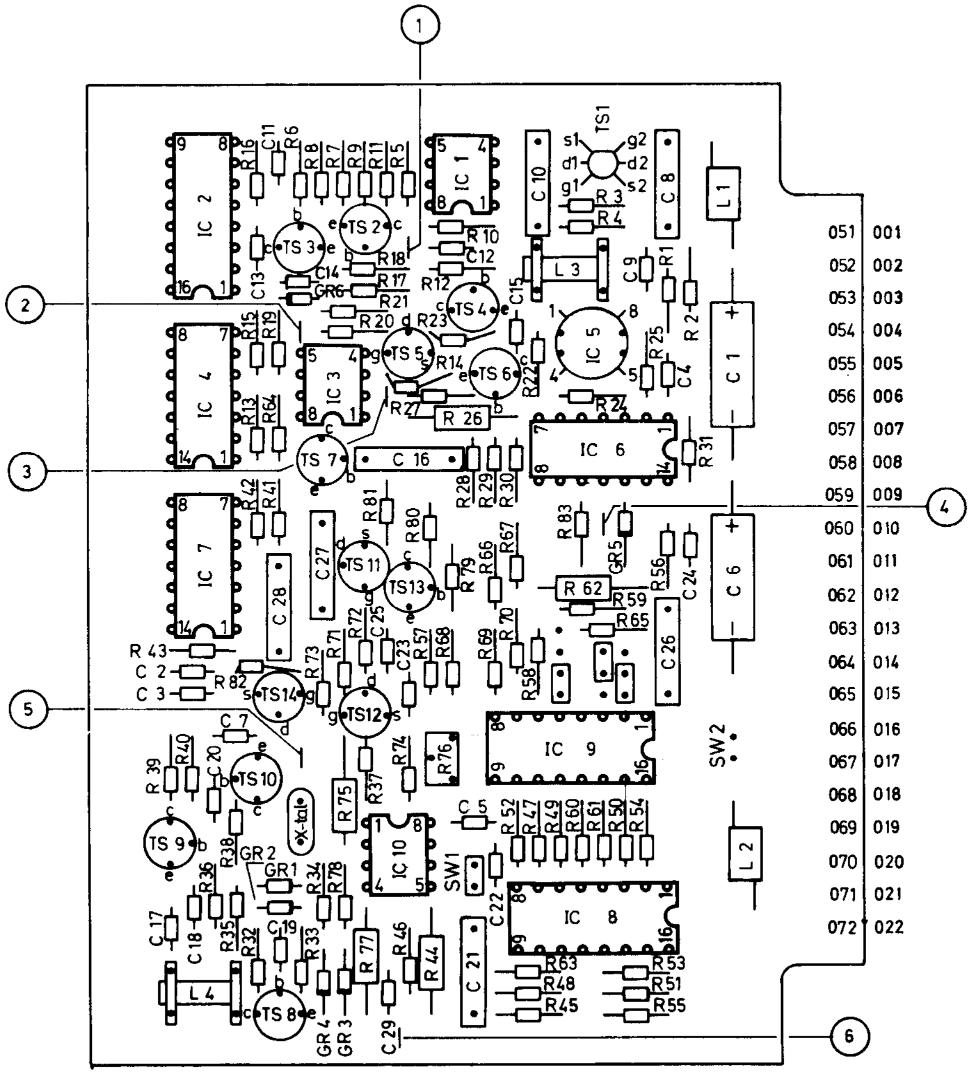
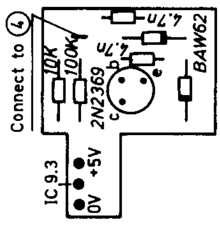
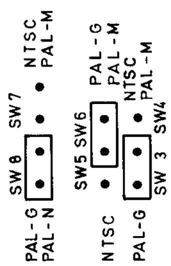
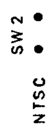


Fig. 11-10 Block diagram, sync generator, unit 5









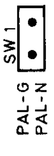
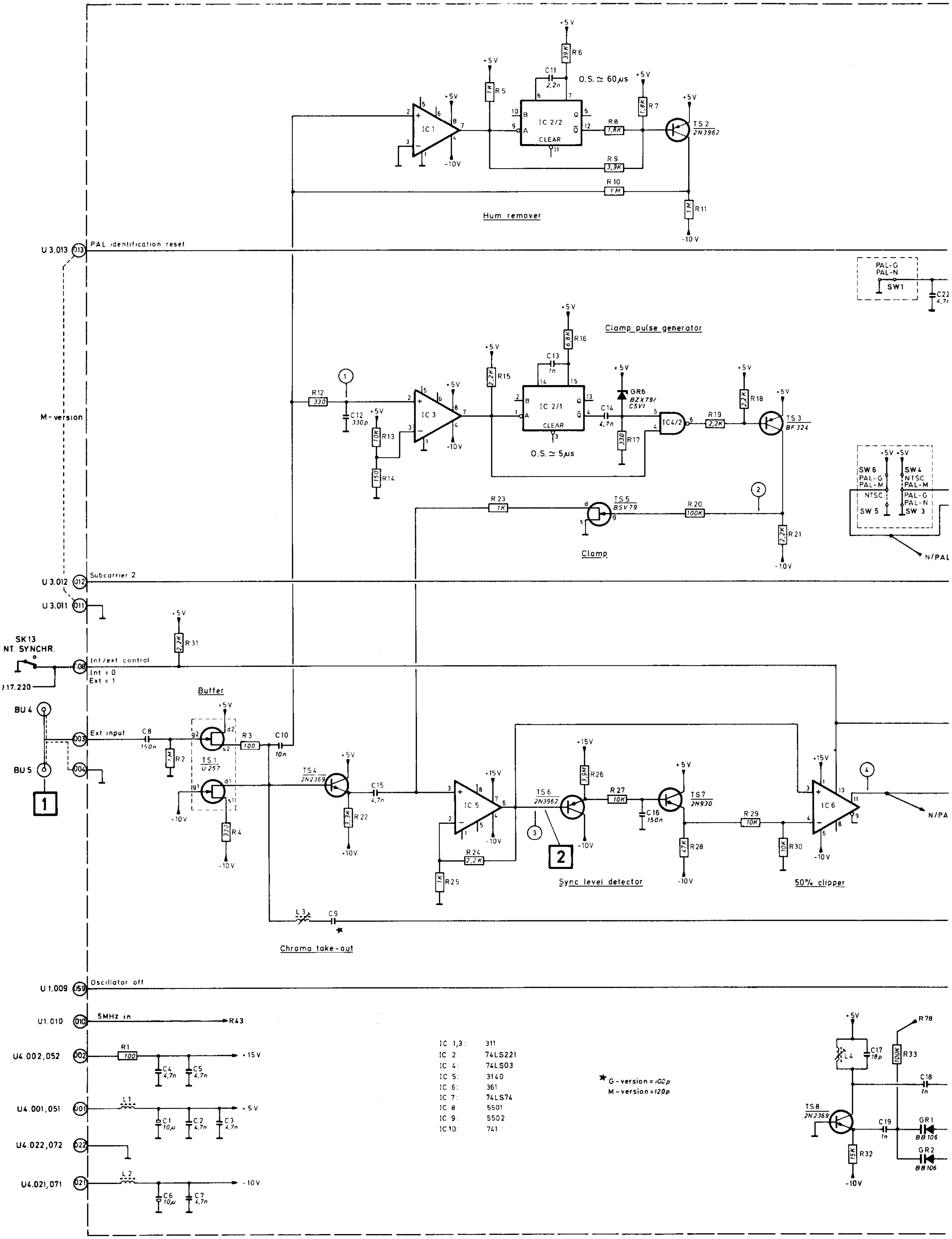


Fig. 11-11 Component location, sync generator, unit 5/G/L/I/M/N


Hum remover
O.S. ≃ 60 µs
IC 1
IC 2/2
CLEAR
R5 1K
R6 39K
R7 1,8K
R8 1,8K
R9 3,9K
R10 1M
R11 1M
C11 2,2n
TS 2 2N3962
+5V
-10V
U 3.013
PAL identification reset
PAL-G
PAL-N
SW1
C22
Clamp pulse generator
IC 3
IC 2/1
IC4/2
O.S. ≃ 5µs
R12 330
C12 330p
R13 10K
R14 150
R15 2,2K
R16 6,8K
C13 1n
GR6 BZX79/ C5V1
C14 4,7n
R17 330
R18 2,2K
R19 2,2K
TS 3 BF 324
M-version
R 23 1K
TS 5 BSV 79
R 20 100K
R 21 2,2K
Clamp
SW 6
PAL-G
PAL-M
NTSC
SW 5
SW 4
NTSC
PAL-M
PAL-G
PAL-N
SW 3
N/PAL
U 3.012
Subcarrier 2
U 3.011
SK13
NT. SYNCHR.
J17.220
Int/ext control
Int = 0
Ext = 1
R 31 2,2K
Buffer
BU 4
BU 5
1
Ext input
C8 150n
R2 1M
TS 1 U 257
R3 100
C10 10n
R4 330
TS 4 2N2369
C15 4,7n
R 22 3,3K
IC 5
R 24 2,2K
R 25 1K
TS 6 2N3962
R 26 3,9M
R 27 10K
C 16 150n
TS 7 2N930
R 28 47K
R 29 10K
R 30 10K
IC 6
2
Sync level detector
50% clipper
N/PA
+15V
-10V
L3
C9
Chroma take-out
U 1.009
Oscillator off
U1.010
5MHz in
R43
U4.002,052
R1 100
C4 4,7n
C5 4,7n
+15V
U4.001,051
L1
C1 10µ
C2 4,7n
C3 4,7n
+5V
U4.022,072
U4.021,071
L 2
C6 10µ
C7 4,7n
-10V
IC 1,3: 311
IC 2: 74LS221
IC 4: 74LS03
IC 5: 3140
IC 6: 361
IC 7: 74LS74
IC 8 5501
IC 9: 5502
IC 10: 741
G-version = 100p
M-version = 120p
R78
L4
C17 18p
R33 100K
C18 1n
TS8 2N2369
C19 1n
R32 15K
GR1 BB106
GR2 BB106

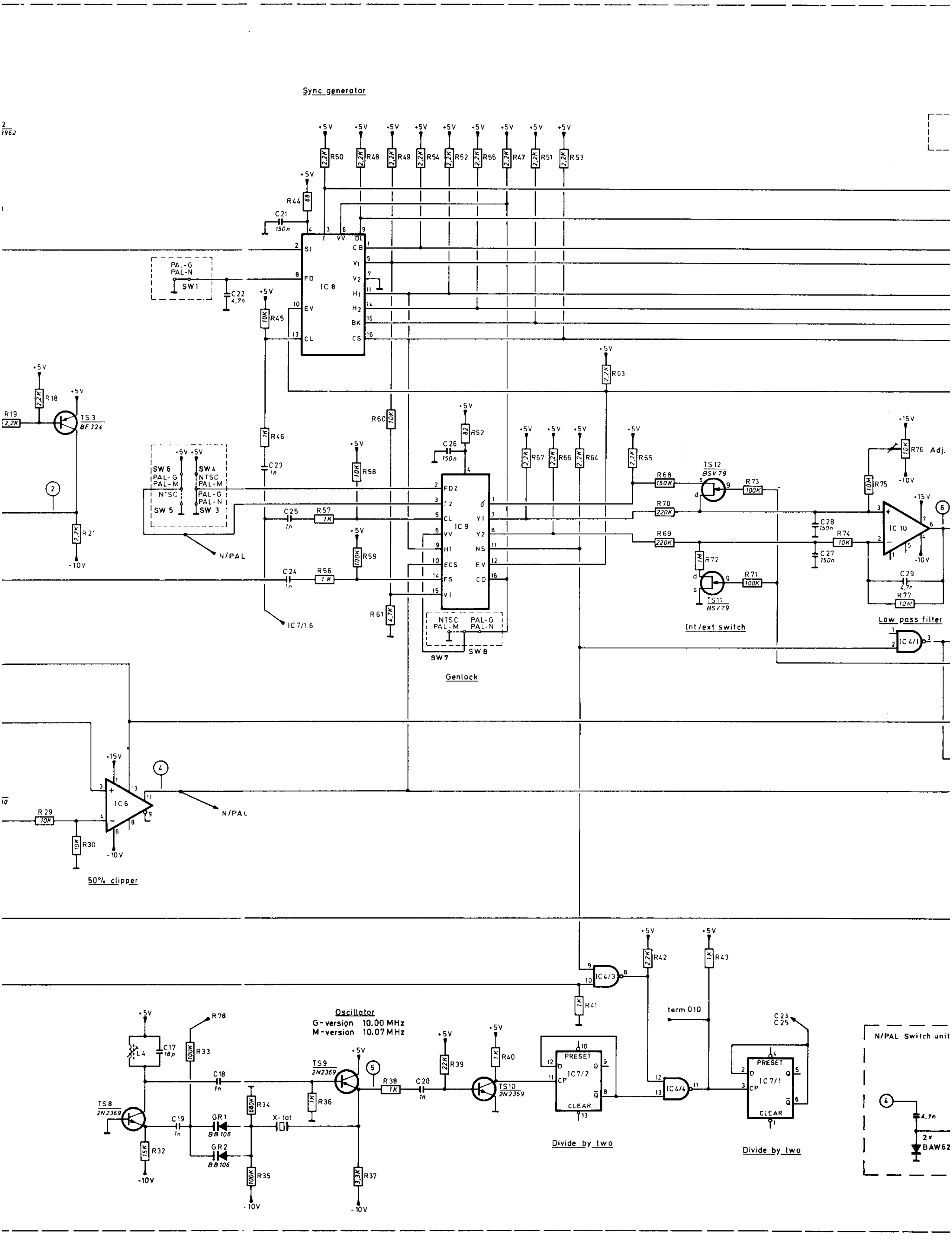


Fig. 11-12 Circuit (

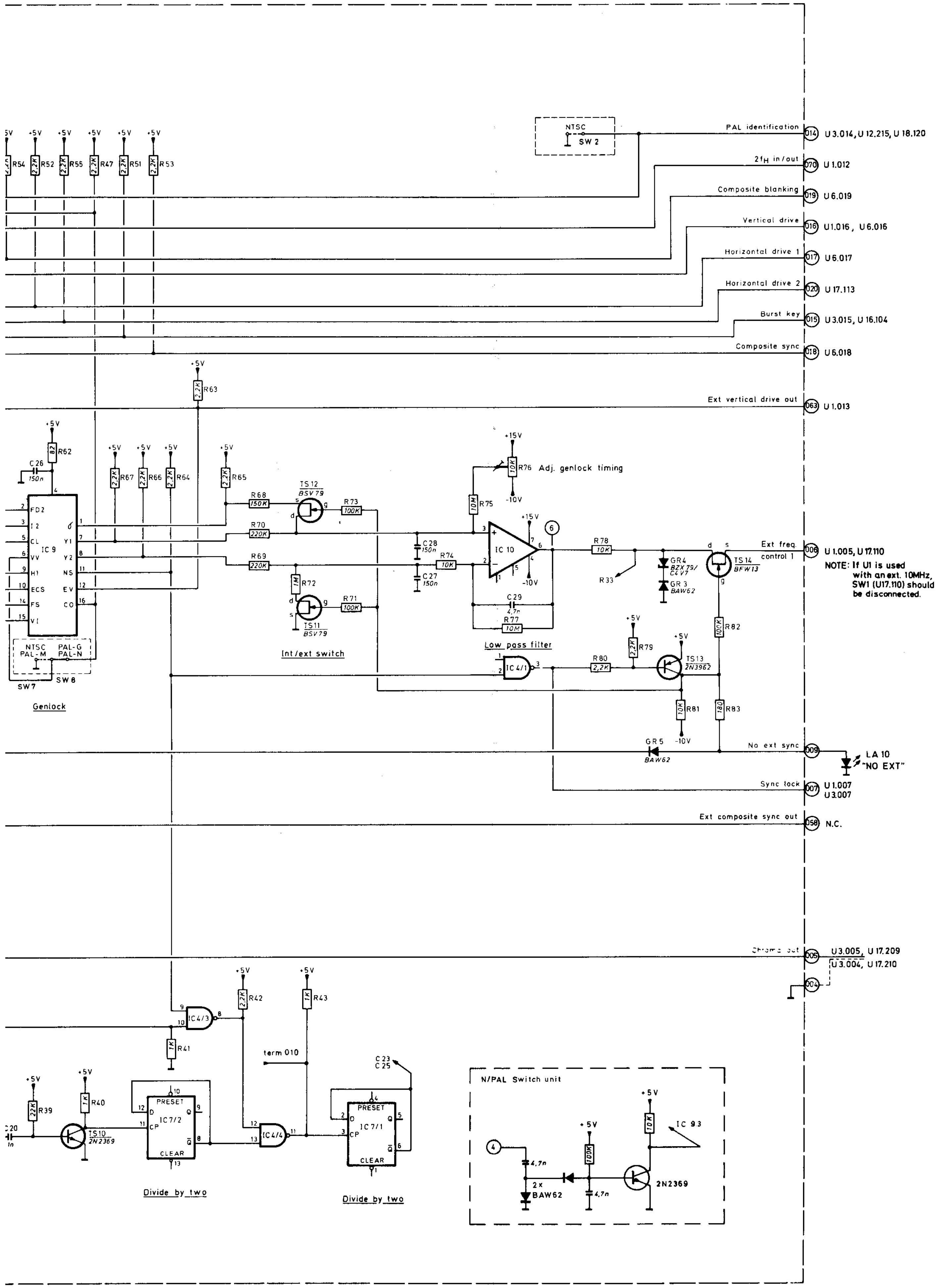


Fig. 11-12 Circuit diagram, sync generator, unit 5 /G/L/I/M/N

12. Unit 6 Sync interface

This unit interfaces the timing signals generated from the sync generator.

Circuit description

The composite sync and blanking signals are buffered by IC1 before leaving the unit at TTL level. The signals are primarily used for adding sync and blanking to the auxiliary signal output on unit 19.
The sync signal is also amplified by TS6-10 for external use. BU2 and BU7 are to be terminated into 75ohms when used in order to fulfil the specification of 4Vpp ±0.4V.
The current generator TS11, TS12 supplies the sync signal to the main output amplifier on unit 19. The current, and hereby the sync amplitude is determined by R31+R32.
f_V and f_H are vertical and horizontal drive pulses at TTL level.

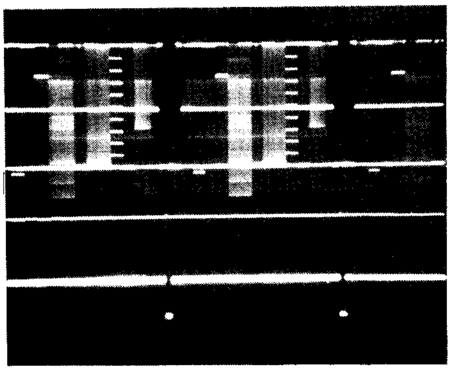
Checking and adjusting

Measuring equipment:
Oscilloscope : e.g. Philips PM3240X
Video level meter : e.g. Philips PM5548
TV monitor : e.g. Philips LDN5006

Connect an oscilloscope to a sync output (BU2 or BU7) and terminate with 75ohms.
Check that the sync signal contains the field complex and has a amplitude of 4Vpp ±0.3V.
Check the field drive pulse for 4-5V amplitude (see 1).
Check the line drive pulse for 4-5V amplitude and a width of 1µs ±0.2µs (see 2).

BU13

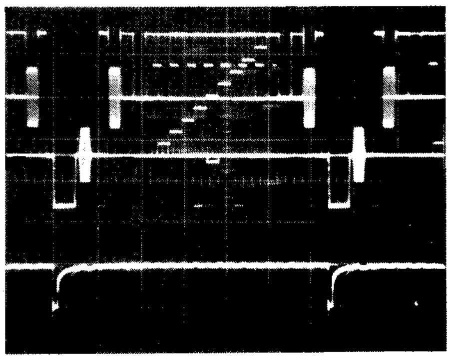
1



BU13 0.5V/div. 5ms/div.
1 5V/div. 5ms/div.

BU13

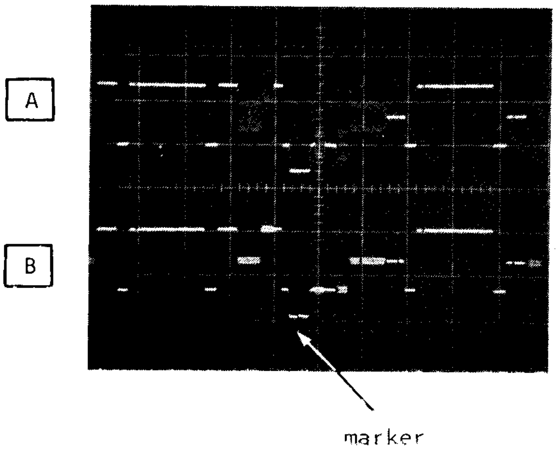
2



BU13 0.5V/div. 10µs/div.
2 5V/div. 10µs/div.

<u>SYNC LEVEL</u> (Note: See unit 16 for removal of set-up).

With minimum measuring area, tune PM5548 to obtain the marker at the sync pulse top.



$\boxed{A}$: Channel A, from BU3 terminated with 75ohms
0.5V/div. 2ms/div. delayed: 10µs/div.

$\boxed{B}$: Channel B, from PM5548, terminal video+
marker out.
1.0V/div. 2ms/div. delayed: 10µs/div.

Adjust R31 to obtain -300mV (NTSC-302mV) at the PM5548.

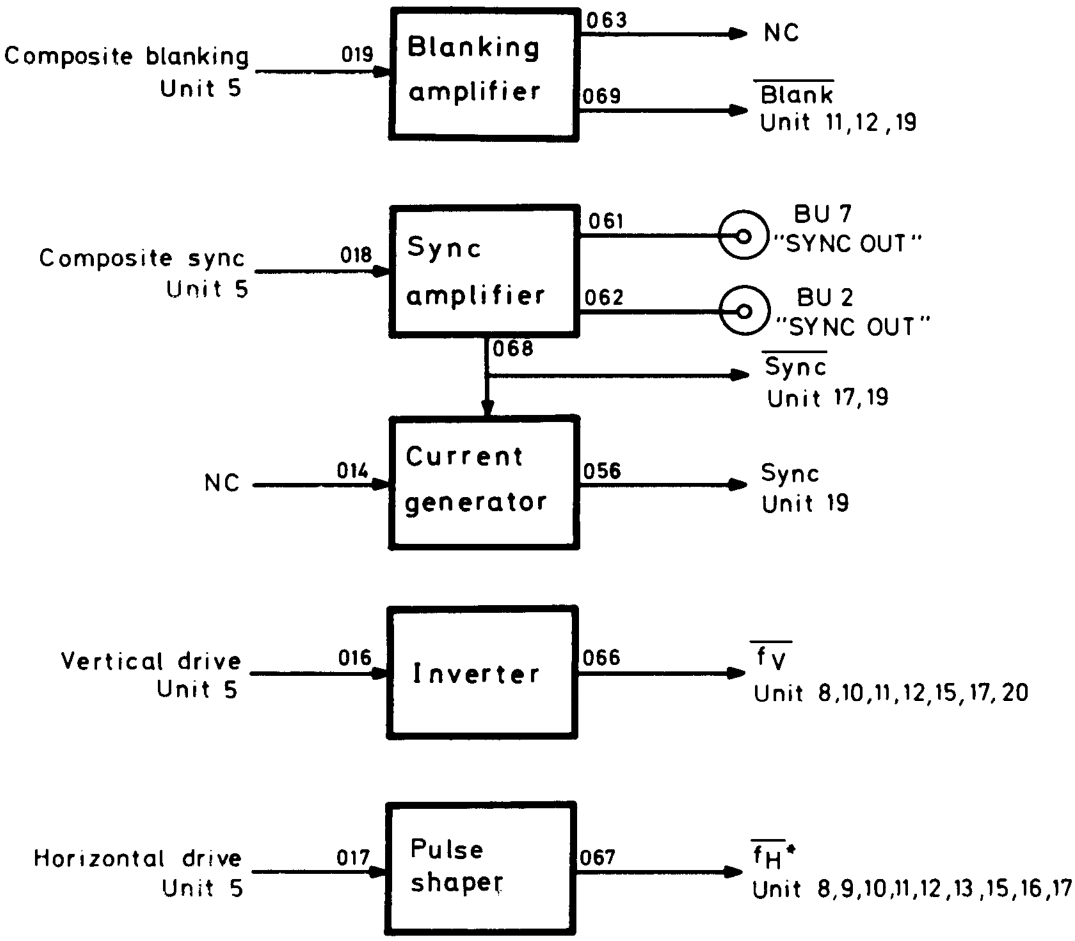


Fig. 12-1 Block diagram, sync interface, unit 6

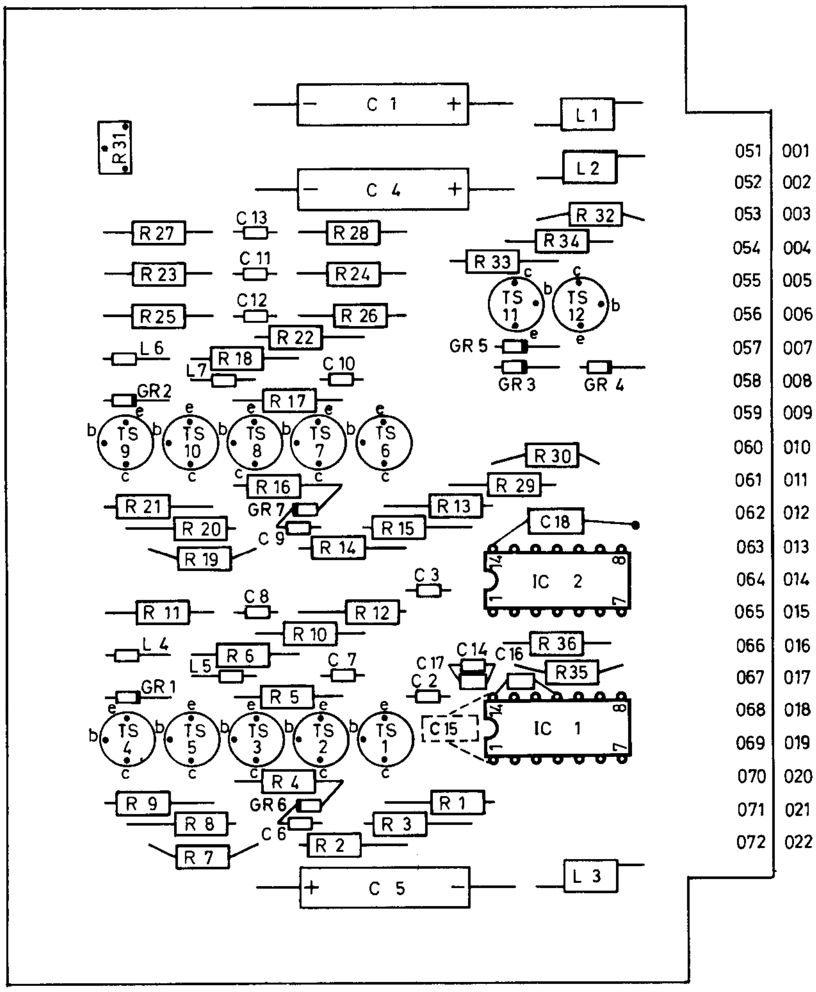
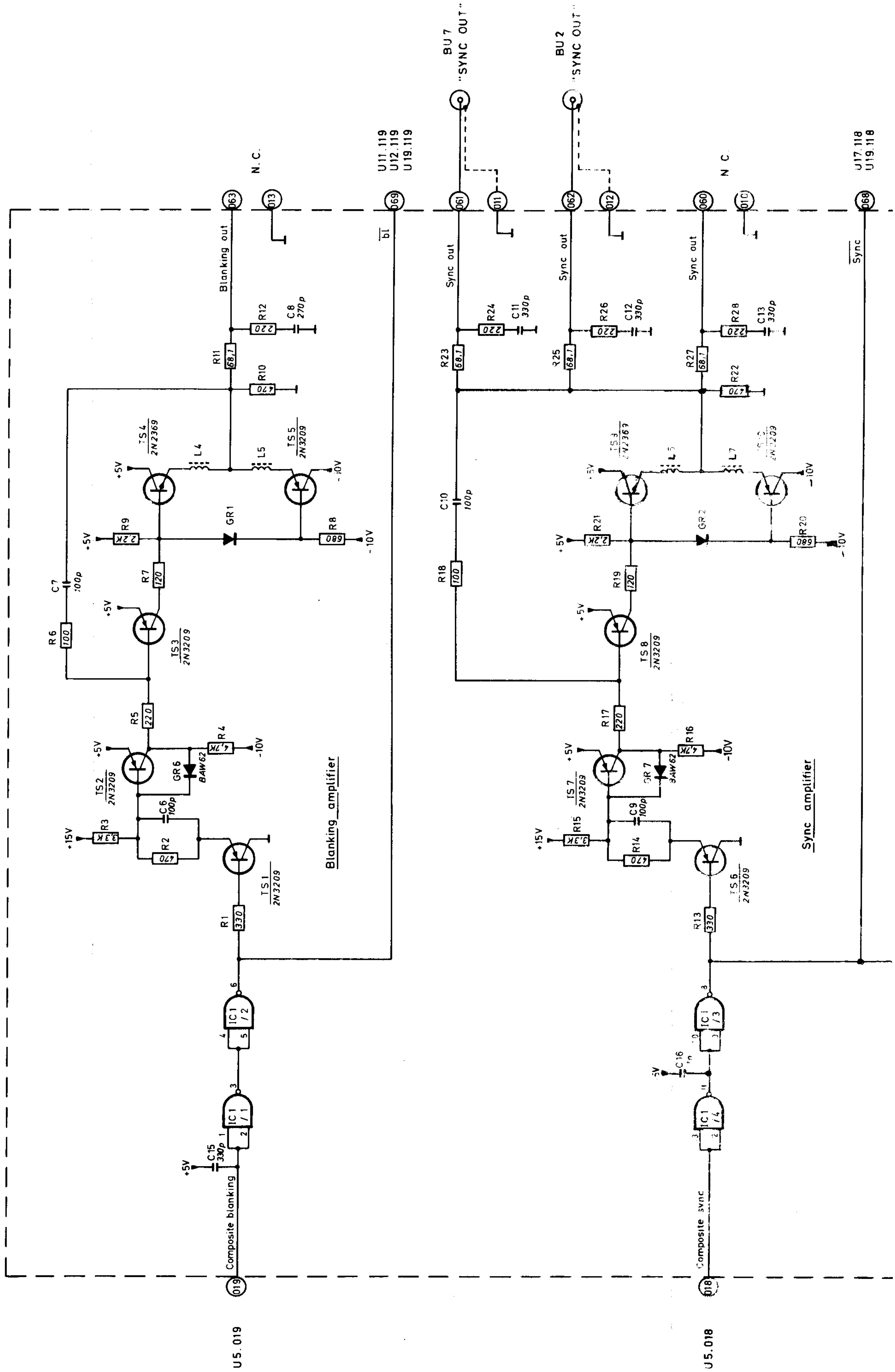


Fig. 12-2 Component location, sync interface, unit 6



Blanking amplifier
Sync amplifier
Composite blanking
Composite sync
Blanking out
Sync out
Sync out
Sync out
BU 7
"SYNC OUT"
BU 2
"SYNC OUT"
N.C.
N.C.
U11.119
U12.119
U19.119
U17.118
U19.118
U5.019
U5.018

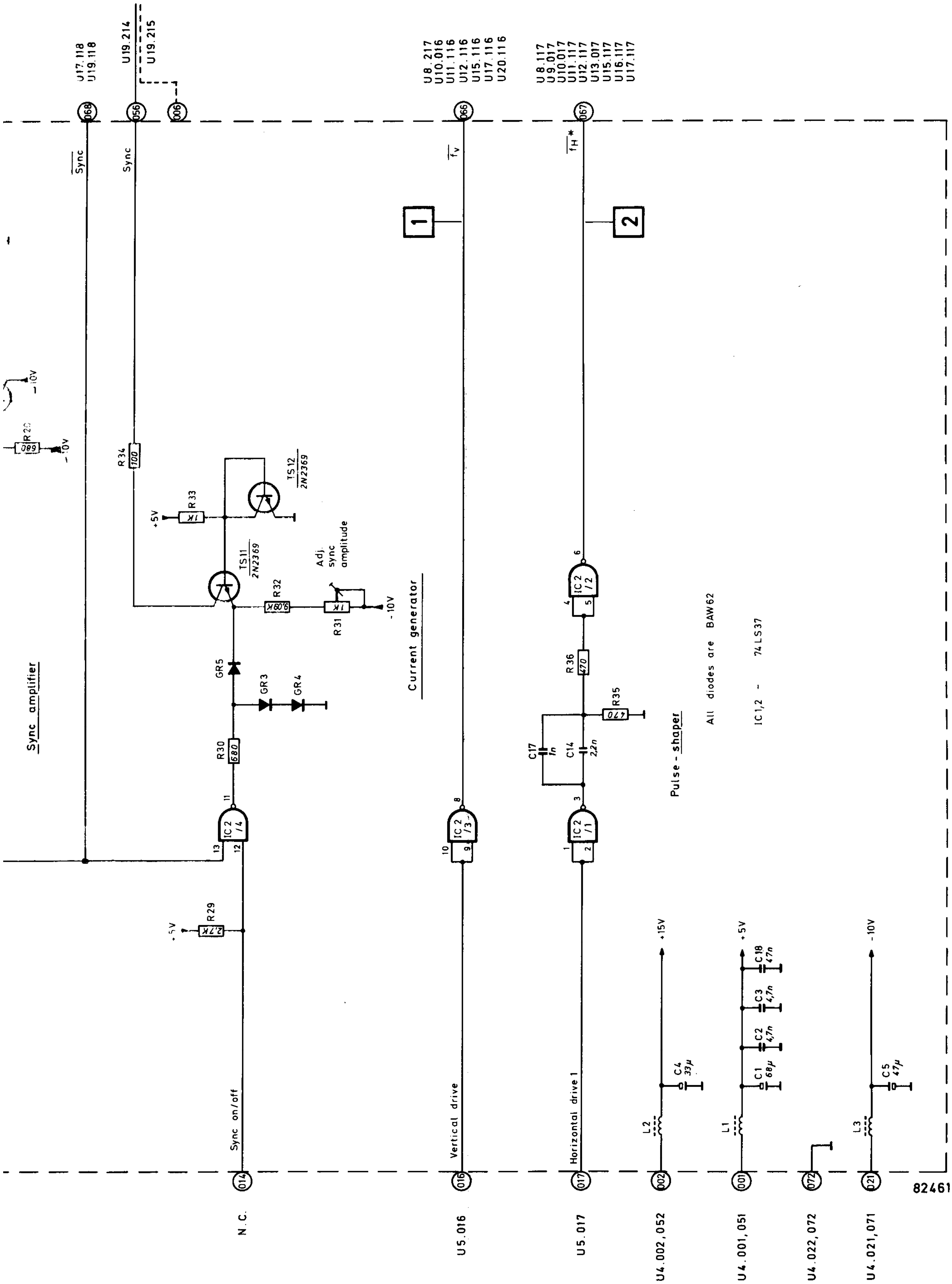


Fig. 12-3 Circuit diagram, sync interface, unit 6

13. Unit 8 Text generator PM8503 (optional)

PM 8503 Text generator can be used in combination with coulour pattern generator PM 5534 and test pattern generator PM 5537.

PM 8503 provides one or two text lines in the patterns. In PM 5534 two text areas are present; the upper text area has space for 9 characters, and the lower text area for 13. In PM 5537 one or two text lines in the black bar may be provided with up to 14 characters per line.

In both PM 5534 and PM 5537 the text facilities are used for displaying authority and source identification, and may include name and channel of the transmitting station.

It is also possible for the PM 8503 to display the local time in the test pattern, when the clock generator PM 8504 is inserted in the pattern generator as unit 20.

PROM for PM 8503
The actual wording of the text produced by the PM 8503 text generator depends on the programming of a small integrated circuit (socket-mounted). This circuit (PROM = Programmable Read-Only memory) is included with the PM 8503, however the user must specify the wording of the caption.
Basically, the text generator consists of two character memories with associated shift registers, a text PROM, an 8.3MHz oscillator, and some control circuits.

The two character memories, "A" and "B", contain the digital patterns for 64 characters, which they write out in the order they are instructed to by the text PROM, and the character height is determined by the character height address circuit.

Circuit description

The text generator is designed to produce one or two text lines as well as a line showing the local time, the last mentioned requires the presence of the clock generator PM 8504 too.
In order to place the text correctly, information about the desired text/clock area is applied from PM 5534 or PM 5537. This information, given on each line inside the text/clock area, steps the line counter forward.

When the pre-selected start line number is reached, flip-flop IC4 initiates, which allows the start/stop flip-flop IC5/1 to be triggered and reset by the area information until the stop line number in the line matrix is passed.
During the text/clock area periods the power switch TS1, TS2 supplies power to the text PROM and to the two character memories.

When triggered, the start/stop flip-flop IC5/1 starts the 8.3MHz oscillator, and at the same time it brings the timing control as well as the text PROM address counter in working condition. The timing control is clocked with pulses from the 8.3MHz oscillator, and the "D" output steps the text PROM address counter forwards, the output from which is used to address the text PROM. The "D" information is also used, via the gate IC9/3, as a clock load command to PM 8504.

The digital output pattern from the text PROM contains information about the desired character and position - according to the programming of the text PROM - while the character height address circuit indicates the actual character line being scanned. The local time information from PM 8504 is applied parallelly to the digital output pattern via the address switch, which is enabled in the clock area period.

The character information is contained in two memories "A" and "B" with 64 characters each, an example is shown in fig. 13-2.

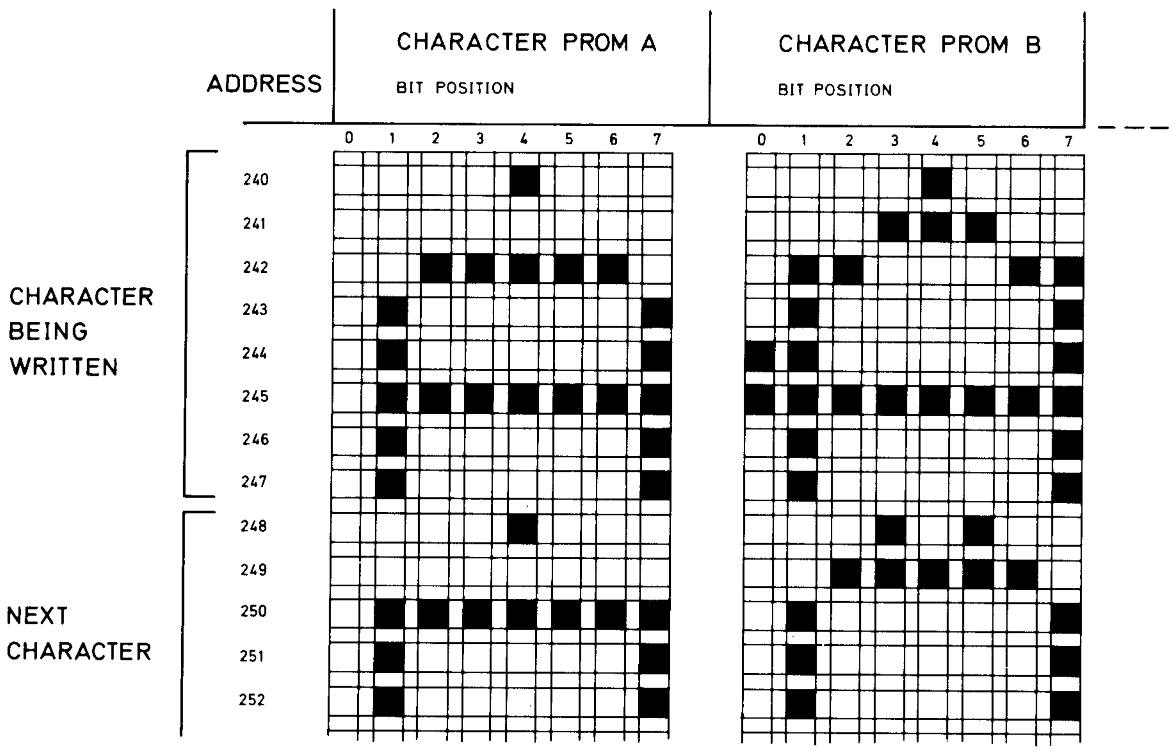


Fig. 13-1 Bit position of a character

In the 1st field the selected character is written out by using memory "A" in the even lines and memory "B" in the odd lines, see fig. 13-2.
This information is applied to the shift registers where the parallel information in both registers will be converted to a serial information, by means of the 8.3MHz oscillator, and led to the character circuit where the dot width adjustment takes place.

Both character memories are also used in the 2nd field, but the write-out procedure is quite different from the procedure in the 1st field, because now the serial character information from the former line is compared to the information for the next line, and the difference between them is detected in the character shaper circuit, see fig. 13-3.
When a difference in the line length exists, the character shaper will prolong or shorten the character information with half a dot width provided that both lines contain information. This feature can be deleted by adding a logical "1" information in bit 0 in the character memory (see fig. 13-1, character PROM B, address 244 and 245).

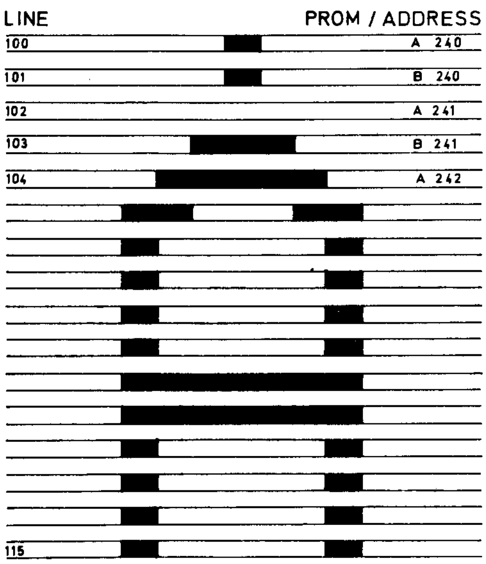


Fig. 13-2 Character write out, 1st field

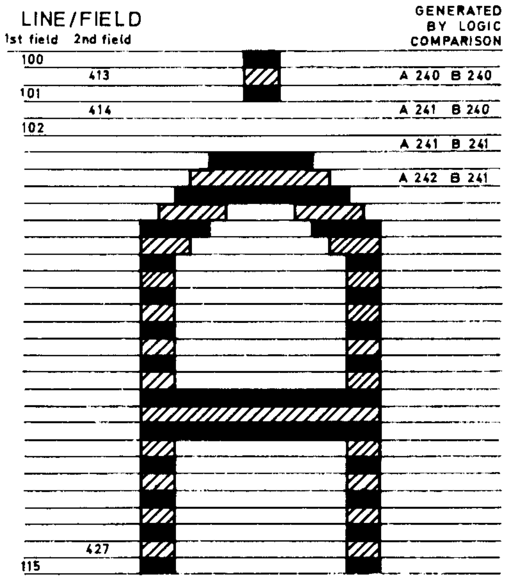


Fig. 13-3 Complete character

When small text-height is selected, the character memory "A" delivers the information used in the 1st field, while memory "B" is used only in the 2nd field.

The table below gives the hex-code for each character contained in the character generators.

Ch.	Hex	Ch.	Hex	Ch.	Hex	Ch.	Hex	Ch.	Hex	Ch.	Hex	Ch.	Hex	Ch.	Hex
Ø	00	H	08	P	10	X	18	space	20	(	28	0	30	8	38
A	01	I	09	Q	11	Y	19	À	21	)	29	1	31	9	39
B	02	J	0A	R	12	Z	1A	Â	22	Ï	2A	2	32	:	3A
C	03	K	0B	S	13	Ä	1B	Æ	23	+	2B	3	33	É	3B
D	04	L	0C	T	14	Ö	1C	Å	24	,	2C	4	34	Û	3C
E	05	M	0D	U	15	Ü	1D	%	25	-	2D	5	35	È	3D
F	06	N	0E	V	16	Ê	1E	&	26	.	2E	6	36	β	3E
G	07	O	0F	W	17	Î	1F	'	27	ô	2F	7	37	Ñ	3F

Checking and adjusting

Measuring equipment:

TV monitor: e.g. PHILIPS LDN 5006

Dot width adjustment

The horizontal and the vertical part of the characters should be alike. If not, then adjust the dot width in the 1st field with R57, and in the 2nd field with R54.

Text position (horizontal)

The text position in the upper text area can be adjusted with R3, and in the lower area with R5.

Clock position (horizontal)

The clock position can be adjusted with R7.

Text and clock position (vertical)

The vertical position can be moved by changing the start line number as well as stop line number in the line matrix.

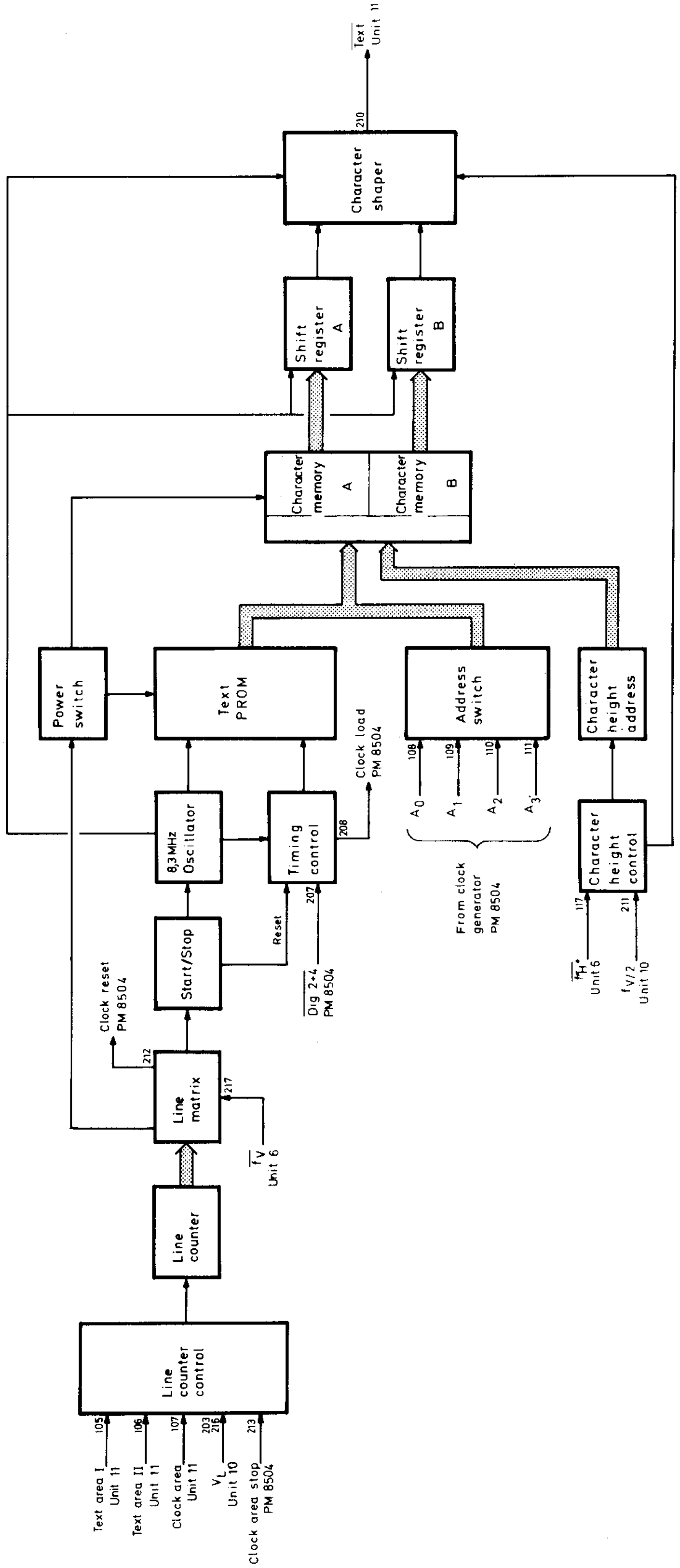


Fig. 13-4 Block diagram

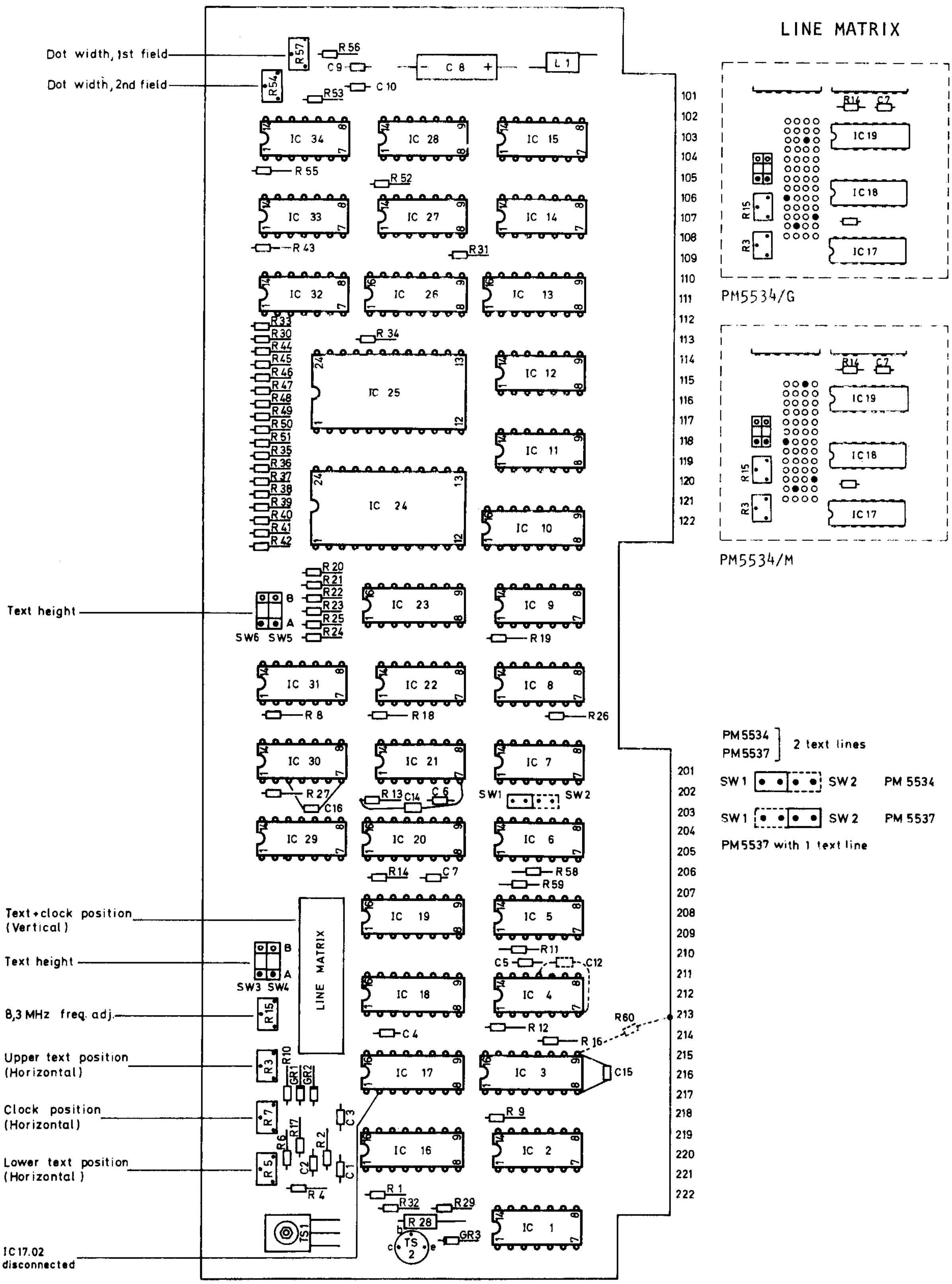
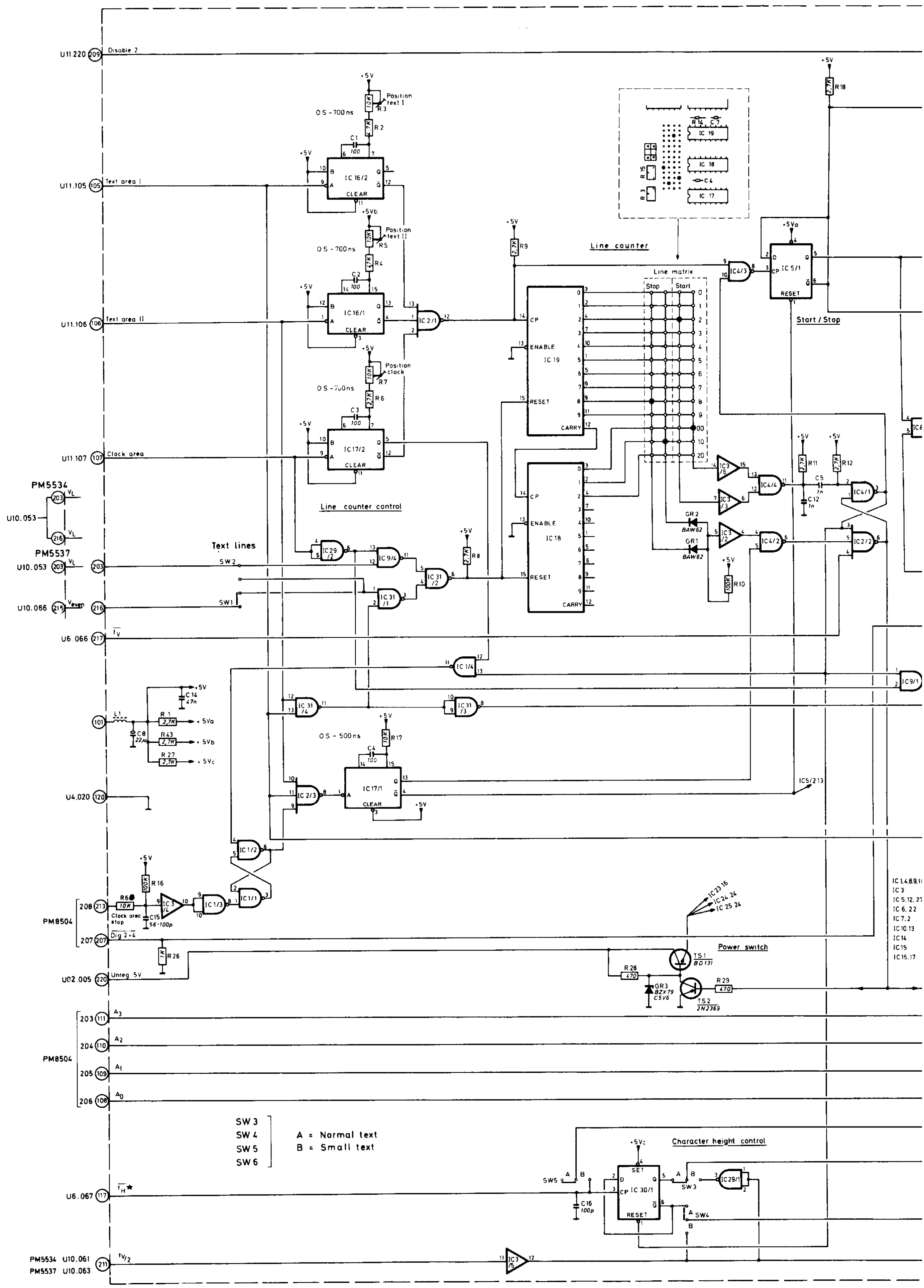
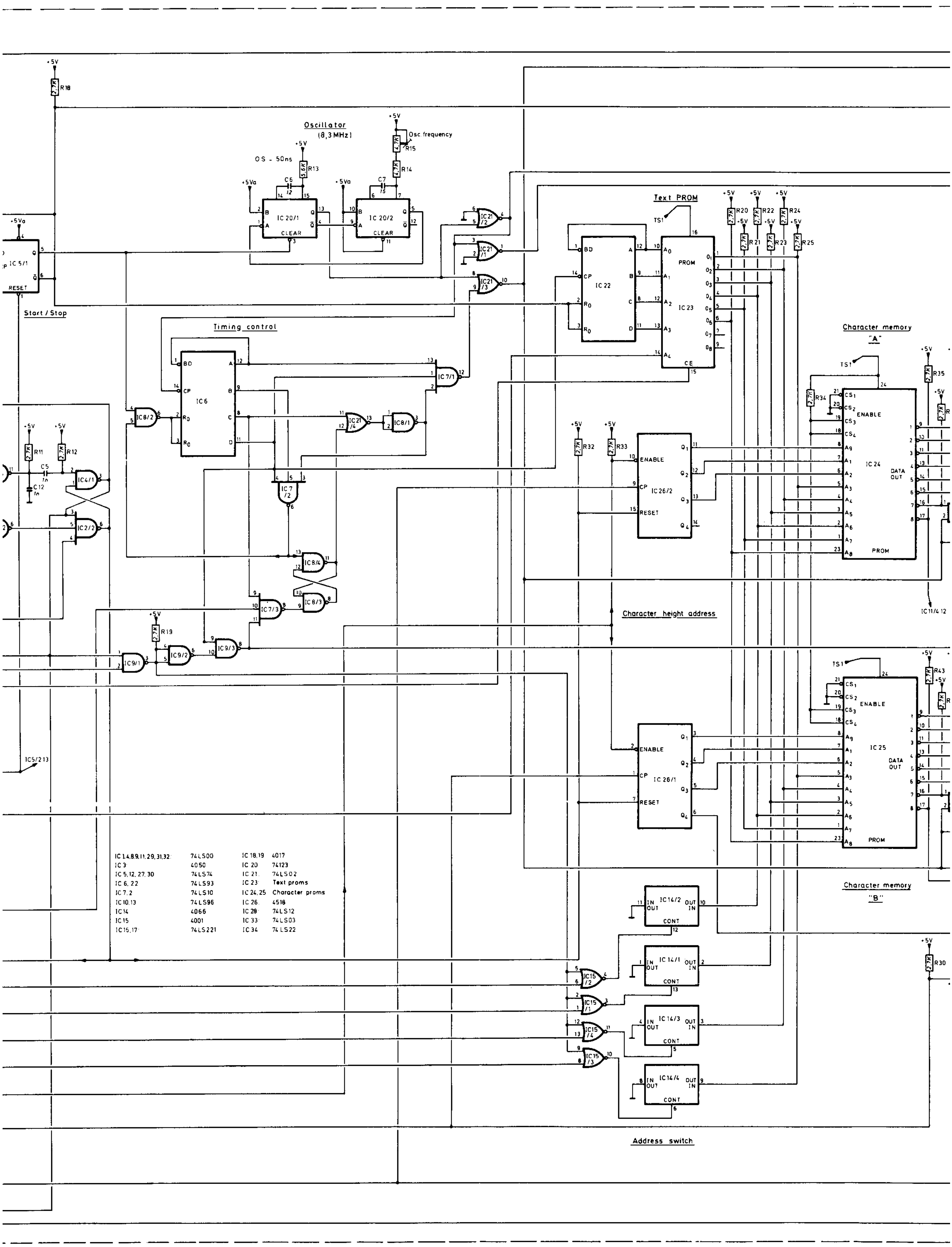


Fig. 13-5 Component location, text generator, unit 8



Line counter
Line matrix
Stop
Start
Start / Stop
Line counter control
Text lines
Power switch
Character height control
SW 3
SW 4
SW 5
SW 6
A = Normal text
B = Small text
PM5534
PM5537
PM8504


Oscillator
(8,3 MHz)
OS - 50ns
Osc. frequency
IC 20/1
IC 20/2
CLEAR
Text PROM
PROM
IC 22
IC 23
IC 5/1
RESET
Start / Stop
Timing control
IC 6
Character memory
"A"
IC 24
ENABLE
DATA OUT
PROM
IC 26/2
IC 26/1
Character height address
IC 25
Character memory
"B"
IC 14/1
IC 14/2
IC 14/3
IC 14/4
CONT
Address switch
IC 1,4,8,9,11,29,31,32: 74LS00
IC 3 4050
IC 5,12,27,30 74LS74
IC 6, 22 74LS93
IC 7, 2 74LS10
IC 10,13 74LS96
IC 14 4066
IC 15 4001
IC 15,17 74LS221
IC 18,19 4017
IC 20 74123
IC 21 74LS02
IC 23 Text proms
IC 24,25 Character proms
IC 26 4518
IC 28 74LS12
IC 33 74LS03
IC 34 74LS22

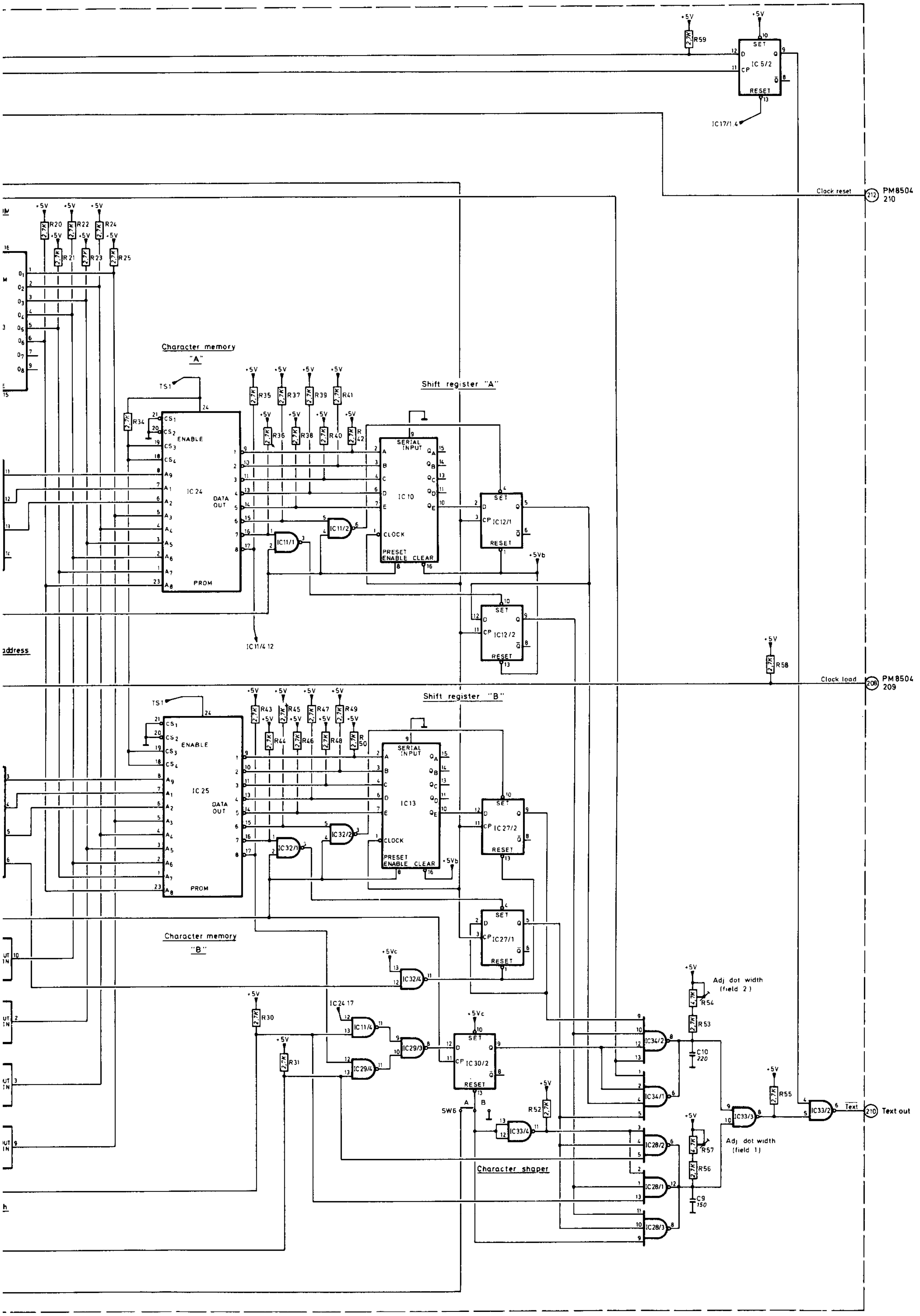


Fig. 13-6 Circuit diagram, text generator, unit 8

STS Jan 2023

14. Unit 9 Horizontal divider

The Horizontal divider unit contains the master oscillator of the Colour pattern generator.
The 15 MHz VCO (Voltage controlled oscillator) generates a clock frequency for the black and white generator unit 11 and the circle generator unit 13.
The 15MHz is also divided into timing signals (H-even) for luminance and chrominance generators.

Circuit description

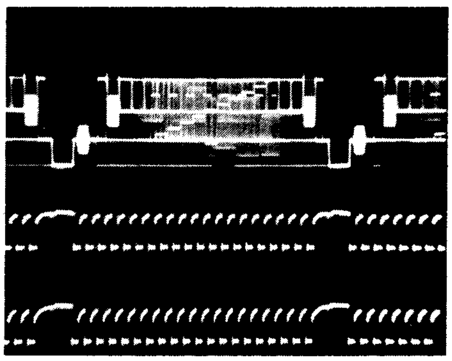
At IC1 a line pulse is delayed depending on the position of R1, hence determining the start of the active part of the line. The output from IC1 triggers the flip-flop IC2/1 and the VCO is enabled. A clear signal present at terminal 15 at H39 (see timing signals) eventually stops the oscillator via the frequency control circuit depending on the position of R17.
The approximately 15.4 MHz signal is divided by 11, IC4, IC5/1. IC6/1 and IC6/2 is the Y-delay and IC7 is the 4 divider for the Del. H even signal. The signal leaves the unit from terminal 8. See $\boxed{1}$.

The chrominance timing signal is divided by 4
by IC8/2, IC8/1 before leaving the unit from terminal 14 as the H-even signal.
See $\boxed{2}$.

BU13

Terminal 8 $\boxed{1}$

Terminal 14 $\boxed{2}$



1 and 2 5V/div. 10µs/div.
BU13 0.5V/div. 10µs/div.

Checking and adjusting

Measuring equipment :
Oscilloscope : e.g. PHILIPS PM 3240X

Master delay

Remove unit 15.
Connect the oscilloscope (10µs/div. delayed: 0.5µs/div.) to a pattern output, terminated with 75ohms.
Adjust R7 to obtain coincidence between the green/magenta shift and the white line in centre cross. Observe also the monitor.
If the position of the 250kHz signal is unstable, misadjust R7 max. 10ns.
Insert unit 15.

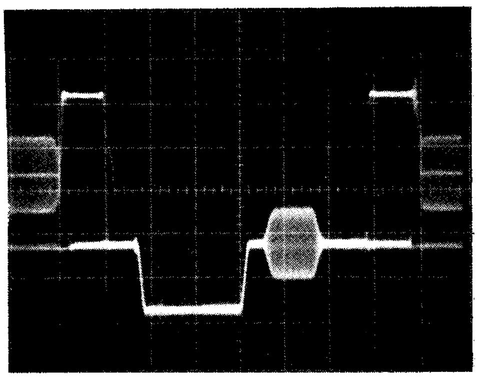
Right position

Adjust R17 to obtain : G-version 3.17 µs, M-version 4.25 µs between sync leading edge and the trailing edge of the last white line.

Left position

Adjust R1 to obtain : G-version 12.17 µs, M-version 11.8 µs between sync leading edge and the leading edge of the first white line. Check 1 for 2.5V ±0.3V.

BU13
pattern
out



BU13 0.2V/div. 10µs/div. Delayed: 2µs/div.

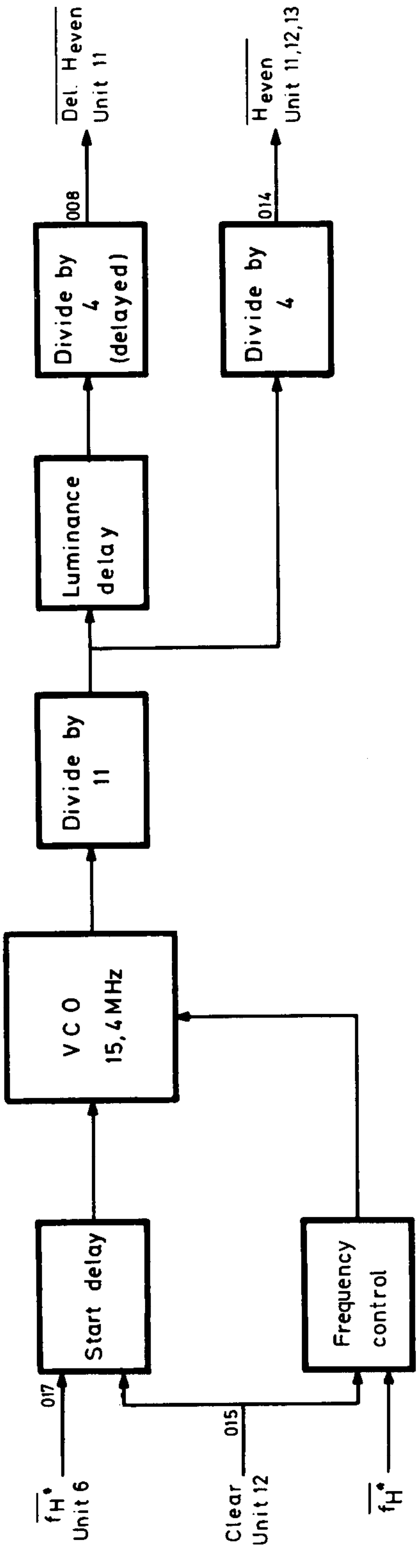


Fig. 14-1 Block diagram, horizontal divider, unit 9

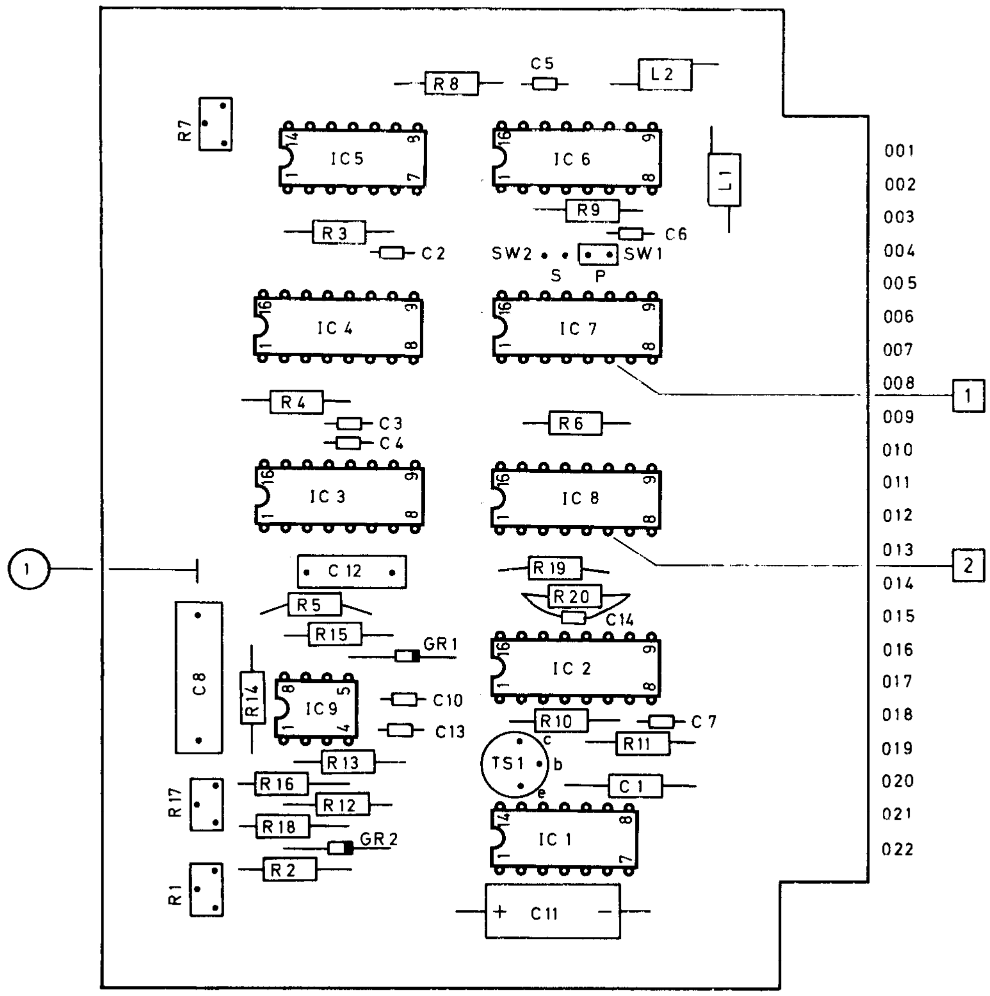
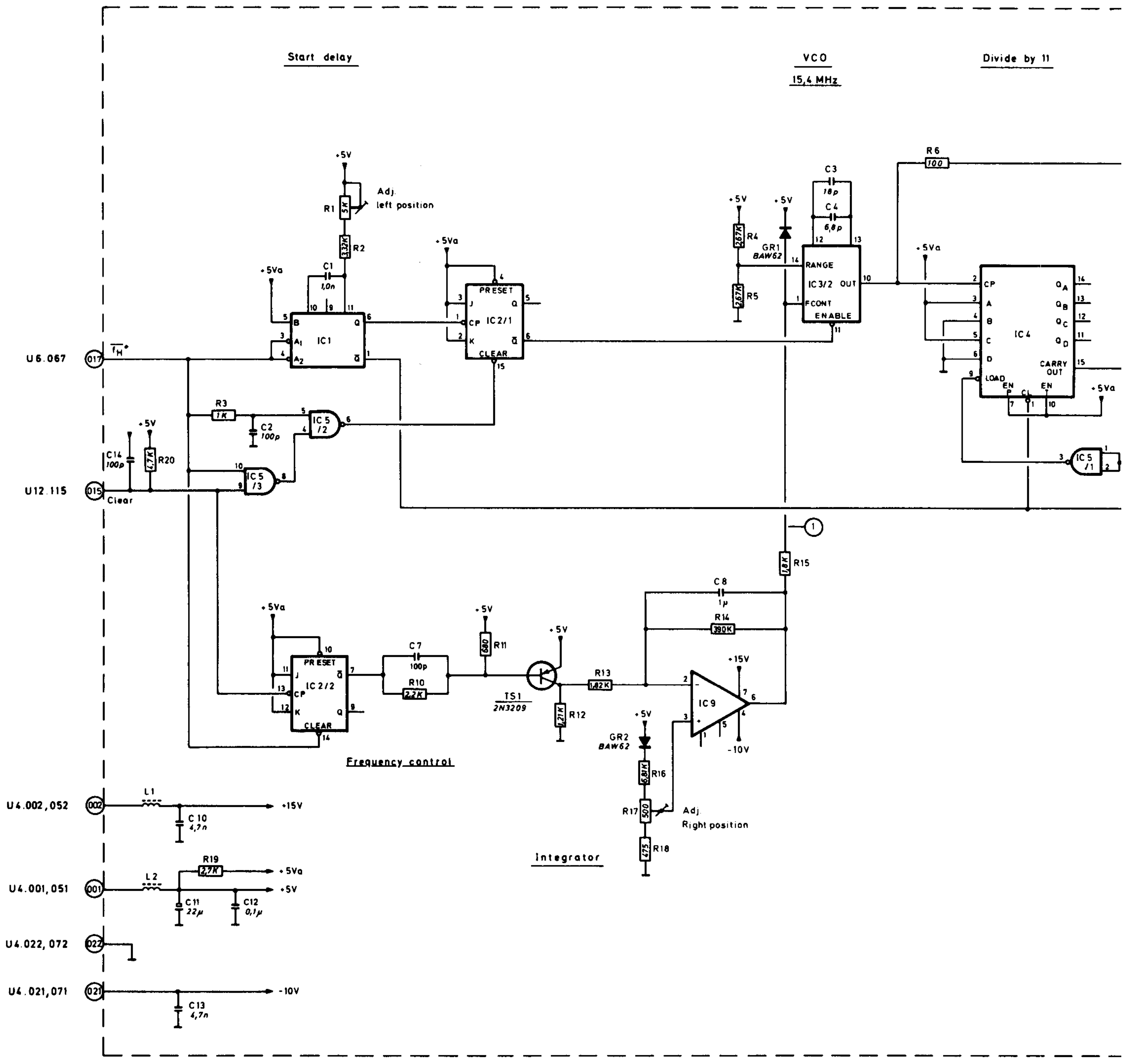


Fig. 14-2 Component location, horizontal divider, unit 9


Start delay
VCO
15,4 MHz
Divide by 11
Adj. left position
Frequency control
Integrator
Adj. Right position
U6.067
U12.115
Clear
U4.002,052
U4.001,051
U4.022,072
U4.021,071
IC1
IC2/1
IC2/2
IC3/2
IC4
IC9
TS1
2N3209
GR1
BAW62
GR2
BAW62

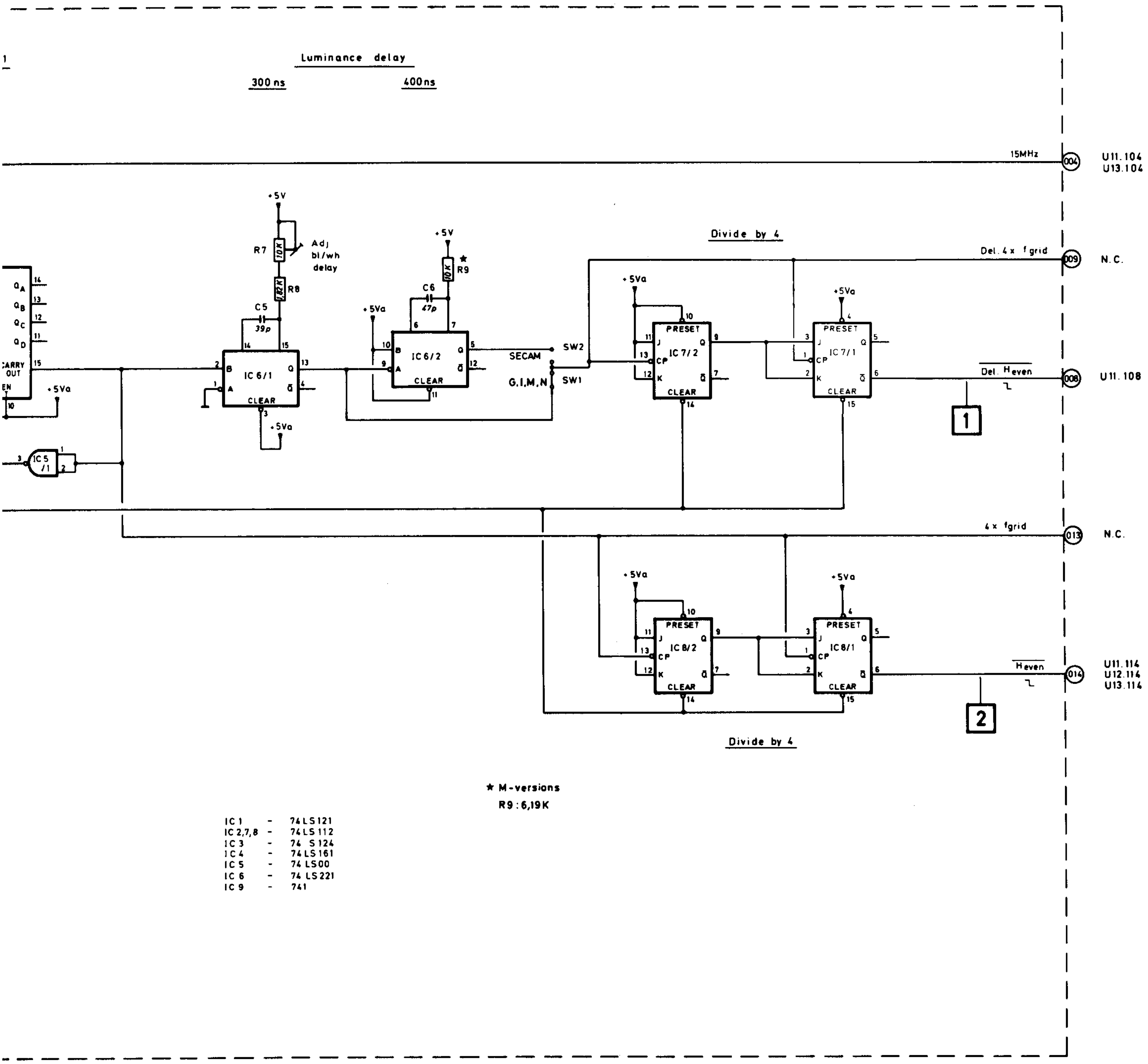


Fig. 14-3 Circuit diagram, horizontal divider, unit 9

15. Unit 10 Vertical divider

This unit delivers f v/2 pulses for field identification as well as the horizontal white lines V_L and the lines in between: V-even.

Circuit description

The f_V signal entering the unit at terminal 16 is inverted by IC2/4 and two field identification signals are produced by the flip-flop IC3/1.
The frame sync pulse is isolated by the field separator in order to reset the vertical delay formed by IC3/2, IC4 and IC5. This delay is a counter clocked by the line frequency entering at terminal 17. The delay depends upon the number of lines in the field blanking period and determines the upstart of the white line generator and therefore also the position of the first white line.
The white line generator is a counter clocked by the line pulse f_H. It is coded for a 21 count in the 625 line system and for a 17 count in the 525 line system selected by SW5.
The reset pulse starts the counter. IC8 counts until a carry at terminal 12 clocks IC7/2 disabling IC8 again. Simultaneously IC10 is enabled for counting and again a carry out disables IC10 and enables IC9.

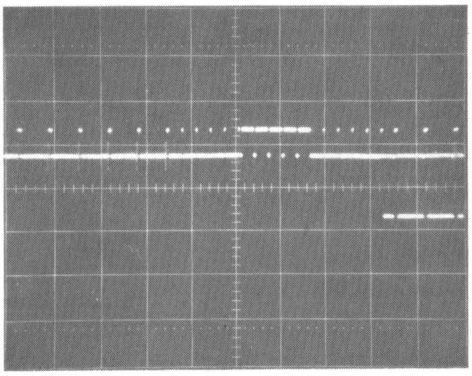
Checking and adjusting

Measuring equipment :
Oscilloscope : e.g. PHILIPS PM 3240X

Check that coding pins are positioned for the TV system in question.

Connect an oscilloscope to a pattern output, terminated with 75ohms.
Check that the grid background is positioned symmetrically in the vertical direction.
The number of lines surrounding the frame blanking output in field 1 and field 2 should be 6 1/2 and 7 respectively for the 625 lines system and 9 1/2 and 10 respectively for the 525 lines system.

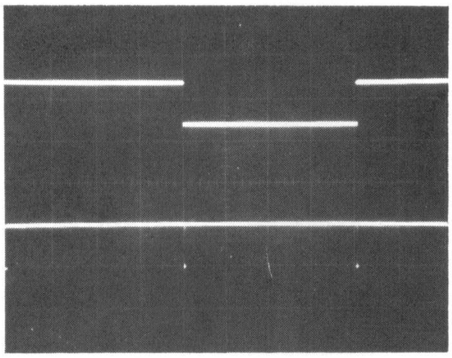
BU13



BU13 0.5V/div. 5ms/div. delayed: 0.1ms/div.

1

2



5V/div. 5ms/div.

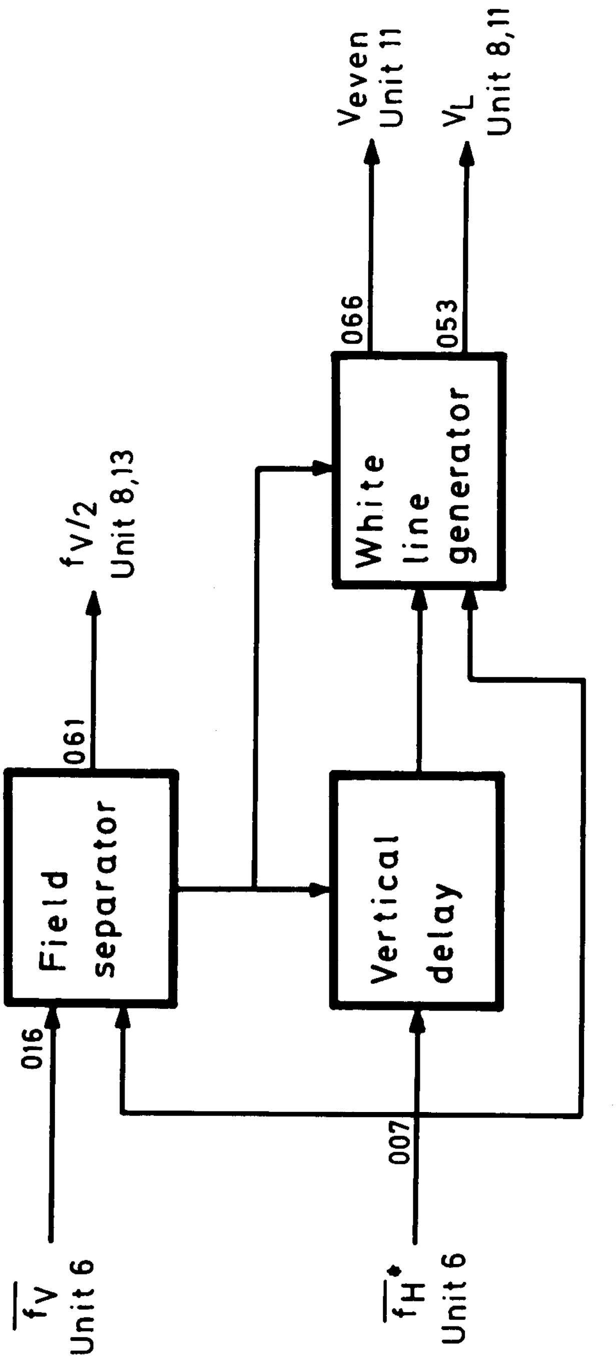
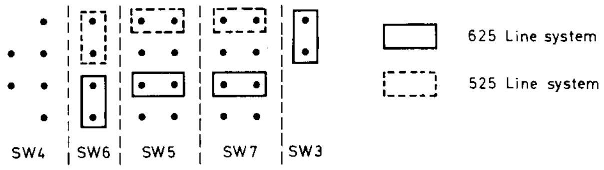


Fig. 15-1 Block diagram, vertical divider, unit 10



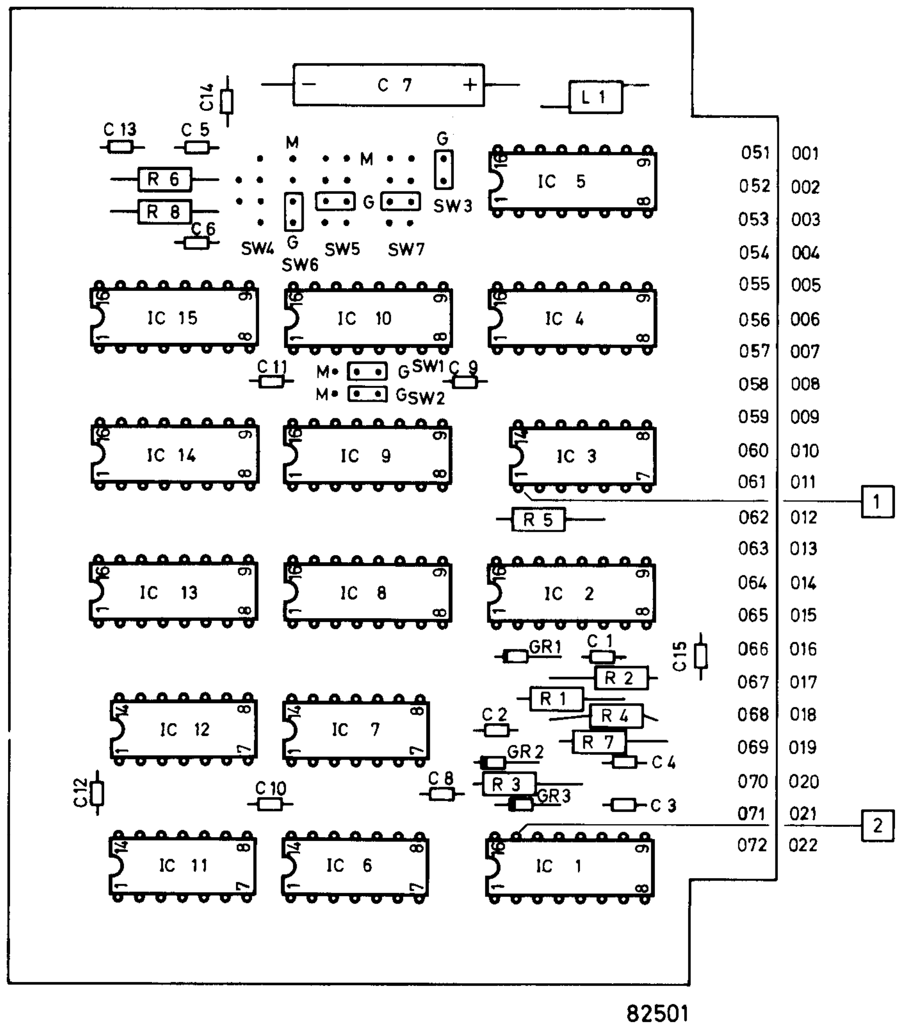
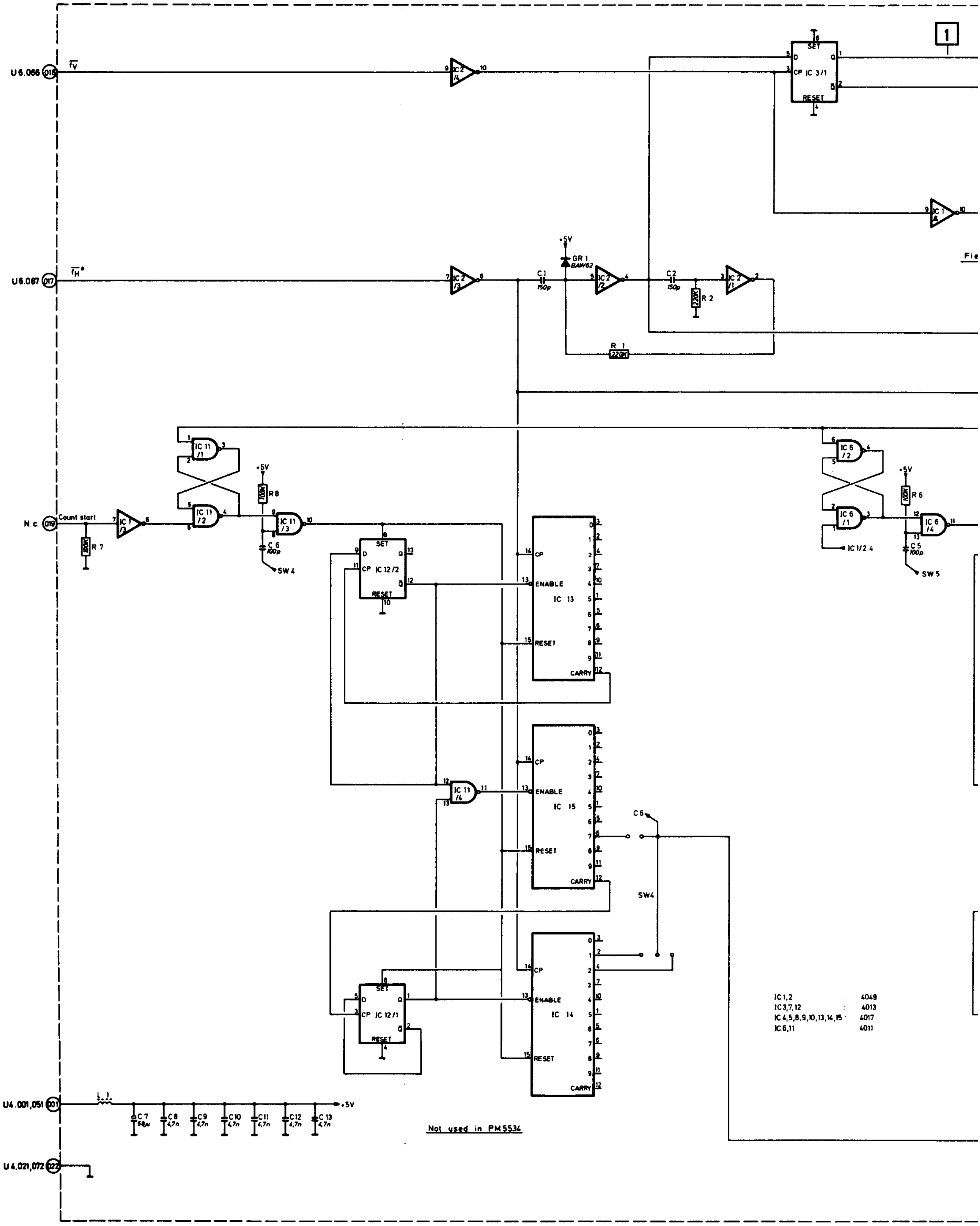


Fig. 15-2 Component location, vertical divider, unit 10



U6.066
016
fV
IC 2/4
SET
CP IC 3/1
RESET
1
U6.067
017
fH*
IC 2/3
+5V
GR 1
BAW62
C1
150p
IC 2/2
C2
150p
R 2
220K
IC 2/1
R 1
220K
IC 1/4
Fie
N.c.
019
Count start
IC 1/3
R 7
100K
IC 11/1
IC 11/2
+5V
R8
100K
IC 11/3
C 6
100p
SW 4
IC 12/2
ENABLE
IC 13
CARRY
IC 11/4
IC 15
C6
SW4
IC 12/1
IC 14
IC 6/2
IC 6/1
+5V
R 6
100K
IC 6/4
C 5
100p
IC 1/2.4
SW 5
IC 1,2 : 4049
IC 3,7,12 : 4013
IC 4,5,8,9,10,13,14,15 : 4017
IC 6,11 : 4011
U4.001,051
001
L 1
C 7
68µ
C8
4,7n
C9
4,7n
C10
4,7n
C11
4,7n
C12
4,7n
C 13
4,7n
+5V
Not used in PM5534
U4.021,072
022

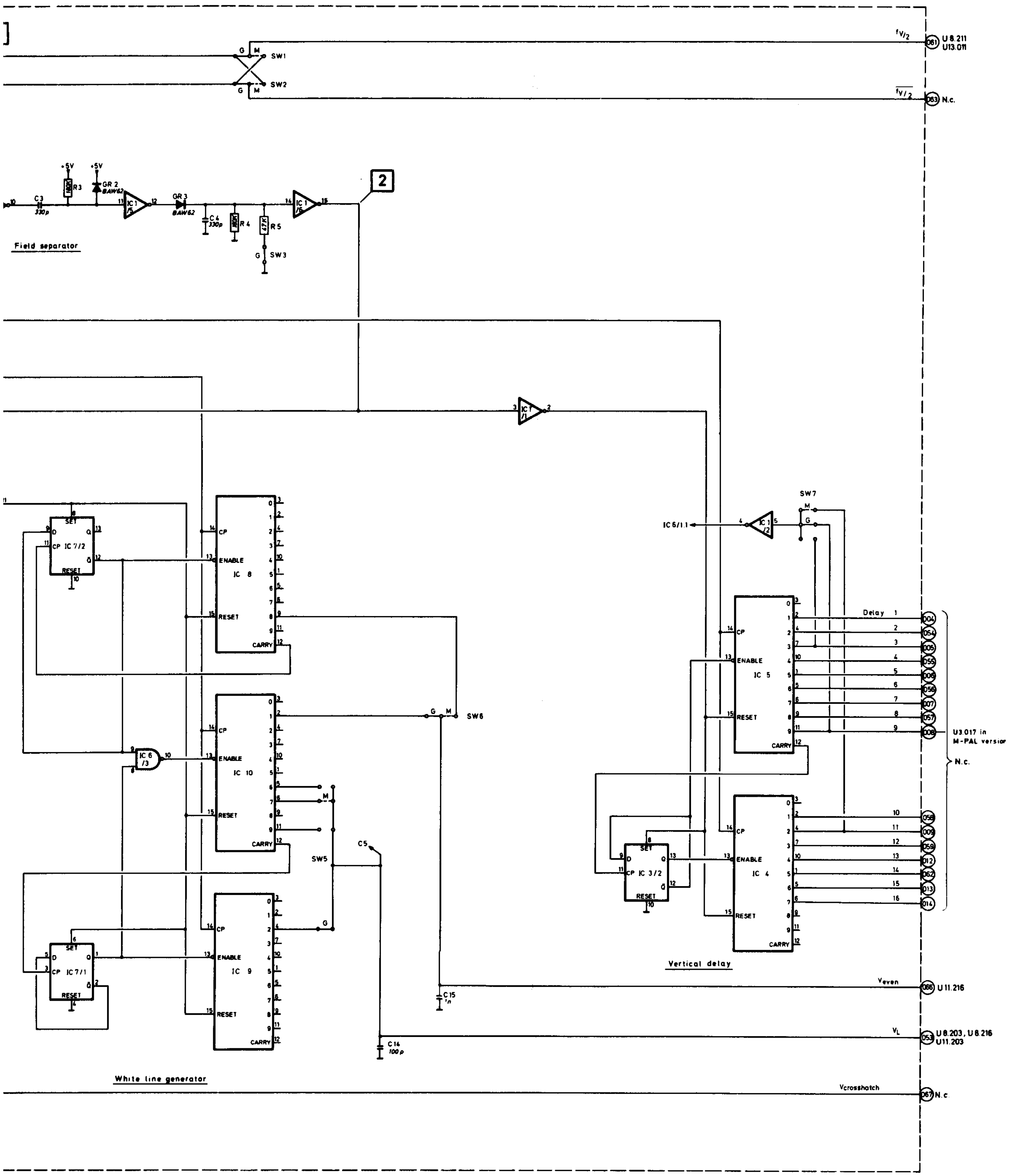


Fig. 15-3 Circuit diagram, vertical divider, unit 10

16. Unit 11 Black and white generator and control

This unit generates part of the Y-signal, the cross hatch auxiliary signal as well as a number of timing pulses for the control of other units.

Circuit description

"Vertical decoder"

IC21 and IC24 generate a number of V-pulses equal to the spacings between the horizontal white lines of the grid.
The decoder is clocked by the V_L pulse and is disabled during the frame blanking period.
All outputs are buffered externally by IC22, IC23 and IC25.

"Horizontal decoder delayed"

IC27 and IC28 generate a number of horizontal basic pulses for the gate network supplying the black and white field information. The decoder consists of two 8 - bit parallel-out serial-in shift registers (Johnson counters) clocked by Del. H-even pulses giving information of the positioning of the vertical white lines in the grid.

250kHz divider

This is a divide by 62 circuitry. IC3, IC4,IC19 and IC20/1 from a 31 divider and IC20/2 divides by 2.
IC26/2 generates the area in which the 250 kHz signal is to be revealed determined by V9-11.
The del. H11-31 signal is a clock signal determining the horizontal starting position of the 250 kHz bar.
The 250 kHz signal is part of the Y-output via TS7, where R32 + R33 determines the amplitude normally set to 75% of white.

Cross hatch generator

The cross hatch generator is a gate network supplying three outputs $\boxed{1}$, $\boxed{2}$ and $\boxed{3}$

$\boxed{1}$ demarcates the grey background in which other signals at TS2 are cut out.
$\boxed{2}$ is the grid background and is disabled by the circle at the emitter of TS3.
$\boxed{3}$ supplies the cross hatch signal for the auxiliary output.

Black/white circle content

This circuitry generates pure black and white areas for display inside the circle area. All pattern bits shown on $\boxed{4} \rightarrow \boxed{11}$ are added in order to conform to $\boxed{12}$.
IC30/2 generates the vertical white line in the centre cross and at IC15/3 this is added to V16 being the horizontal centre line.
IC30/1 generates the vertical white lines. Parts of them are gated by IC36 in order to obtain the black and the white needle pulse.

Centre cross area generator

The vertical position of this area is determined by the V13 and V19 pulses whereas in the horizontal dimension the H21 and H23 pulses are the determining factors supplied to IC32/2.

Circle control

The circle control generates two pulses for the circle generator unit 13. V4 - 28 is the vertical position in which the circle is displayed.

Generator enable decoder

This circuitry generates a number of control signals for the colour bar, the yellow/red/yellow area and the pluge signal.
The delayed red, green and blue signals blank out the horizontal bars in which colours are displayed, and also take care of the centre cross cut in the coulour bar.
See also fig. $\boxed{14}$, $\boxed{15}$ and $\boxed{16}$.
V23'-25 states the vertical extent of an area in the "colour difference normal" area.
V23' differs from V23 by the width of a white line in order to prevent the white line V23 from disappearing from the top of the G-Y = 0 area.
In the same way the V11-V15', being the colour bar gate pulse, is extended by the width of a white line in order not to display the white line at the bottom of the colour bar.
All enable signals are shown on fig. $\boxed{14} \rightarrow \boxed{26}$.

Generator clock control

Three outputs $\boxed{27}$, $\boxed{28}$ and $\boxed{29}$ are clock signals as indicated on the circuit diagram.
Two coding facilities are possible. 6 or 11 level staircase is selected by SW7 and SW8 in order to change the greyscale clock frequency where the 6 level staircase is

considered being normal. SW5 selects the multiburst clock frequency supplying 5 clock pulses for all versions except the I-version, where 6 clock frequencies are available.

Current outputs

TS1, TS2, TS3, TS5 and TS7 are current generators each supplying a fraction of the Y-output current.
TS4 is a current generator supplying the pluge signal and TS6 is a common temperature compensated reference voltage for all current generators.
Signals supplied to unit 19 as currents have to be checked as digital signals on an IC output terminal or on an output terminal of unit 19.

Checking and adjusting

Checking and fault finding is most easily carried out by the use of the built-in test facility described in unit 19 or by means of an oscilloscope.
Note that the two tape covered rails on the component side of the p.c.b. are isolated double layered voltage supplies and should not be used as ground connection for a test probe.

Measuring instruments

Video level meter : e.g. PHILIPS PM 5548
TV monitor : e.g. PHILIPS

NOTE: See unit 16 for removal of set-up.
It is possible to adjust this unit without the use of test print PM 8507, provided the output amplifier unit 19 is adjusted for 0V and 700mV (all versions).
After the adjustment of unit 11 the output amplifier can be readjusted for IRE levels if necessary.
Connect a video level meter to a pattern output. All pattern outputs have to be terminated with 75ohms.

Colour difference normal area (grey level)

Adjust R1 to obtain a 335 mV reading.

Grey back ground in the cross hatch

Adjust R5 to obtain a 335 mV reading.

White line amplitude

Measuring height 1 line.
Adjust R17 to obtain 700 mV reading obtained from a horizontal white line.

White area inside the circle

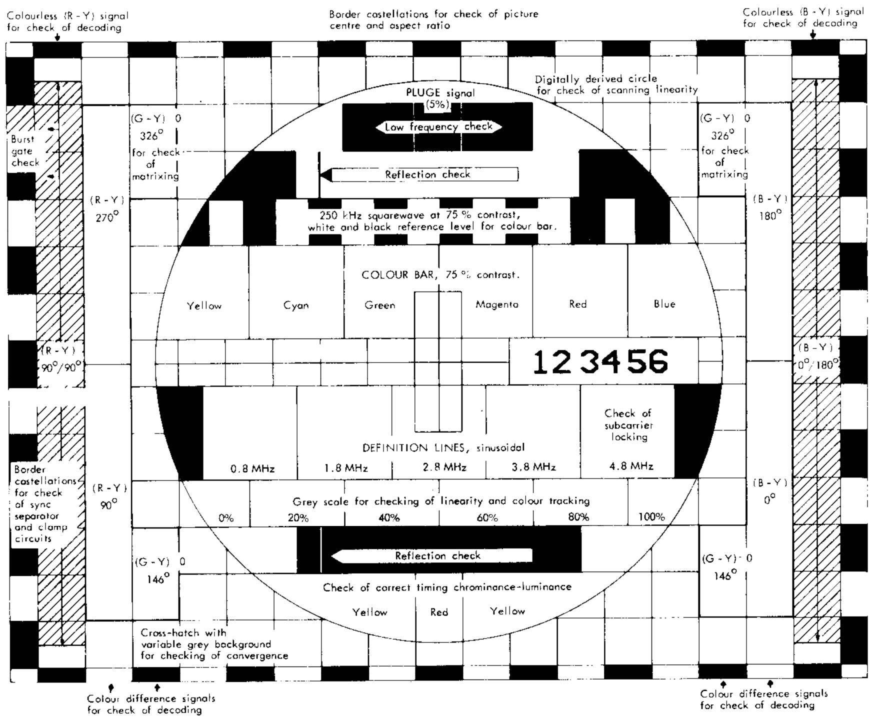
Adjust R27 to obtain a 700 mV reading.

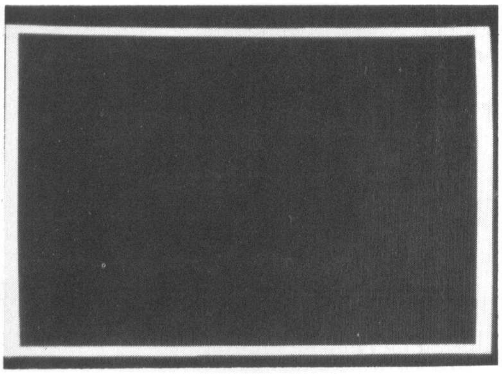
250kHz amplitude (in the grey area)

Adjust R32 to obtain a 525 mV amplitude.

Pluge amplitude

Adjust R22 to obtain a -35 mV amplitude.





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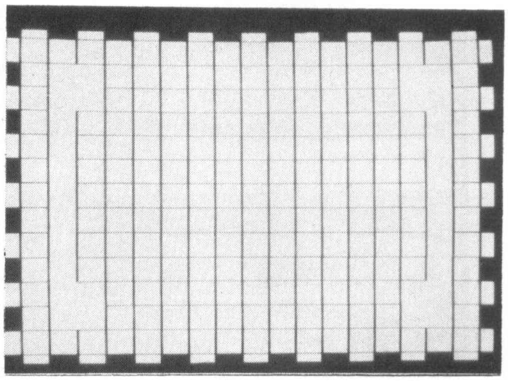

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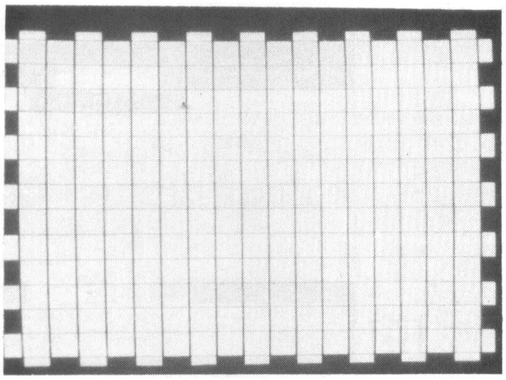

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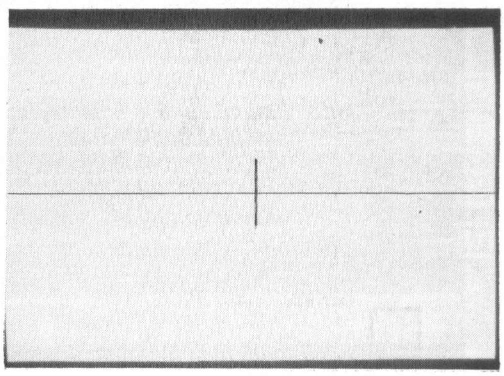

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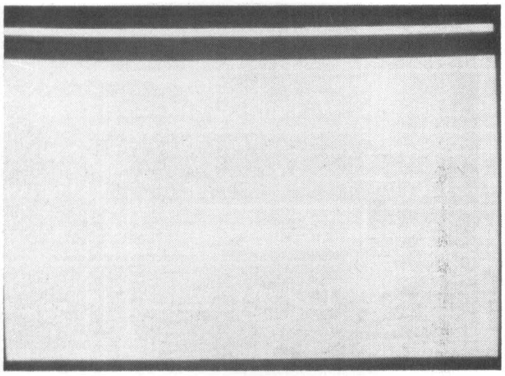

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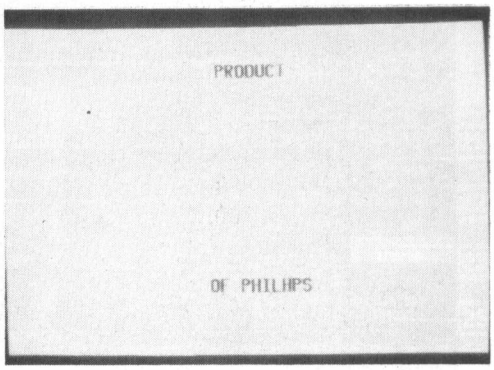

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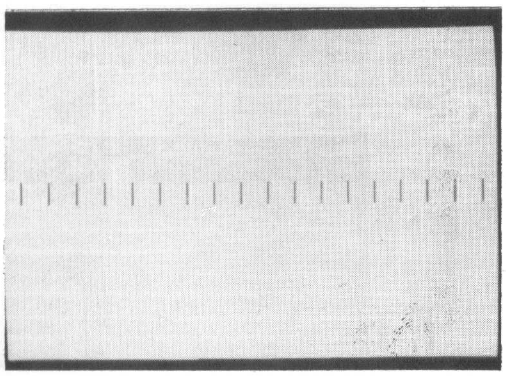

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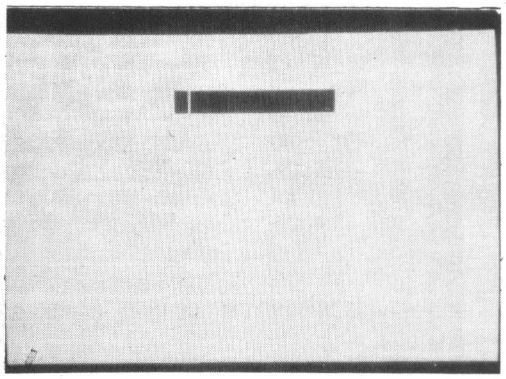

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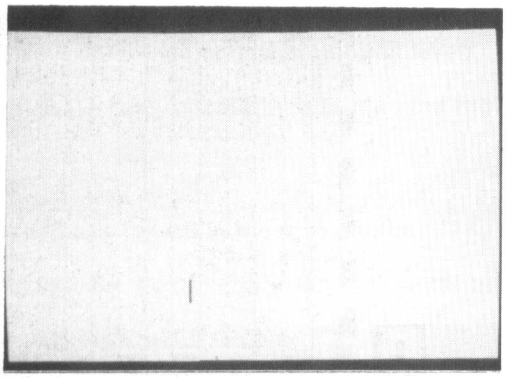

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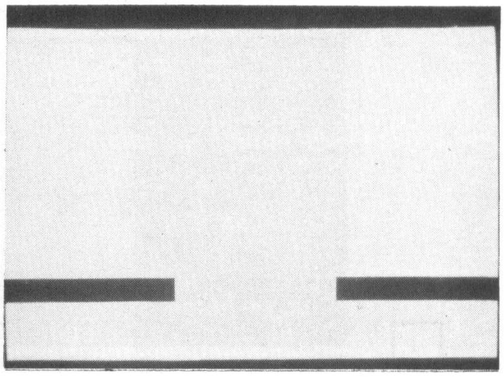

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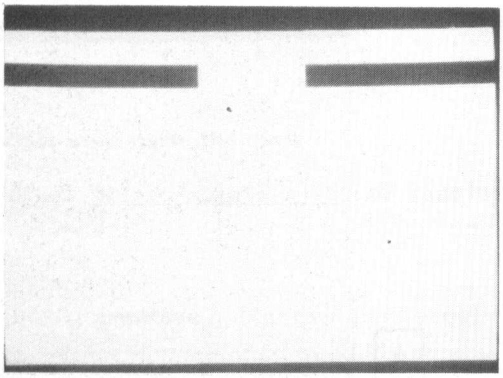

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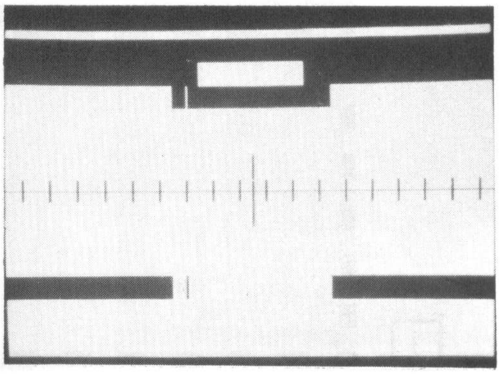

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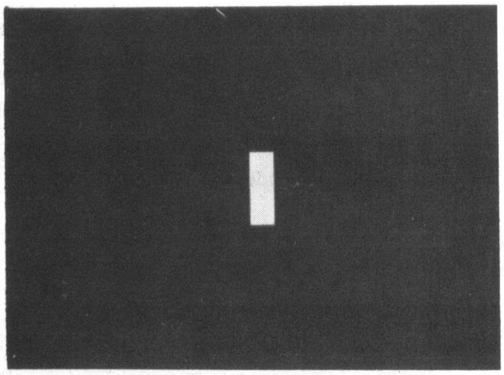

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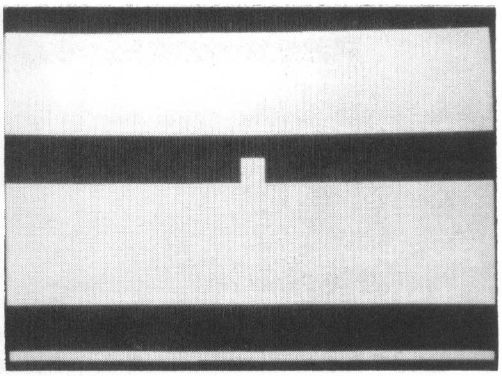

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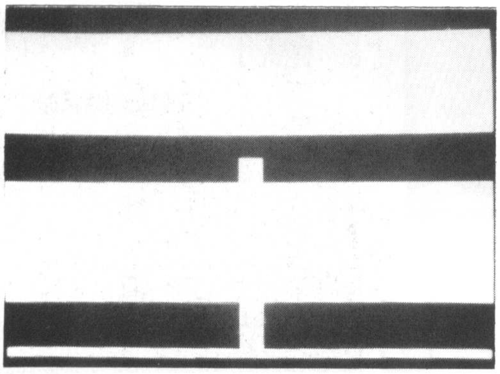

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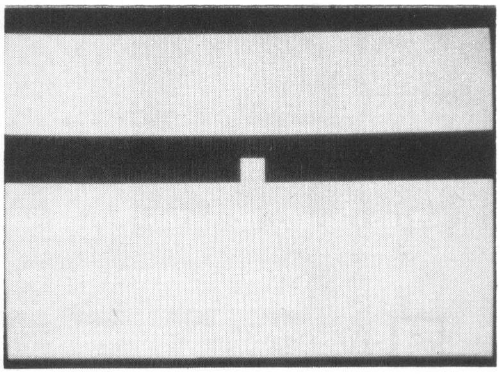

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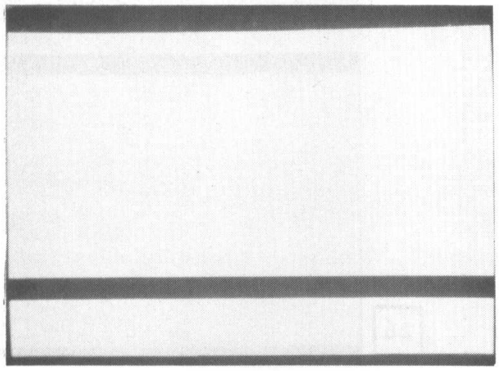

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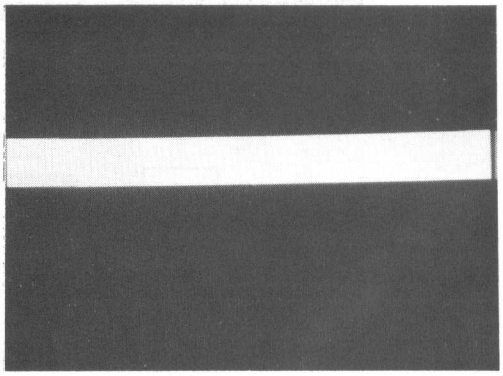

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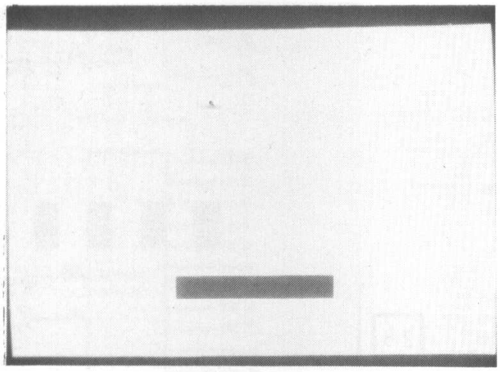

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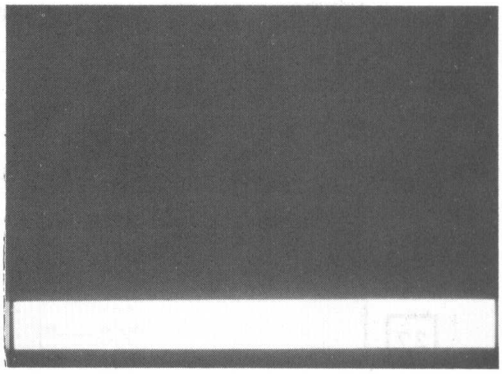

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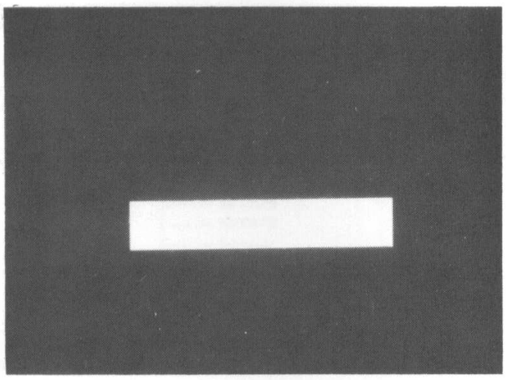

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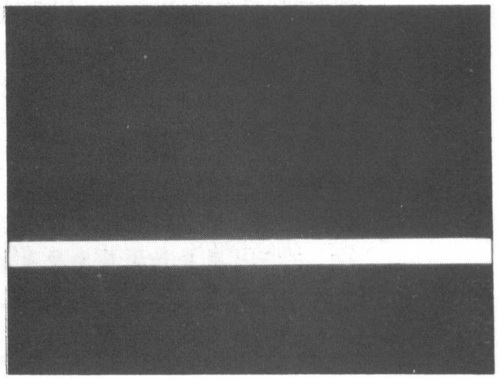

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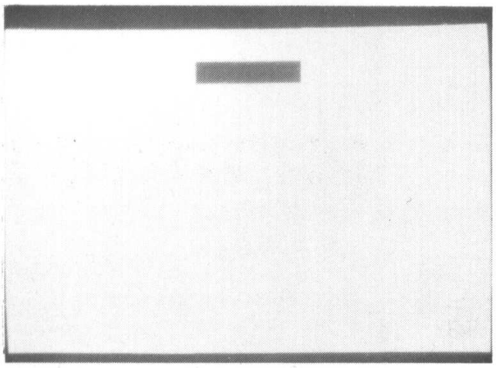

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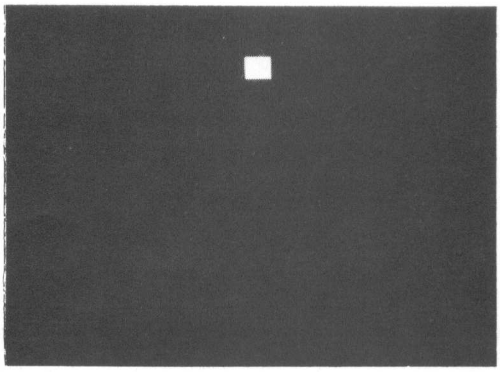

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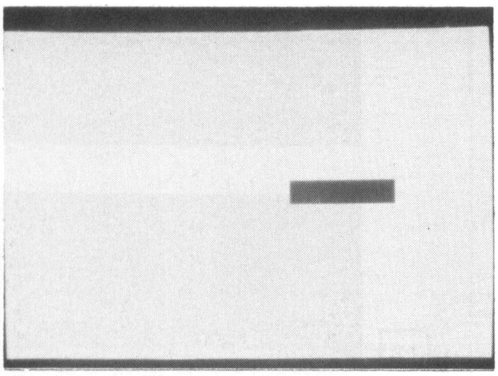
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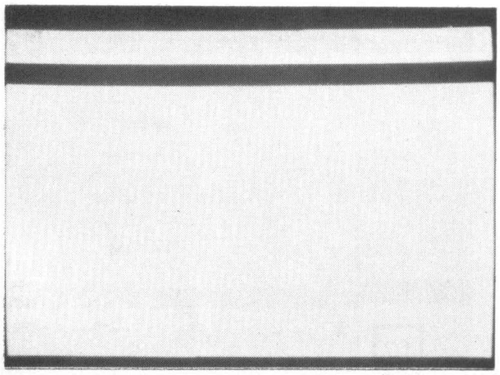
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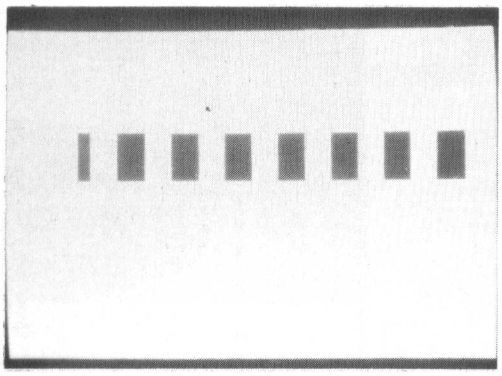
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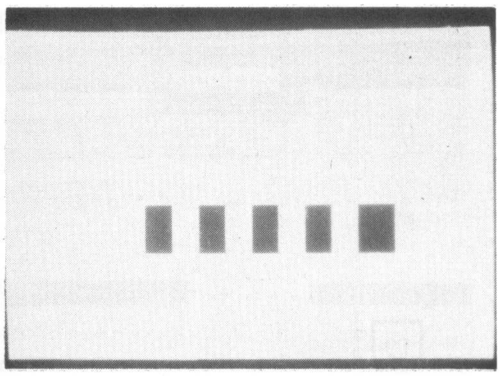
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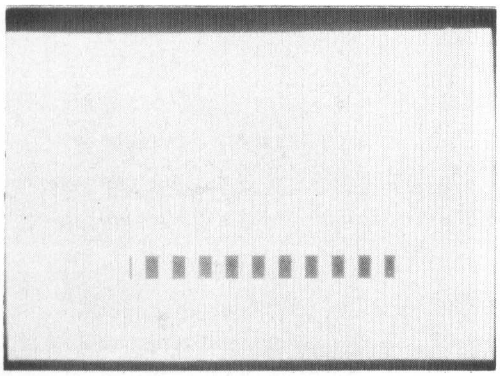
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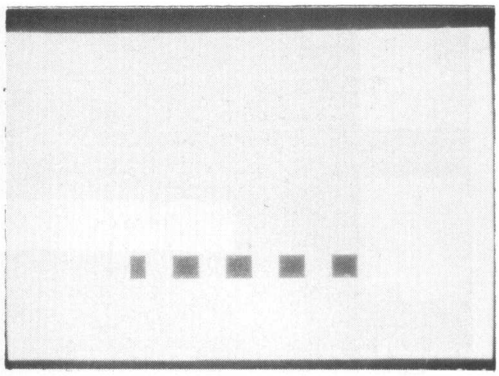
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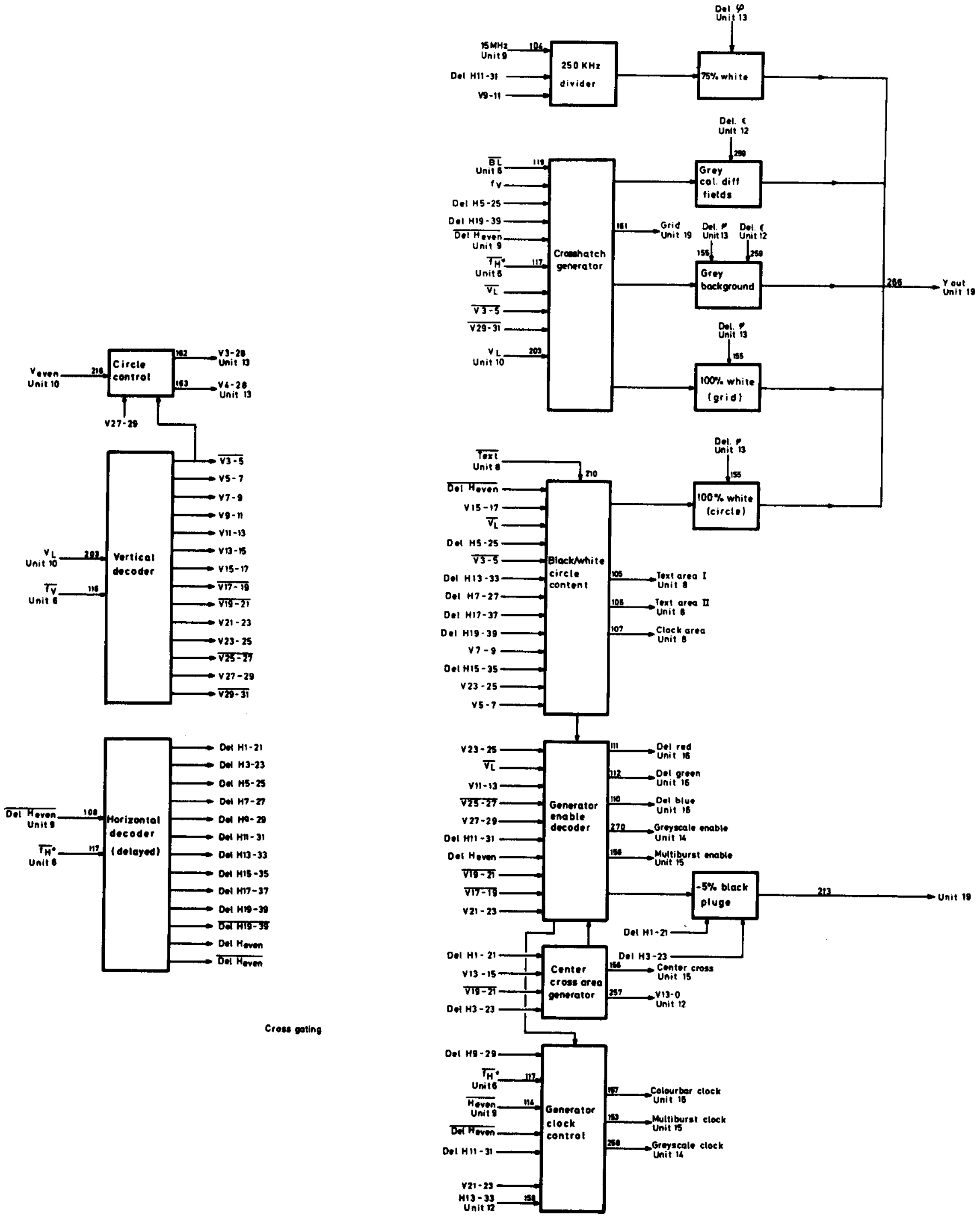
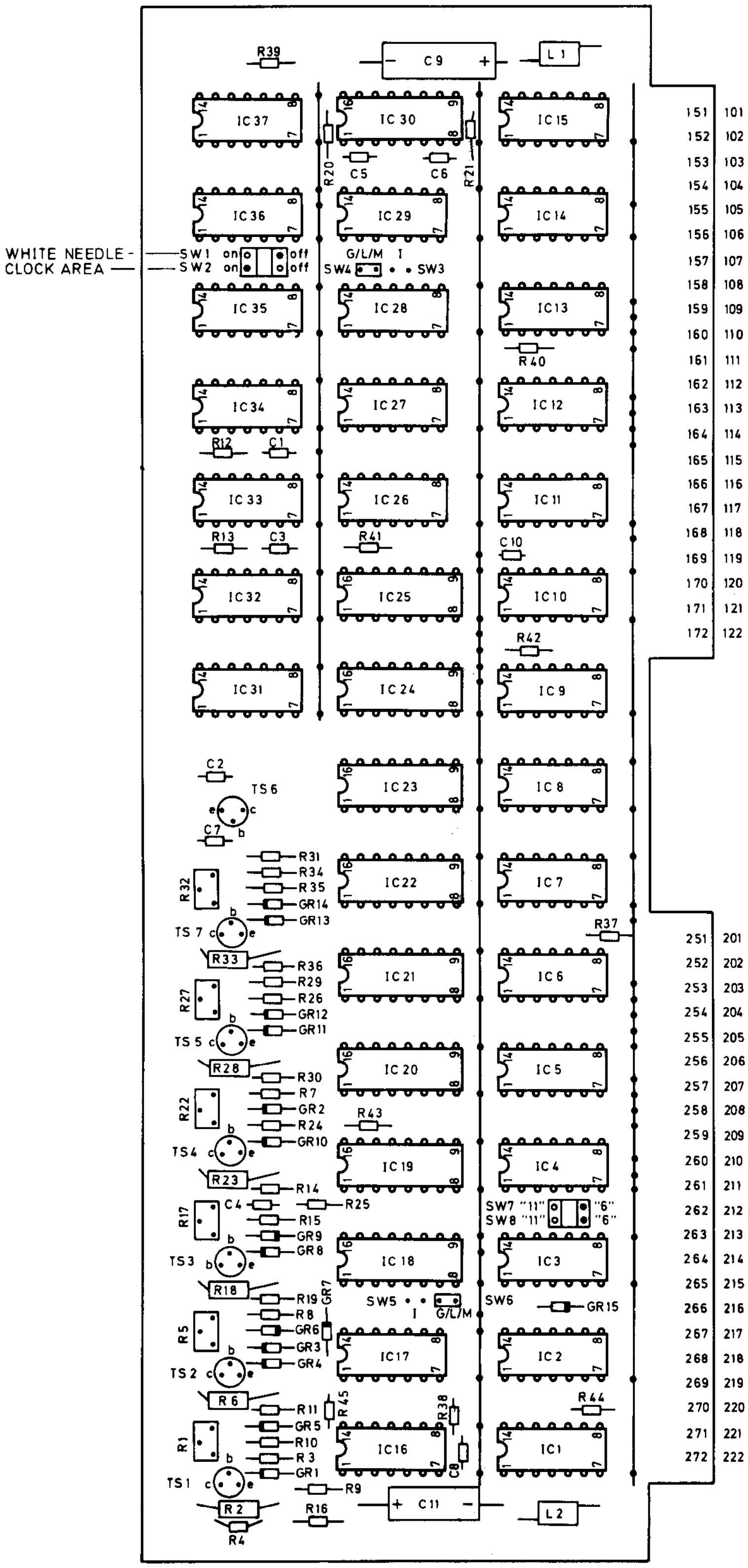


Fig. 16-1 Block diagram, BL/WH gen. + control, unit 11


WHITE NEEDLE-
CLOCK AREA
SW1 on off
SW2 on off
G/L/M I
SW4 SW3
C9
L1
L2
C11
IC 37
IC 36
IC 35
IC34
IC 33
IC32
IC31
IC 30
IC 29
IC 28
IC 27
IC 26
IC25
IC 24
IC 23
IC22
IC 21
IC 20
IC 19
IC 18
IC17
IC16
IC 15
IC 14
IC13
IC 12
IC 11
IC10
IC 9
IC 8
IC 7
IC 6
IC 5
IC 4
IC 3
IC 2
IC1
SW7 "11" "6"
SW8 "11" "6"
SW5
SW6
G/L/M
TS6
TS 7
TS 5
TS4
TS3
TS 2
TS1
151 101
152 102
153 103
154 104
155 105
156 106
157 107
158 108
159 109
160 110
161 111
162 112
163 113
164 114
165 115
166 116
167 117
168 118
169 119
170 120
171 121
172 122
251 201
252 202
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254 204
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263 213
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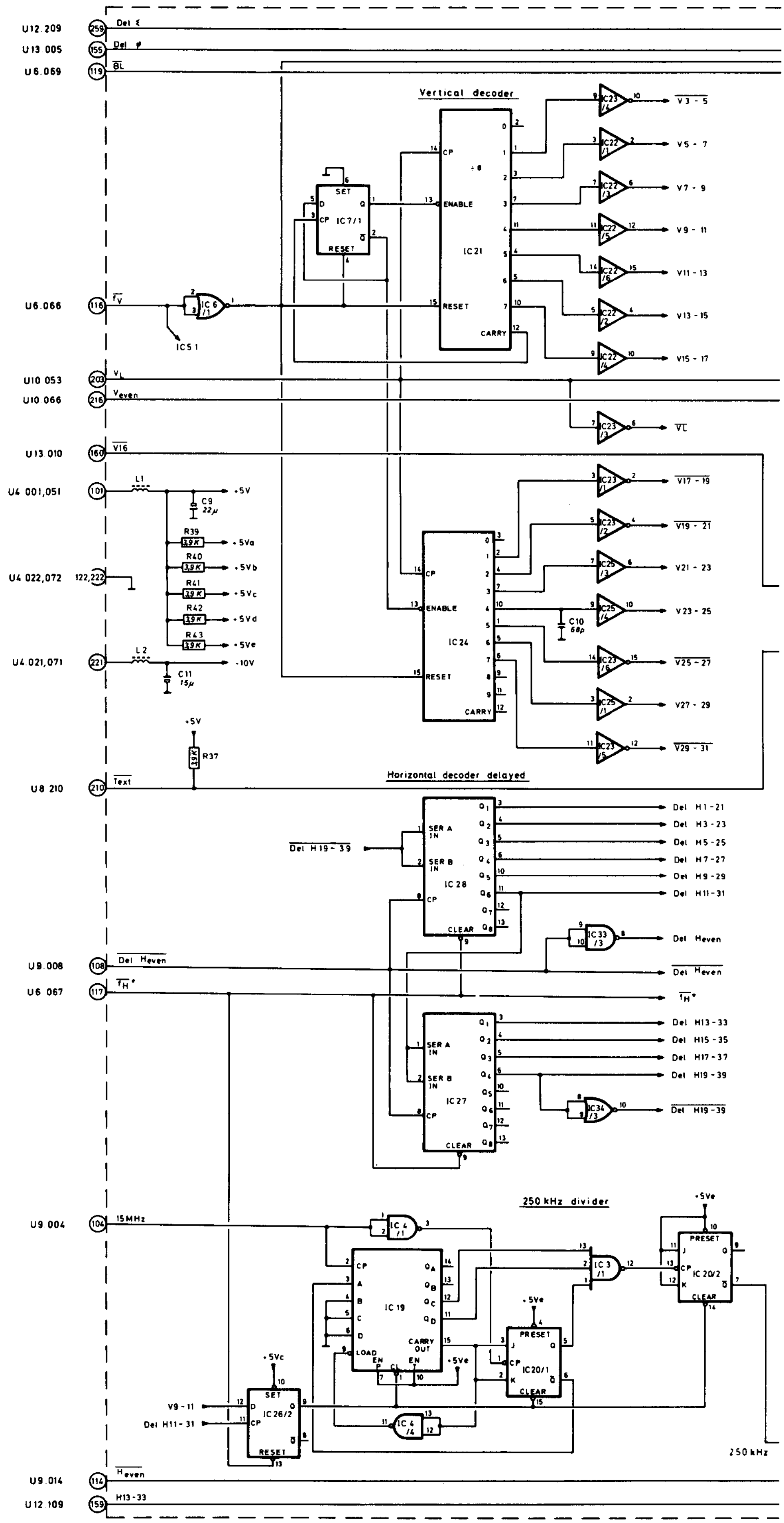
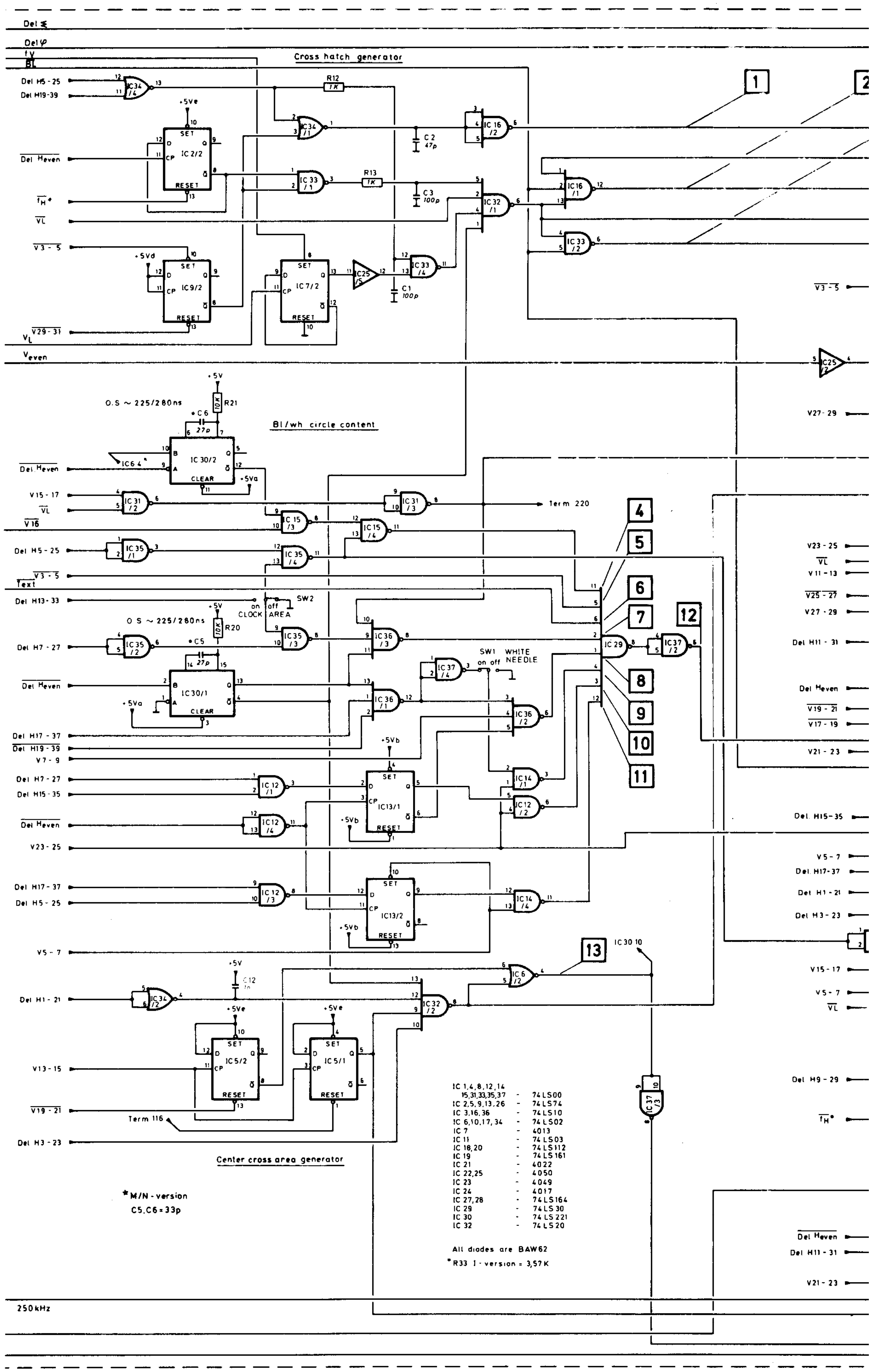
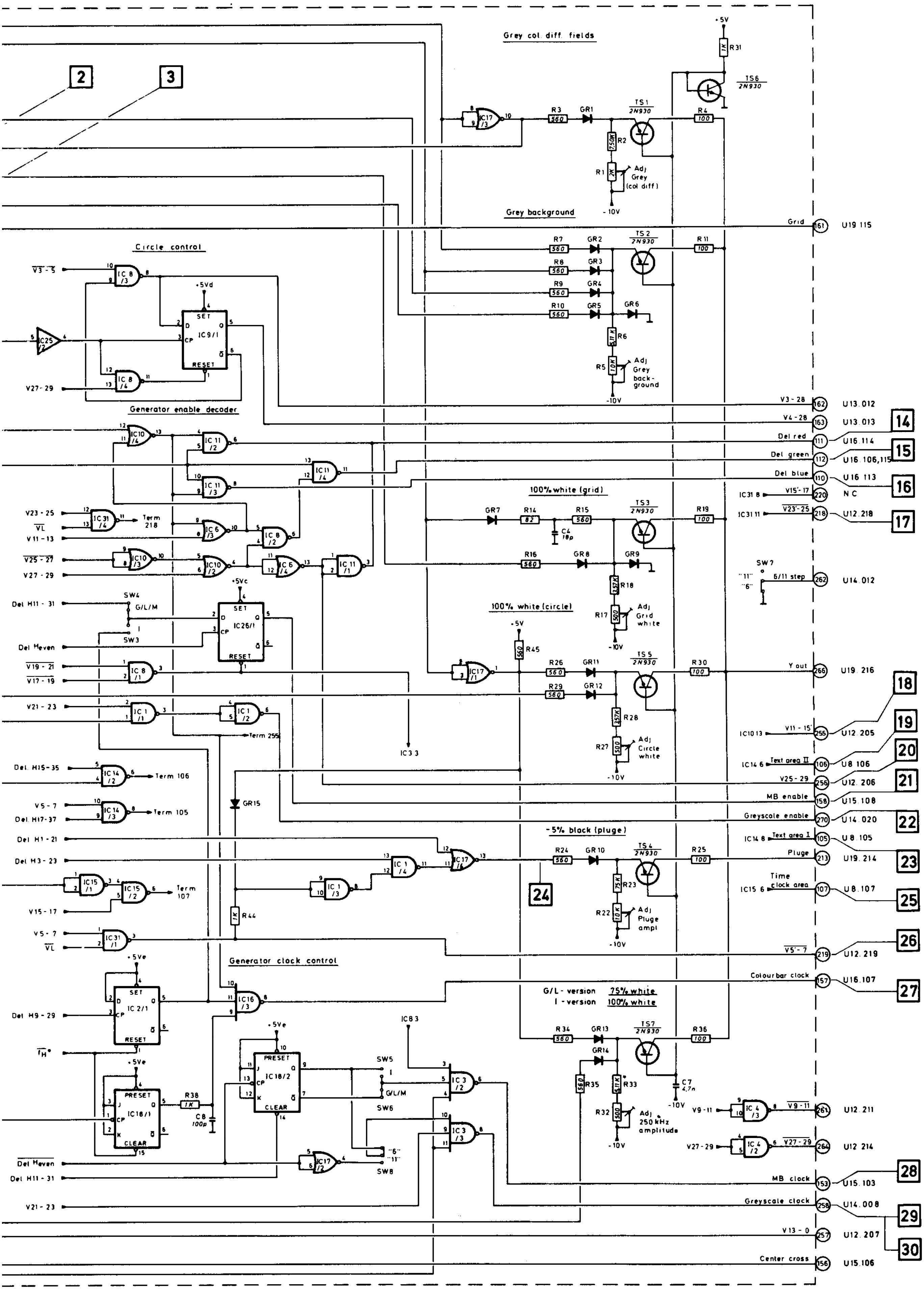
265 215
266 216
267 217
268 218
269 219
270 220
271 221
272 222


Vertical decoder
Horizontal decoder delayed
250 kHz divider
IC21
IC24
IC28
IC27
IC19
IC 20/1
IC 20/2
IC 26/2
U12.209
U13.005
U6.069
U6.066
U10 053
U10 066
U13.010
U4 001,051
U4 022,072
U4.021,071
U8 210
U9.008
U6 067
U9.004
U9.014
U12 109
250 kHz


Cross hatch generator
Bl/wh circle content
Center cross area generator
O.S ~ 225/280ns
Term 220
Term 116
SW1 WHITE NEEDLE on off
SW2 on off CLOCK AREA
IC 1,4,8,12,14 15,31,33,35,37 - 74LS00
IC 2,5,9,13,26 - 74LS74
IC 3,16,36 - 74LS10
IC 6,10,17,34 - 74LS02
IC 7 - 4013
IC 11 - 74LS03
IC 18,20 - 74LS112
IC 19 - 74LS161
IC 21 - 4022
IC 22,25 - 4050
IC 23 - 4049
IC 24 - 4017
IC 27,28 - 74LS164
IC 29 - 74LS30
IC 30 - 74LS221
IC 32 - 74LS20
All diodes are BAW62
*R33 J-version = 3,57K
*M/N-version
C5,C6=33p



Grey col. diff. fields
Grey background
Circle control
Generator enable decoder
100% white (grid)
100% white (circle)
-5% black (pluge)
Generator clock control
G/L - version 75% white
I - version 100% white
Adj Grey (col diff)
Adj Grey background
Adj Grid white
Adj Circle white
Adj Pluge ampl
Adj 250 kHz amplitude
Grid 161 U19 115
V3 - 28 162 U13 012
V4 - 28 163 U13 013
Del red 111 U16 114
Del green 112 U16 106,115
Del blue 110 U16 113
IC31 8 V15 - 17 220 NC
IC31 11 V23 - 25 218 U12 218
6/11 step 262 U14 012
Y out 266 U19 216
IC10 13 V11 - 15 255 U12 205
IC14 6 Text area II 106 U8 106
V25 - 29 256 U12 206
MB enable 158 U15 108
Greyscale enable 270 U14 020
IC14 8 Text area I 105 U8 105
Pluge 213 U19 214
IC15 6 Time clock area 107 U8 107
V5 - 7 219 U12 219
Colourbar clock 157 U16 107
V9 - 11 263 U12 211
V27 - 29 264 U12 214
MB clock 153 U15 103
Greyscale clock 258 U14 008
V13 - 0 257 U12 207
Center cross 156 U15 106
2
3
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

17. Unit 12 Colour difference generator

This unit generates the colour difference signals displayed on each side of the circle. Also a red, green and blue signal for colour bar control and timing signals for circle control are generated.
Delayed Σ is the colour difference normal area blanked out in the cross hatch background.

Horizontal divider

The horizontal divider is a Johnson counter similar to IC7 and IC8 on unit 11. The timing signals are used for colour generation and are therefore not delayed.
IC1, IC2 and IC6/1 are clocked by the symmetrical H-even pulse. This indicates that H_L and $\overline{H}_L$ are white line pulses. They are used in the "difference signals address" circuitry for addition or subtraction of the white line width from the resulting pulses obtained here. See also page 41 "How to read the pulses in the diagrams".

Divider decoder

The clear pulse (H39) is used on unit 9 to stop the master oscillator.

Horizontal bar generator

The vertical position of the colour diff. normal areas is determined by four horizontal bars.
V5' and V23' are pulses that ensure that the white horizontal border lines remain unbroken.

Difference signals address

Vertical and horizontal timing pulses are added here, in order to produce the colour difference areas shown on $\boxed{1}$ to $\boxed{6}$. H_L pulses subtract the white line width from the otherwise resulting pulse, and the R/C configurations delay the H-pulses, when two areas are to be combined without the separation of a white line.

Difference signals generator

From the "difference signals address" circuit the eight signals are fed to eight individually adjustable current generators. An incomming signal is negative going, thus making a current flow. The current are added two and two in order to form the colour difference outputs.
A survey of adjustable elements can be found in figure 17-1. They should only be used for minor corrections when a test print PM8507 is not available.

Field control

The $f_{H/2}$ pulses control the colour difference alternating signals with a frequency half of that of the line frequency (PAL-ID).
The coding facility fast-slow-off should normally be set to the off-position.
However, when coded for fast or slow the alternating frequency is divided by two and four respectively. This service facility is useful together with an oscilloscope when the "ALT" signals are discoloured on display and readjustment of a TV set is necessary. (Of use in PAL-versions only).

Luminance adder and delay

The Σ signal supplied from here is the colour difference normal areas. After having been gated out the signal is present at IC10.13.
The signal is used on unit 11 to supply grey background level, hence the luminance delay circuit. The Y-delay is adjustable by means of R37, but extended delay for L-versions can be obtained by means of SW4.

Colourbar control

The colourbar control signals red, green and blue are coupled directly to the current generators on unit 16 for switching purposes.
IC21/1 supplies the centre cross cut and the red bar in the yellow-red-yellow area, whereas IC21/2 supplies the two horizontal bars, colour bar and yellow-red-yellow.

Checking and adjusting

Measuring equipment :

Video level meter	: e.g.	PHILIPS PM 5548
Test print	:	PHILIPS PM 8507
TV monitor	: e.g.	PHILIPS LDN 5006

This unit should be adjusted only after the output amplifier unit 19 has been carefully aligned for black level 0V and white level 700 mV for all versions. Afterwards unit 19 can be realigned for IRE amplitude if desired.

Connect the video level meter to a pattern output and terminate all pattern outputs with 75ohms.

Amplitudes

Insert PM 8507 in the place of unit 18.
On unit 19 remove SW2.
Area numbers refer to fig. 17-1

NOTE: See unit 16 for removal of set-up.

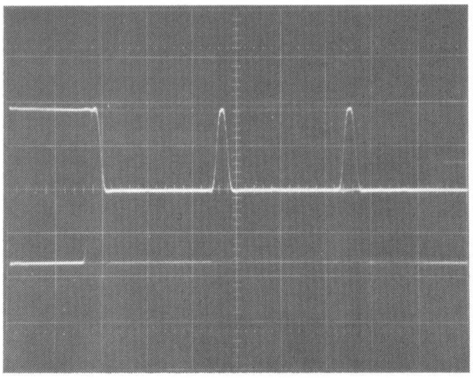
Testprint on -(R-Y).
Adjust R1 to obtain 134 mV of area 2.
Testprint on +(R-Y).
Adjust R5 to obtain 134 mV of area 4.
Testprint on -(R-Y).
Adjust R9 to obtain 75 mV of area 3.
Testprint on +(B-Y).
Adjust R13 to obtain 111 mV of area 3.
Testprint on +(R-Y).
Adjust R17 to obtain 75 mV of area 5.
Testprint on -(B-Y).
Adjust R23 to obtain 111 mV of area 5.
Adjust R27 to obtain 134 mV of area 6.
Testprint on +(B-Y).
Adjust R30 to obtain 134 mV of area 7.

Remove PM 8507 and insert SW2 on unit 19.

<u>The width of colour difference area.</u>

Remove unit 18.

Connect the oscilloscope to a pattern output, terminated with 75ohms.

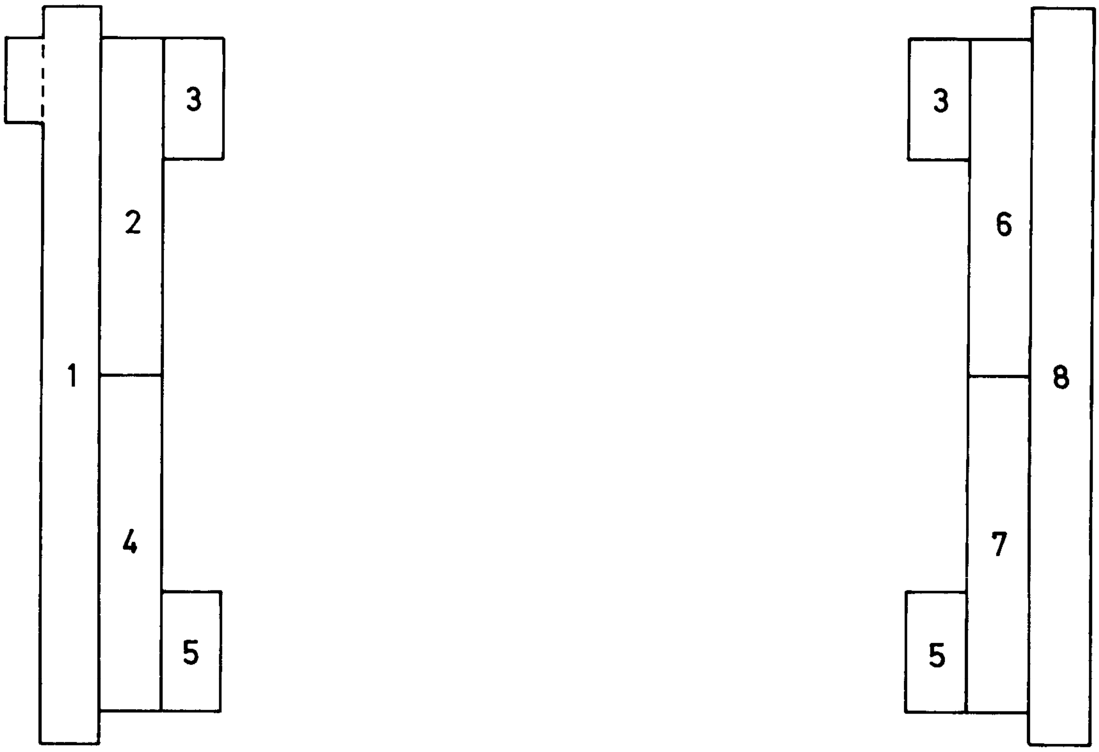


0.2V/div. 10µs/div. delayed: 1µs/div.

Adjust R37 and observe the leading edge of the third white line, it should almost show double contour.

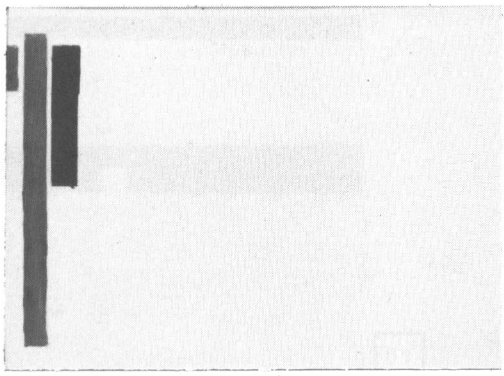
Adjust R21 and observe the back edge of the second white line, it should just almost show double contour.

Reinsert unit 18.



Area	Pulse	Adj.
1	A,B	R1,R5
2	A	R1
3	C,D	R9,R13
4	B	R5
5	E,F	R17,R23
6	G	R27
7	H	R30
8	G,H	R27,R30

Fig. 17-1 Location of colour diff. areas



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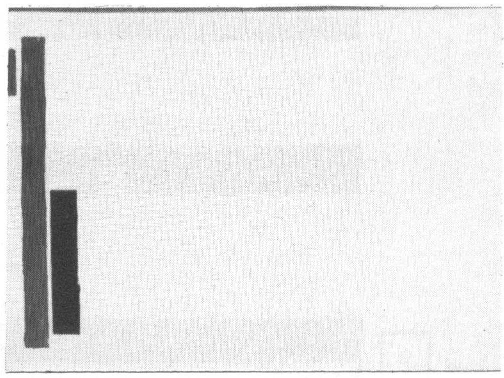

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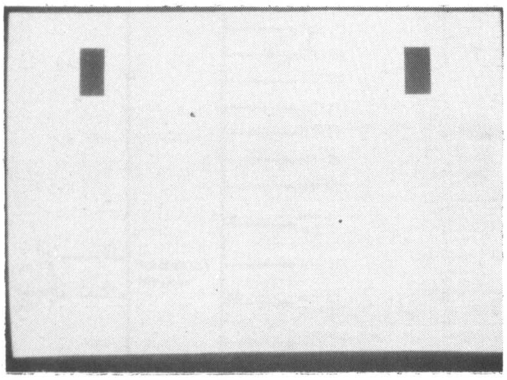

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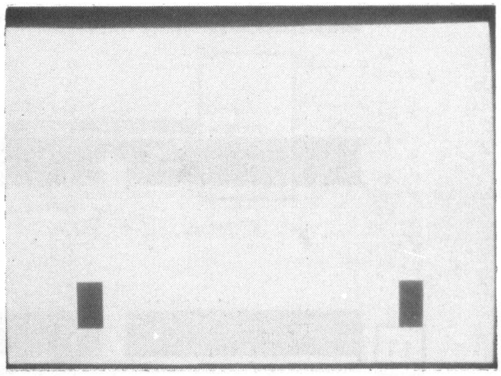

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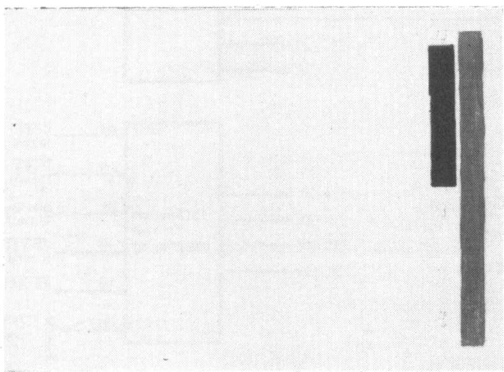

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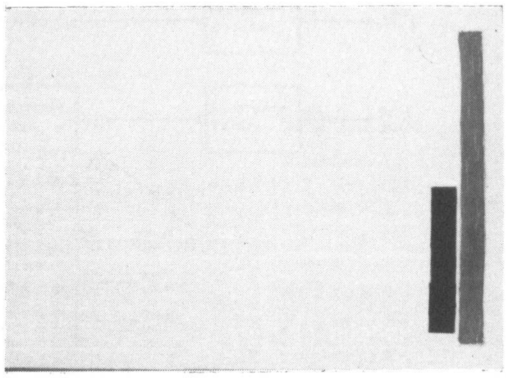

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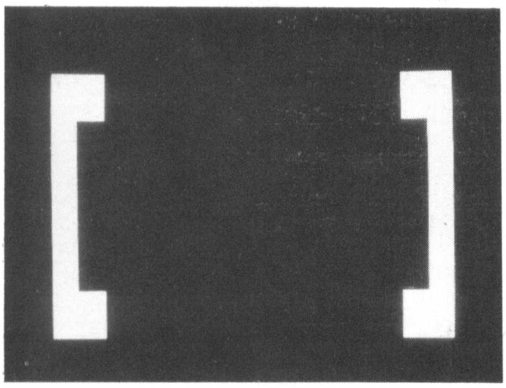

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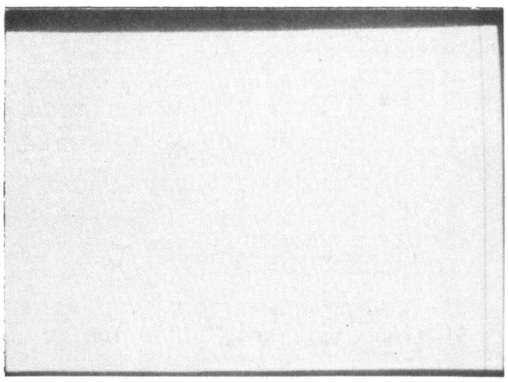

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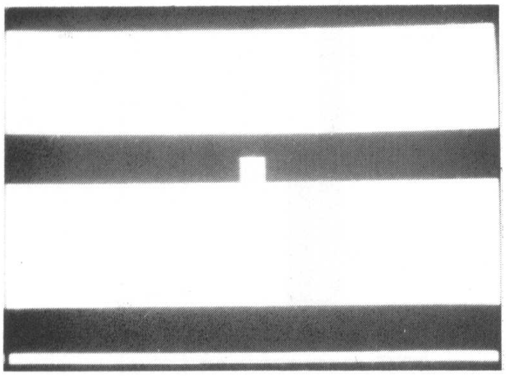

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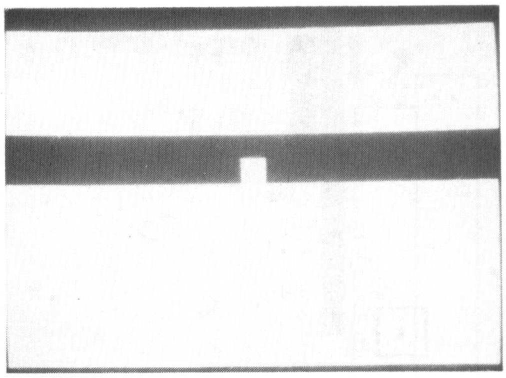

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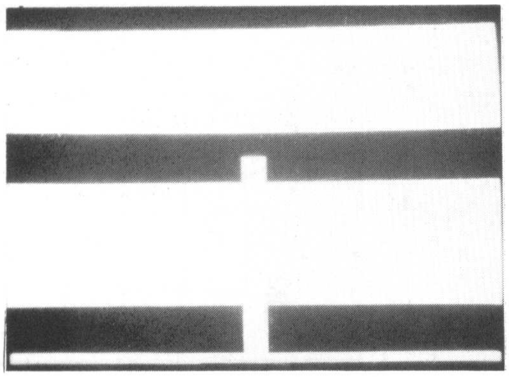

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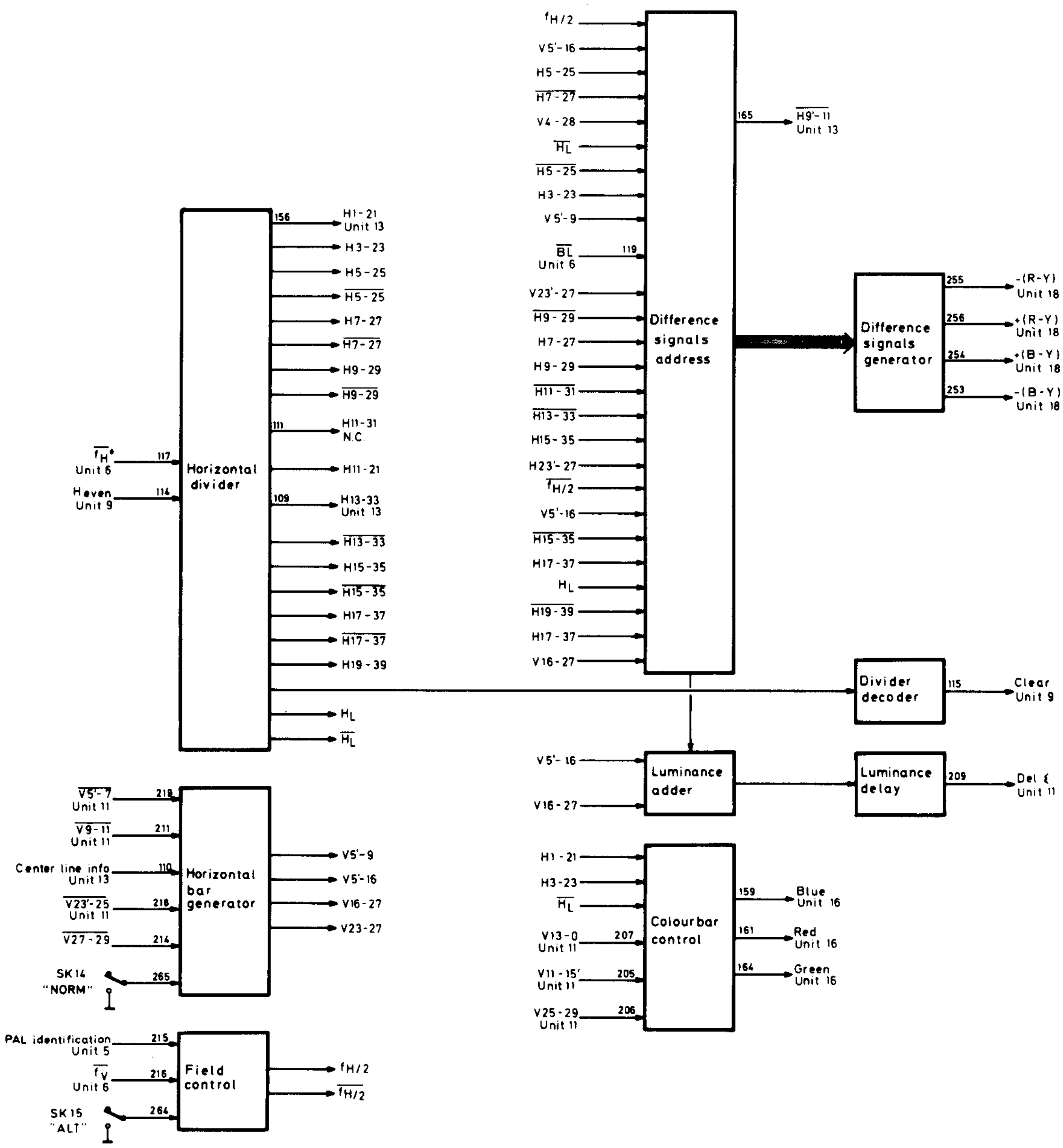


Fig. 17-2 Block diagram, colour diff. generator, unit 12

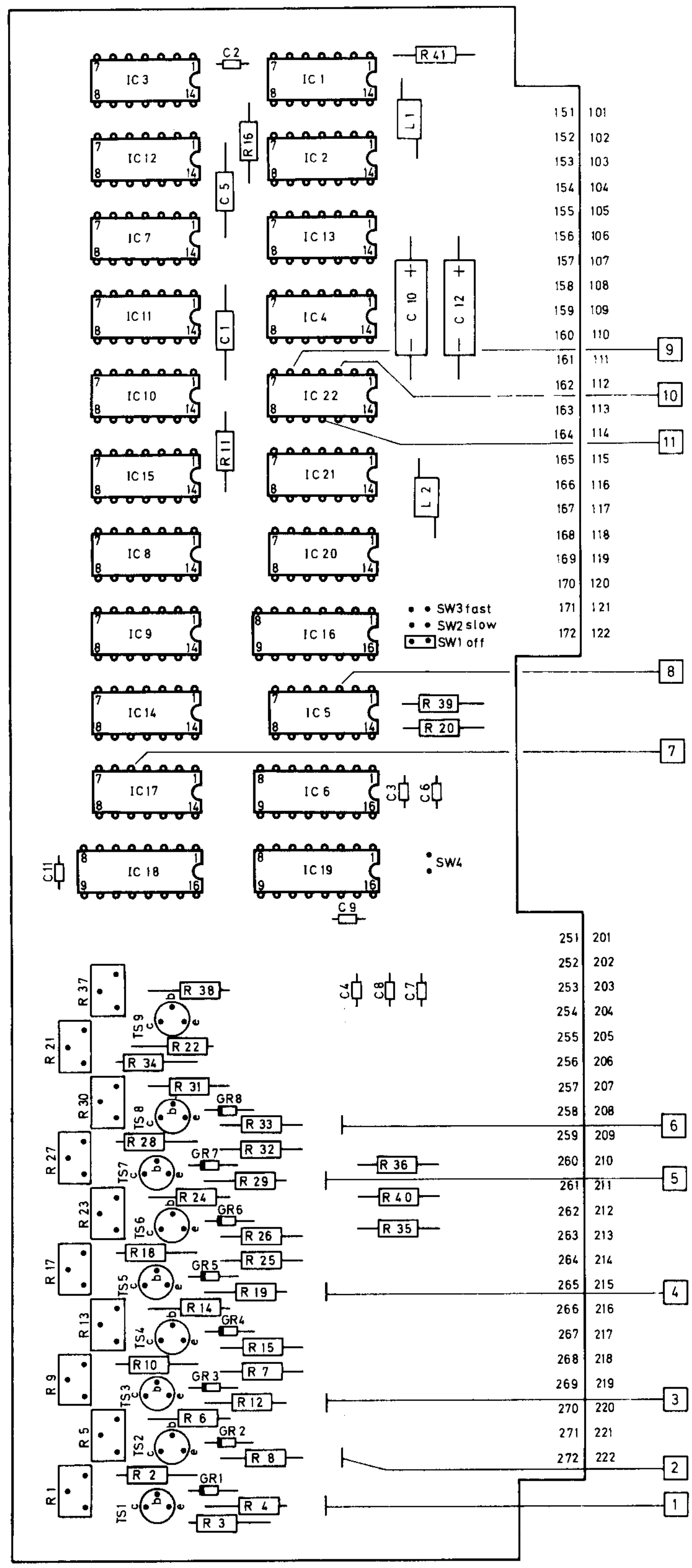
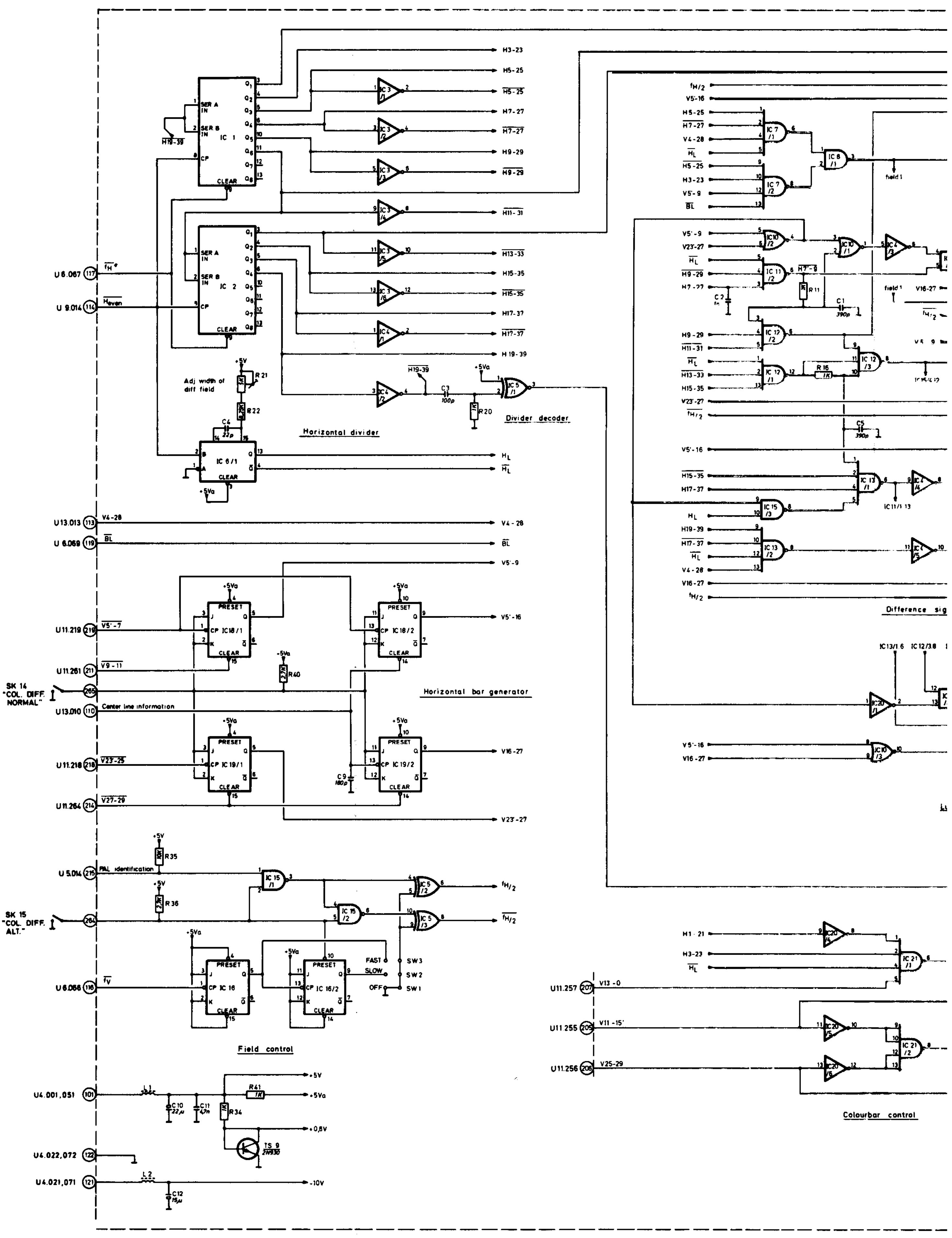


Fig. 17-3 Component location, colour diff. generator, unit 12



Horizontal divider
Adj width of diff field
Divider decoder
Horizontal bar generator
SK 14 "COL. DIFF. NORMAL"
Center line information
PAL identification
SK 15 "COL. DIFF. ALT."
FAST
SLOW
OFF
Field control
Difference sig
Colourbar control

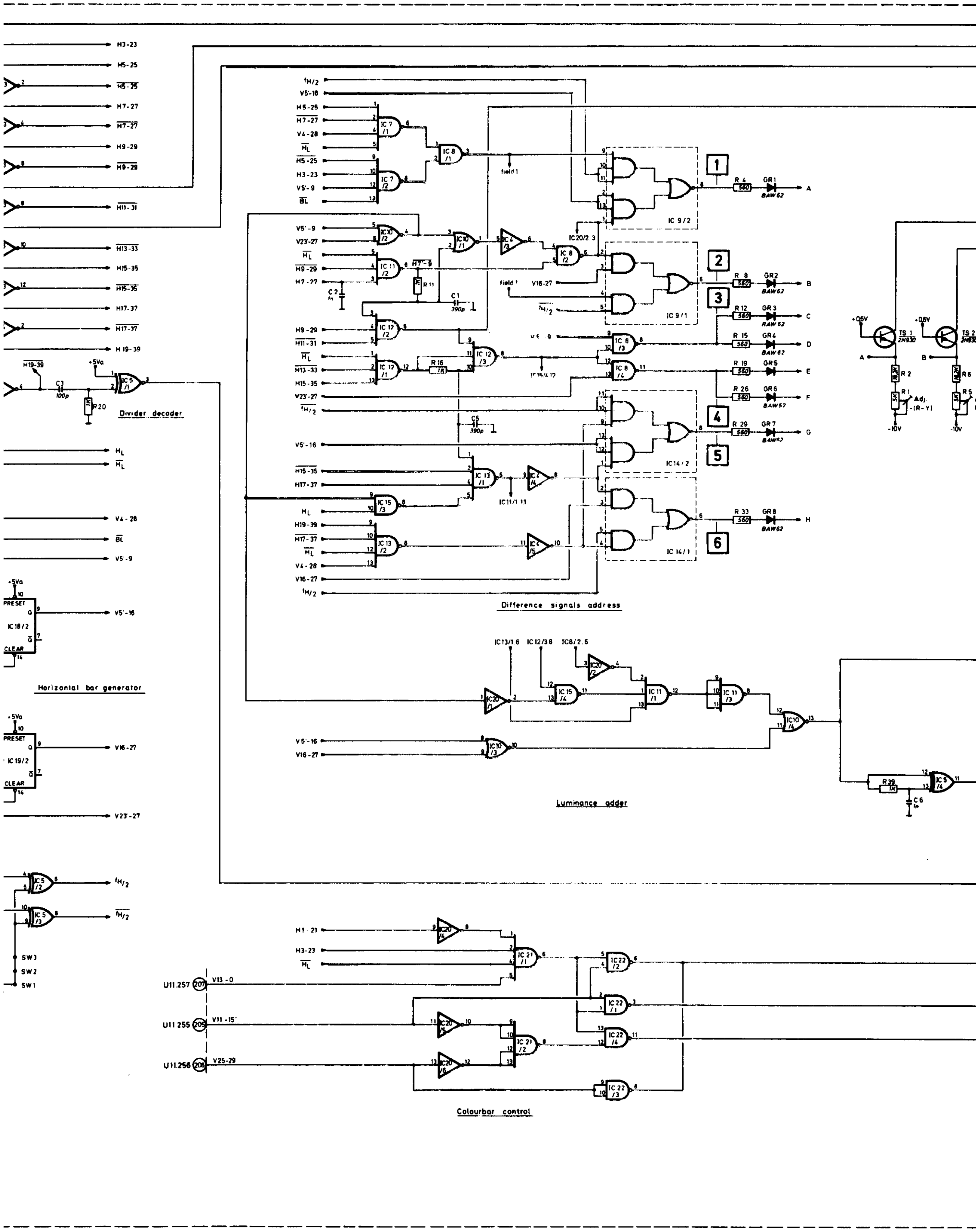

Divider decoder
Horizontal bar generator
Difference signals address
Luminance adder
Colourbar control

Fig. 1

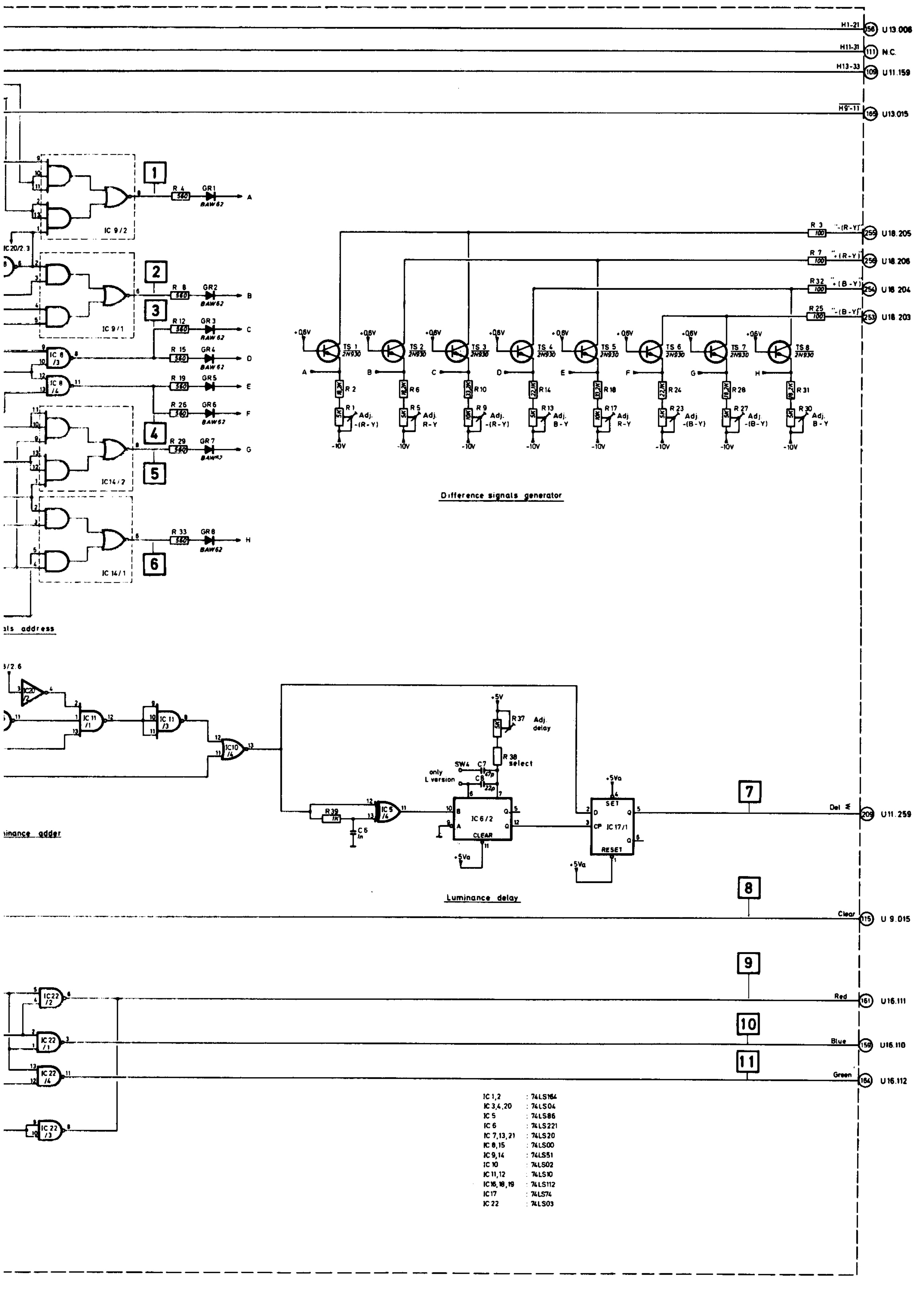


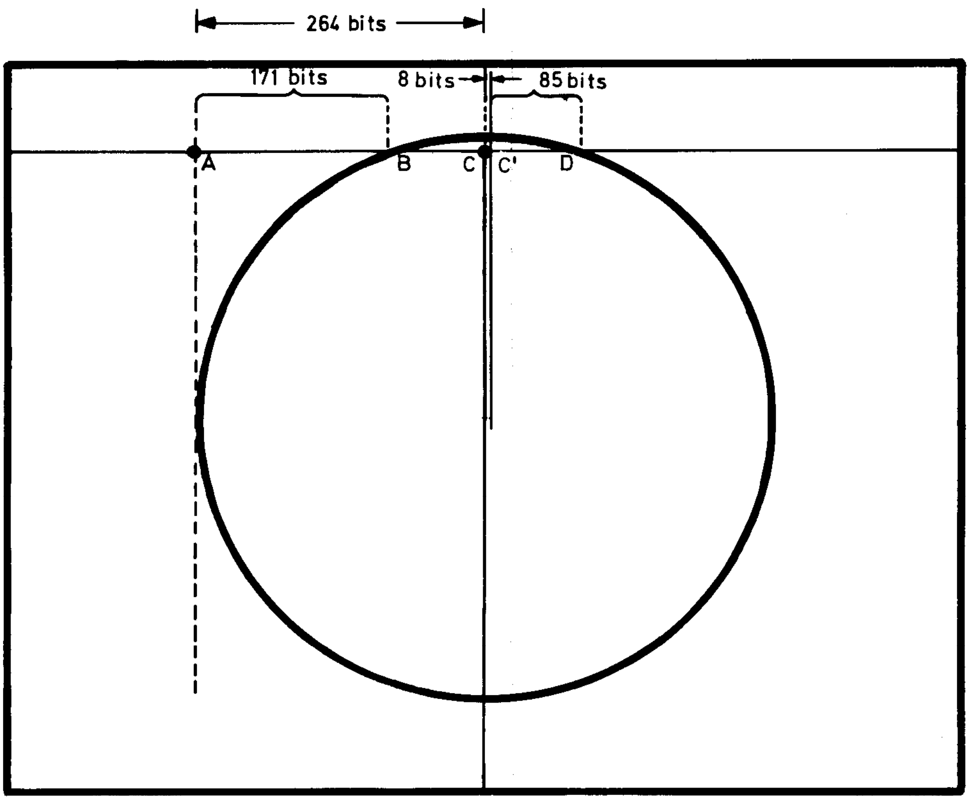
Fig. 17-4 Circuit diagram, colour diff. generator, unit 12

18. Unit 13 Circle generator

This unit consists of a circle register and a circle memory addressed by an address counter. A circle start/stop circuit controls the circle register.
Delayed ϕ and ϕ are outputs for the Y-signals and chrominance signals respectively while the centre line information mainly is a part of the black and white circle content on unit 11.

Principle of operation

The circle on the TV screen is built up by a number of line segments B-C and C-D.
For each line of the circle the length of B-D has a value determined by the circle geometry.
This line segment is expressed by a binary figure, characteristic for each single line and has been stored in a circle memory (ROM).



The conversion of the lineary figure (word) into a line segment is made in pre-settable circle register counter clocked by a 15 MHz clock pulse.

The address counter

The address counter consists of two up/down counters IC7 and IC11 in cascade.
The count direction is determined by the field identification pulse $f_{V/2}$. This pulse is "0" during the first field and "1" during the second field.
Consequently the address counter counts up during the first field period and counts down during the second field period.
The line pulses f_H* are used as clock pulses for the address counter and the outputs are addressing the memory.
In order to obtain a fixed start position for the address counter, the V3-28 pulse generates a load pulse which sets the counter to a certain value depending on the positioning of the coding pins SW2 and SW3.

PRE-SETTING OF THE ADDRESS COUNTER						
ADDRESS COUNTER		625 LINE SYSTEM		525 LINE SYSTEM		MEMORY
	OUTPUT	FIELD I	FIELD II	FIELD I	FIELD II	INPUT
IC 7	A	1	0	1	0	A1
	B	1	0	0	1	A2
	C	1	0	0	1	A3
	D	0	1	0	1	A4
IC 11	A	1	0	1	0	A5
	B	1	0	0	1	A6
	C	1	0	0	1	A7
	D	1	0	0	1	A8

The memory

The information stored in the memory is an 8-bit word, one for every line.
In each field period the circle is organized on 252 lines (G-version) or 204 lines (M-version) and the memory is a 256 x 8 bit ROM.
The 8 bit word in the memory is an expression of the line part A-B. The same word inverted is equivalent to the line part C'-D. All memory outputs, and hereby the memory word, are inverted by IC12 and IC14 controlled by the H2-22 pulse from IC5/2.

The circle register

Data inputs to the circle register are at first not inverted. Data is read into IC13 and IC15 at the H9' moment, and at H10 the count starts.
When Q_D (IC15) goes "0" IC16/2 is clocked and the output of IC16/2 now indicates the leftmost edge of the circle. Q_D is also the stop count pulse for the control circuit "circle start/stop".
H2-22 from IC5/2 now inverts the memory word and IC13 and IC15 are reloaded by IC10/2.
At H22 +8 bit the counting starts again and continues intil Q_D goes "0" for the second time.
IC16/2 changes its state forming the rightmost edge of the circle.
By means of V4-28 the circle is gated out in the vertical direction by IC9/1.

Circle start/stop

This circuitry operates the circle register by telling it when to start and stop counting. During one line the circle register is operated twice.
A load pulse from IC10/2 is generated on H9' and H22, and the circle register is clocked by the 15 MHz clock pulse via the clock gate IC9/3.
The clock gate is controlled by the flip-flop IC16/1 and is opened twice during one line. The clock pulse input to the flip-flop is the "stop count" pulses while the preset input is the "start count pulses".
The start pulses are generated at H10 and H22 +8 bit. The 8 bit delay is a necessity because of the maximum width of the half-circle being 264 bits, while the memory word only is capable of expressing 256 bits at the most.
The H2-22 pulse generated from IC5/2 is delayed 8 bits by IC6. The pulses H10 and H22 +8 bits are added by IC4/1 and differentiated by R2/C2. The output obtained from IC9/4 is two negative going needle pulses at the horizontal positions H10 and H22 +8 bits.

Circle delay

The delayed circle "Del.ϕ" is a signal used as part of the black and white information.
Positive and negative transitions from IC9/1 are clocked through IC5/1 by means of delayed pulses from IC10/1.
SW1 is only connected in the secam version in order to obtain a longer delay.

Centre line decoder

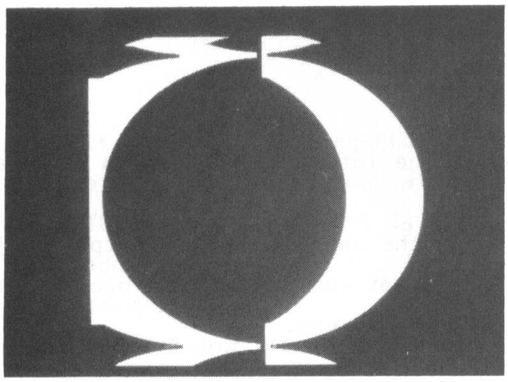
The centre line decoder supplies the centre line information. Being a vertical signal no delay of this signal is necessary.
IC2/3 gives a negative going output only when the address counter output is 1000 0000. Loading of the address counter is so arranged that the centre line occurs with inverted interlacing with respect to the rest of the pattern.

Checking and adjusting

Measuring instruments:

Oscilloscope : e.g. PHILIPS PM 3240X

Connect an oscilloscope to a pattern output and terminate with 75 ohms.
Obtain on the oscilloscope the third and the fourth white vertical line and adjust R12 to obtain a circle start to be placed in the middle between these two lines. Then check that the circle finishes between the third and fourth last white line. Distribute possible inaccuracy on each side of the circle.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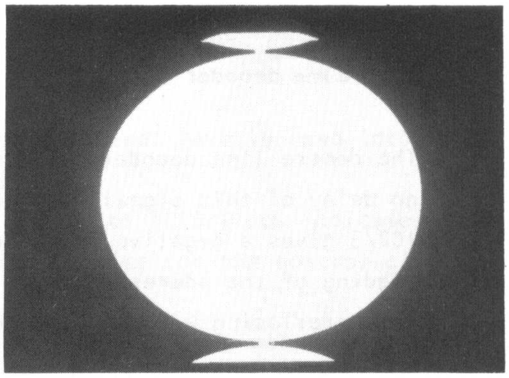
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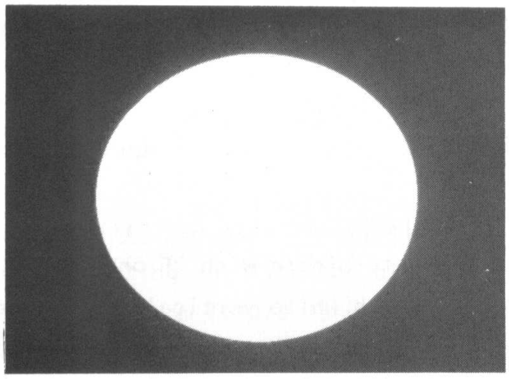
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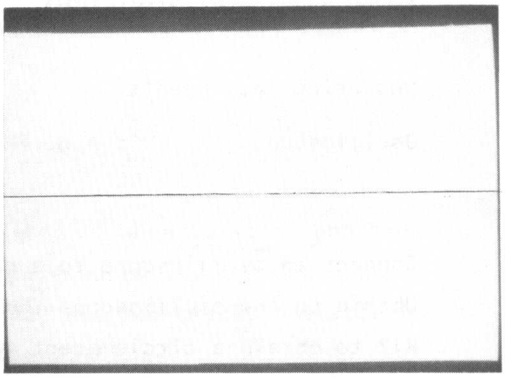
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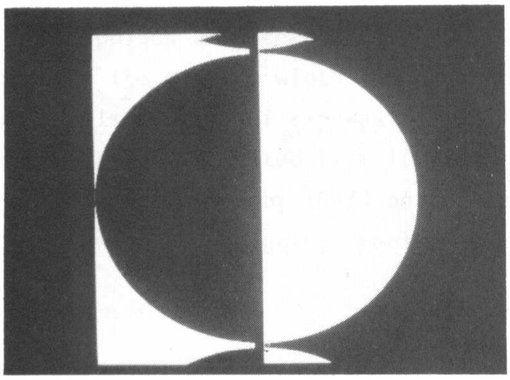
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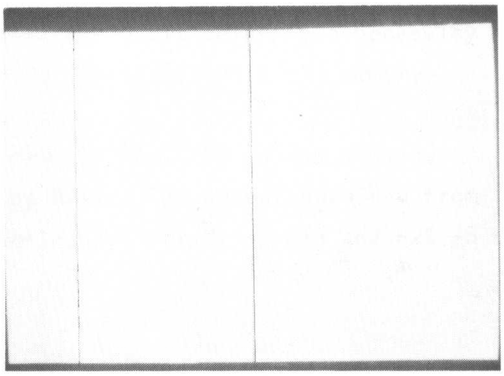
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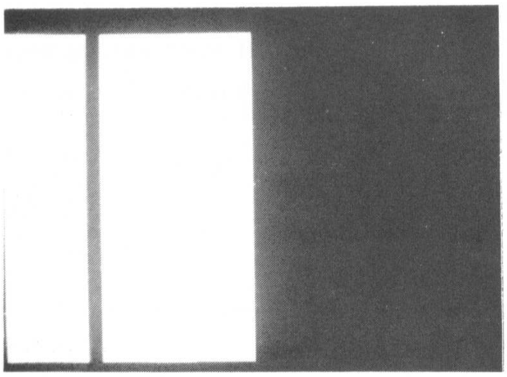

7

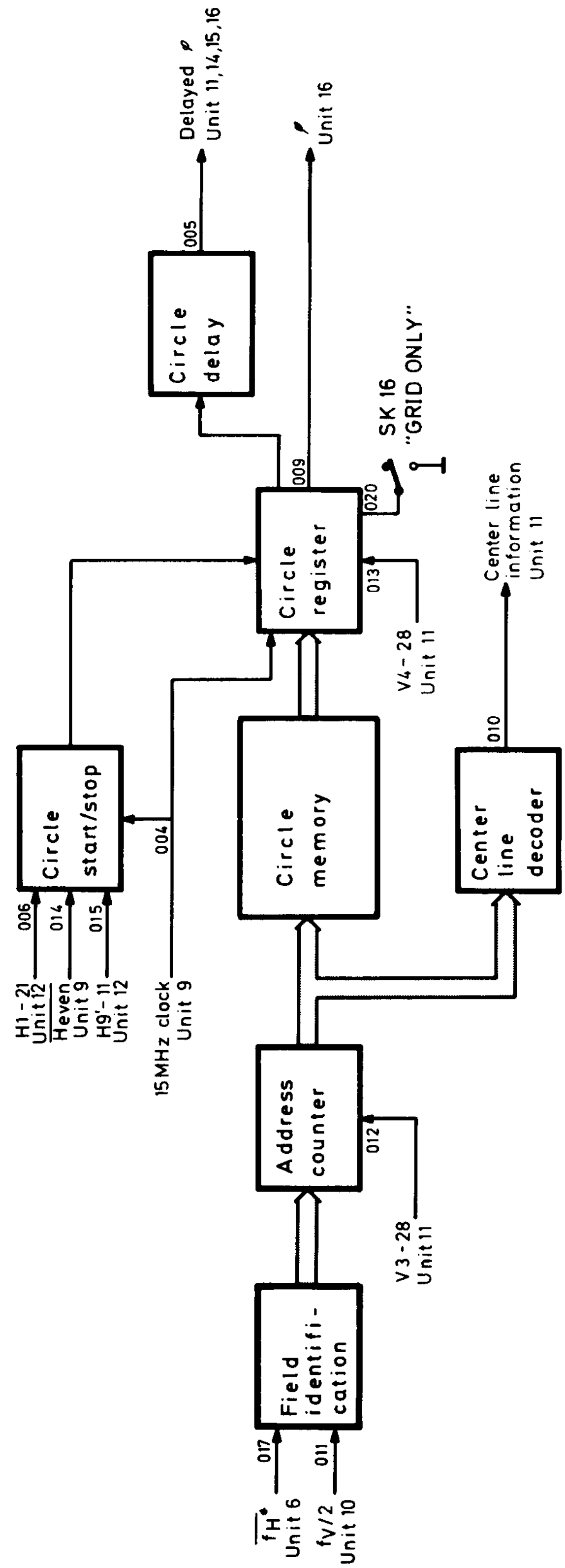
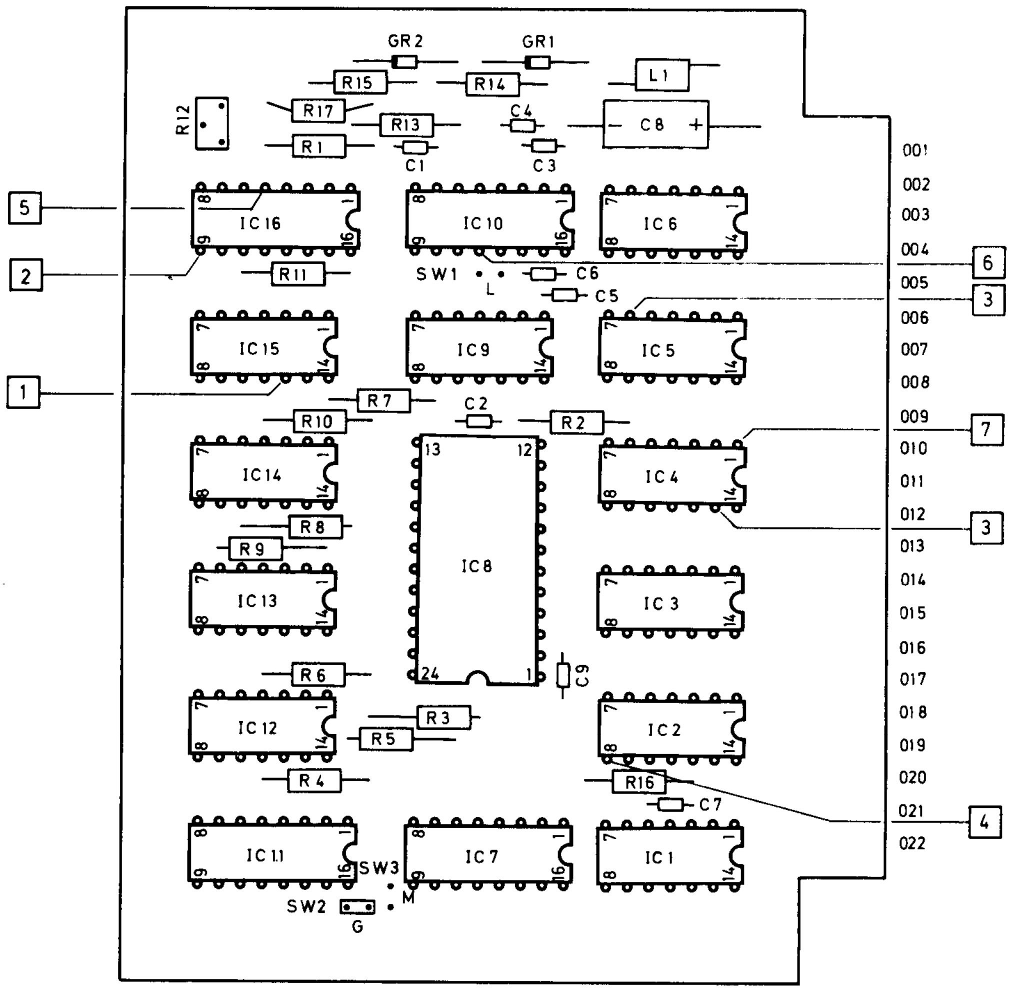
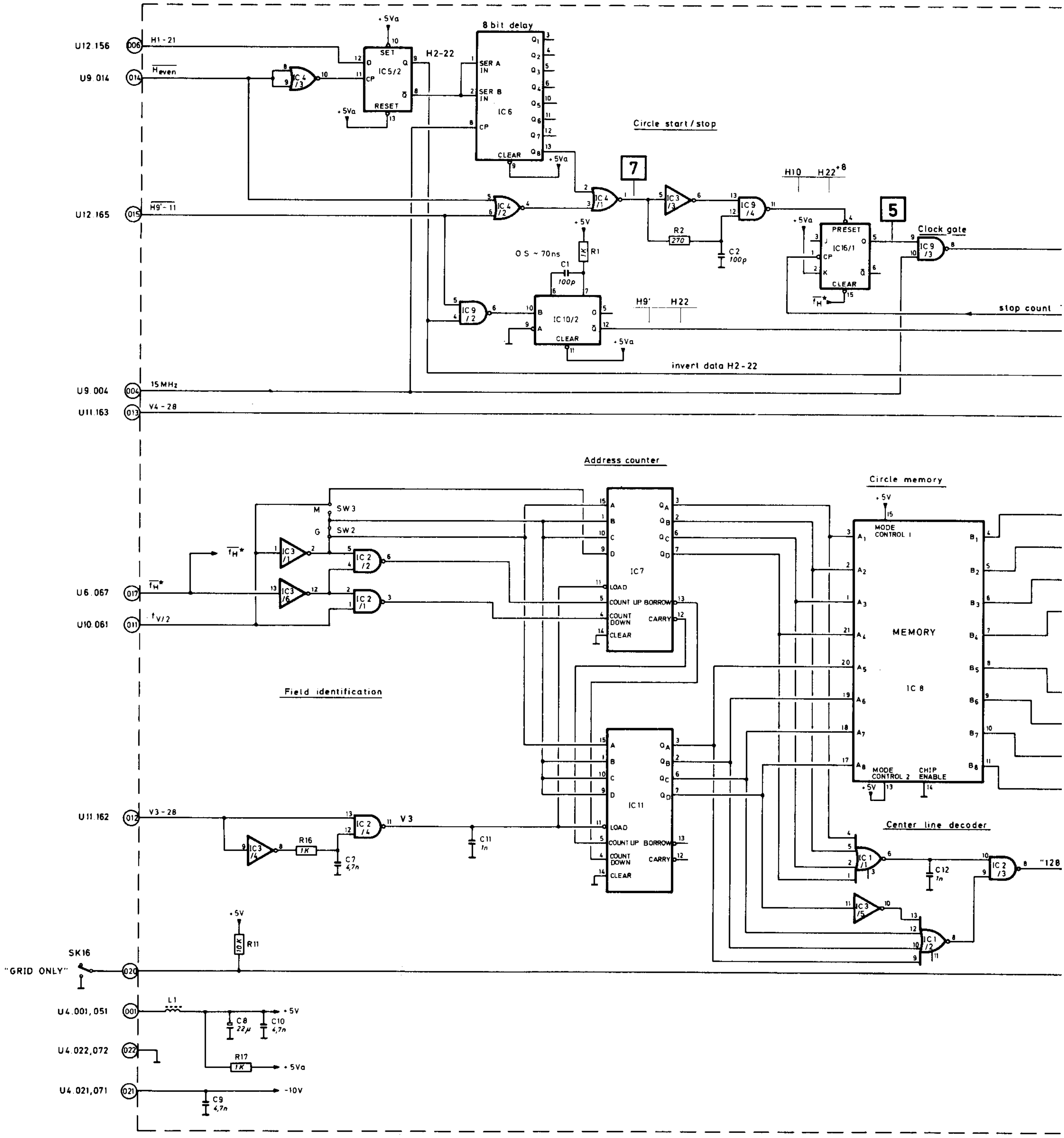


Fig. 18-1 Block diagram, circle generator, unit 13



82551

Fig. 18-2 Component location, circle generator, unit 13



U12.156
H1 - 21
U9.014
Heven
U12.165
H9' - 11
U9.004
15MHz
U11.163
V4 - 28
8 bit delay
IC 6
IC 5/2
H2-22
Circle start / stop
Clock gate
stop count
invert data H2 - 22
OS ~ 70ns
IC 10/2
IC16/1
H10
H22
H9'
H22
Address counter
IC 7
IC 11
Circle memory
MEMORY
IC 8
Center line decoder
Field identification
U6.067
U10.061
U11.162
V3 - 28
V3
SW 3
SW 2
SK16
"GRID ONLY"
U4.001, 051
U4.022, 072
U4.021, 071
+5V
+5Va
-10V
"128

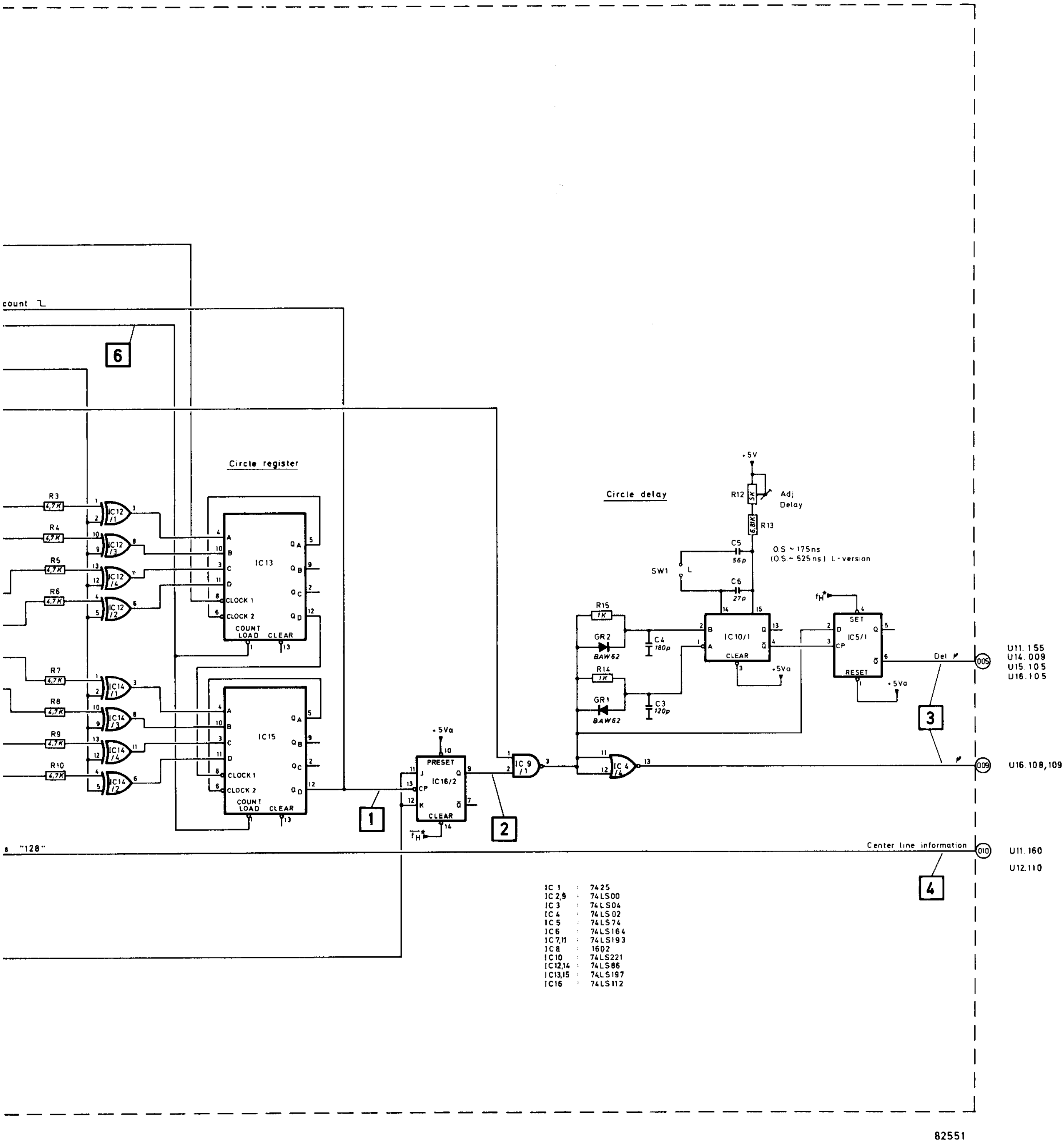


Fig. 18-3 Circuit diagram, circle generator, unit 13

19. Unit 14 Greyscale generator

The greyscale generated on this unit is given as a current to the output amplifier unit 19.

Greyscale level control

The greyscale level control consists in principle of ten independent current generators TS3 to TS12.
Each current generator contributes with 10% of the total current flow. 6/11 steps merely indicates that the black level is included, but no current is flowing.
Assuming a 10 riser greyscale signal is to be provided, current generator TS3 is activated and a current flows through R45 provided the current switch is open. This current flow indicates the first greyscale level (10%). The second greyscale level (20%) is obtained by addressing TS4 as well as TS3, thus the two currents are added and flowing through R45.
Each of the following steps are then made by adding one more current generator to the generators already employed.

Greyscale address

The entire function of the greyscale level control is controlled by the greyscale address circuit. This consists of two shift registers IC1 and IC3. The function of these registers is controlled by command pulses from unit 11. In the ten riser greyscale mode terminal 012 is "1" and the greyscale address acts as a serial shift register which activates one more current generator for each greyscale clock received from unit 11 at terminal 8.

In the 5 riser greyscale mode terminal 012 is "0", and the greyscale address works as a parallel shift register. In this mode each greyscale clock pulse causes the greyscale address to employ two current generators, which means that the first greyscale level obtained will be 20% of the maximum level, the second level will be 40% and so on.
At the same time the greyscale clock frequency from unit 11 will be only half the frequency in order to extend the diviation of the five riser greyscale to be similar to that of the 10 riser greyscale.

Greyscale on/off

The greyscale on/off circuit operates the current switch TS13-TS14. The delayed circle information on terminal 9 is "0" at IC5.8. and GR22 will switch off TS2. Outside the circle IC5.8 will be "1" and TS2 is then turned on. GR23 is of no interest in this situation.

Greyscale current switch

The bias voltages for TS13 and TS14 are produced by R38, R39 and R40 enabling a current to flow via R45, TS14 and TS13 to the greyscale level control.
However, when TS2 goes on +5V will be added to TS14 emitter which then goes off disabling the current flow.

Checking and adjusting

Measuring equipment :

Video level meter : e.g. PHILIPS PM 5548
TV monitor : e.g. PHILIPS LDN 5006

This unit should be adjusted only after the output amplifier unit 19 has been carefully aligned for black level 0V and white level 700 mV for all versions.
On unit 11 the 11 step greyscale should be selected by means of SW7 and SW8.
Position the video level meter marker on the greyscale from black to white and obtain a 70 mV increase for each step by adjusting R9, R12, R15....R36 in that order.
Realign unit 19 for IRE amplitude and select SW7 and SW8 on unit 11 as required.

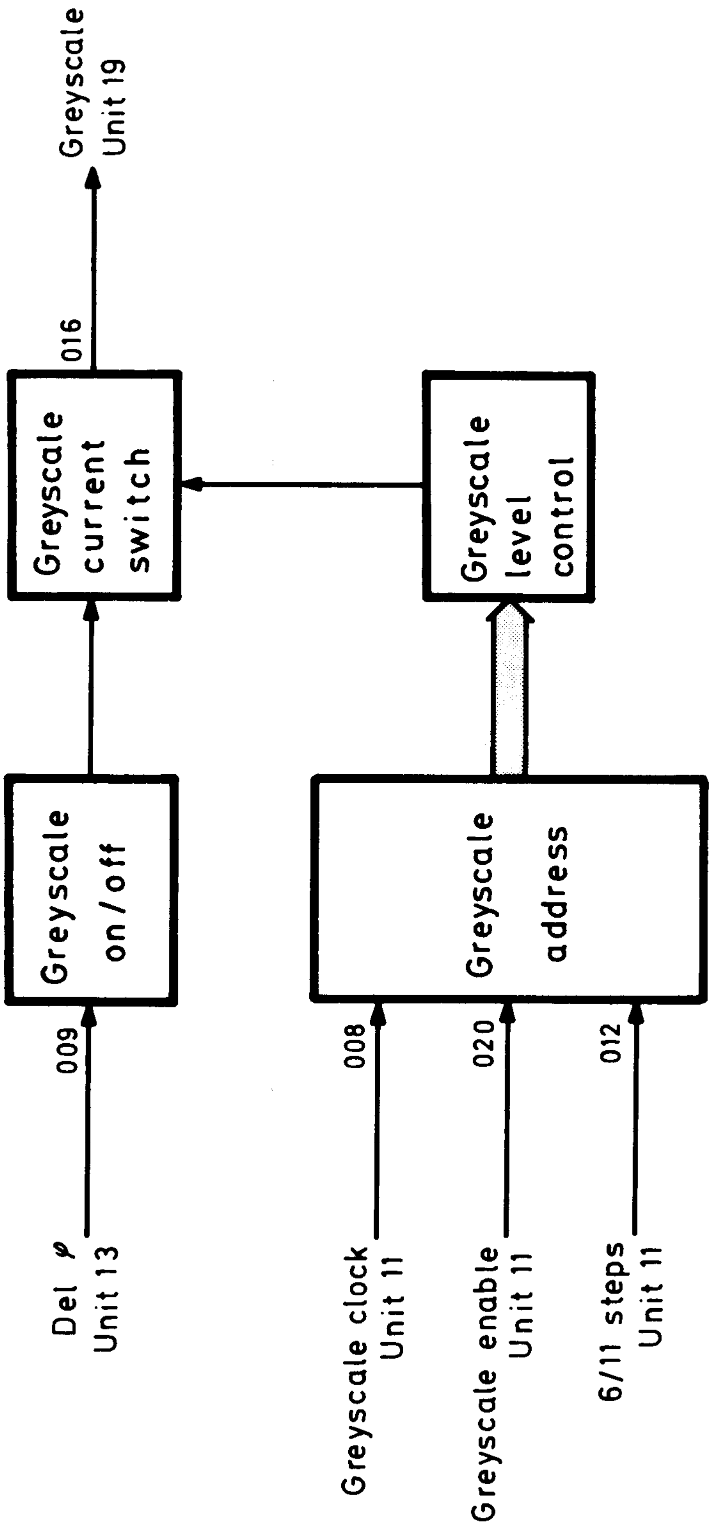


Fig. 19-1 Block diagram, greyscale generator, unit 14

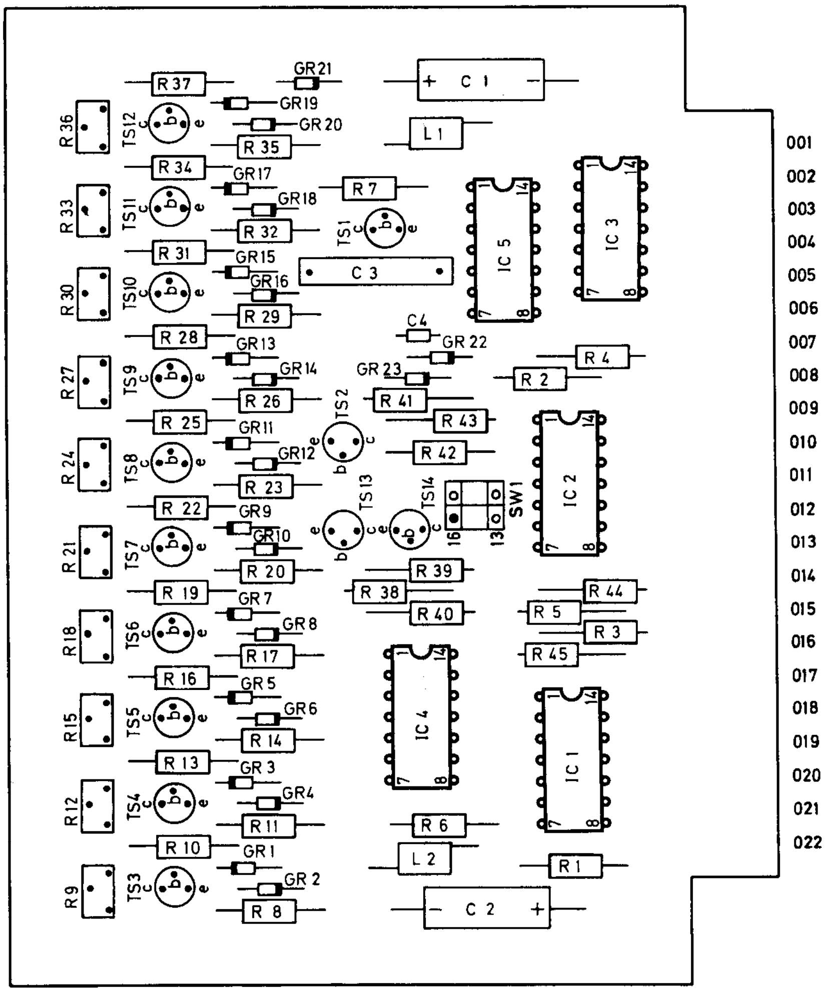
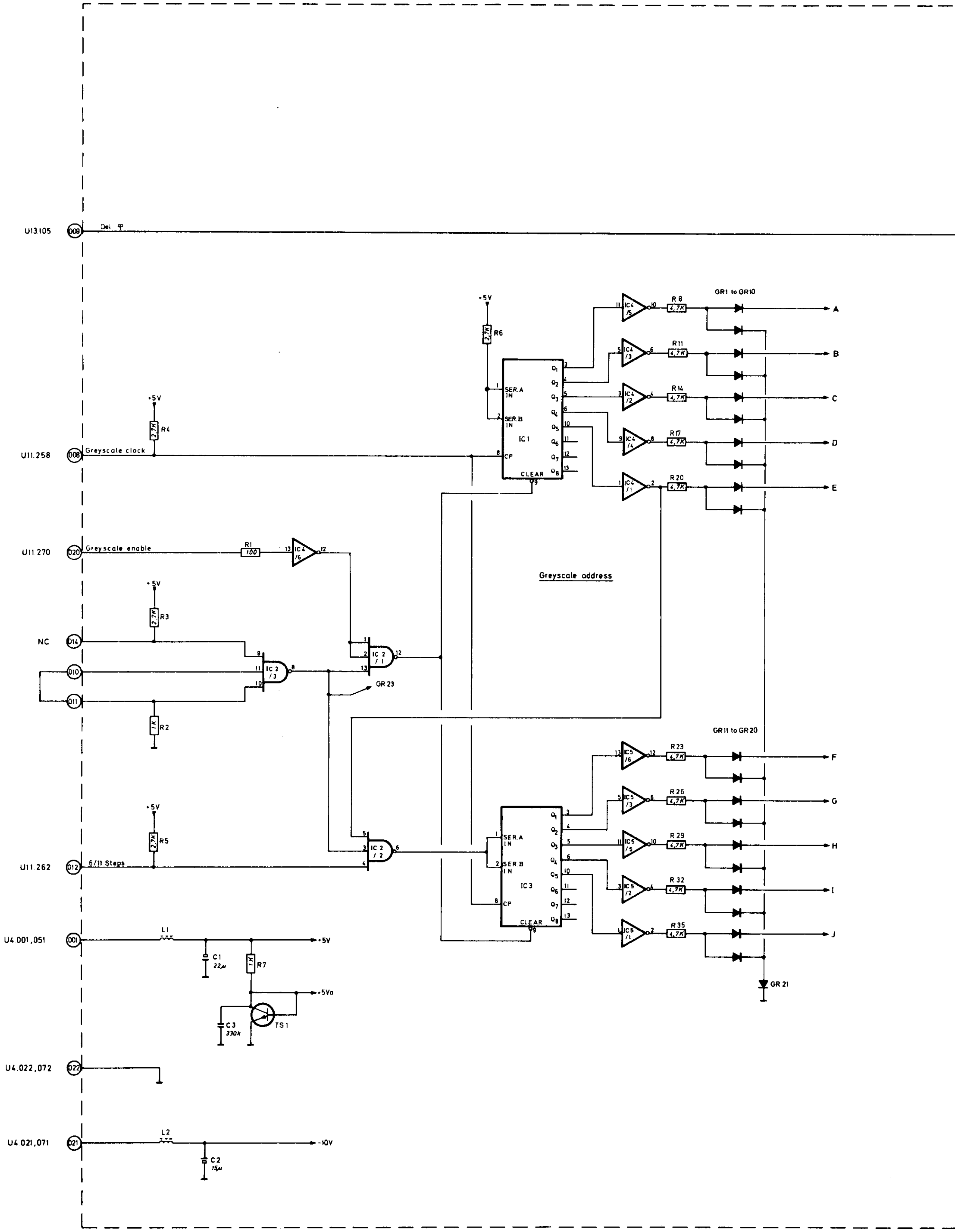


Fig. 19-2 Component location, greyscale generator, unit 14



U13105
Del φ
U11.258
Greyscale clock
U11.270
Greyscale enable
NC
U11.262
6/11 Steps
U4.001,051
U4.022,072
U4.021,071
+5V
R4
R3
R2
R5
R6
R1
100
IC1
IC3
IC2 /1
IC2 /2
IC2 /3
IC4 /6
SER.A IN
SER.B IN
CP
CLEAR
GR 23
Greyscale address
GR1 to GR10
GR11 to GR20
GR 21
R 8
R11
R14
R17
R 20
R 23
R 26
R 29
R 32
R 35
A
B
C
D
E
F
G
H
I
J
L1
L2
C1
22µ
C2
15µ
C3
330k
R7
TS1
+5Va
-10V

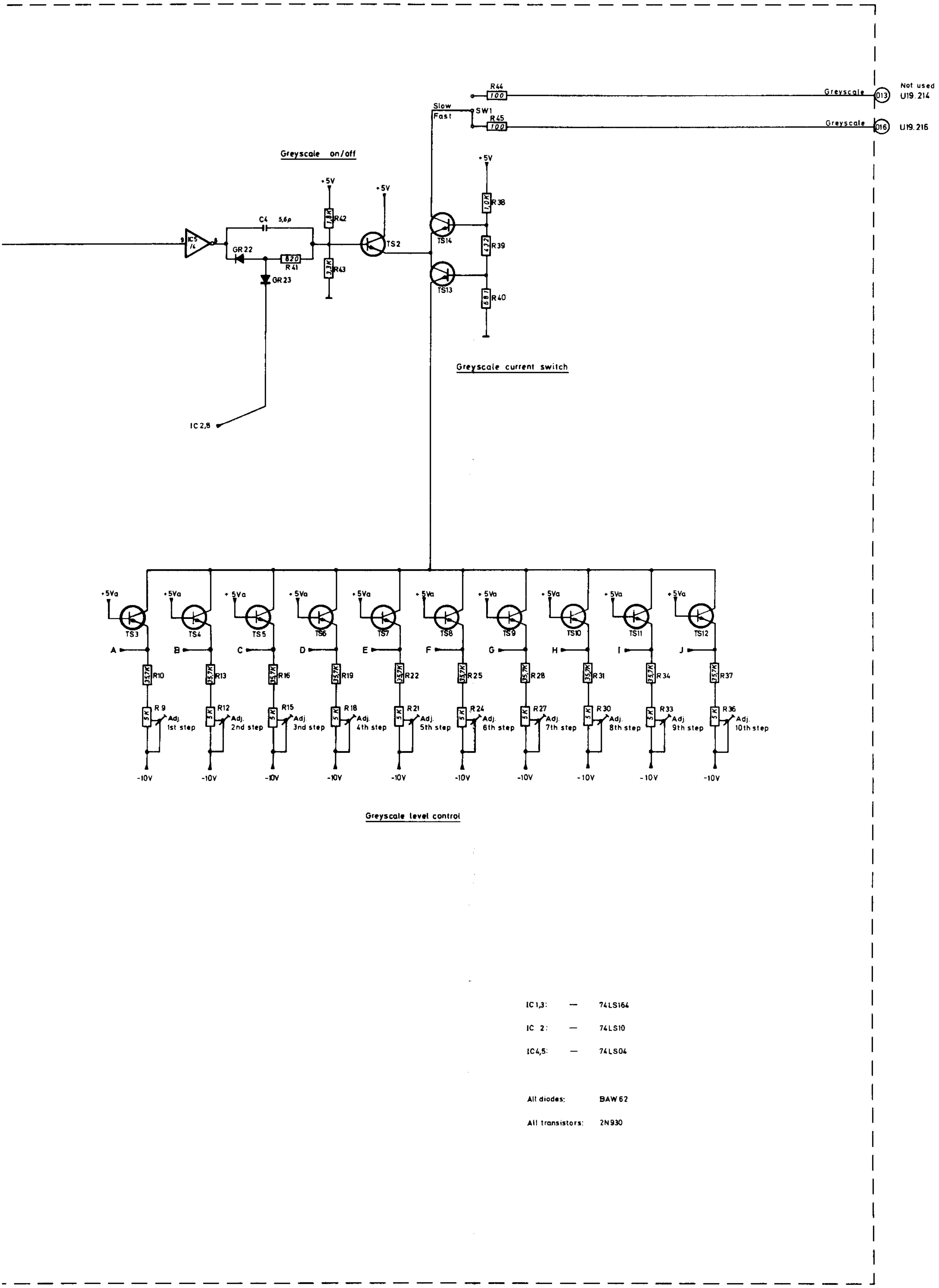


Fig. 19-3 Circuit diagram, greyscale generator, unit 14

20. Unit 15 Multiburst generator

This unit supplies the multiburst signal being part of the circle information. The output is negative going and is supplied as a voltage directly to the output amplifier unit 19.
In principle the generator consists of a current controlled triangle oscillator and a sinewave shaper.

The oscillator

When the instrument is switched on, C7 holds 0V.
The multiburst enable signal from terminal 108 will be present as a negative going signal at TS31 collector. Outside the multiburst area TS33 is on and IC8 determines the black level as a voltage across C7.
The multiburst enable signal switches off TS32 and hereby also TS25. A current "I" will now be allowed to flow via TS26 and charge C7. This voltage increase is sent as a signal to TS36 via a buffer TS21 and an emitter follower TS22.
The "triangle amplitude control" is a comparator circuit. The voltage is divided between R69 and R78/TS35 and compared to a positive or negative voltage, adjustable by R76 and R72 respectively.
As the "signal" goes positive, TS29 eventually is switched off and TS30 switched on. TS30 now supplies a current for GR17 (tunnel diode) making it jump to a higher d.c. level.
This new level switches on TS20, and the 2 x I circuit now draws a current half of which is taken from TS26 and the other half from C7 discharging it.
The output from TS22 is now negative going and is compared to the negative reference (R72). When TS23 eventually turns off and TS24 on the voltage across GR17 declines making it jump to its lower level causing TS20 to switch off and the cyclus is finished
The multiburst enable signal has turned on TS33 outside the multiburst area, and allowed IC8 to determine the black level. It also has operated TS32, TS25 and TS26 causing the oscillator to start by letting the current I flow. The positive going trailing edge of the pulse now momentarily switches on TS34 causing TS28 to switch on and TS27 off.
The d.c. level across GR17 will go low, if not already being so and TS20 will be in the off-state.
So will also TS26 operated by TS25 and TS32.
The oscillator is back to its off-state and IC8 determines the d.c black level across C7.

Oscillator control current

Two circuits supply currents for the generation of the positive and negative going output.
TS16 supplies the current I while TS18 supplies the current 2xI.
In order to obtain correct matching of the entire frequency range, two adjustable elements are present.

Multiburst frequency control

The I and 2I generators are controlled by 5 or 6 current generators (depending on version in question).
TS7-TS12 are activated one at a time making it possible to adjust each frequency independently. The current generators again are controlled by a shift register.

Multiburst address

This is a shift register controlled by the multiburst clock signal from terminal 103.
During line blanking a "1" is present at IC3.1.
When IC3 is clocked the "1" will pass to the output Q_1 causing the monostable multivibrator IC2 to change state.
The following clock signal will cause the "1" to move to Q_2 while Q_1 returns to "0".
IC2 does not change state until the following line blanking period f_H*.
The outputs A, B, C.....F control the multiburst frequency control circuit, but are themselves controlled by TS3 in the sweep control circuit.

Multiburst control

From this circuit two outputs are supplied:
The multiburst enable signal and the centre cross cut.
IC1/1 adds the multiburst enable signal and the centre cross information resulting in a square identical to the centre cross incision in the multiburst bar.
For I-versions the multiburst enable signal is prolonged in order to obtain six frequency areas, and in this instance the Del.ϕ information from terminal 105 is added to the centre cross cut in order to limit the multiburst bar to the circle periphery.

Amplifier

This amplifier acts a buffer and supplies the signal to the sine shaper of approximately 75 ohms impedance.
TS37-38 subtract the centre cross cut from the multiburst signal and in I-versions also the circle periphery.

Sine shaper

At the joint R106/R115 the triangular signal is influenced by the sine shaper circuit. The transistors TS46-TS51 are switched at different levels above and below the average value of the supplied signal.
The top and bottom of the triangular wave is influenced by TS46 and TS51 as they draw a relative high current when turned on. The other transistors have their influence at different levels of the signal, resulting in a near enough sine wave.
Top and bottom limits can be adjusted by R98 and R112 respectively

Attenuator

R128 or R129 selected by SW5 or SW6 attenuates the signal to 50% or 75% white level respectively.
100% multiburst gain is adjusted by R130 and the negative going signal is supplied to the output amplifier unit 19 via the emitter follower TS59.

Sweep control

Facility is provided for displaying a sweep signal instead of the multiburst bar.
An externally controlled sweep signal can be obtained by adding the control signal to terminal 110 and selecting SW1.
An automatic sweep is obtained if SW2 is selected.
In this instance the field signal f_V opens TS2 during the field blanking period discharging C1. The current generator TS4 recharges C1 during the field period giving a linear increasing frequency output from the oscillator.
When any sweep mode is selected, TS3 is switched on disabling the multiburst address outputs.

Checking and adjusting

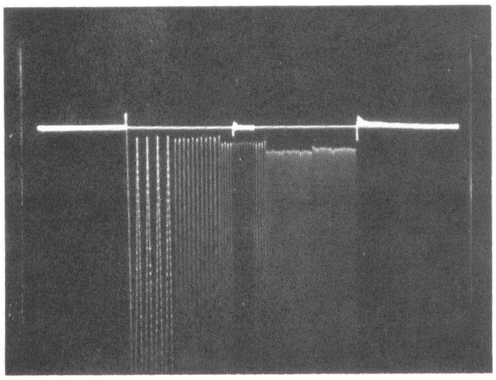
Measuring instruments:

Oscilloscope : e.g. PHILIPS PM 3240X

Before any attempt is made to adjust this unit, make sure that the instrument has been switched on for at least 15 min. and the power supply has been correctly adjusted.
If complete readjustment of the multiburst generator is necessary adjust the potentiometers R12, R42 and R52 to mid-positions. Switch off SW5 and SW6.

Black level

Connect an oscilloscope to 1 and adjust R67 to obtain a black level coinciding with the multiburst black in the centre cross area.



1 0,5V/div. 5μs/div.

Positive amplitude

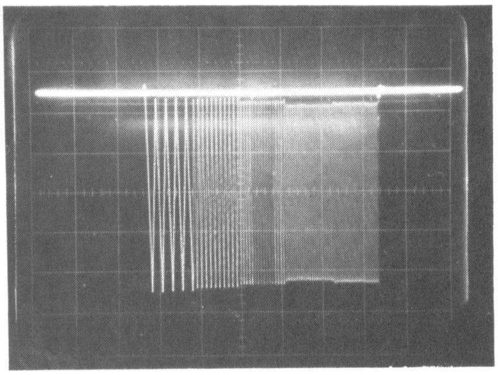
With the oscilloscope at 1, adjust R72 to obtain a coincidence between the low frequencies and the black level.

Negative amplitude

Adjust R76 to obtain a 5Vp-p amplitude at the low frequencies.

Symmetrical amplitude

Adjust R42 and R52 several times in turn to obtain the best possible symmetrical display.



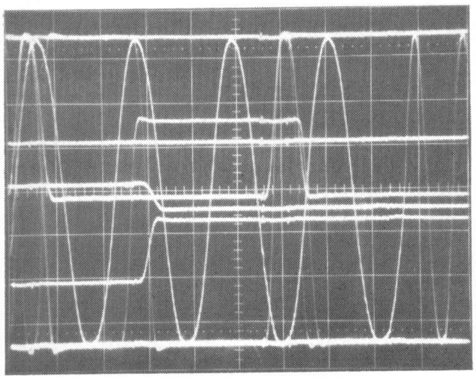
1 MB 1V/div. 5µs/div.

SYMMETRICAL TRIANGLE

The oscilloscope at 1 . Time base 10µs/div., delayed: 0.2µs/div.
Adjust R12 to obtain a symmetrical triangle at the lowest frequency.
Change time base to 10µs/div., delayed: 0.05µs/div.
Adjust R32 to obtain a symmetrical triangle at the highest frequency.
Repeat adjustment for the low frequency.

Distortion

1 Connect an oscilloscope (0.1V/div., 10µs/div., delayed: 0.5µs/div.) to a pattern output terminated with 75ohms.
Remove unit 18.
Adjust R98 and R112 to best sine wave.



0.1V/div. 10µs/div. Delayed: 0.5µs/div.

MULTIBURST AMPLITUDE

Connect an oscilloscope (0.1V/div, 10µs/div delayed: 0.5µs/div) to a pattern output terminated with 75ohms.

Adjust R130 till multiburst amplitude is 100%.
After this adjustment, check the DC black level on unit 19.

MULTIBURST FREQUENCIES

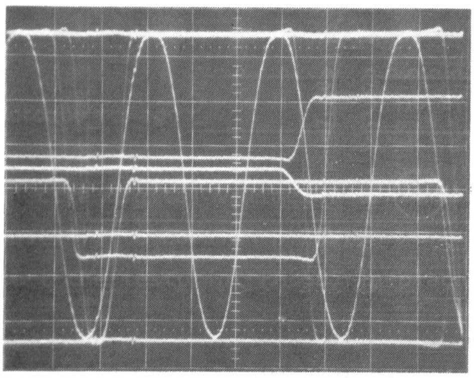
Connect an oscilloscope to a pattern output terminated with 75ohms.
Remove unit 18. Work out the display of the oscilloscope in use.

G-version:
Time base 10µs /div., delayed: 0.2µs/div.
Adjust R16 to obtain 0.8MHz = 1.25µs
Adjust R18 to obtain 1.8MHz = 0.56µs
Adjust R20 to obtain 2.8MHz = 0.36µs
Adjust R22 to obtain 3.8MHz = 0.26µs
Adjust R24 to obtain 4.8MHz = 0.21µs

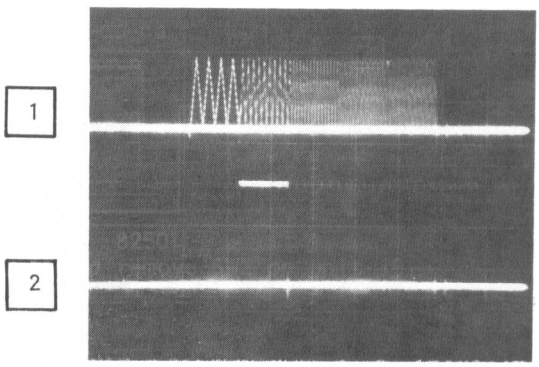
M/N-versions:
Time base 10µs/div., delayed: 0.2µs/div.
Adjust R16 to obtain 0.5MHz = 2µs
Adjust R18 to obtain 1.0MHz = 1µs
Adjust R20 to obtain 2.0MHz = 0.5µs
Adjust R22 to obtain 3.0MHz = 0.33µs
Adjust R24 to obtain 4.0MHz = 0.25µs

I-version (special):
Time base 10µs/div., delayed: 0.2µs/div.
Adjust R16 to obtain 1.5MHz = 0.67µs
Adjust R18 to obtain 2.5MHz = 0.4µs
Adjust R20 to obtain 3.5MHz = 0.29µs
Adjust R22 to obtain 4.0MHz = 0.25µs
Adjust R24 to obtain 4.5MHz = 0.22µs
Adjust R26 to obtain 5.25MHz = 0.19µs

Reinsert SW5 or SW6 if desired.



0.1V/div. 10µs/div. delayed: 0.2µs/div.
The oscillogram shows 1.8MHz = 0.56µs



1.0V/div. 5µs/div.

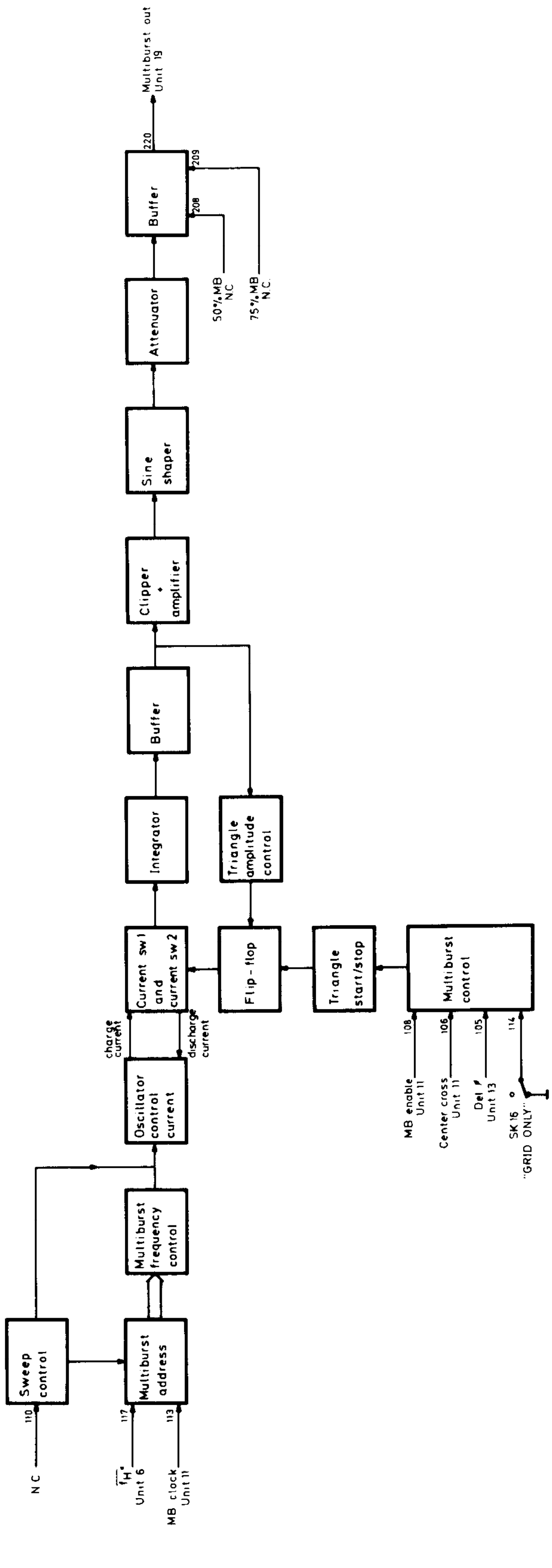


Fig. 20-1 Block diagram, multiburst generator, unit 15

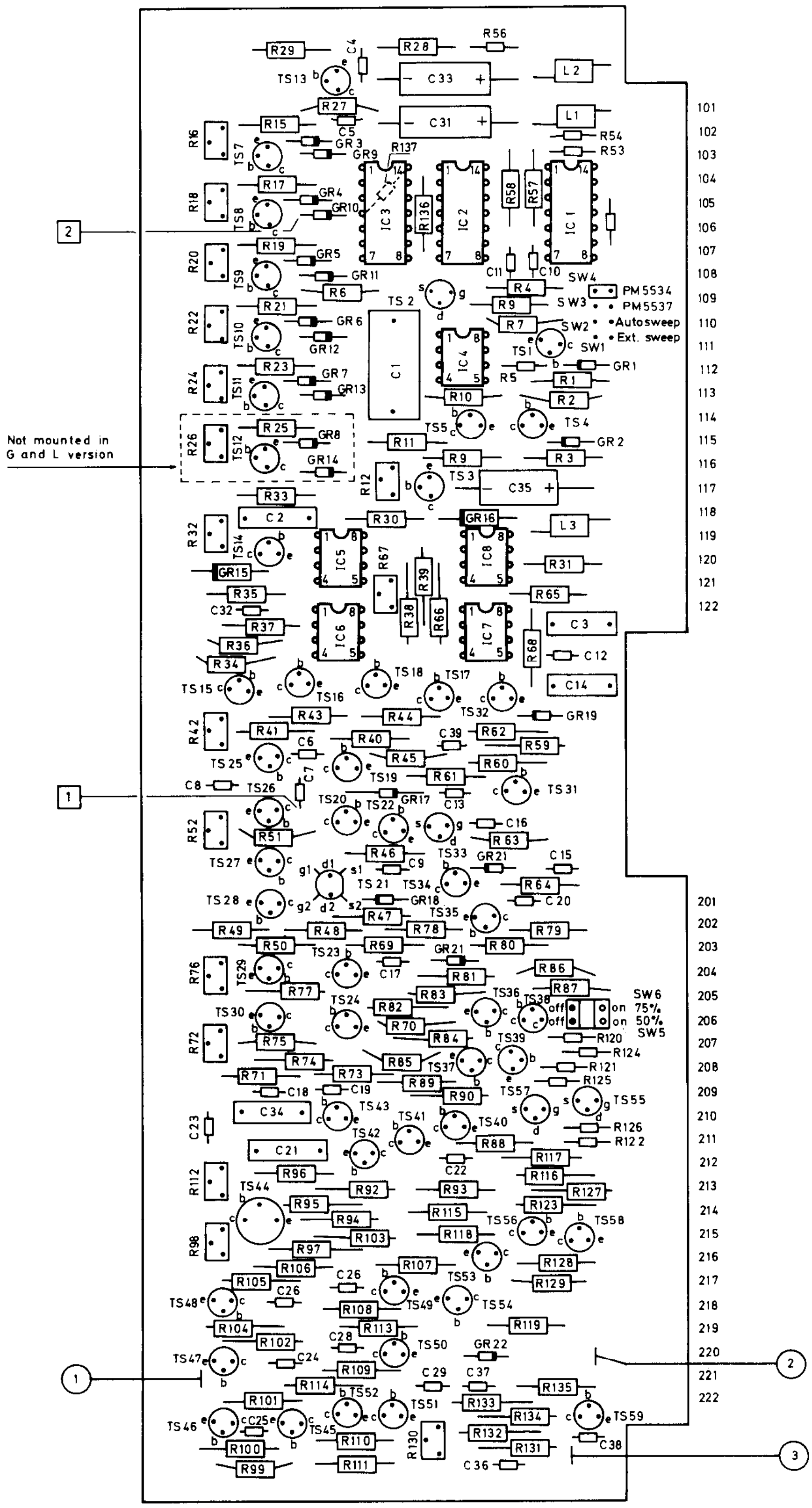
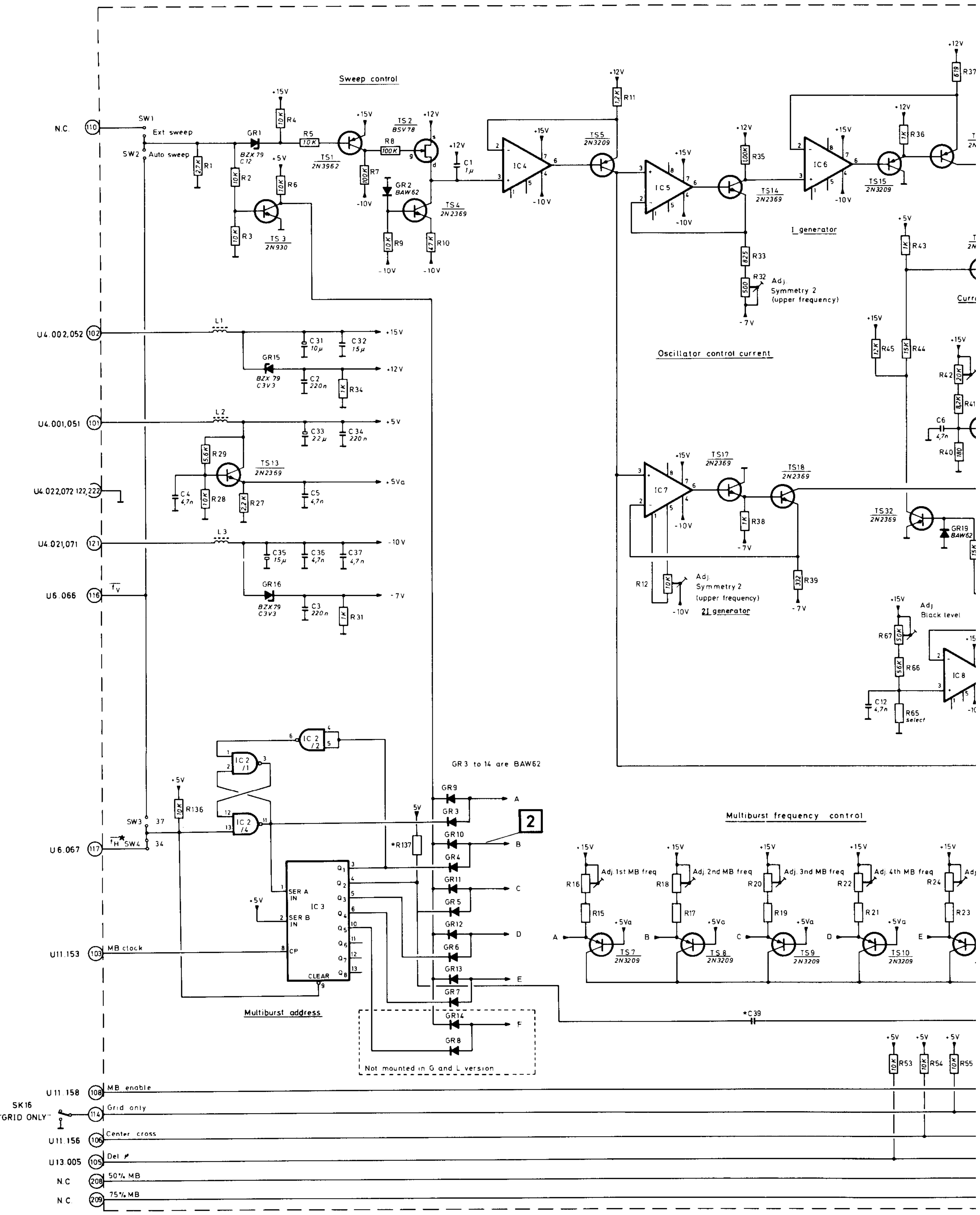
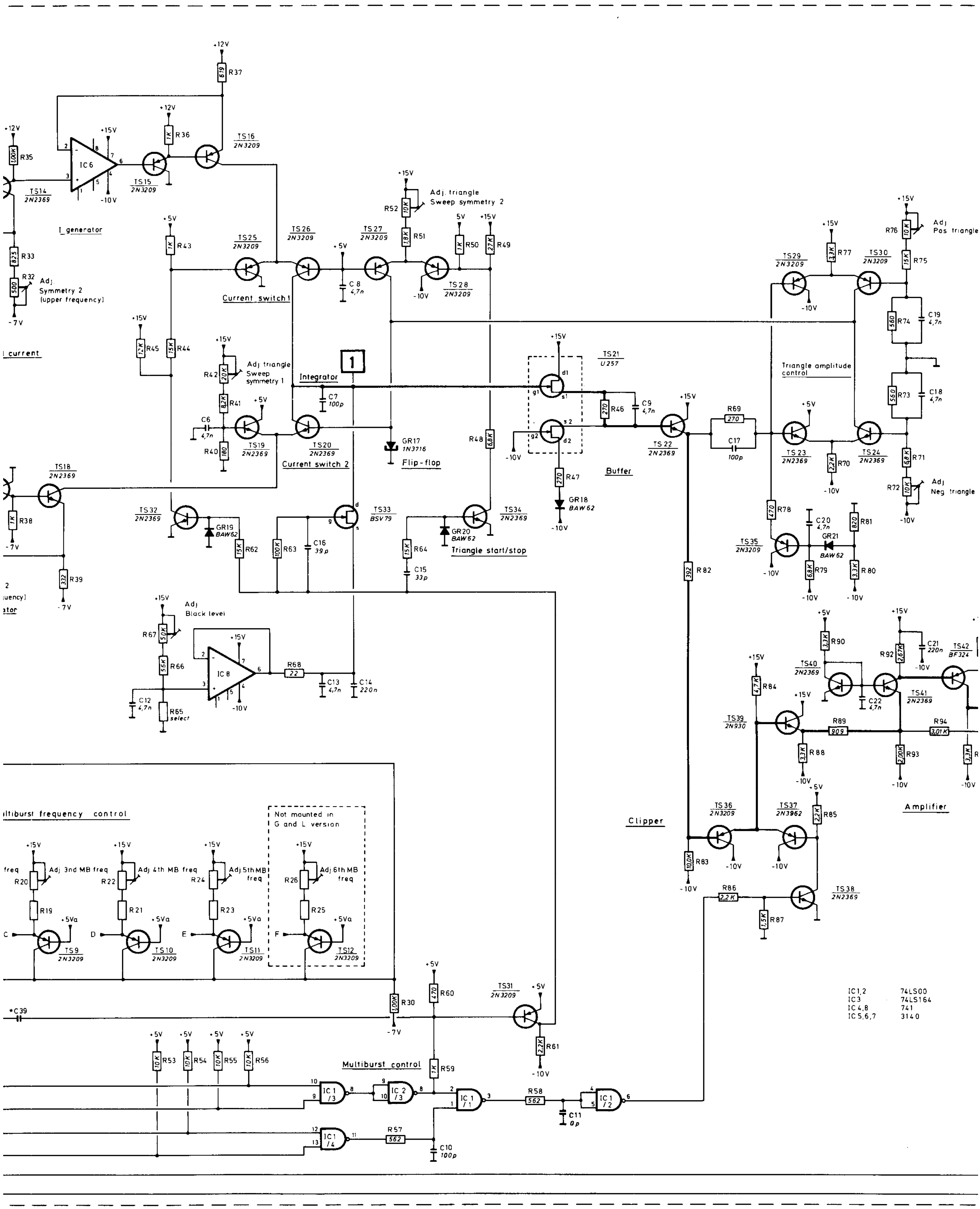
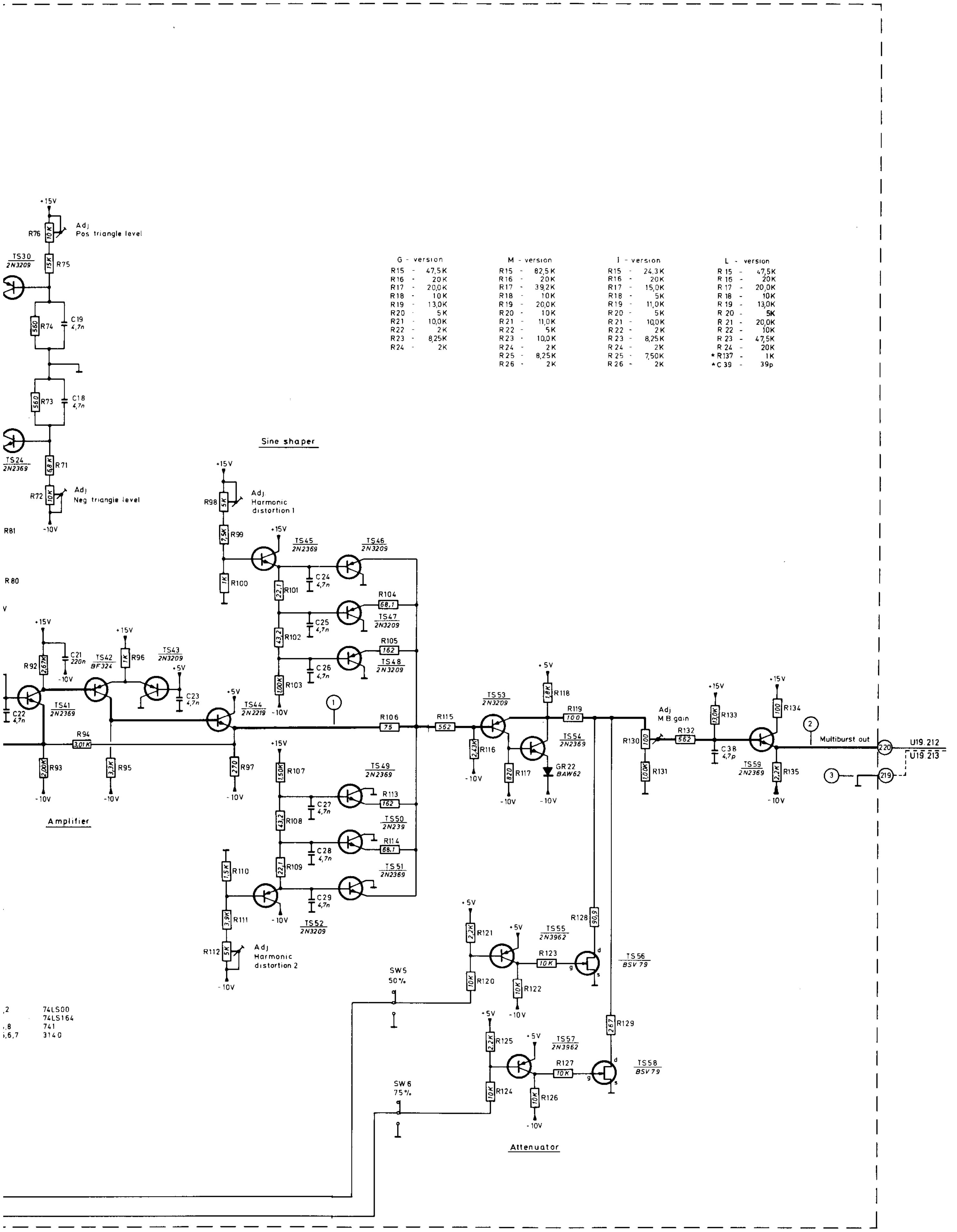


Fig. 20-2 Component location, multiburst generator, unit 15



Sweep control
Oscillator control current
I generator
2I generator
Multiburst frequency control
Multiburst address
GR3 to 14 are BAW62
Not mounted in G and L version
Adj. Symmetry 2 (upper frequency)
Adj Black level
Adj 1st MB freq
Adj 2nd MB freq
Adj 3nd MB freq
Adj 4th MB freq
SW1 Ext sweep
SW2 Auto sweep
N.C.
U4.002,052
U4.001,051
U4.022,072 122,222
U4.021,071
U6.066
U6.067
U11.153
U11.158 MB enable
SK16 "GRID ONLY" Grid only
U11.156 Center cross
U13.005 Del
N.C 50% MB
N.C 75% MB


I generator
I current
Current switch 1
Current switch 2
Integrator
Flip-flop
Buffer
Triangle start/stop
Triangle amplitude control
Clipper
Amplifier
Multiburst frequency control
Multiburst control
Not mounted in G and L version
Adj. triangle Sweep symmetry 2
Adj triangle Sweep symmetry 1
Adj Symmetry 2 (upper frequency)
Adj Pos triangle
Adj Neg triangle
Adj Black level
Adj 3nd MB freq
Adj 4th MB freq
Adj 5th MB freq
Adj 6th MB freq
IC6
IC8
TS14 2N2369
TS15 2N3209
TS16 2N3209
TS18 2N2369
TS19 2N2369
TS20 2N2369
TS21 U257
TS22 2N2369
TS23 2N2369
TS24 2N2369
TS25 2N3209
TS26 2N3209
TS27 2N3209
TS28 2N3209
TS29 2N3209
TS30 2N3209
TS31 2N3209
TS32 2N2369
TS33 BSV79
TS34 2N2369
TS35 2N3209
TS36 2N3209
TS37 2N3962
TS38 2N2369
TS39 2N930
TS40 2N2369
TS41 2N2369
TS42 BF324
TS9 2N3209
TS10 2N3209
TS11 2N3209
TS12 2N3209
GR17 1N3716
GR18 BAW62
GR19 BAW62
GR20 BAW62
GR21 BAW62
IC1,2 74LS00
IC3 74LS164
IC4,8 741
IC5,6,7 3140



G - version	M - version	I - version	L - version
R15 - 47,5K	R15 - 82,5K	R15 - 24,3K	R 15 - 47,5K
R16 - 20K	R16 - 20K	R16 - 20K	R 16 - 20K
R17 - 20,0K	R17 - 39,2K	R17 - 15,0K	R 17 - 20,0K
R18 - 10K	R18 - 10K	R18 - 5K	R 18 - 10K
R19 - 13,0K	R19 - 20,0K	R19 - 11,0K	R 19 - 13,0K
R20 - 5K	R20 - 10K	R20 - 5K	R 20 - 5K
R21 - 10,0K	R21 - 11,0K	R21 - 10,0K	R 21 - 20,0K
R22 - 2K	R22 - 5K	R22 - 2K	R 22 - 10K
R23 - 8,25K	R23 - 10,0K	R23 - 8,25K	R 23 - 47,5K
R24 - 2K	R24 - 2K	R24 - 2K	R 24 - 20K
	R25 - 8,25K	R25 - 7,50K	*R137 - 1K
	R26 - 2K	R26 - 2K	*C 39 - 39p

Fig. 20-3 Circuit diagram, multiburst generator, unit 15

21. Unit 16 Colour bar generator

The colour area signals inside the circle are generated as ±(R-Y) and ±(B-Y) for modulation on unit 18. The corresponding luminance signal is generated to be added to the other parts of the Y-signal on unit 19.

(R-Y) and (B-Y) generator

These current generators are functioning in parallel and R75 controls via IC6 and TS21 their commom reference.
The colour bar areas are generated from a binary counter, but centre cross incision as well as burst generation and yellow-red-yellow area signals are also provided for.
The outputs are in inverted comma notation because of the abnormal use of the phase.
Considering the (R-Y) generator:

The outputs R-Y = xR-yG-zB,

where x,y and z are factors determining quantity.

xR is supplied via terminal 206 and -yG-zB is supplied via terminal 205.
This implies that all areas in the colour bar containing a red signal are supplied via terminal 206, and the areas not containing a red signal are supplied as a current via terminal 205.
The same description is valid for the (B-Y) generator.
The transistors TS16-TS19 are opened only when the ϕ signal is present at their emitters.
The burst level signals D, H and I of course, are not restricted to the circle area, as they are displayed outside the TV pattern and operated by the burst key signal from terminal 104.

Luminance generator

The black and white content of the colour areas inside the circle is supplied as currents from the luminance generator directly to the output amplifier of unit 19.
The reference current is the same as for the (R-Y) and (B-Y) generators, namely R75, IC6 and TS21.
Via GR23 the Del. ϕ signal opens TS20 only during the display of the delayed circle, whereas the N signal supplied by TS14 is not restricted by TS20.

The J, K and L inputs are Y-signals for the colour bar and the yellow-red-yellow areas, and the N input is for set-up in M- and N-versions. The M input is used only in special I-versions for 25% set-up of colour areas inside the circle provided coding of SW6 and SW7 has taken place.

Chroma and BL/WH addresses

Each of them is a 4 bit counter clocked by the colour bar clock pulse.
IC7 is straight forward and supplies signals for the (R-Y) and (B-Y) outputs. IC4 is clocked by a delayed colour bar clock signal, where the delay is introduced by IC8/1. Enable and disable pulses for the chroma signals are supplied via the terminals 110, 111 and 112 and for the luminance signal via the terminals 113, 114 and 115.

Checking and adjusting

Measuring equipment:

Digital voltmeter	:	e.g. PHILIPS PM 2422
Video level meter	:	e.g. PHILIPS PM 5548
Test print	:	PHILIPS PM 8507
TV monitor	:	e.g. PHILIPS LDN 5006

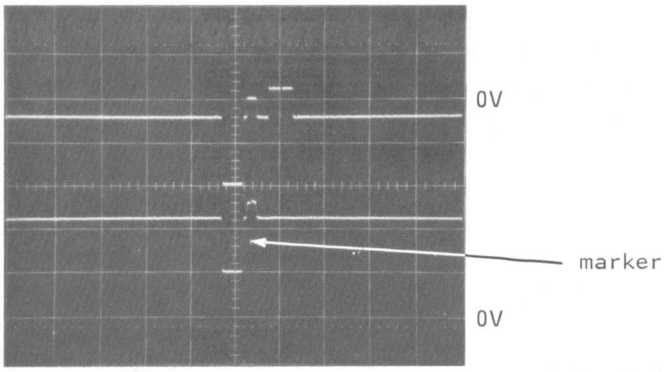
This unit should be adjusted only after the output amplifier unit 19 has been carefully aligned for black level 0V and white level 700 mV for all versions.
Afterwards unit 19 can be realigned for IRE output if desired.
On unit 16: For I-versions open SW7 and connect SW6.

NOTE: For M and N-versions
Remove grey wire from pin 16.211 for removal of set-up. Now all black/white adjustments can take place.

Reference voltage

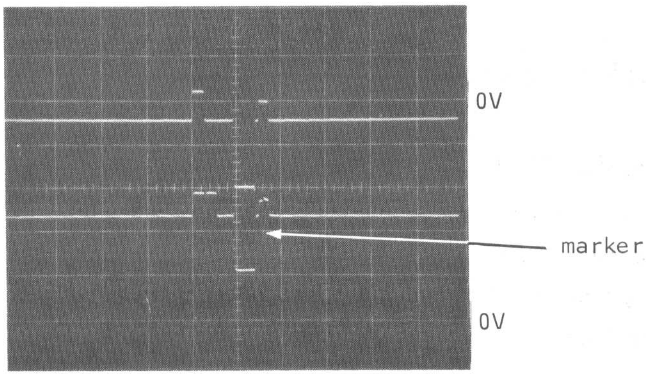
Connect a digital voltmeter to 4.
Adjust R75 to obtain -5.25V.
Insert the testprint PM8507 in place of unit 18, and remove SW2 on unit 19.

1



1a. 0.2V/div. 2ms/div. delayed: 10µs/div.
1b. 0.5V/div. 2ms/div. delayed: 10µs/div.

2



2a. 0.2V/div. 2ms/div. delayed: 10µs/div.
2b. 0.5V/div. 2ms/div. delayed: 10µs/div.

Note: 1a and 2a; oscilloscope connected to BU3, terminated with 75ohms.
1b and 2b; oscilloscope connected to PM5548 terminal video + marker out.

Connect a video level meter PM5548 to a pattern output and terminate all pattern outputs with 75ohms.

Y amplitude

Testprint on "fast".
Adjust R62 to obtain 308 mV of the green area.
Adjust R60 to obtain 157 mV of the red area.
Adjust R58 to obtain 60 mV of the blue area.

Special I-version only

SW6 open and SW7 connected.
Adjust R64 to obtain 235 mV of the blue area.

Burst amplitude (R-Y)

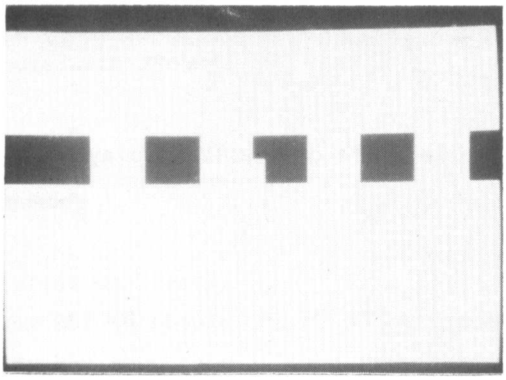
Testprint on R-Y
Obtain the burst amplitude on the video level meter.
The burst area can be found left of the display on the monitor. (See also osc. no. 1).
Adjust R18 to obtain 86 mV.

R-Y amplitudes

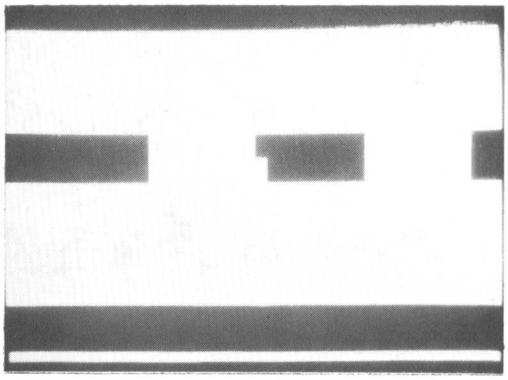
Testprint on -(R-Y).
Adjust R16 to obtain 220 mV of the green area.
Testprint on +(R-Y).
Adjust R14 to obtain 262 mV of the red area.
Testprint on -(R-Y).
Adjust R12 to obtain 43 mV of the blue area.

Burst amplitude (B-Y)

Testprint on -(B-Y).
Adjust R40 to obtain 86mV of the burst (marker left of the TV display).
(See osc. no. 2).



1



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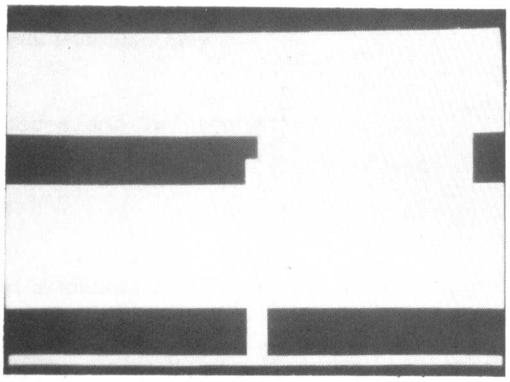
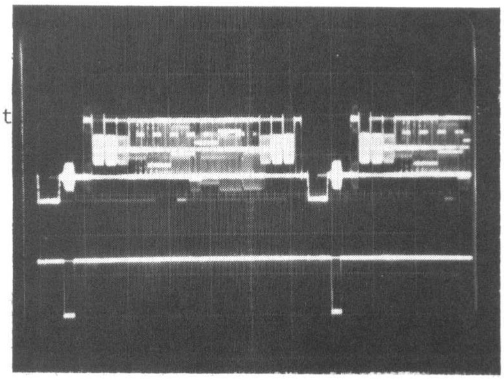


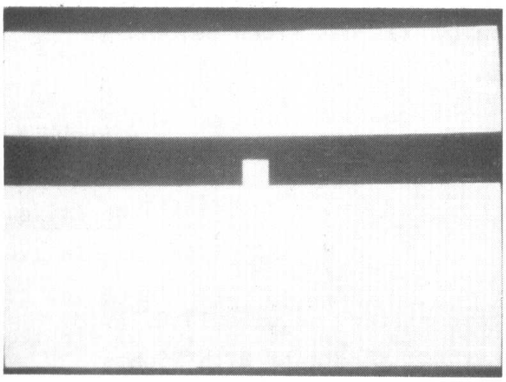
3

Pattern out
10μs/div.
0.5V/div.



4

10μs/div. 2V/div.



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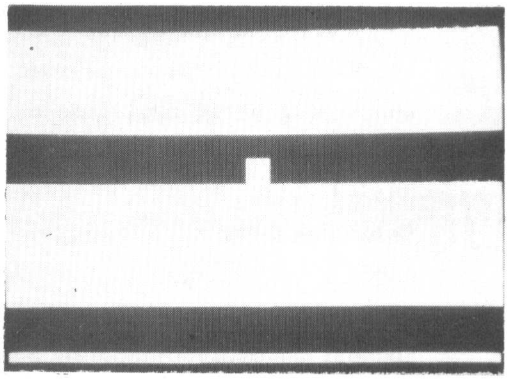

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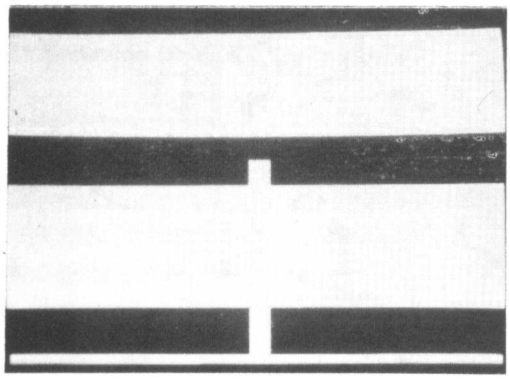

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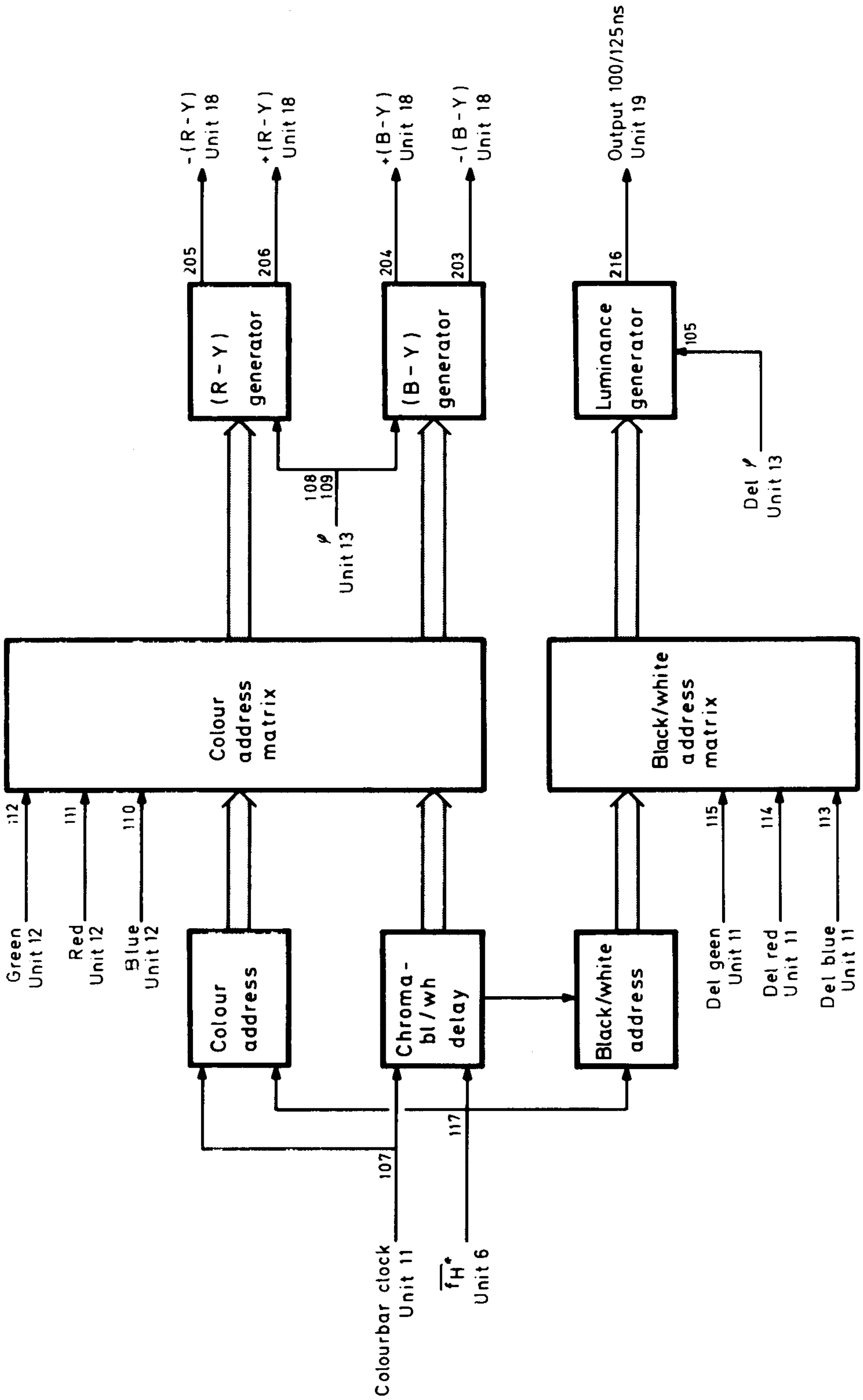


Fig. 21-1 Block diagram, colour bar generator, unit 16

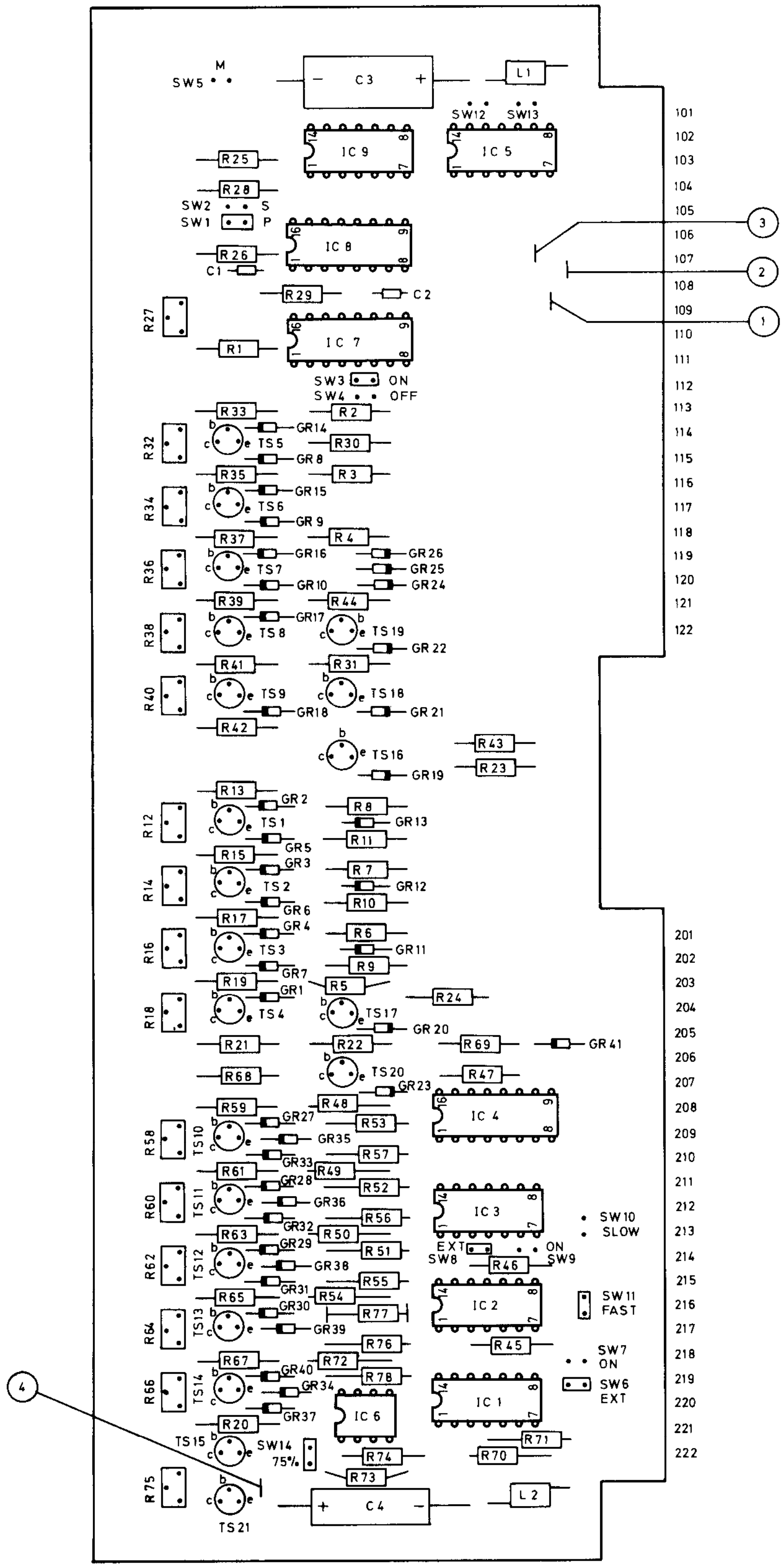
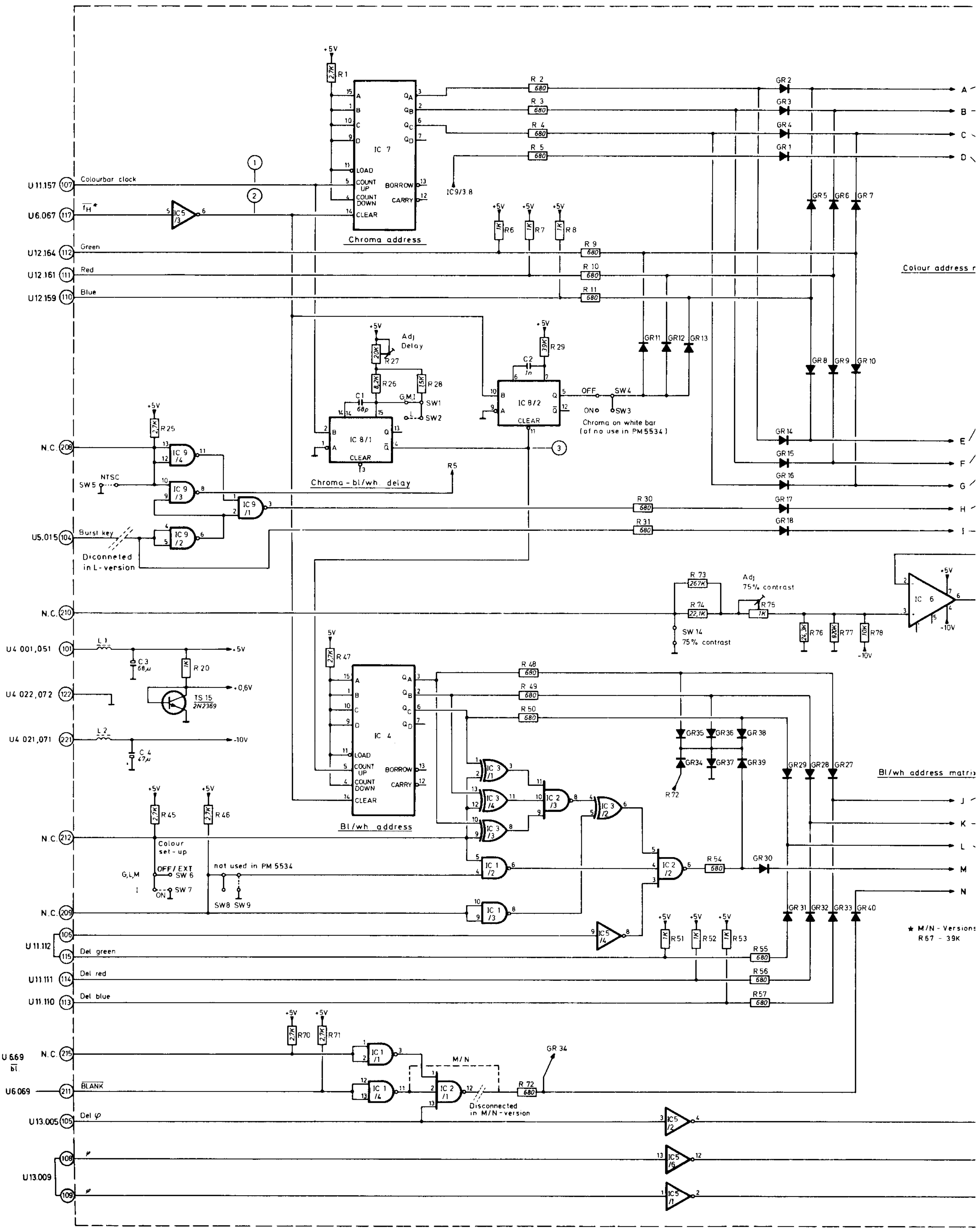


Fig. 21-2 Component location, colour bar generator, unit 16



Colourbar clock
Chroma address
Chroma - bl/wh delay
Adj Delay
Chroma on white bar (of no use in PM5534)
Colour address r
Burst key
Diconneted in L-version
Adj 75% contrast
SW 14 75% contrast
Bl/wh address
Bl/wh address matrix
Colour set-up
OFF/EXT
not used in PM 5534
Del green
Del red
Del blue
BLANK
M/N
Disconnected in M/N-version
Del φ
★ M/N - Versions R67 - 39K
U11.157
U6.067
U12.164
U12.161
U12.159
U5.015
U4 001,051
U4 022,072
U4 021,071
U11.112
U11.111
U11.110
U6.69
U6 069
U13.005
U13.009

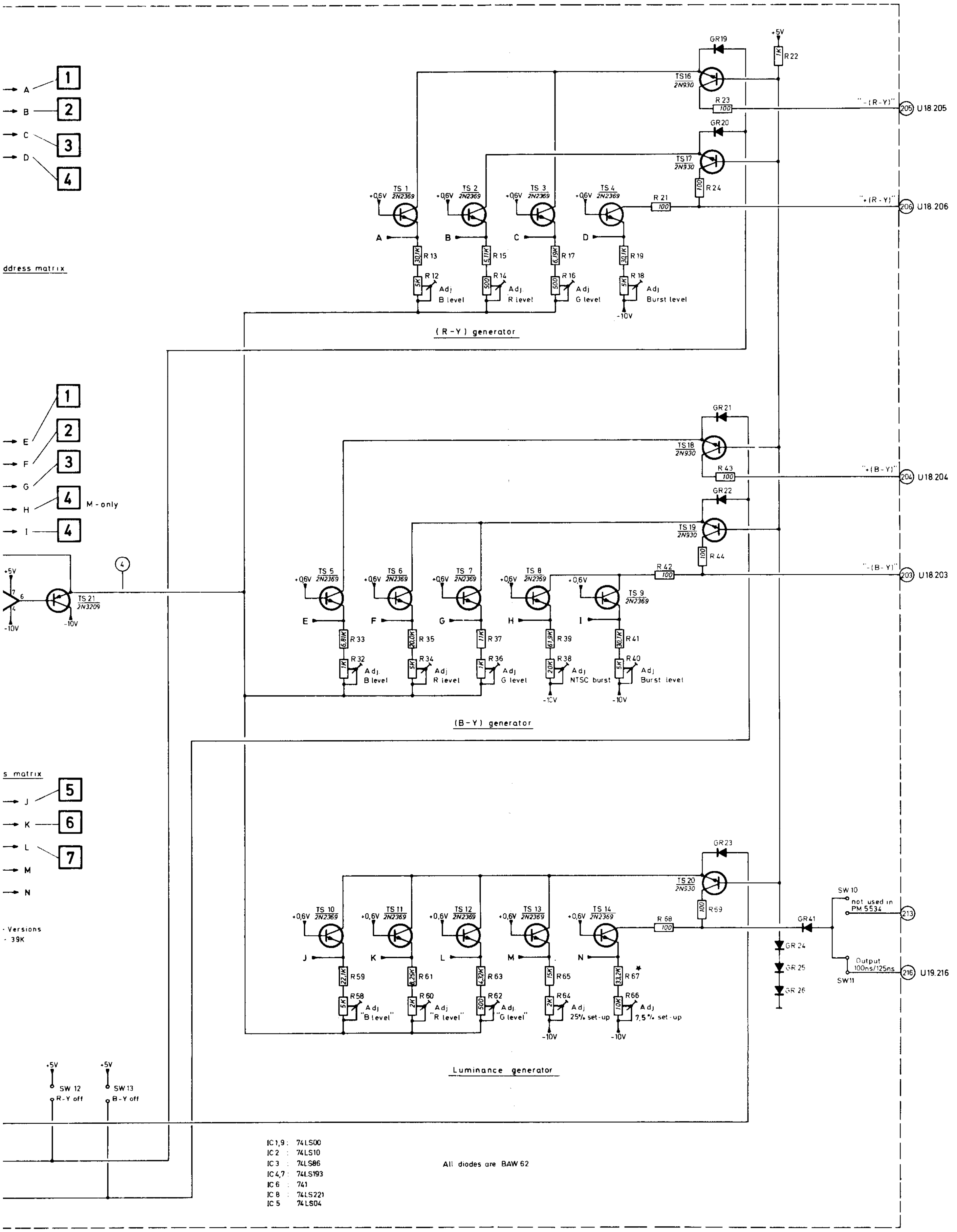


Fig. 21-3 Circuit diagram, colourbar generator, unit 16

22. Unit 17 Secam control

This unit supplies the signals necessary for the timing and identification of the secam system. It also contains a B-Y frequency detector and an R-Y oscillator.

Line address

The line address circuit is mainly a decade counter clocked by the line frequency f_H* delayed 300 ns and reset for every field f_V.
By means of the gates IC7 and IC8 certain line numbers are selected.

Line detectors

From the lines selected in the line address circuit specific line numbers are gated out.
From IC11/2 the lines 311-319 and 623 1/2-6 are selected.
From IC11/1 the lines 7-15 and 320-328 are selected.
From IC10/2 the lines 16-22 and 329-335 are selected.

Phase.shifter

The delayed line pulse f_H* is divided by 3 by IC11/1 and IC14/2 and on $f_{V/2}$ is supplied by IC17/2.
The signals are gated out to supply a 00π00π signal from terminal 105 and the same signal complement from terminal 106.

Ramp generator

The line numbers 7-15 and 320-328 are supplied as negative going signals to generators at R15.
C12 is charged via R16 + R17 as soon as the input goes negative and C13 ensures a constant supply. The ramp produced across C12 is found at the output terminals 203 and 205.
The currents supplied to the chrominance modulator is determined by R20 and R21 respectively, thus resulting in different slopes for the two signals.
Ramp start is adjusted by means of R8.

B-Y frequency detector

The purpose of the B-Y frequency detector is to lock the red/blue sequence to an external source.
When a secam signal is connected to BU4 or BU5, the chroma passes a turned circuit on unit 5 and enters unit 17 at terminal 209.
The amplifier TS9 is turned at 3.9 MHz. and a blue input produces via IC1 a clear signal for IC10/1 thus keeping the R/B sequence switch on unit 18/L synchronous to the external signal.

R-Y frequency generator

This is a 8,8 MHz crystal controlled square wave oscillator and 1 divider. The circuit belongs to unit 18/L section 2 as the f_R and $\overline{f_R}$ signals are used for phase comparison purposes here.

Checking and adjusting

Measuring equipment.:

Oscilloscope	: e.g. PHILIPS PM 3240X
Counter	: e.g. PHILIPS PM 6612

Clamp pulse

Connect an oscilloscope to 1 . (10µs/div., delayed: 1µs/div.).
Adjust R5 to obtain a pulse width of 8,8µs ±0,2µs.

Blanking pulse

Oscilloscope at 2 . (10µs/div., delayed: 1µs/div.).
Adjust R11 to obtain a pulse width of 6,5µs ±0,1µs.

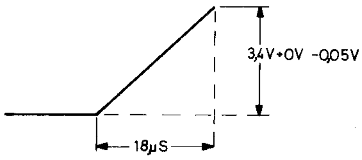
Ramp start

Oscilloscope at 3 and pattern out, (terminated with 75ohms).
(10µs/div., delayed: 2µs/div.).
Adjust R8 to obtain a ramp start 8.0µs ±0.1µs after sync leading edge.

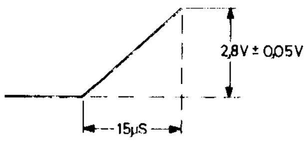
Slope

Oscilloscope at 4 and 10 . (5µs/div.).

At 10 :



At 4 :



Oscillator

Counter at 5 .

Adjust C10/L4 to obtain 8,8125 MHz ±0,5 kHz

Detector

Apply a 3,9 MHz 1Vpp signal to terminal 209 via 10 Kohms.

Switch to ext. synchr. but without an external signal connected.

Oscilloscope at 8 , d.c. input.

Adjust L3 to obtain maximum DC voltage.

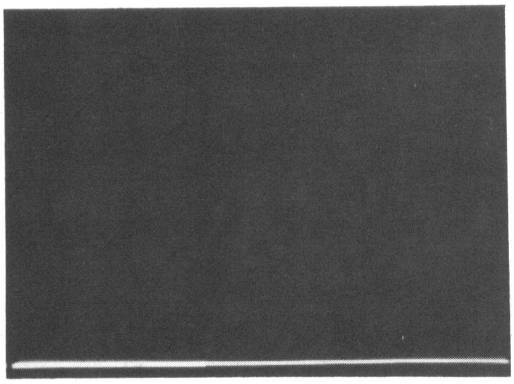
Comparator

Oscilloscope at 9 . (5ms/div., delayed: 0.1ms).

Apply an external secam signal to BU4 or BU5.

Adjust R36 to obtain a noise free square wave signal.

1



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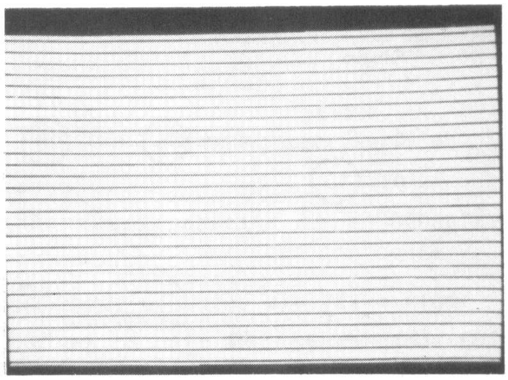

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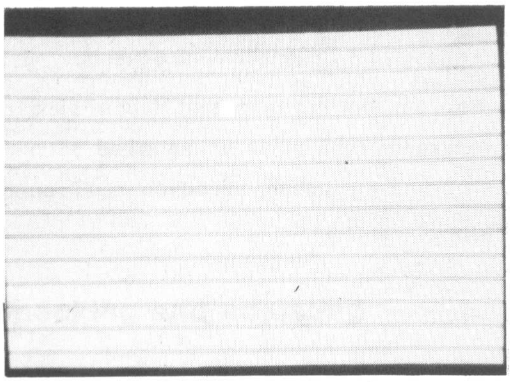

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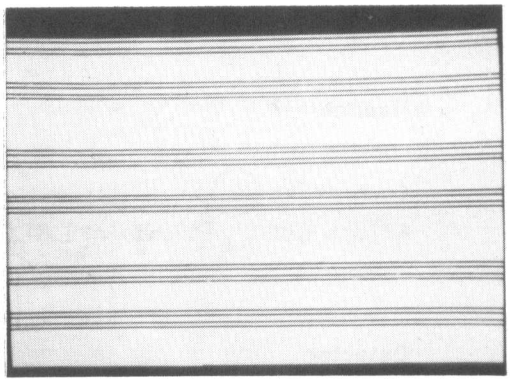


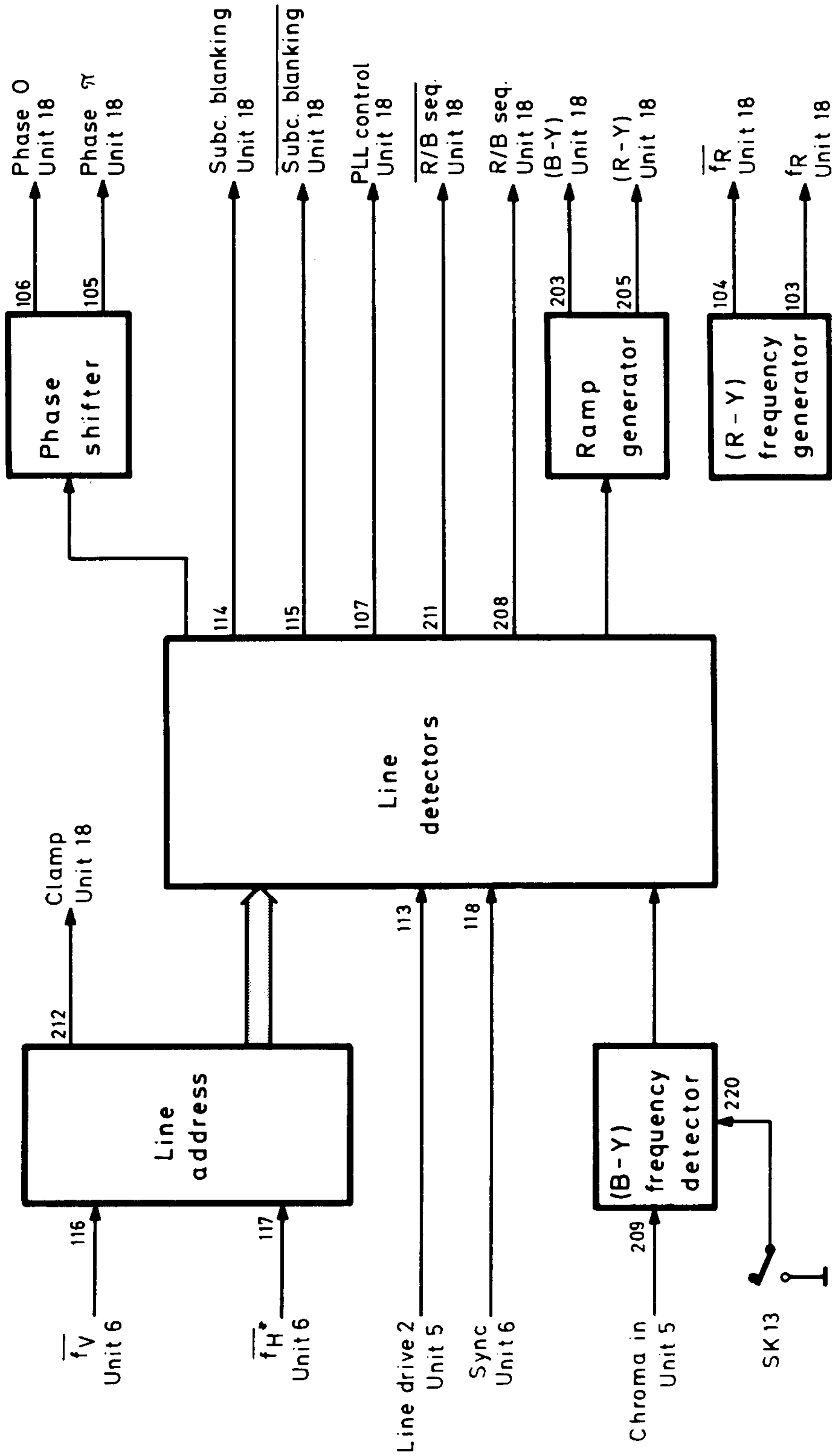


Fig. 22-1 Block diagram, secam control, unit 17

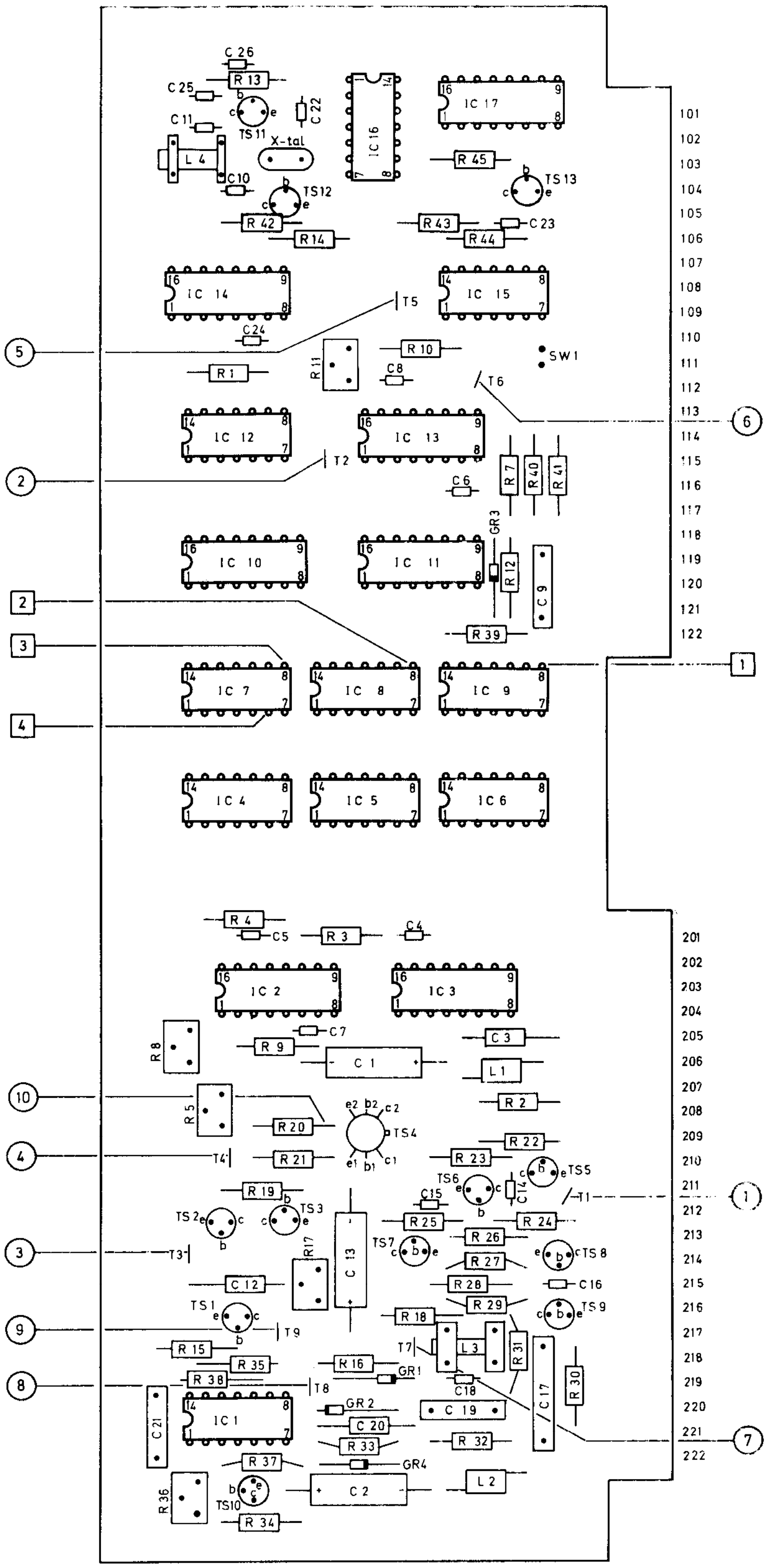
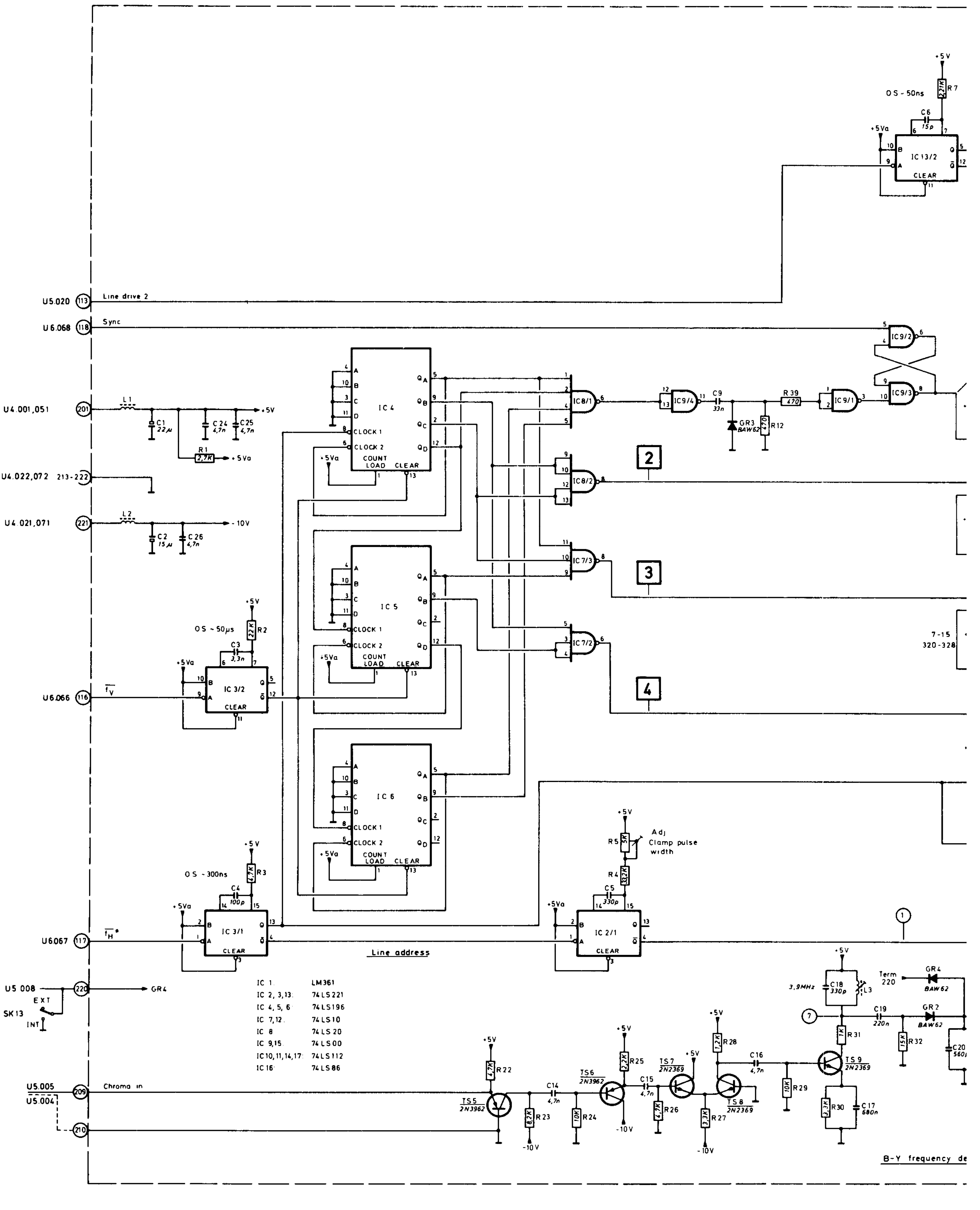


Fig. 22-2 Component location, secam control, unit 17



U5.020
Line drive 2
U 6.068
Sync
U4.001,051
U4.022,072 213-222
U4.021,071
U6.066
U6067
Line address
U5 008
EXT
SK13
INT
GR4
U5.005
U5.004
Chroma in
OS - 50ns
OS ~ 50μs
OS - 300ns
Adj Clamp pulse width
Term 220
B-Y frequency de
7-15
320-328
IC 1 LM361
IC 2, 3, 13: 74LS221
IC 4, 5, 6 74LS196
IC 7,12. 74LS10
IC 8 74LS20
IC 9,15 74LS00
IC10, 11, 14, 17: 74LS112
IC16 74LS86

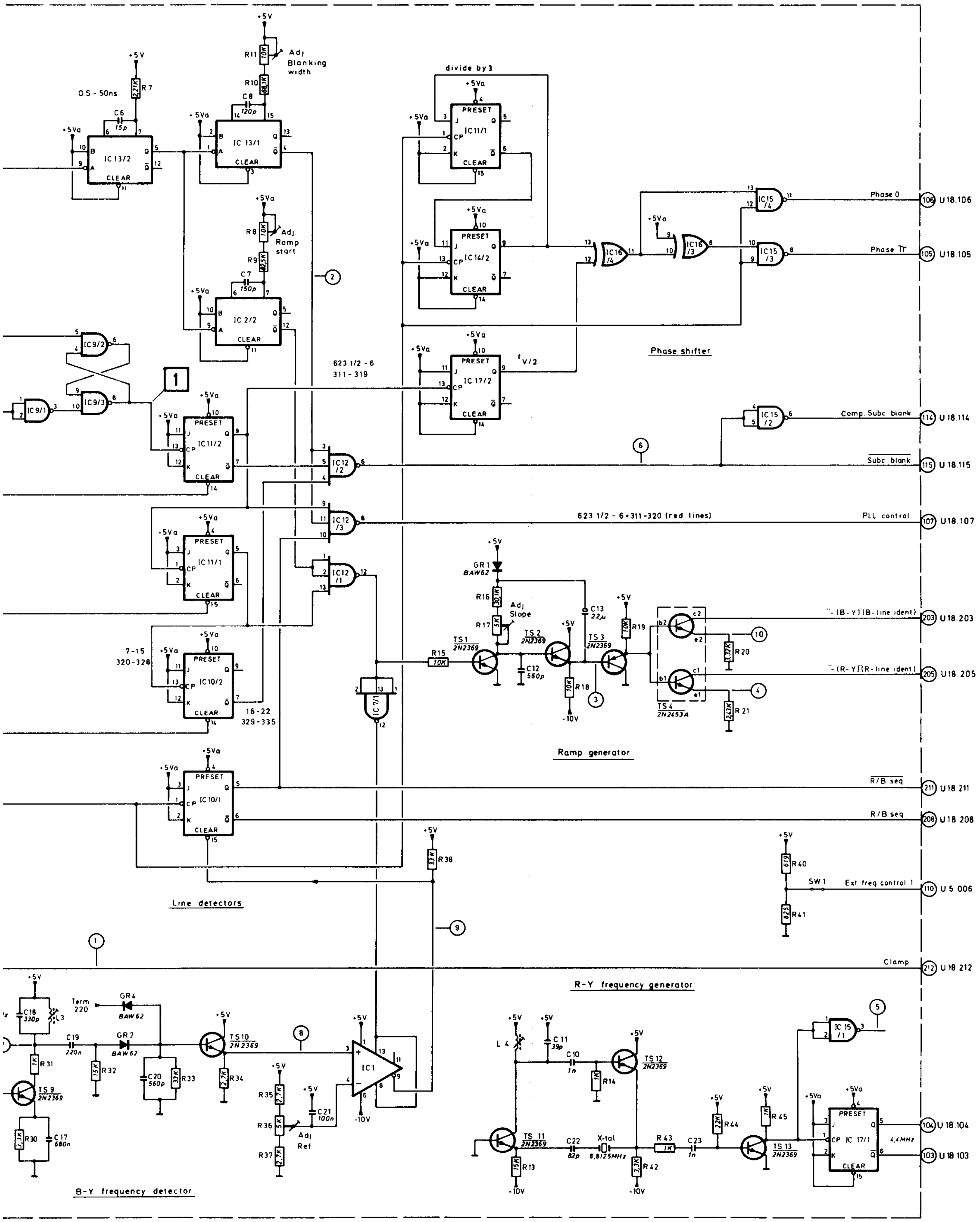


Fig. 22-3 Circuit diagram, secam control, unit 17

23. Unit 18 G/I/M/N Chrominance modulator

All signals on the previous units (except unit 3, containing the subcarrier oscillator) have been luminance signals supplied as currents or a.c. levels.
Colour area signals are supplied as "R-Y" or "B-Y" and are added at the input terminals to this unit.

R-Y modulator

When the "colour difference signals" are present at the terminals 205 and 206 a current will flow from the point R10/R11 via TS1 and out through the terminal. In order to increase noise immunity TS1 is added to obtain low input impedance.
The differential modulator inputs X^+ and X^- (IC1.1 and IC1.4) sense the collector levels on TS1 via R12 and R13.
The subcarrier is supplied to R65 for a 90° phase shift with respect to the B-Y modulator, in order to obtain a quadrature modulated chroma signal, and this signal is taken to TR2.
The PAL switch operated by a positive and negative going PAL identification signal (positive for every other line and vice versa) switches in turn TS5 and TS6 on, each alowing the 90° subcarrier to pass one half of TR2. In this way a 90° or 180° subcarrier phase is obtained for the Y-inputs of the modulator.
In NTSC versions SW1 should be connected and TS6 stays on continuously allowing the subcarrier to pass the lower part of TR2 only.

B-Y modulator

The two modulators operate likewise however the B-Y modulator has no 90° subcarrier phase shift and no PAL switch.

Subcarrier phase control

The "subc 2" signal from terminal 111 is impedance transformed by TS8. An externally adjustable phase control network consists of a number of coils and varicap diodes.
The subcarrier signal is externally phase controlled by P1 varying the d.c. level across the varicap diodes, thus the phase shift of the subcarrier signal passing this circuit.
A tuned subcarrier amplifier supplies the subcarrier signal to the modulators.

Chroma filter

The currents supplied by the modulators "OUT" terminals are added and sensed by TS15 and the signal passes a normal chroma band pass filter. Emitter follower ensure low impedance.

Checking and adjusting

Measuring instruments:

Oscilloscope : e.g. PHILIPS PM 3240X
Vectorscope : e.g. PHILIPS PM 5567

Subcarrier resonance

Connect an oscilloscope to 1 , and adjust L6 to maximum amplitude.

B-Y balance

Connect an oscilloscope to a pattern output and terminate with 75 ohms.
Adjust R21 and R8 simultaneously to obtain minimum rest-subcarrier.

Chroma filter

Connect an oscilloscope to a pattern output, and terminate with 75ohms.
Remove unit 10 + 13.
Switch on the instrument and connect momentarily +5V to terminal 11.255.
A colour bar with some superimposed signals will be seen.
Obtain on the oscilloscope the green/magenta jump (10µs/div., delayed: 0.1µs/div.).
Adjust L10 to obtain the nicest possible green/magenta jump.
Reinsert unit 10 and unit 13.

180° phase R-Y (not in NTSC-versions)

Connect a vectorscope to a pattern output and terminate with 75ohms.
Connect SW13 on unit 16 (B-Y off).
Adjust C28 for coincidence between the two axes.

(It might also be necessary to readjust R14 on unit 16).
Remove SW13 on unit 16.

180° phase (not in NTSC-versions)

Connect SW12 on unit 16 (R-Y off).
On the Vectorscope adjust gain to obtain coincidence between the circle on the Vectorscope display and one or both of the B-Y axes.
If unsymmetrical B-Y display, adjust R32 on unit 16.
Remove SW12 on unit 16.

90° phase

NTSC-versions: Remove SW2 on unit 5, SW5 on unit 16 and SW1 on unit 18.
Connect an oscilloscope to a pattern output, and terminate with 75ohms, select 5µs/div. and trigger on line.
Obtain a jumping display by means of the time base adjustment in an uncalibrated position.
Adjust L7 to obtain minimum jumping of the colour bar part of the display.
NTSC-versions: Reconnect coding pins.

Red/blue jump

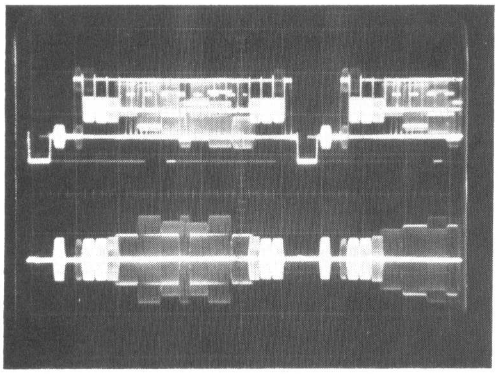
Connect an oscilloscope to a pattern output and terminate with 75ohms.
Produce a colour bar display as under "Chroma filter".
Obtain on the oscilloscope the red/blue jump in the colour bar, and adjust L9 for minimum double colour.
Readjust chroma filter by means of L10.

Check "Colour bar delay" on unit 16.

Amplitudes

Connect a vectorscope to a pattern output and terminate with 75 ohms.
Adjust R28 to obtain a correct display on the vectorscope.

BU13



1

BU13 0.5V/div. 10µs/div.

1 1V/div. 10µs/div.

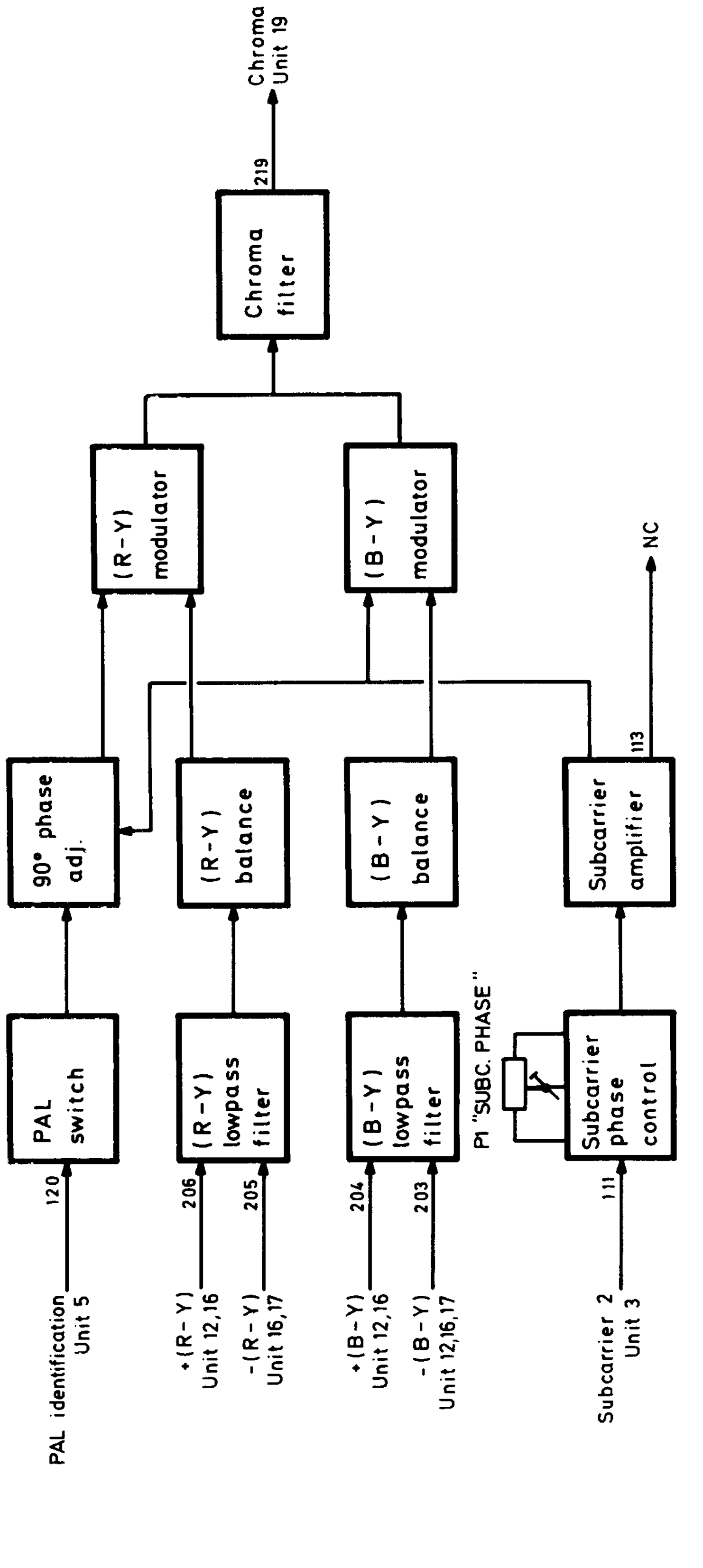


Fig. 23-1 Block diagram, chrominance modulator, unit 18/G/I/M/N

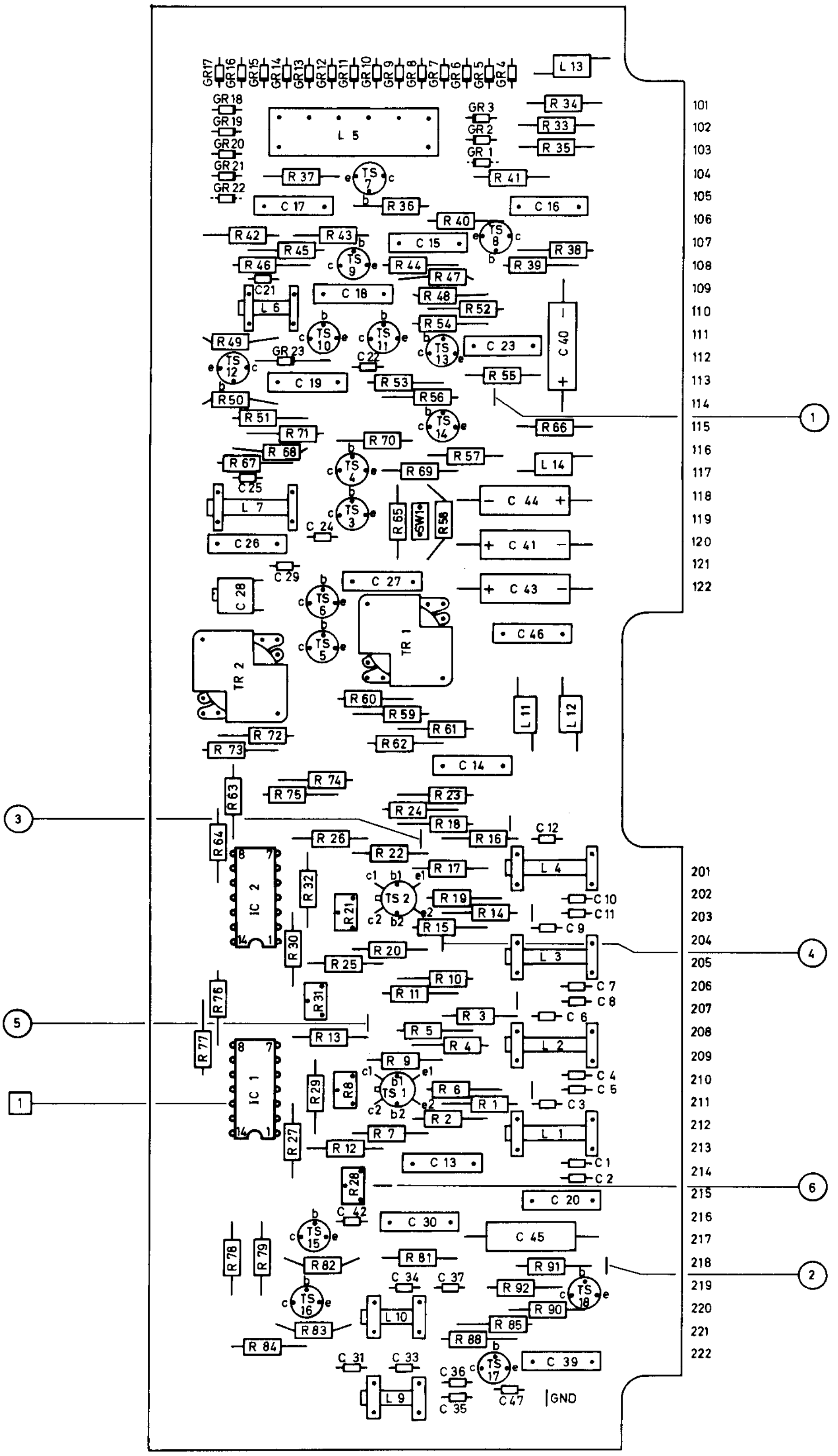
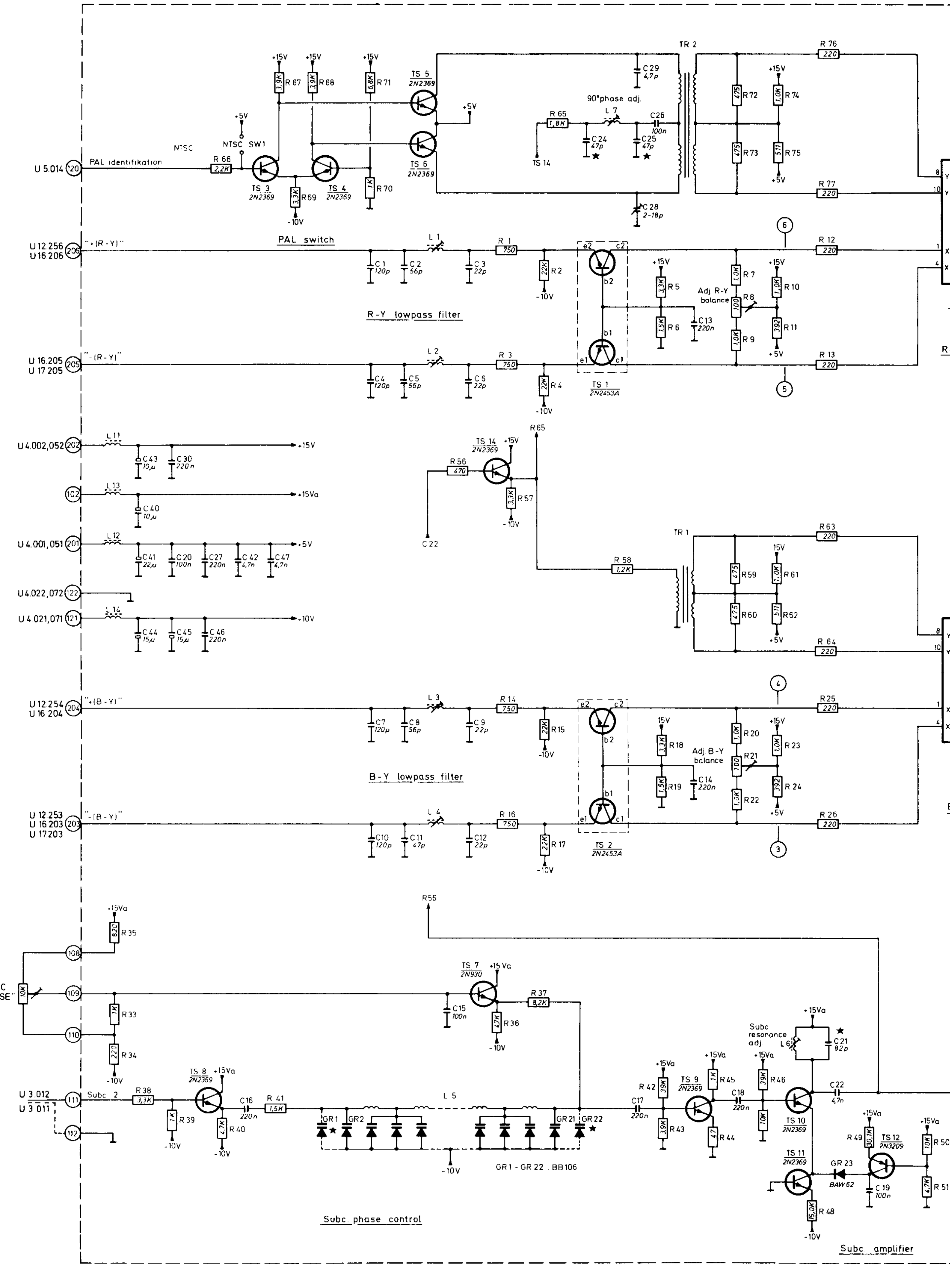


Fig. 23-2 Component location, chrominance modulator, unit 18/G/I/M/N



PAL identifikation
NTSC
NTSC SW1
PAL switch
90°phase adj.
TR 2
TR 1
R-Y lowpass filter
B-Y lowpass filter
Adj R-Y balance
Adj B-Y balance
P1 "SUBC PHASE"
Subc resonance adj.
GR1 - GR22 : BB106
Subc. phase control
Subc amplifier

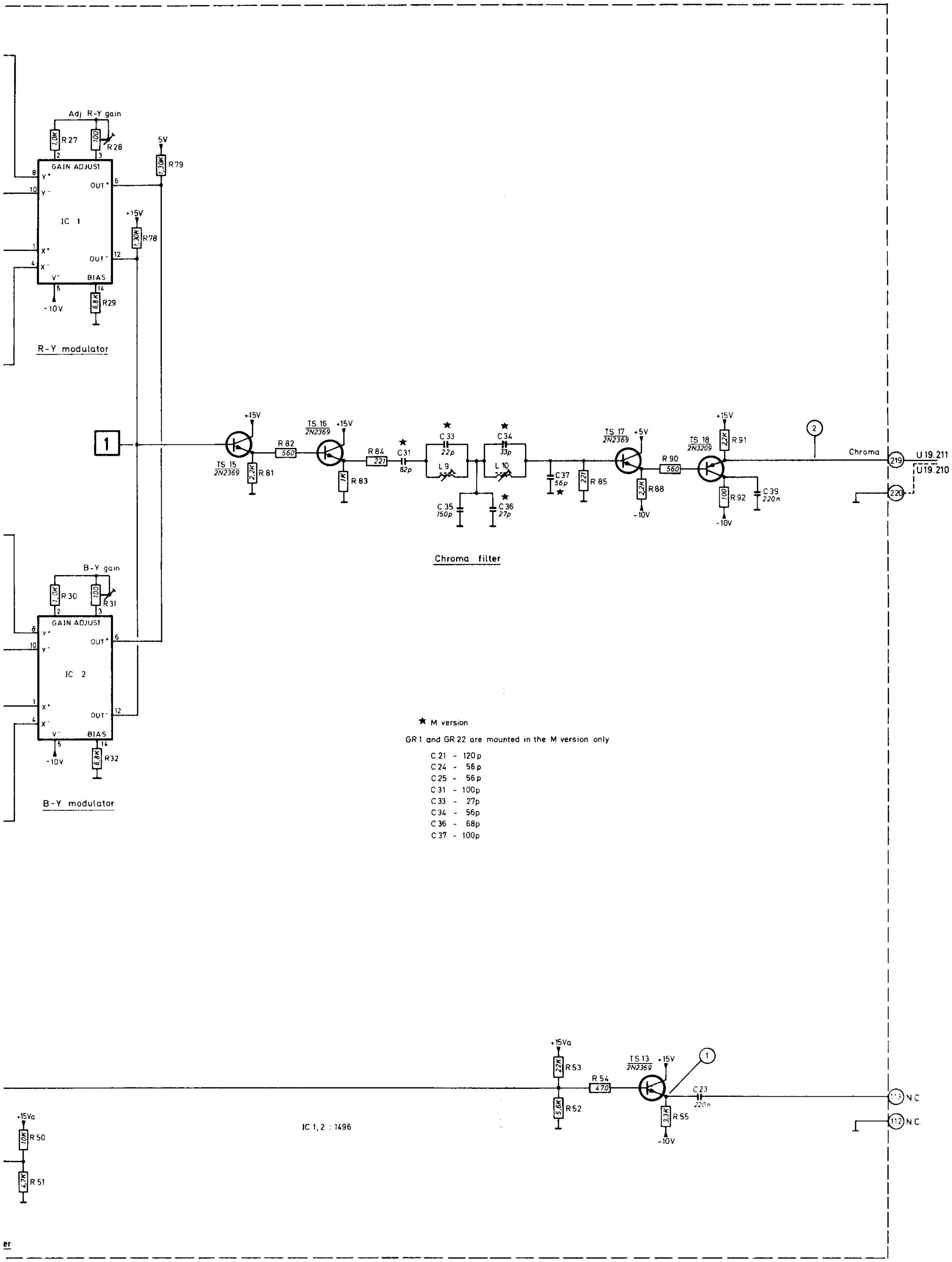


Fig. 23-3 Circuit diagram, chrominance modulator, unit 18 /G/I/M/N

24. Unit 18L Chrominance modulator

Section 1

Two differential input amplifiers supply the "±(R-Y)" and the "±(B-Y)" signals.
The "-(R-Y)" and the "-(B-Y)" ramp pulses from unit 17 are applied to the complement inputs in order to obtain a correct R/B sequence of the nine field ID pulses.
The R/B sequence switch is operated by the complement signals present at the terminals 206 and 211. TS9 and TS11 are the switches operated in turn synchronous to the line frequency. The proper sequential signal is now present at TS11, where clamping to 0V is assured by TS12.
The pre-emphasis and clipping amplifier TS17,TS18 and TS19 handles the signal in several ways. C6 in combination with the resistor network is the LF pre-correction filter. TS18 is switched by the R/B sequence from TS16 resulting in different d.c. levels for every other line. The d.c. levels obtained here are eventually turning the voltage controlled oscillator on section 2 in order to obtain the two subcarrier frequencies 256 kHz apart. C9 having a large capacity with respect to the line frequency, acts as being short-circuited a.c. wise, thus conducting the signal to TS21 of section 2.
Four adjustable elements make it possible to adjust for gain and balance having fundamental influence on the VCO.

Section 2

The signal passes the LP-filter where attenuation takes place.
The VCO operates at 4.406 MHz and is phase controlled by the phase 0 and phase π inputs. The VCO is frequency controlled by the incoming signal, thus a frequency modulated signal is present at IC1.
This signal is pre-corrected by the HF precorrection filter, but is also taken to the phase comparator for comparison to the 4.406 MHz signal present here as f_R and $\overline{f_R}$.
When an output from IC1/4 occurs this charges C20 to an average d.c. level, and this correction voltage is added to the incoming signal when switched through by the PLL signal (phase locked loop control). In this way the VCO is set to 4.406 MHz once every field. The PLL control signal is active on red lines during the interval lines 311-319 and 623 1/2-6.
The signal is taken to the output amplifier of unit 19 via the chroma blanking transistors TS32-TS33. These are switches operated in oposite phases by the subcarrier blanking signal.

Checking and adjusting

Measuring equipment:

Oscilloscope : e.g. PHILIPS PM3240X

Secam scope : e.g. THOMSON CSF TTV 6900

Unit 18 cannot be adjusted when mounted on an extension board.
Before adjusting: Remove unit 15 and unit 16. Remove SW1 and SW2 on unit 19.

Clipping balance

Oscilloscope at pattern output, terminated with 75ohms, ac input (5ms/div., delayed: 0.1ms/div.).
Adjust R54 to obtain symmetrical identification pulses with respect to zero line.

PLL centre frequency

This adjustment is only needed after a repair.
Oscilloscope at test point 2, dc input (5ms/div., delayed: 20μs/div.).
Set R57 and R80 to mid-position.
Look at the line in front of the identification pulses.
Adjust R80 to obtain symmetrical pulse.
Observe also the monitor.

Phase lock speed

This adjustment is only needed after a repair.
Oscilloscope as before.
Turn R57 fully anticlockwise.
Phase lock now slow.
Turn fully clockwise.
Phase lock is now oscillating.
Turn R57 slowly anticlockwise and obtain a steady zero line as long as possible.
Observe also the monitor.

Tilt

Oscilloscope at pattern out terminated with 75ohms.
If the signal amplitudes are not constant during the field period a leakage in TS21 or TS28 is present - replace.

Amplitude

Oscilloscope at pattern out, terminated with 75ohms.
Adjust R97 to obtain approx. 200mVpp during the active part of the field.

Insert unit 16, SW1 and SW2 (Unit 19).

Frequency R

Secam scope at pattern out.
R-Y.
Adjust R47 to obtain 4.12625MHz ±0.5kHz in red area.

Frequency B ref

Secam scope at pattern out.
Select B-Y.
Adjust R51 to obtain 4.250MHz ±0.5kHz in black area.

Frequency max. R-Y

Secam scope at pattern out.
Select R-Y.
Adjust to 4.75625MHz ±5kHz in vertical identification pulses. Half of the adjustment should be carried out by means of R54 and the rest by means of R46.

Frequency min. B-Y

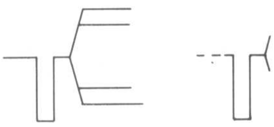
Secam scope at pattern out.
Select B-Y.
Adjust to 3.900MHz ±5kHz in vertical identification pulses. Half of the adjustment should be carried out by means of R54 and the rest by means of R46.

Fine adjustment

Repeat adjustments, freq. R, freq. B ref., freq. max. R-Y, freq. min. B-Y.

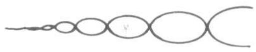
Amplitude

Oscilloscope at pattern out terminated with 75ohms (5ms/div., delayed: 20µs/div.).
Adjust R97 to obtain 214mVpp ±5mV.



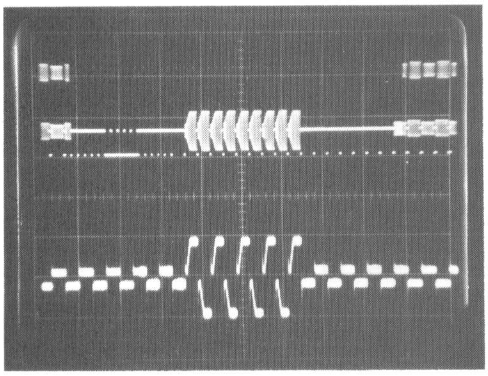
Phase reversing 0/π

Oscilloscope at pattern out terminated with 75ohms (10µs/div., delayed: 0.5µs/div.).
Control of phase reversing.



BU13

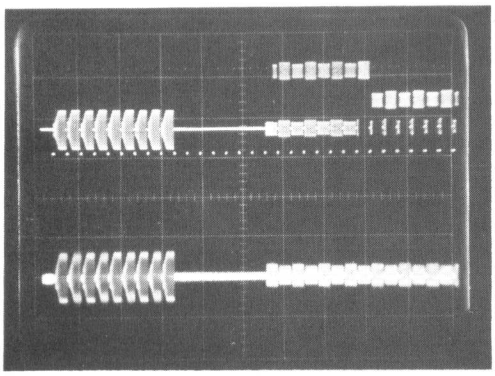
1



0.5V/div 0.2ms/div.

BU13

2



0.5V/div. 0.2ms/div.

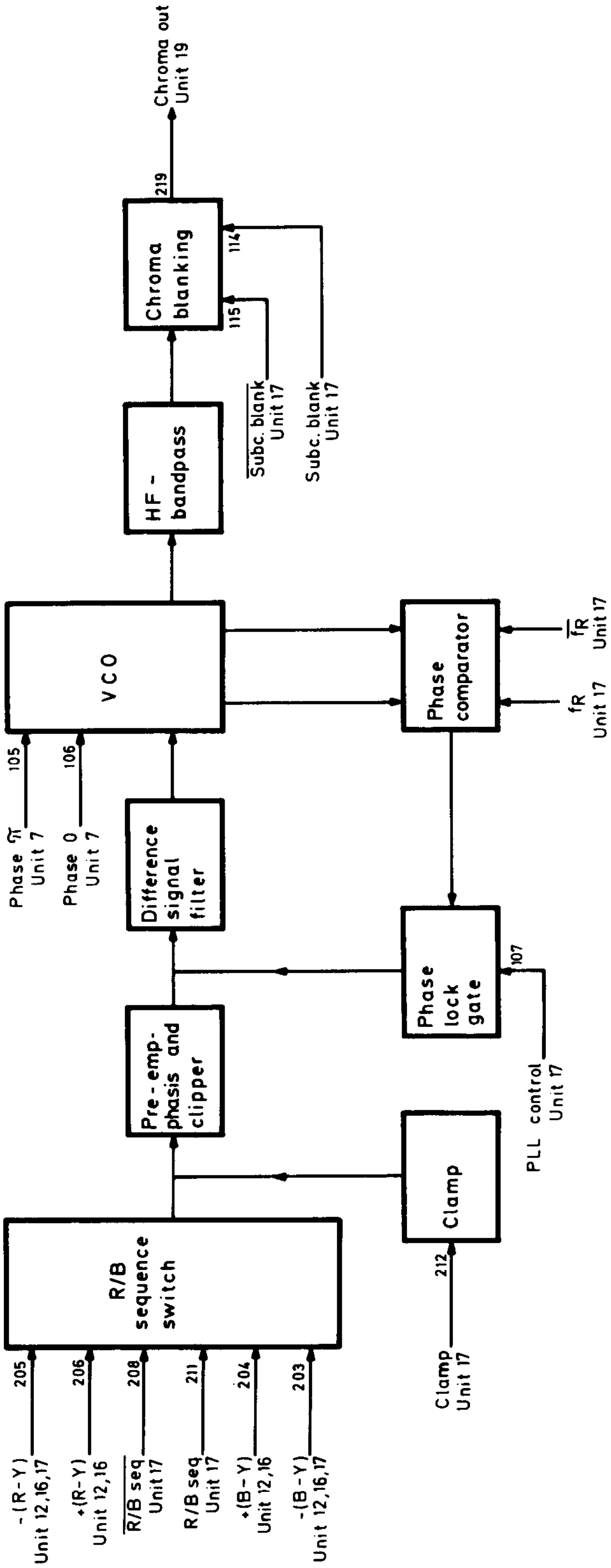


Fig. 24-1 Block diagram, chrominance modulator, unit 18/L

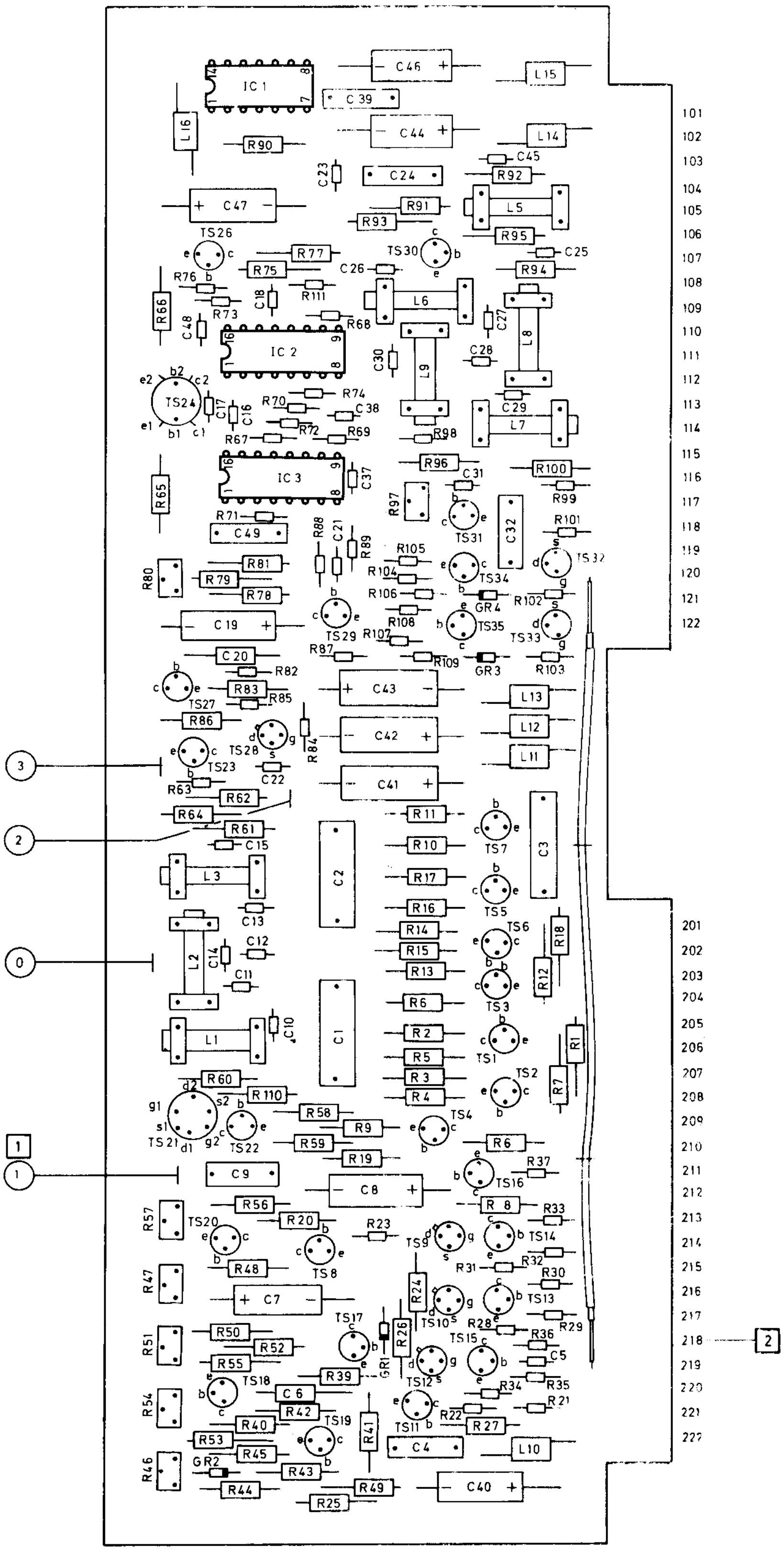
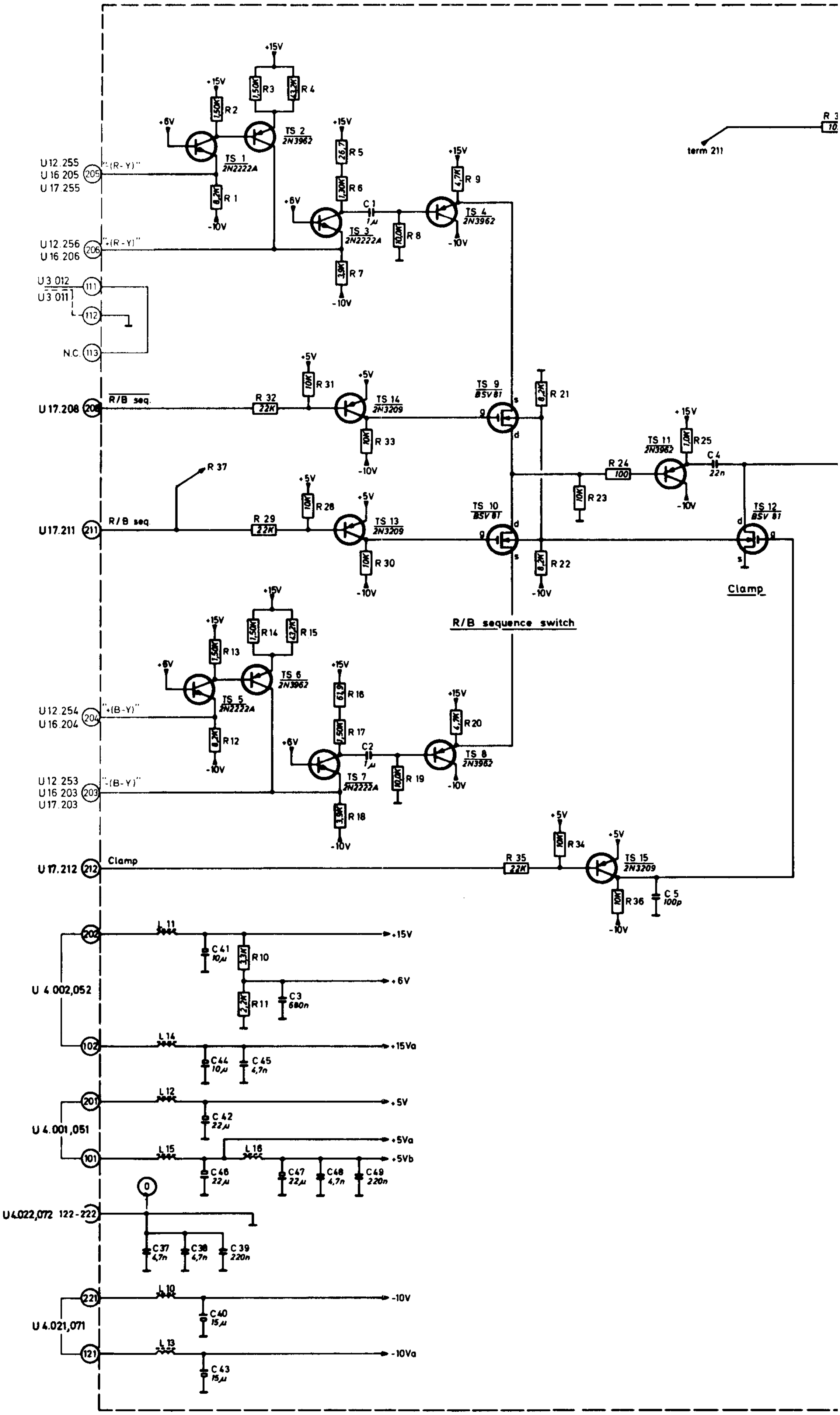


Fig. 24-2 Component location, chrominance modulator, unit 18/L



U12.255
U16.205
U17.255
"-(R-Y)"
U12.256
U16.206
"+(R-Y)"
U3.012
U3.011
N.C.
U17.208
R/B seq.
U17.211
R/B seq.
R 37
U12.254
U16.204
"+(B-Y)"
U12.253
U16.203
U17.203
"-(B-Y)"
U17.212
Clamp
U 4.002,052
U 4.001,051
U4.022,072 122-222
U 4.021,071
TS 1 2N2222A
TS 2 2N3962
TS 3 2N2222A
TS 4 2N3962
TS 5 2N2222A
TS 6 2N3962
TS 7 2N2222A
TS 8 2N3962
TS 9 BSV81
TS 10 BSV81
TS 11 2N3962
TS 12 BSV81
TS 13 2N3209
TS 14 2N3209
TS 15 2N3209
term 211
R/B sequence switch
Clamp
+15V
+6V
+15Va
+5V
+5Va
+5Vb
-10V
-10Va

Fig. 2

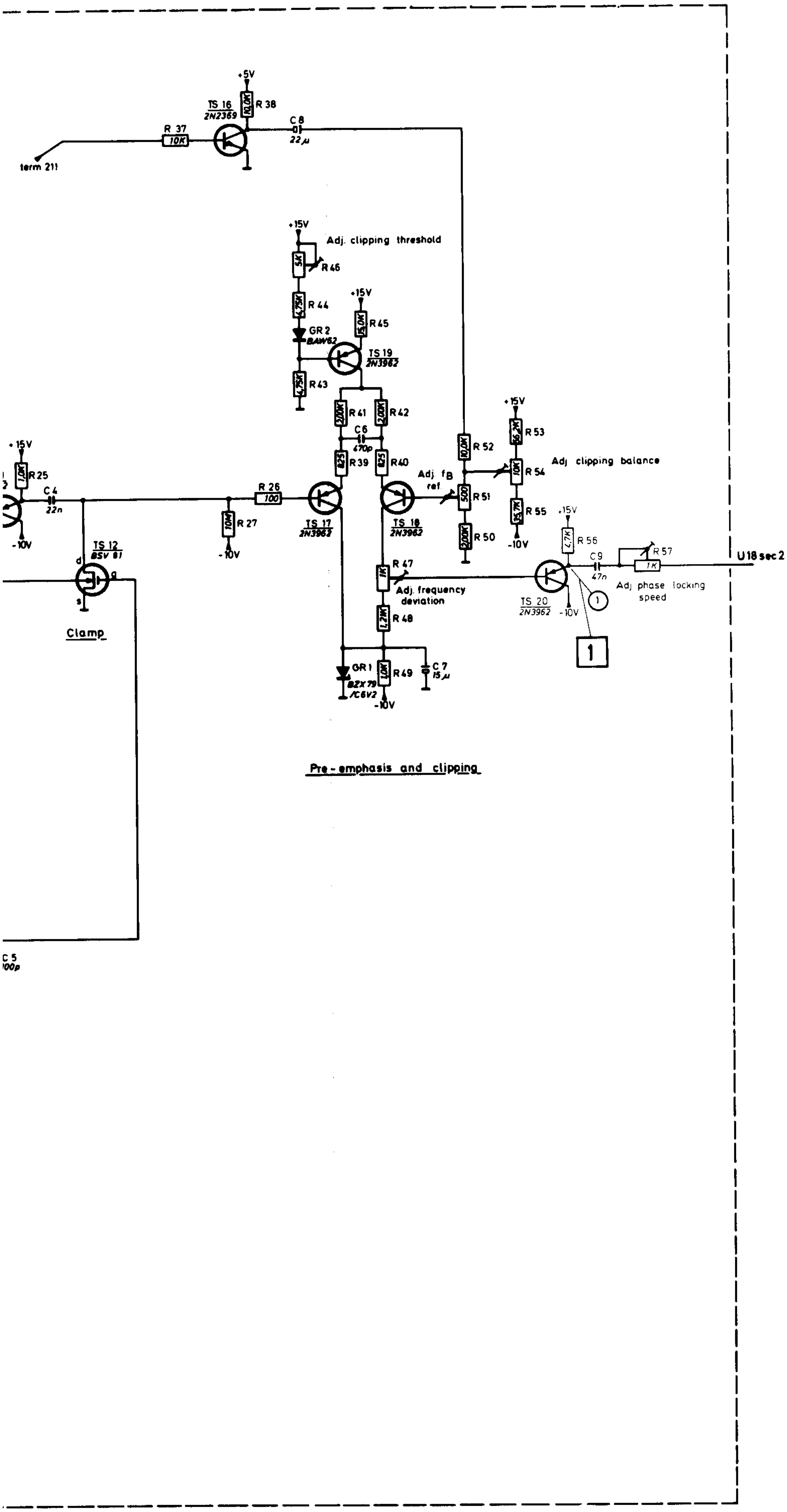
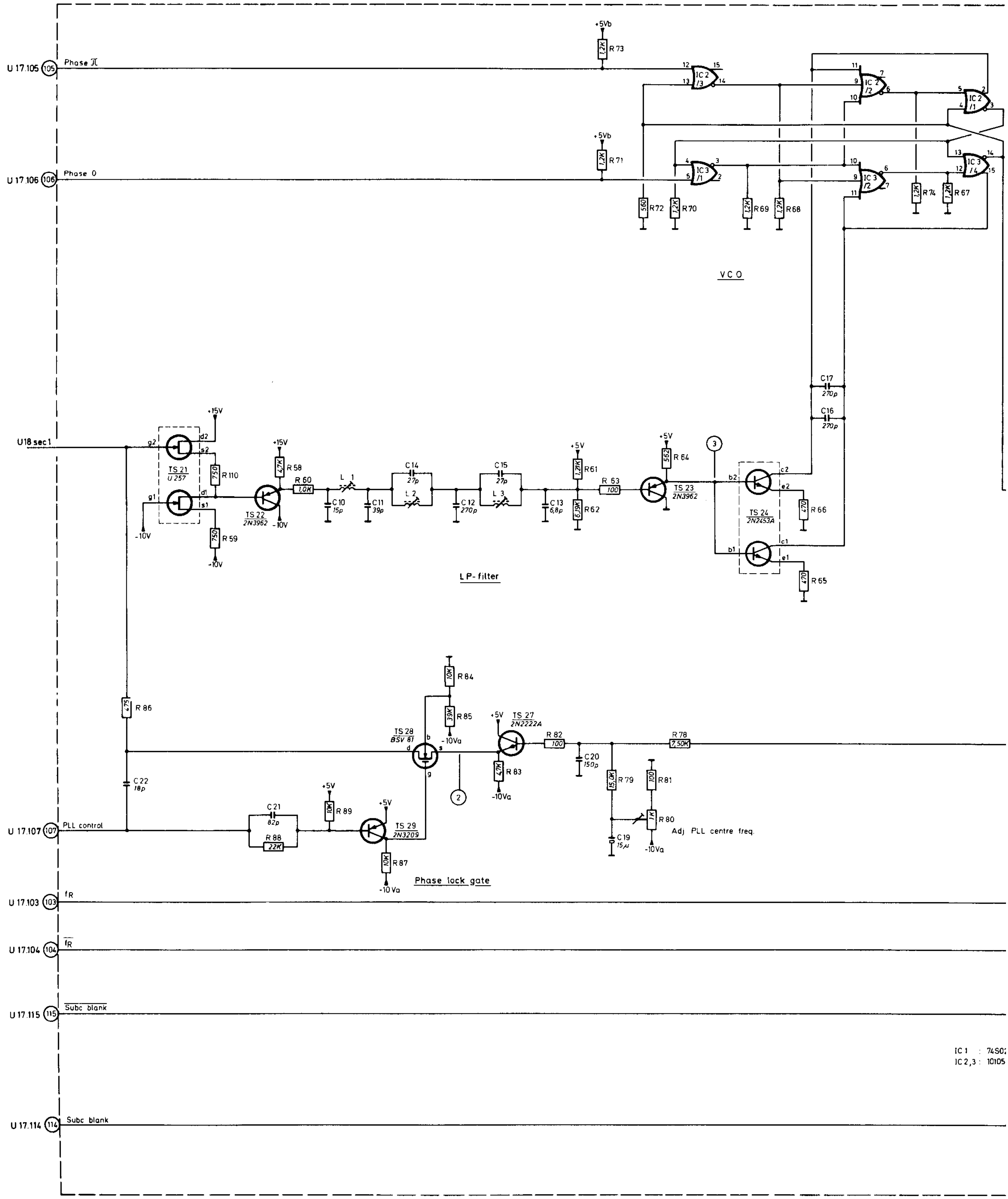


Fig. 24-3 Circuit diagram, chrominance modulator, unit 18 /L sec. 1



U 17.105
Phase π
U 17.106
Phase 0
U18 sec 1
U 17.107
PLL control
U 17.103
fR
U 17.104
fR
U 17.115
Subc blank
U 17.114
Subc blank
VCO
LP-filter
Phase lock gate
Adj PLL centre freq.
TS 21 U 257
TS 22 2N3962
TS 23 2N3962
TS 24 2N2453A
TS 27 2N2222A
TS 28 BSV 81
TS 29 2N3209
IC 1 : 74S0
IC 2,3 : 10105

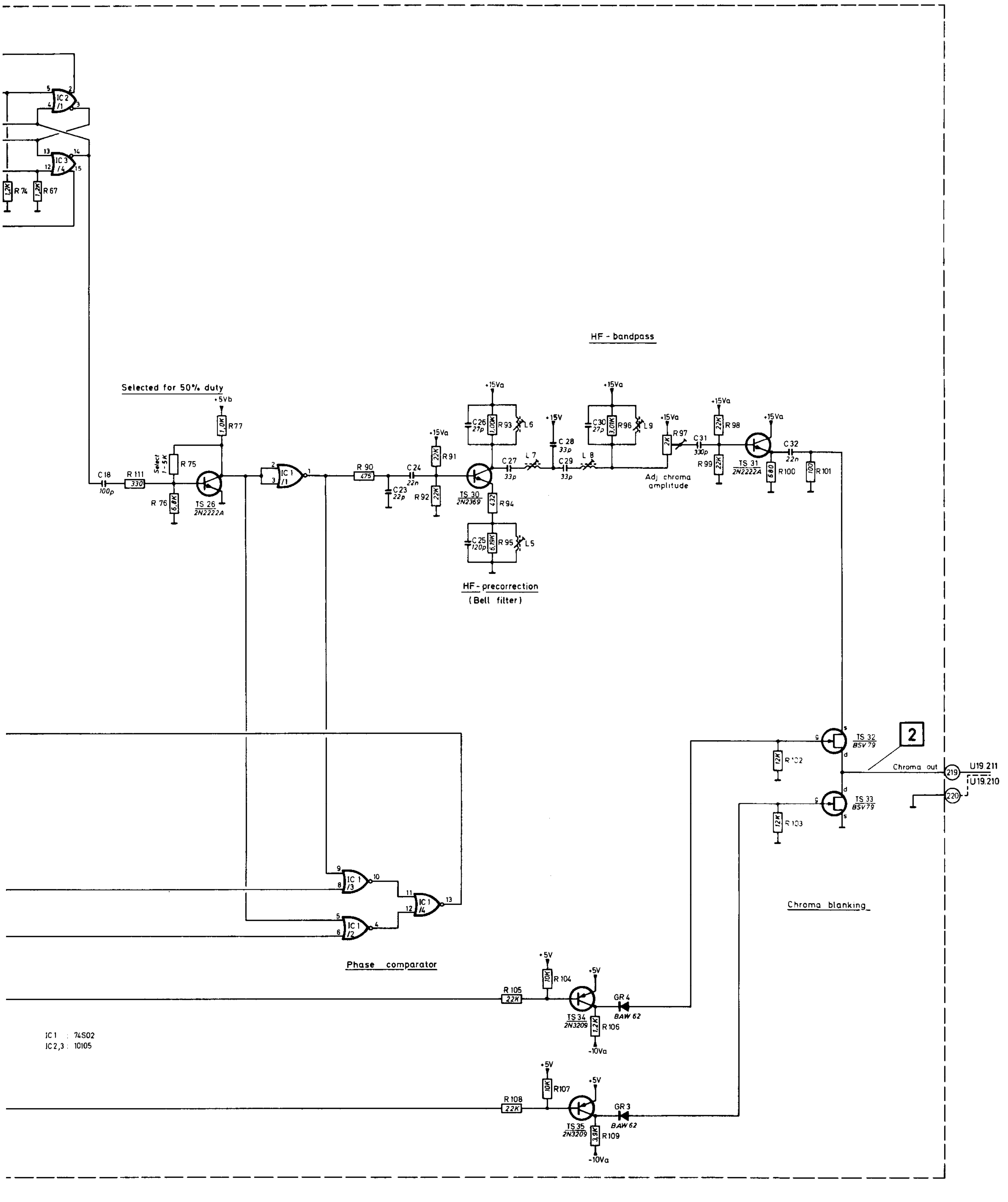


Fig. 24-4 Circuit diagram, chrominance modulator, unit 18 /L sec. 2

25. Unit 19 Output amplifier

The output amplifier supplies 3 outputs:
The pattern output, the auxiliary output and the test output.

The pattern output

The pattern output is supplied by two similar output amplifiers: the chroma/multiburst amplifier and the black/white amplifier.
The chroma and multiburst signals are voltages supplied to the matrix R1, R2 an R3 and then to the temperature compensated preamplifier TS2. The output amplifier is a push-pull amplifier supplied with a heavy negative and adjustable feed-back.
Due to this negative feed-back the output impedance is very low ($\sim 0\ \Omega$), which means that the impedance of the outgoing signal is determined by for instance R20//R21//R22.
The black/white amplifier is supplied with current signals connected to the terminals 214 and 216.
An active input on terminal 214 or 216 will cause TS7 or TS14 to go "on" and the current flowing produces a voltage across R34.
The two Thomson filters shape the incoming signal in order to fulfil specifications.

Auxiliary and test outputs

Two rather simple output amplifiers supply the auxiliary and the test output signals.
Grid is the cross hatch signal that via inverter IC1/6 is supplied to TS15. TS16 supplies the sync. to the output.
Terminal 112 is the test input used for tracing of logic signals in the instrument and eventually displayed as a test pattern on TV monitor connected to BU15.
The incoming signal is reduced by GR7-GR8. The signal is buffered by TS17 and blanking added. TS19 supplies the sync. signal and the test signal is ready for monitor display terminated with 75 ohms.

Checking and adjusting

Measuring equipment:

Oscilloscope	:	PHILIPS PM 3240
TV monitor	:	PHILIPS LDN 5006
Video level meter	:	PHILIPS PM 5548
Test print	:	PHILIPS PM 8507

cilloscope

Before any output level adjustment in the instrument is carried out, unit 19 should be checked or readjusted.

DC black level

Connect an oscilloscope (d.c.) terminated with 75 ohms to a pattern output. All units must be inserted.
Adjust R33 to obtain a black level = 0V.

Output amplitude

Instead of unit 18 insert test print PM8507 and activate the "Ref." button.
Connect PM5548 to a pattern out. All pattern outputs should be terminated with 75ohms.
Remove SW2.
Adjust R36 to obtain a 700mV output.
Check once more the DC black level, with all units inserted.

Chroma output amplitude

This adjustment is only necessary after a unit repair.
Connect an oscilloscope to a pattern output. Adjust R8 in order to obtain a chroma amplitude in the yellow and cyan areas equal to white.
After this adjustment it is necessary to check multiburst amplitude. (See unit 15).

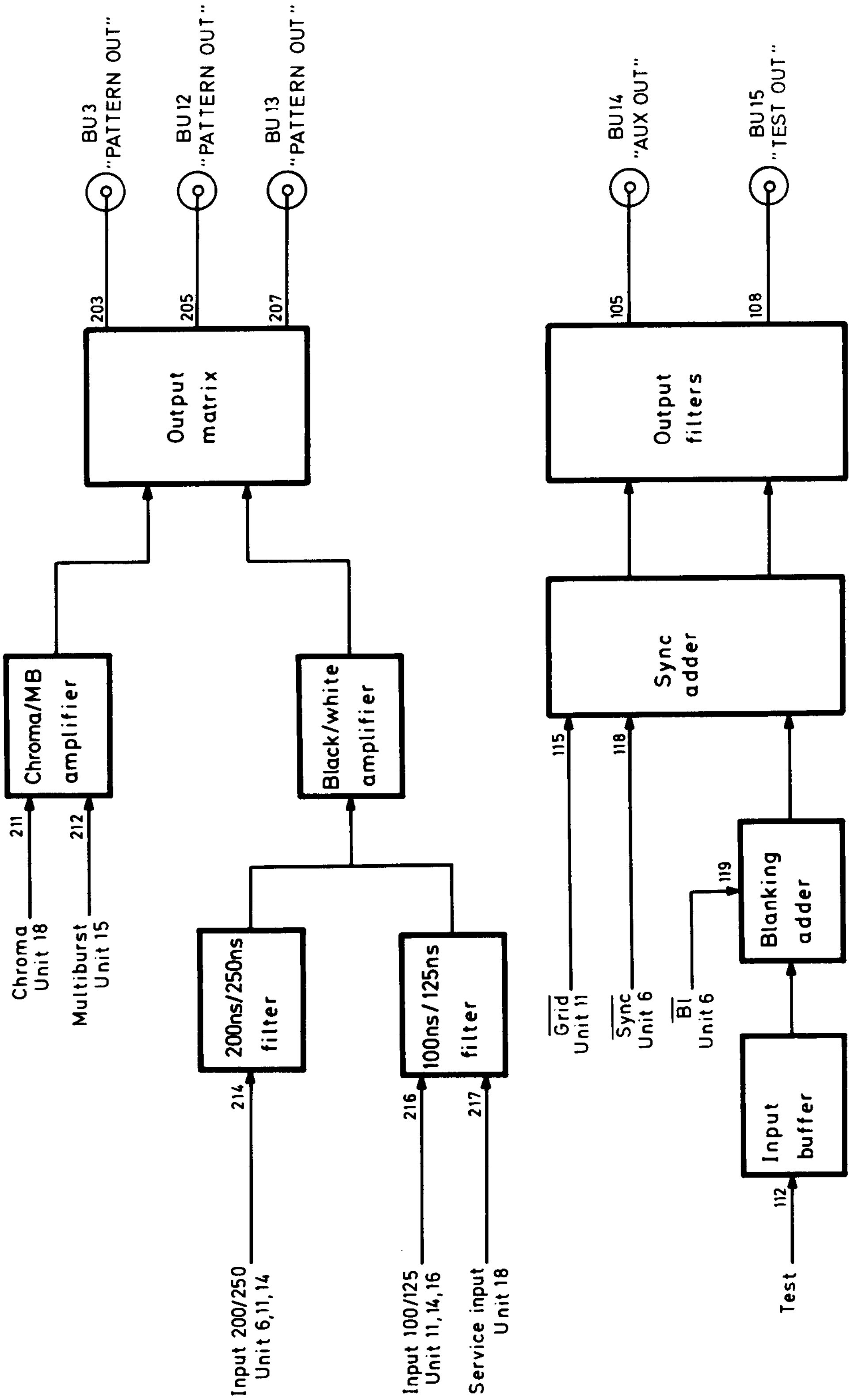
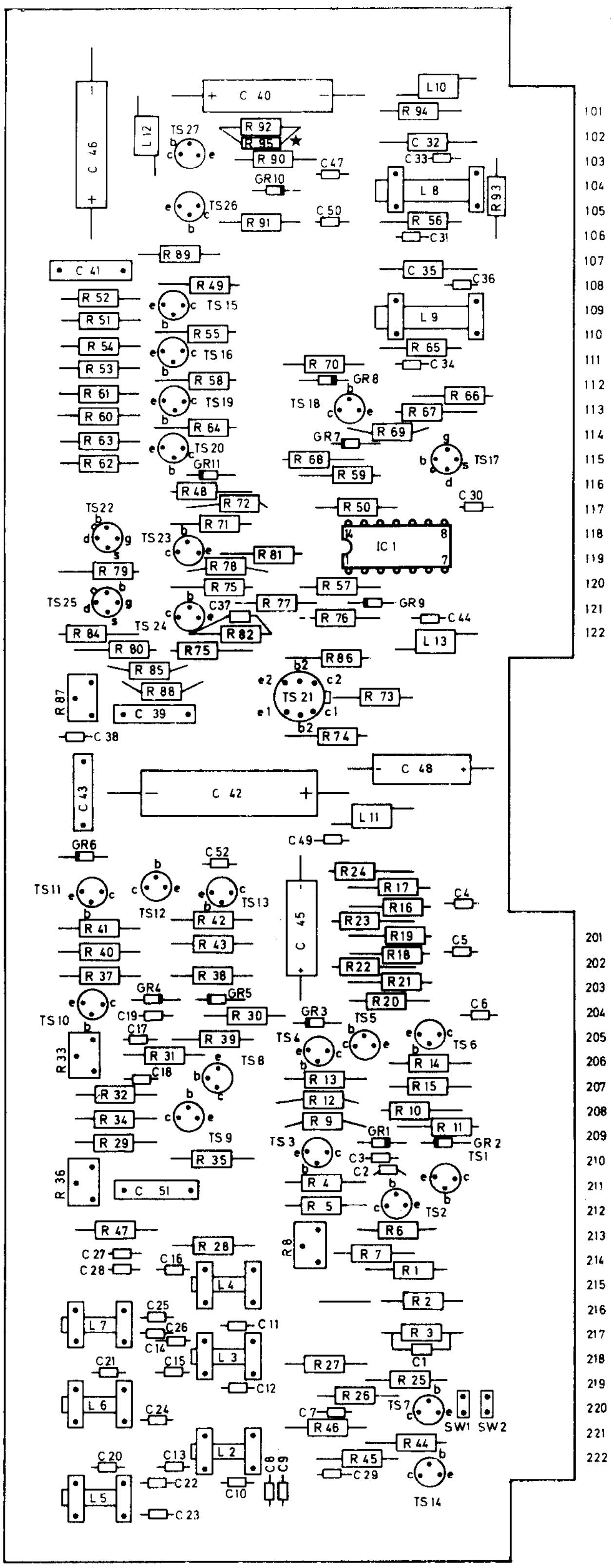
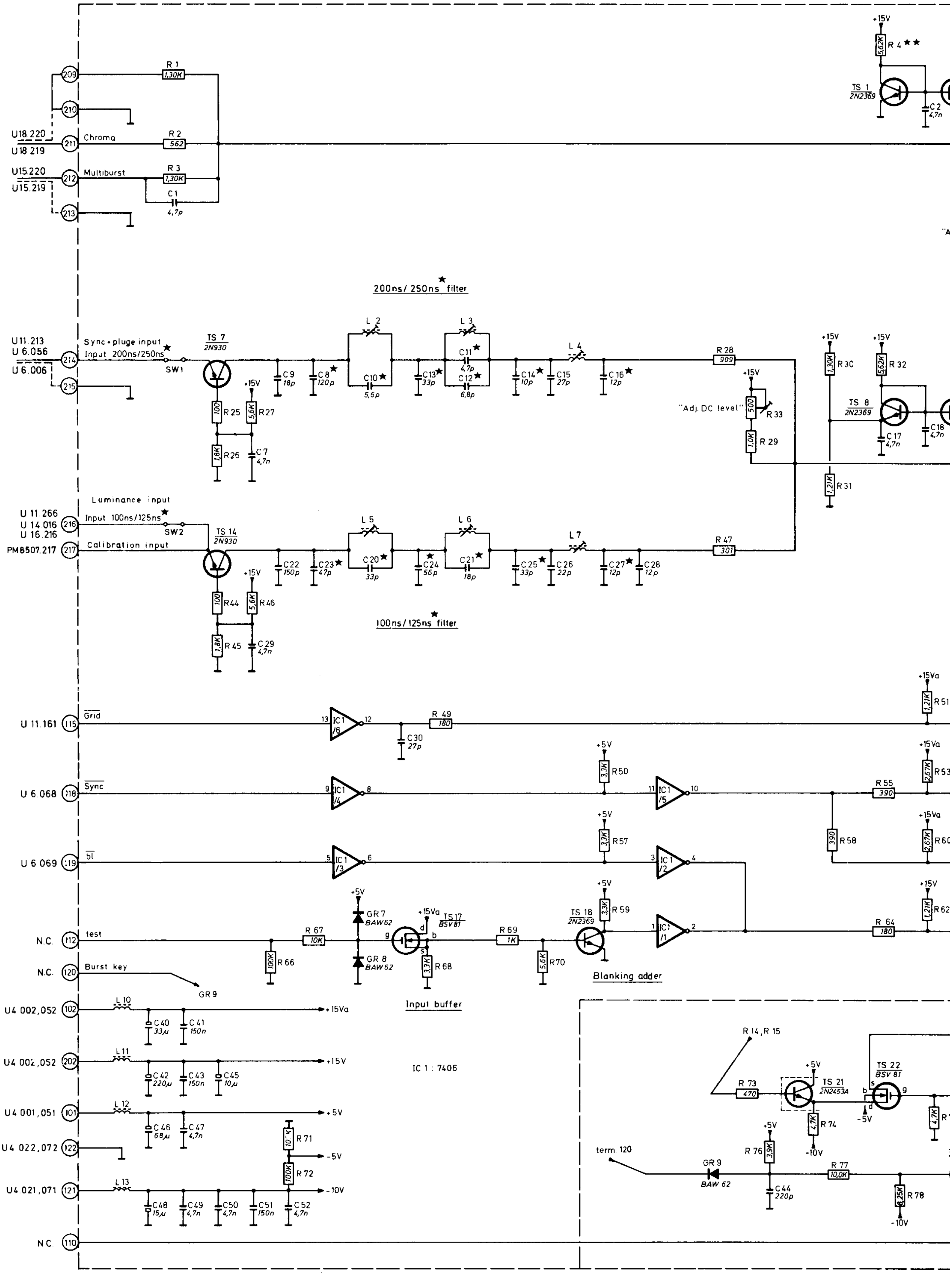


Fig. 25-1 Block diagram, output amplifier, unit 19



★ Only in M-version

Fig. 25-2 Block diagram, output amplifier, unit 19



Chroma
Multiburst
200ns/ 250ns filter
Sync + pluge input
Input 200ns/250ns
Luminance input
Input 100ns/125ns
Calibration input
100ns/125ns filter
"Adj. DC level"
Grid
Sync
bl
test
Burst key
Input buffer
Blanking adder
IC 1 : 7406
term. 120

STS Jan 2023

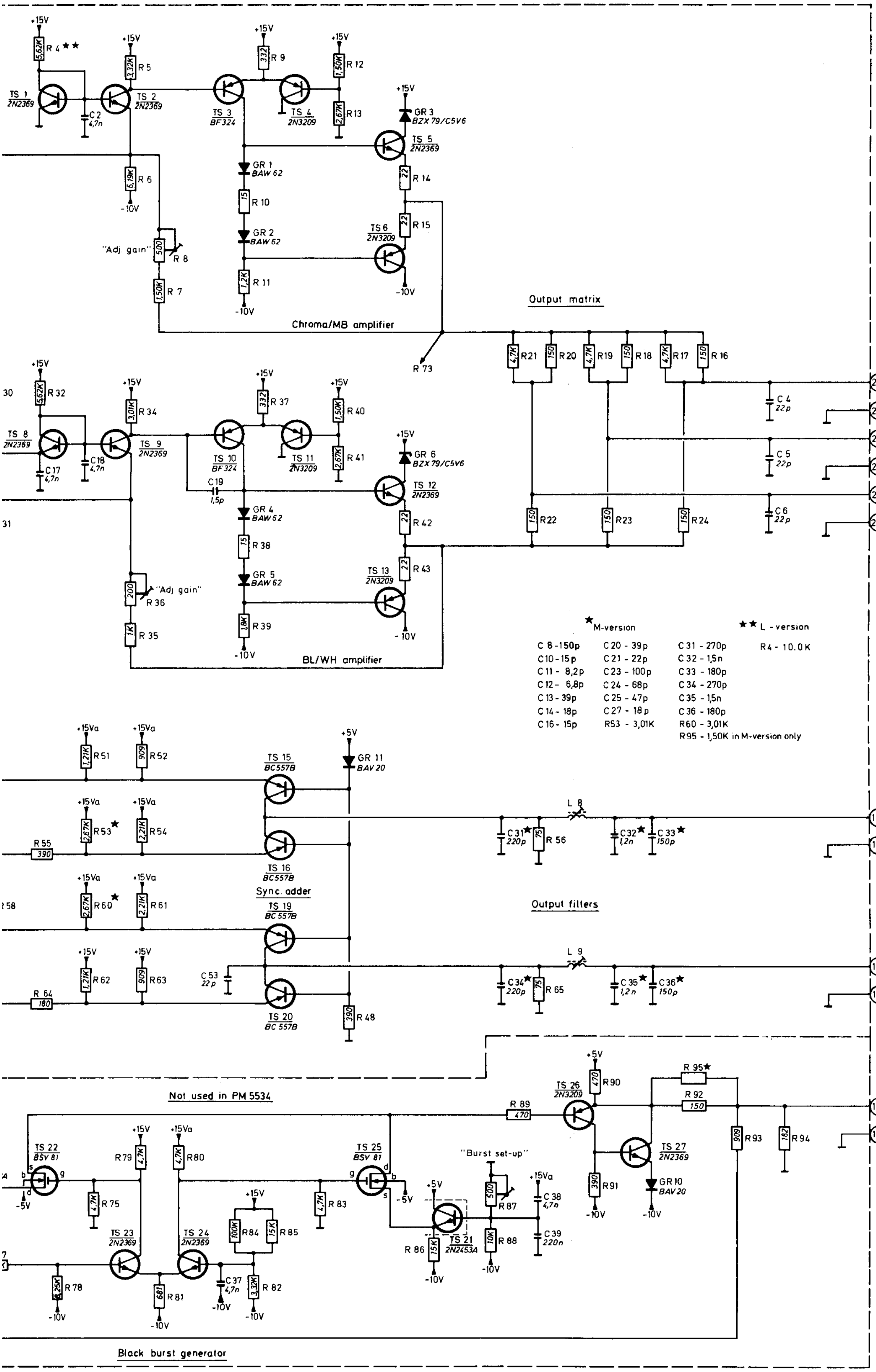


Fig. 25-3 Circuit diagram, output amplifier, unit 19

26. Unit 20 PM8504 clock generator

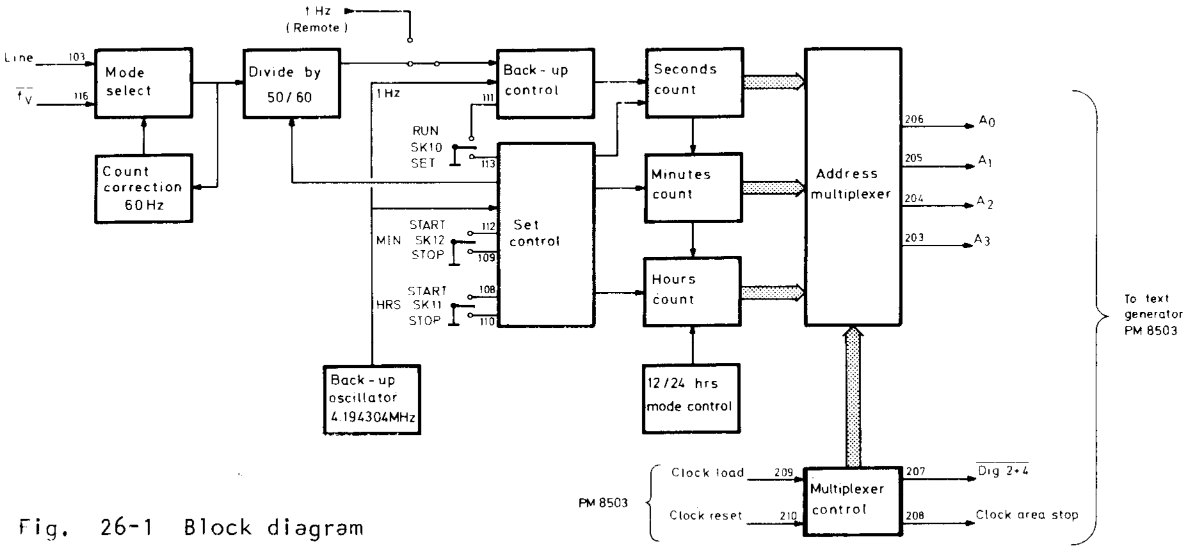


Fig. 26-1 Block diagram

This unit produces the necessary control signals for the text generator PM 8503 to display the local time.

In principle, the clock generator consists of a row of counters, which is driven by a 1Hz clock pulse. Information about the position of each counter in the row is then led to the address multiplexer, where the write-out procedure is controlled by command pulses from the text generator in order to show the right character at the right place in the test pattern.

Circuit description

The counter row consists of three "divide by 60" integrated circuits IC13, IC14 and IC15 to obtain a simple indication of seconds, minutes and hours.

The hours counter is programmed to display either 24 hours or 12 hours by decoding the output information to initiate the 12/24 hours mode control, which resets the counter as desired.

The counter row outputs are led to the address multiplexer, which consists of analogue gates, where the outputs are connected as shown in the diagram.

These analogue gates are controlled by the multiplexer control circuit, which counts the clock load pulses from PM 8503. Each count means a new character address to be executed in the text generator - similar to the purpose of the text PROM in PM 8503 - and the sequence ends when the multiplexer control delivers a clock area stop pulse to PM 8503.

In addition, the multiplexer control generates a pulse, Dig 2+4 and this pulse is

used to divide the displayed time information into the three groups: seconds - minutes - hours.
The multiplexer control receives a reset pulse at the end of each line inside the clock area as well as the two text areas.

The drive pulse for the counter row is in the normal mode derived from the field frequency, f_V, which is divided by 50 or 60 in IC9 to obtain a 1Hz pulse.
When the field frequency in the NTSC system is used to drive the clock counters, the field frequency, which is 59,940059MHz, is multiplied by 1.001 in the 60Hz count correction circuit to obtain 60Hz.
The drive pulse can be derived from the mains frequency when SW3 in the mode select circuit is in the "Line" position.
Another way to drive the clock generator is to apply an external 1Hz clock signal via the remote socket BU16 (only in PM 5537) when SW1 is in the "EXT 1Hz" position.

In case of mains failure the stand-by battery BATT 1 and the back-up oscillator keep the counter row in working condition as follows:
The presence of +5V is detected by IC20/3 in the back-up control, and if this voltage should disappear, the output level from IC20/3 goes high, which allows the 1Hz signal from the back-up oscillator to pass through IC20/1.

The actual time setting is carried out by means of three switches, SK10, SK12 and SK11, which initiate three flip-flops in the "set control" as follows:
When SK10 has been switched shortly to position SET, flip-flop IC8/2, IC8/3 stop the "divide by 50/60" circuit and disables gate IC18/3.
Now, when either SK12 or SK11 is set shortly to position START, this initiates the relevant flip-flop, which enables either IC18/1 or IC18/2, and the 1Hz signal from the back-up oscillator has access either to the minutes counter or the hours counter until a stop command is given with the same switch.
When either IC18/1 or IC18/2 is enabled the seconds counter will automatically be reset to zero by means of IC17/1.

The item display should be set one or two minutes ahead of actual time, and at the exact moment SK10 should be switched to RUN to start the clock.

Checking and adjusting

Measuring equipment:

Counter : e.g. PHILIPS PM 6612

Back-up osc. frequency

The oscillator frequency should be 1 sec ±10µ sec (measured at TS1's collector). If not, the frequency can be adjusted with C16.

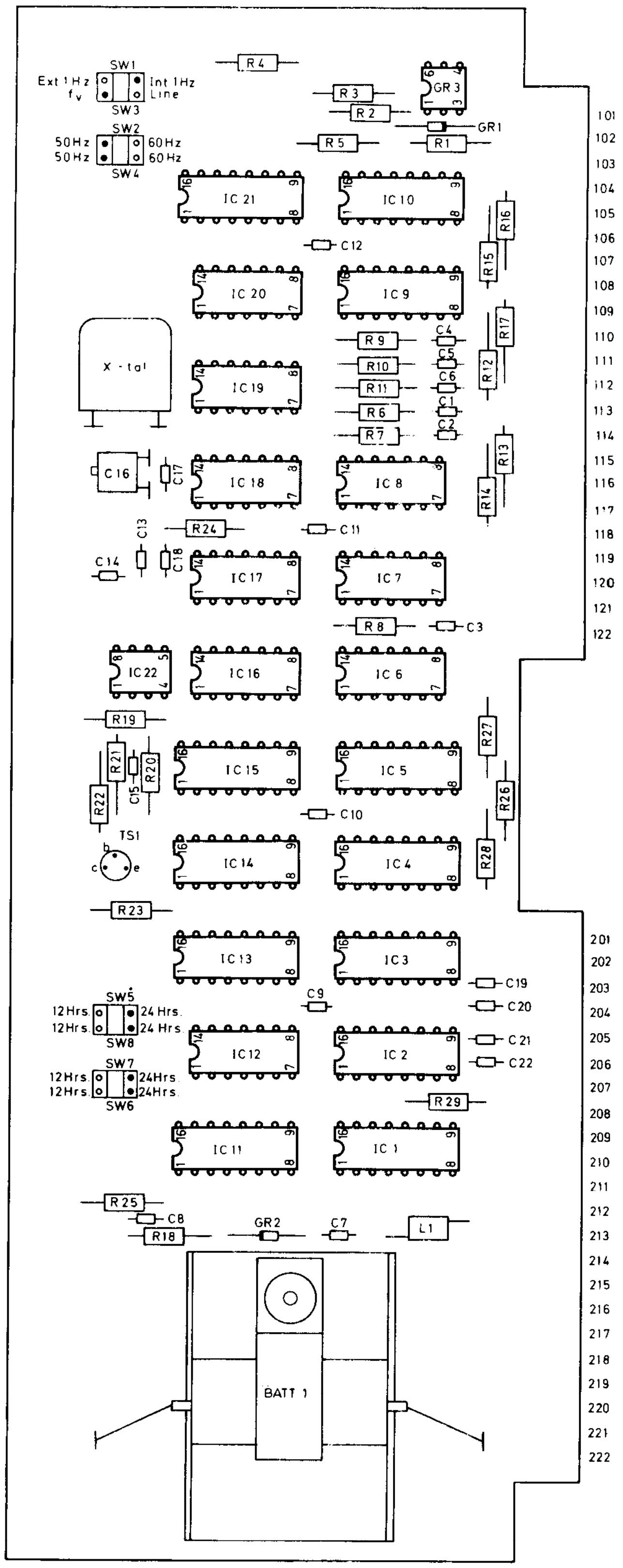
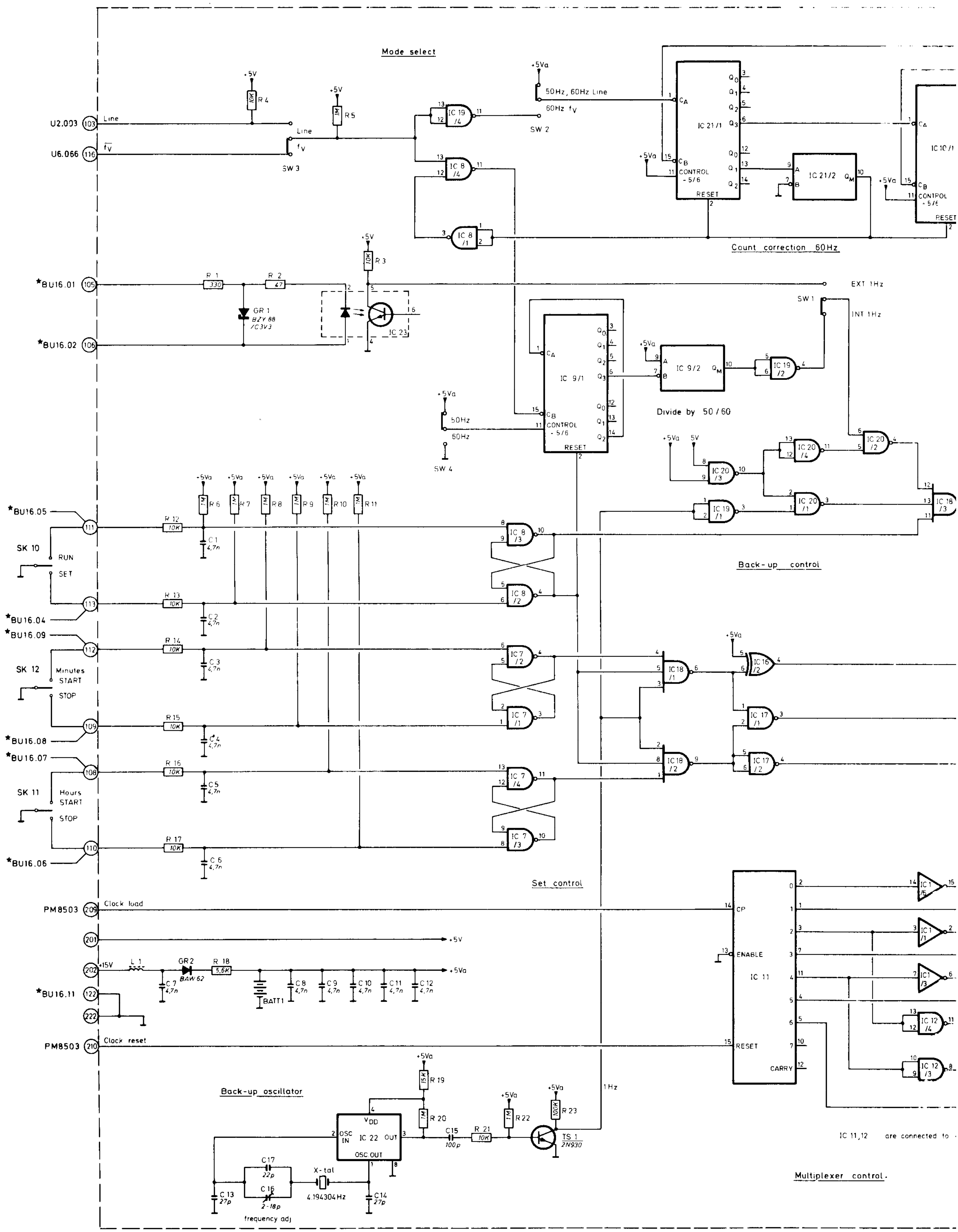


Fig. 26-2 Component location, Clock generator


Mode select
Count correction 60Hz
Divide by 50 / 60
Back-up control
Set control
Back-up oscillator
Multiplexer control.
U2.003
U6.066
BU16.01
BU16.02
BU16.05
SK 10
RUN
SET
BU16.04
BU16.09
SK 12
Minutes START
STOP
BU16.08
BU16.07
SK 11
Hours START
STOP
BU16.06
PM8503
Clock load
Clock reset
EXT 1Hz
INT 1Hz
50Hz, 60Hz Line
60Hz fv
frequency adj
4.194304 Hz
IC 11,12 are connected to

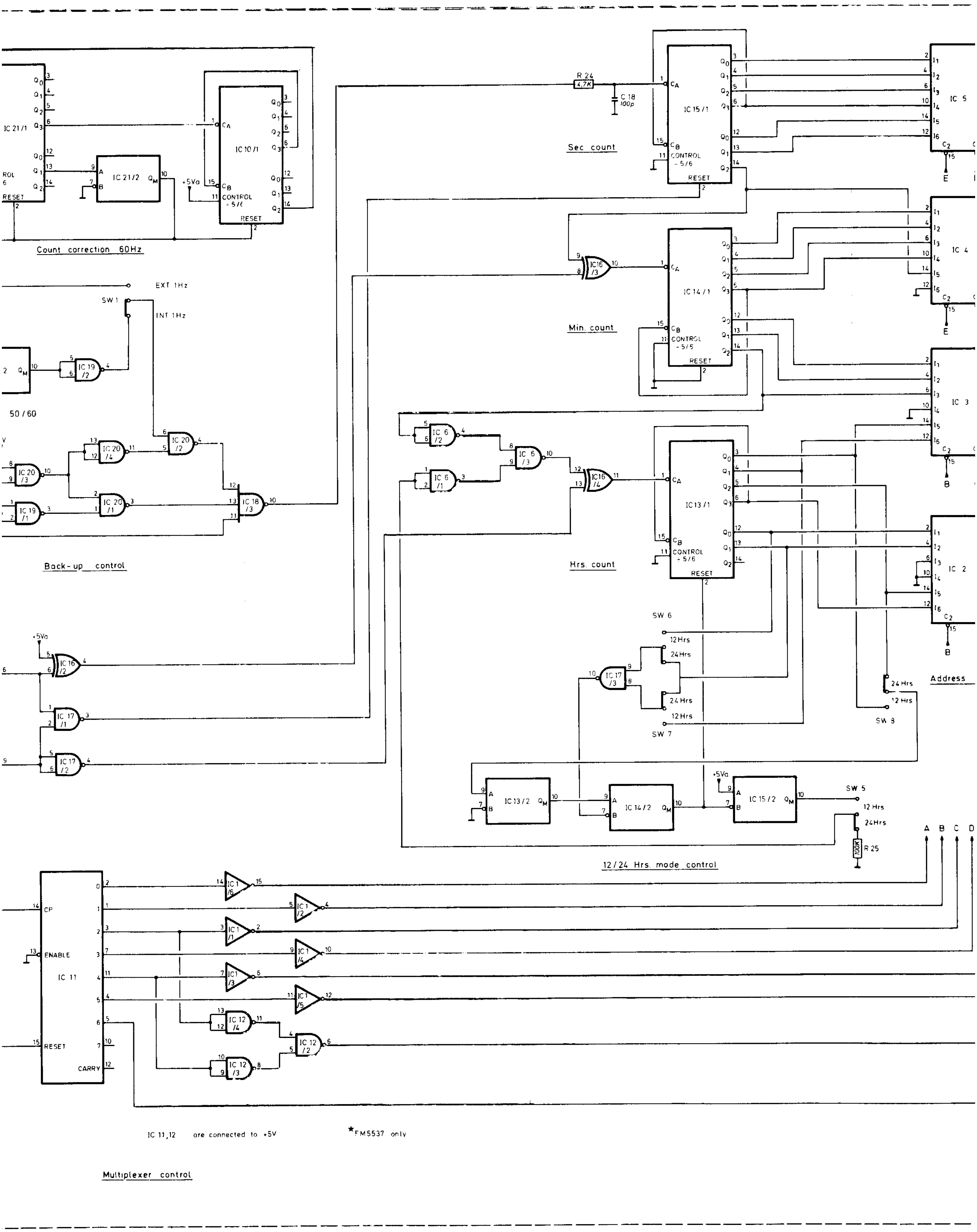

Count correction 60Hz
IC 21/1
IC 21/2
IC 10/1
EXT 1Hz
SW 1
INT 1Hz
IC 19 /2
50 / 60
IC 20 /4
IC 20 /2
IC 20 /3
IC 20 /1
IC 19 /1
IC 18 /3
Back-up control
IC 16 /2
IC 17 /1
IC 17 /2
R 24
4,7K
C 18
100p
IC 15 / 1
Sec count
IC 16 /3
IC 14 / 1
Min. count
IC 6 /2
IC 6 /1
IC 6 /3
IC16 /4
IC 13 / 1
Hrs. count
IC 5
IC 4
IC 3
IC 2
SW 6
12 Hrs
24 Hrs
IC 17 /3
SW 7
SW 8
Address
IC 13 / 2
IC 14 / 2
IC 15 / 2
SW 5
R 25
100K
12 / 24 Hrs. mode control
IC 11
CP
ENABLE
RESET
CARRY
IC 1 /6
IC 1 /2
IC 1 /1
IC 1 /4
IC 1 /3
IC 1 /5
IC 12 /4
IC 12 /2
IC 12 /3
A B C D
IC 11,12 are connected to +5V
*FM5537 only
Multiplexer control

Fig. 2

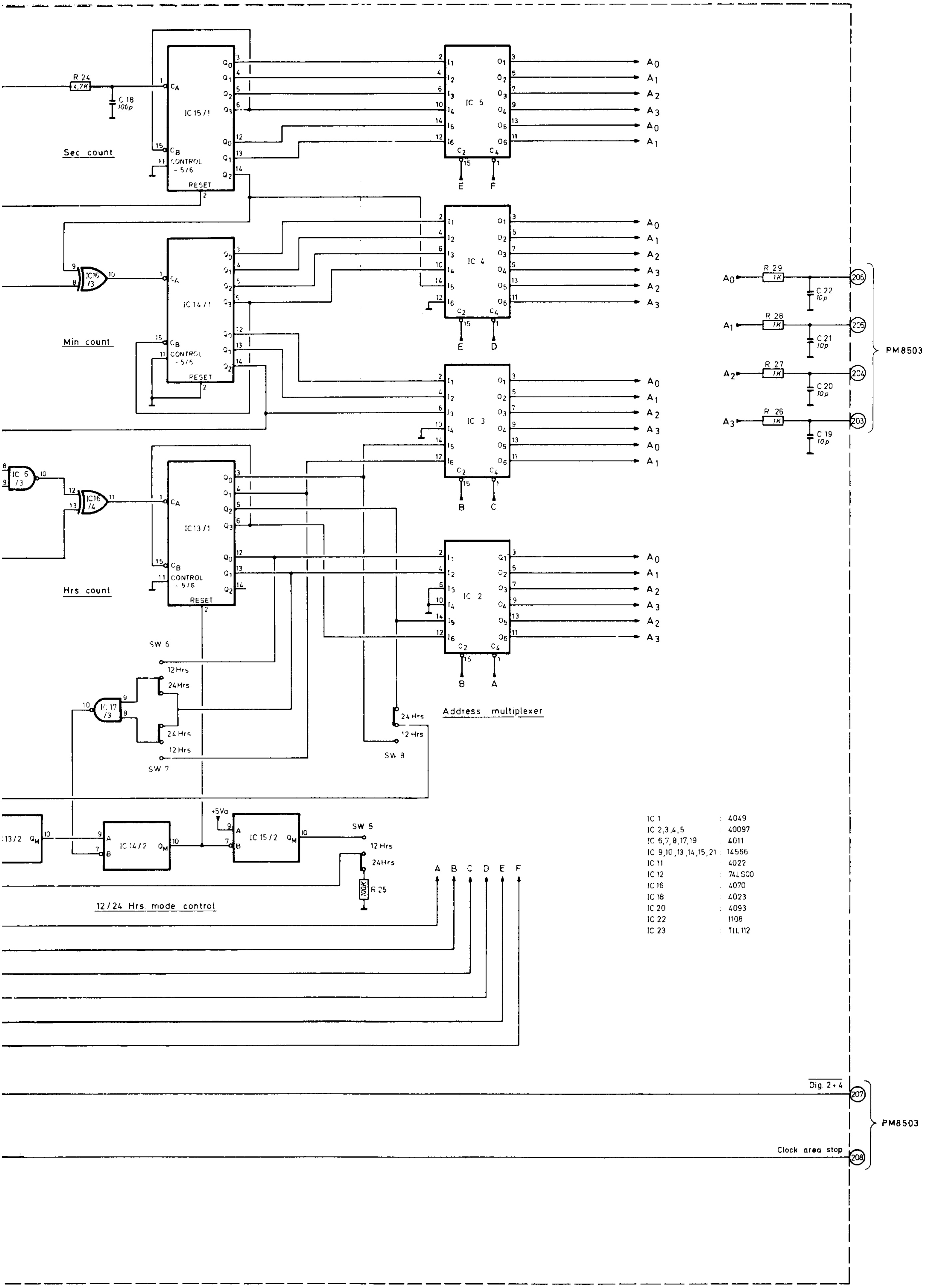
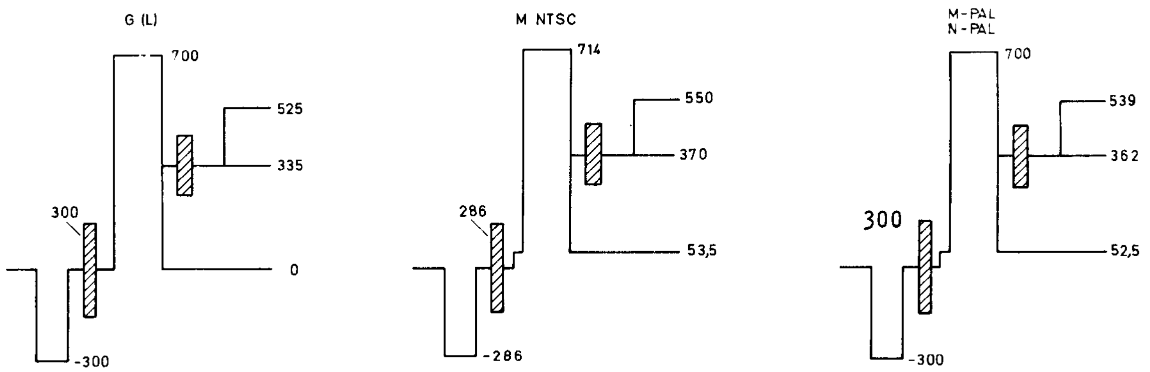


Fig. 26-3 Circuit diagram, clock generator, unit 20

27. Survey of amplitudes

	G,(L)	M-NTSC	M-PAL	N-PAL	I-(BBC)
White	700	714	700	700	700
250 kHz	525	549	539	539	700 175
Background	335	370	362	362	335
Black	0	54	52,5	52,5	0
Sync	-300	-286	-300	-300	-300
Burst	300	286	300	300	300
Yellow	465	493	483	483	640
Cyan	368	401	393	393	543
Green	308	345	337	337	483
Magenta	217	259	253	253	392
Red	157	202	198	198	332
Blue	60	110	108	108	235
Pluge	-35	5%	5%	5%	-35



28. PM8507 Test-card (optional)

This unit is of equal practical use, when adjusting the PM 5534 or PM 5537.
Each instrument deliver a complex test pattern.
The test pattern consists of individual signals supplied as currents and added at the input terminals of the output amplifiers.
It is the task of this unit to make it possible to select one signal at the time for the output amplifier, in order to make readings and adjustments of each signal selected.

PM 8507 has to be inserted in the position of unit 18 and SW2 on unit 19 has to be open.

SK1: "REF".

When SK1 is operated a reference current is supplied to terminal 217 of the output amplifier making it possible to pre-adjust unit 19 for an output of 700 mV.

SK2-SK5: ±(R-Y) and ±(B-Y).

These switches select the colour difference signals normally applied to the chrominance modulator.
The selected signal is applied to terminal 217 of the output amplifier.

SK6-SK7: "SLOW" and "FAST".

SK7 and SK6 in fact are on/off switches for the luminance signals.

Checking and adjusting

Measuring equipment:

Digital voltmeter : e.g. PHILIPS PM 2422

Remove SW1 and insert the test unit into a PM 5534 or PM 5537 in the place of unit 18.
Check or readjust supply voltages: +5.000V ±0.001V, -10.000V ±0.001V.
Connect a digital voltmeter across R9 and select R8 in order to obtain 2,500V.
Connect SW1.

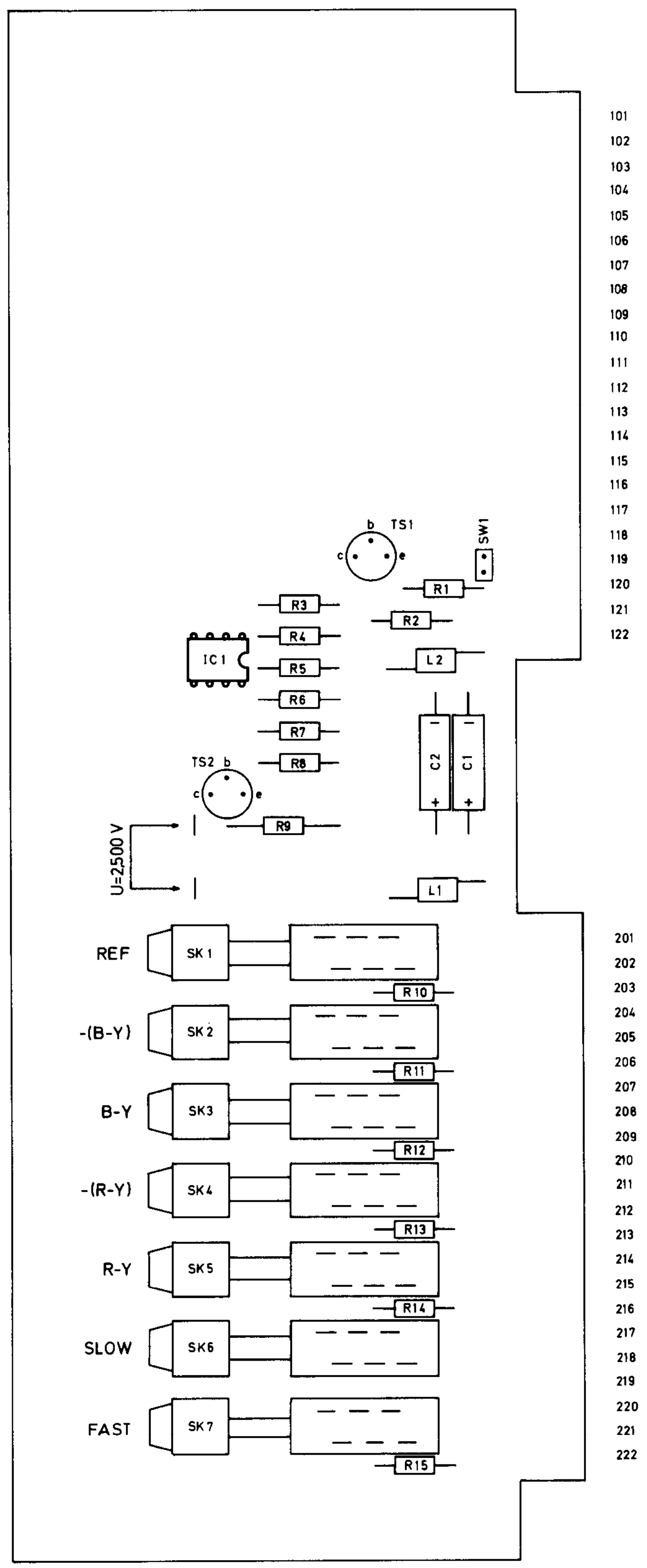


Fig. 28-1 Component location, test-card, PM8507

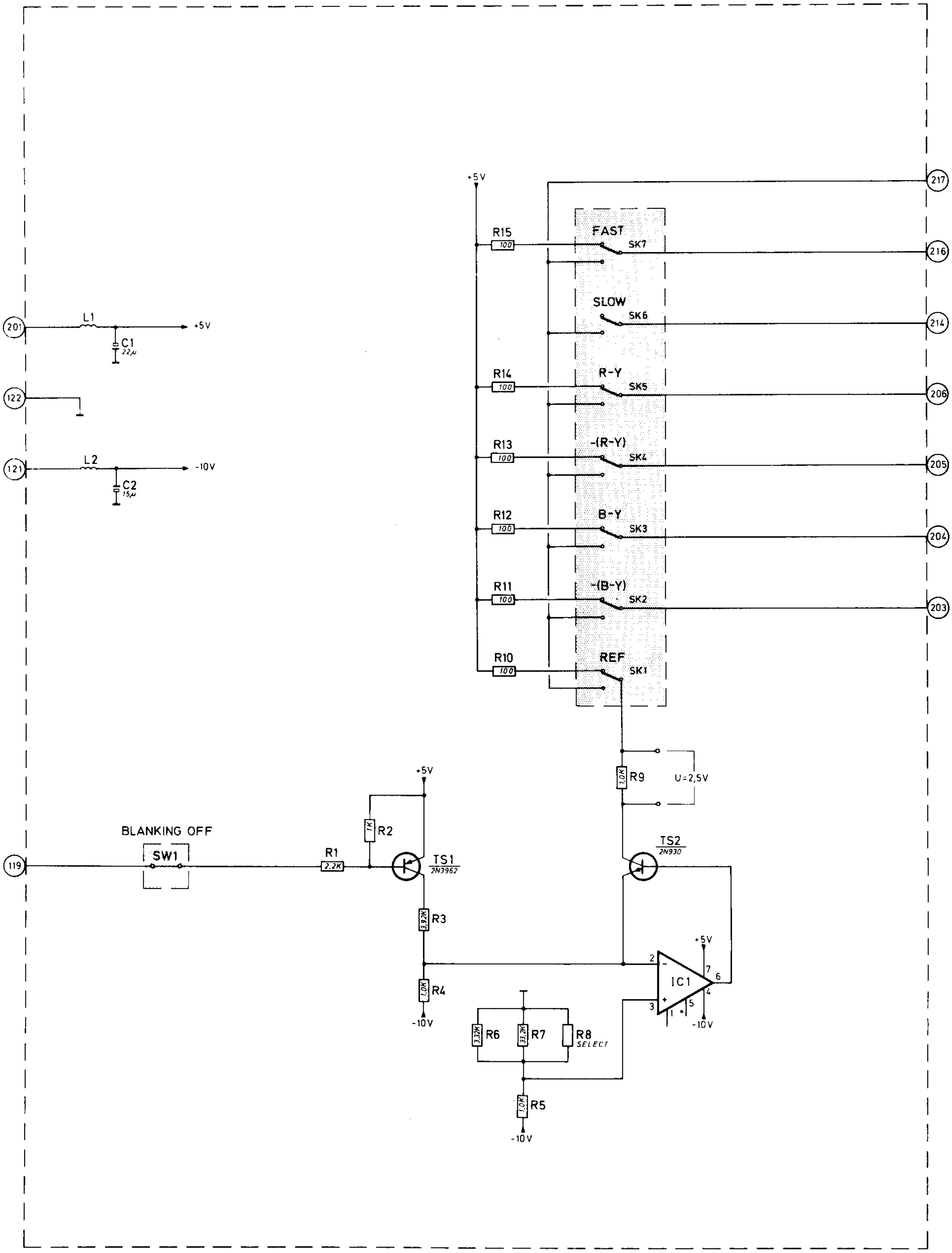


Fig. 28-2 Circuit diagram, test-card, PM8507

29. List of mechanical parts

Item	Description	Quant	Ordering number
1	Textplate	1	5322 455 74077
2	Ornamental strip 6/6	1	5322 460 64006
SK1	Mains switch	1	5322 276 14322
SK1	Button	1	5322 414 24902
SK1	Lens, white	1	5322 381 14146
LA1	Lamp, 6V 60mA	1	5322 134 44061
P1	Potentiometer	1	4822 101 20299
BU1-3	BNC connector	3	5322 267 14027
BU4-7	BNC connector assy	1	5322 218 64057
BU12-15	BNC connector assy	1	5322 218 64057
BU17	Earth connector	1	5322 290 40011
BU18	Earth connector	1	5322 290 40012
VL1	Fuse holder	1	5322 256 40039
BU19	Mains socket	1	5322 265 30066
4	Locking bracket	2	5322 417 64026
	Mains transformer TR 1	1	5322 146 34092
	Bridge rectifier	1	5322 130 54058
	Transistor BDX 65A TS1-3 Darlington	3	4822 130 40997
	Fuse 230V 0,5A	1	4822 253 30017
	Fuse 115V 1,0A	1	4822 253 30021

CONTROL PANEL

Item	Description	Quant	Ordering number
3	Textplate	1	5322 455 74078
SK10-12	Switch	3	5322 277 14248
LA10	Red led with clip	1	5322 130 34446
SK13-16	Push button unit	1	5322 276 44073
SK13-16	Push button	4	5322 414 14011

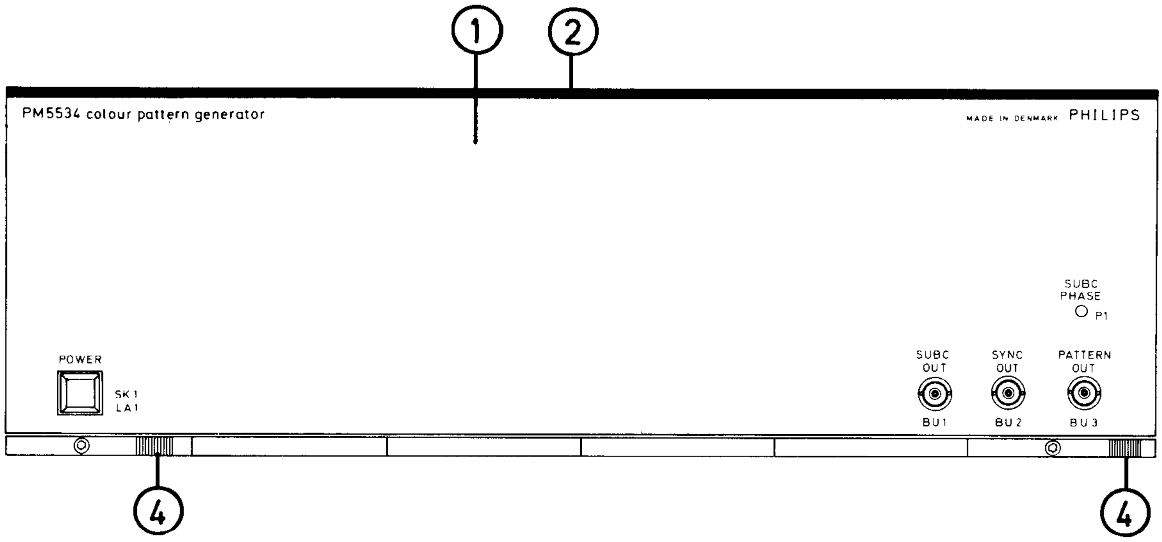


Fig. 29-1 Front of the instrument

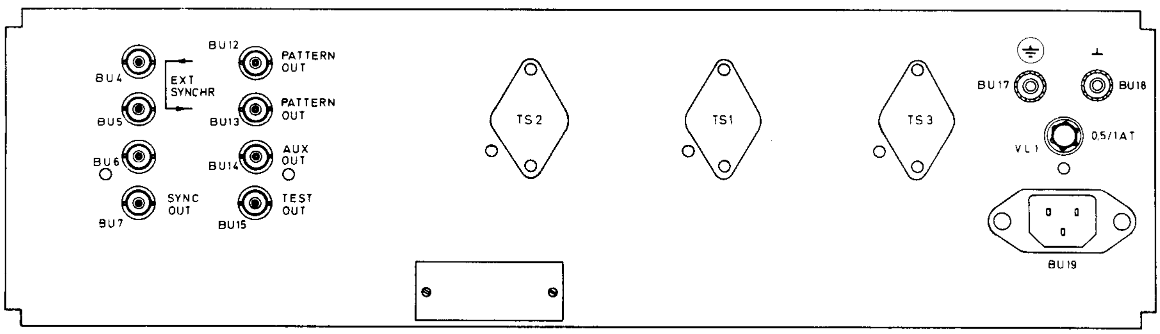


Fig. 29-2 Rear of the instrument

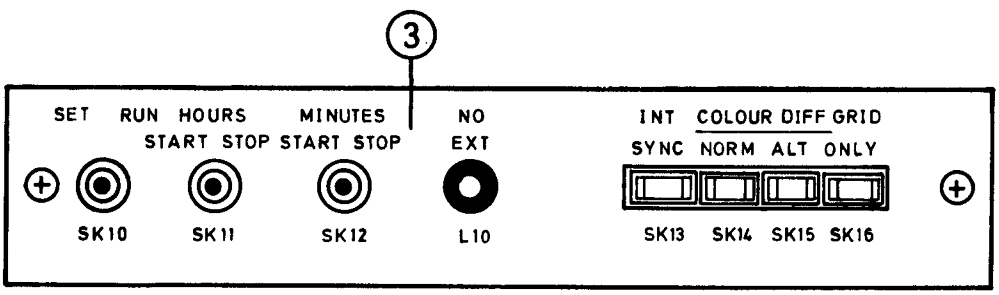


Fig. 29-3 Front of the control panel

30. List of electrical parts

Unit	Description	Print number	Ordering number
2	Rectifier unit	4008 108 83460	5322 216 64314
3/G	Subcarrier generator	4008 108 79950	5322 212 84109
3/N	Subcarrier generator	4008 108 86200	5322 216 64357
3/M-PAL	Subcarrier generator	4008 108 86210	5322 216 64358
3/M-NTSC	Subcarrier generator	4008 108 82670	5322 212 84071
4	Voltage regulator	4008 108 82450	5322 216 64293
5/G	Sync generator	4008 108 79940	5322 212 84108
5/M	Sync generator	4008 108 82680	5322 212 84072
6	Sync interface	4008 108 82460	5322 216 64294
9	Horizontal divider	4008 108 82490	5322 216 64296
10	Vertical divider	4008 108 82500	5322 216 64297
11/G	BL/WH gen. control	4008 108 82510	5322 216 64298
11/M	BL/WH gen. control	4008 108 82690	5322 216 64308
12	Colour diff. generator	4008 108 82530	5322 216 64299
13/G	Circle generator	4008 108 82550	5322 216 64301
13/M	Circle generator	4008 108 84840	5322 216 64359
14	Greycale	4008 108 82570	5322 216 64302
15/G	Multiburst generator	4008 108 82580	5322 216 64303
15/I	Multiburst generator	4008 108 82750	5322 216 64313
15/M	Multiburst generator	4008 108 82720	5322 216 64309
16	Colour bar generator	4008 108 82590	5322 216 64304
17/L	Secam control	4008 108 82640	5322 216 64306
18/G	Chrominance modulator	4008 108 82600	5322 216 64291
18/L	Chrominance modulator	4008 108 82650	5322 216 64307
18/M	Chrominance modulator	4008 108 82730	5322 216 64311
19/G	Output amplifier	4008 108 82610	5322 216 64315
19/M	Output amplifier	4008 108 82740	5322 216 64312

Resistor not listed in this chapter are standard resistors of the following type:
Carbon film, CR16 0,2W, 5 and 10%
Carbon film, CR25 0,33W, 5 and 10%
Carbon film, CR37 0,5W, 5 and 10%

Semi-conductors not listed in this chapter are standard types (see list of standard semi-conductors) placed at the end of the manual.

Unit 2

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1	5322 209 85714	TIL112

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	4822 124 40351	2200UF	30%	40V	ELECTROLYTIC
C2	4822 124 40371	3300UF	30%	25V	ELECTROLYTIC

Unit 3

Number	Ordering number	Type
CRYSTALS		
G/PAL	5322 242 74144	TCXO 8.867237MHz
M/NTSC	5322 242 74143	TCXO 7.159090MHz
M/PAL	5322 242 74384	TXCO 7.151223MHz
N/PAL	5322 242 74383	TXCO 7.164112MHz
TRANSISTOR		
TS12	5322 130 40516	BFW13
COILS		
L4/G	5322 156 24142	
L4/M	5322 156 24021	
L4M/N	5322 156 24021	

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,2,3	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C4,5,6,7,8 9,10,20,22	4822 122 30128	4.7NF	10%	100V	CERAMIC
C11,12,14 26,27	4822 122 31081	100PF	2%	100V	CERAMIC
C13	4822 122 31054	10PF	2%	100V	CERAMIC
C15	4822 121 50591	1N0	±1%	630V	FOIL
C16,17	4822 121 40232	220NF	10%	100V	FOIL
C18	4822 122 31061	18PF	2%	100V	CERAMIC
C19	5322 125 50051	2P0-18P			TRIMMING
C21	5322 121 54077	N33	±1%	630V	FOIL
C23,24,25	5322 121 40232	100NF	10%	100V	FOIL
RESISTORS					
R55	5322 116 54638	18K2	1%	0.4W	METAL FILM
R56	5322 116 54662	35K7	1%	0.4W	METAL FILM
R63	5322 116 54459	75E	1%	0.4W	METAL FILM
POTENTIOMETERS					
R17,24	5322 100 10117	2K2		0.5W	TRIMING POTM

Unit 4

Number	Ordering number	Type
TRANSISTORS		
TS1,2,3	5322 130 40051	2N930

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,4	4822 122 31175	1NF	10%	100V	CERAMIC
C2	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C3	5322 121 40323	100NF	10%	100V	FOIL
C5	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C6	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C7	4822 122 30055	330PF	10%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
RESISTORS					
R7,18,19	5322 113 60072	3.3	10%	1W	WIRE-WOUND
R8	5322 113 44301	2.7	10%	2W	WIRE-WOUND
R15,16	5322 113 60079	2.2	10%	1W	WIRE-WOUND
R17	5322 113 60099	2.7	10%	1W	WIRE-WOUND
POTENTIOMETERS					
R3,10,24	5322 103 10052	500E		0.5W	TRIMMING POTM

Unit 5

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC8	5322 209 81945	QQ5506
IC9	5322 209 85573	QQ5502
CRYSTALS		
X-TAL	5322 24274163	10.000MHz (625 LINE SYSTEM)
X-TAL	5322 242 74159	10.06993MHz (525 LINE SYSTEM)
TRANSISTORS		
TS3	5322 130 44396	BF324
TS7	5322 130 40051	2N930
TS14	5322 130 40516	BFW13
COILS		
L1,2	5322 158 10052	
L3,4	5322 156 24148	

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,6	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C2,3,4,5,7 14,15,22,29	4822 122 30128	4.7NF	10%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
C8,16,21,26					
27,28	4822 121 40231	100NF	10%	100V	FOIL
C9	4822 122 31081	N10	+-2%	100V	CERAMIC
C9/M	4822 122 31081	N10	+-2%	100V	CERAMIC
C10	5322 121 44201	10NF	10%	630V	FOIL
C11	4822 122 30112	2.2NF	10%	100V	CERAMIC
C12	4822 122 30055	330PF	10%	100V	CERAMIC
C13	4822 122 31175	1NF	10%	500V	CERAMIC
C17	4822 122 31061	18PF	2%	100V	CERAMIC
C18,23	4822 122 31175	1NF	10%	500V	CERAMIC
C19,20	4822 122 30027	1NF	10%	100V	CERAMIC

POTENTIOMETER

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
R76	5322 101 14127	10K		0.15W	TRIMMING, POTM

Unit 6

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description

CAPACITORS

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
C1	5322 124 24108	68UF	12%	6.3V	ELECTROLYTIC
C2,3	4822 122 30128	4.7NF	10%	100V	CERAMIC
C4	5322 124 24187	33UF	20%	25V	ELECTROLYTIC
C5	5322 124 24111	47UF	20%	10V	ELECTROLYTIC
C6,7,9,10	4822 122 31081	100PF	2%	100V	CERAMIC
C8	4822 122 31168	270PF	10%	500V	CERAMIC
C11,12,13,15	4822 122 30055	330PF	10%	100V	CERAMIC
C14	4822 122 30114	2.2NF	10%	100V	CERAMIC
C15	4822 122 31353	330PF	10%	100V	CERAMIC
C16,17	4822 122 30027	1N0	+-10%	100V	CERAMIC
C18	5322 122 31684	47N	-20+50%	63V	CERAMIC

POTENTIOMETER

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
R31	4822 100 10254	1K		0.5W	TRIMMING, POTM

Unit 9

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1	5322 209 84017	SN74121N-00
IC3	5322 209 85181	SN24L124N

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	4822 121 50591	1NF	1%	630V	FOIL
C2,7,14	4822 122 31081	18PF	2%	100V	CERAMIC
C3	4822 122 31061	18PF	2%	100V	CERAMIC
C4	4822 122 31049	6.8PF	0.25PF	100V	CERAMIC
C5	4822 122 31069	39PF	2%	100V	CERAMIC
C6	4822 122 31072	47PF	2%	100V	CERAMIC
C8	5322 121 40197	1UF	10%	100V	CERAMIC
C10,13	4822 122 30128	4.7NF	10%	100V	CERAMIC
C11	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C12	5322 121 40323	100NF	10%	100V	FOIL
POTENTIOMETERS					
R1	5322 101 14067	5K		0.5W	TRIMMING,POTM
R7	5322 101 14127	10K		0.15W	TRIMMING,POTM
R17	5322 101 14049	470E		0.5W	TRIMMING,POTM

Unit 10

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,2	4822 122 31085	150PF	2%	100V	CERAMIC
C3,4	4822 122 30055	330PF	2%	100V	CERAMIC
C5,6,14	4822 122 31081	100PF	2%	100V	CERAMIC
C7	5322 124 24108	68UF	20%	6.3V	ELECTROLYTIC
C8,9,10,11					
12,13	4822 122 30128	4.7NF	10%	100V	CERAMIC
C15	4822 122 30027	1N0	+-10%	100V	CERAMIC

Unit 11

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC22,25	4822 209 10261	HEF4050BD
IC 23	4822 209 10306	HEF4049BD
TRANSISTORS		
TS1-7	5322 130 40051	2N930

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,3,8	4822 122 31504	100PF	2%	100V	CERAMIC
C2	4822 122 31072	47PF	2%	100V	CERAMIC
C4	4822 122 31061	18PF	2%	100V	CERAMIC
C5,6	4822 122 30045	27PF	2%	100V	CERAMIC
C5M,6M	4822 122 31067	33PF	2%	100V	CERAMIC
C7M	4822 122 31067	100PF	2%	100V	CERAMIC
C7	4822 122 30128	4.7NF	10%	100V	CERAMIC
C9	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C10	4822 122 31076	68PF	2%	100V	CERAMIC
C11	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C12	4822 122 31175	1NF	10%	500V	CERAMIC
POTENTIOMETERS					
R1	5322 100 10117	2K		0.5W	TRIMMING, POTM
R5,22	5322 101 14127	10K		0.15W	TRIMMING, POTM
R17,27,32	5322 101 14049	470E		0.5W	TRIMMING, POTM

Unit 12

Number	Ordering number	Type
TRANSISTORS		
TS1-9	5322 130 40051	2N930

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,5	5322 121 54128	390PF	1%	630V	FOIL
C2,6	4822 122 30027	1NO	10%	100V	CERAMIC
C3	4822 122 31081	100PF	2%	100V	CERAMIC
C4	4822 122 31063	22PF	2%	100V	CERAMIC
C7	4822 122 31027	47PF	2%	100V	CERAMIC
C8	4822 122 31063	22PF	2%	100V	CERAMIC
C9	4822 122 31172	180PF	10%	500V	CERAMIC
C10	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C11	4822 122 30128	4.7NF	10%	100V	CERAMIC
C12	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
POTENTIOMETERS					
R1,5,13,21 23,27,30,37	5322 101 14067	5K			TRIMMING, POTM
R9,17	5322 101 14127	10K			TRIMMING, POTM

Unit 13

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1	5322 209 84348	SN7425N-00
IC8	5322 209 54313	1602A (625 LINE SYSTEM)
IC8	5322 209 54314	1602A (525 LINE SYSTEM)
IC13,15	5322 209 85612	74LS112

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,2	4822 122 31081	100PF	2%	100V	CERAMIC
C3	5322 122 34243	N12	+-20%	100V	CERAMIC
C4	4822 122 31172	180PF	10%	500V	CERAMIC
C5	4822 122 31074	56P	+- 2%	100V	CERAMIC
C6	4822 122 30045	27PF	2%	100V	CERAMIC
C7,9,10	4822 122 30128	4.7NF	10%	100V	CERAMIC
C8	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C11,12	4822 122 30027	1NO	+-10%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
POTENTIOMETER					
R12	5322 101 14067q	5K			TRIMMING, POTM

Unit 14

Number	Ordering number	Type
TRANSISTORS		
TS1-14	5322 130 40051	2N930

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C2	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C3	4822 121 40257	330NF	10%	100V	FOIL
C4	4822 122 31047	5.6PF	0.25PF	100V	CERAMIC
POTENTIOMETERS					
R9,9,12,15 18,21,24,27 30,33,36	5322 101 14067	5K			TRIMMING, POTM

Unit 15

Number	Ordering number	Type
TS2	5322 130 44093	BSV78
TS3,39	5322 130 40051	2N930
TS42	4822 130 41448	BF324
TUNNEL DIODE		
GR17	5322 130 30066Q	1N3716

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	5322 121 40197	1UF	10%	100V	FOIL
C2,3	4822 121 40232	220NF	10%	100V	FOIL
C4,5,6,8,9 12,13,18,19 20,22,23,24, 25,26,27,28, 29,32,36,37	4822 122 30128	4.7NF	10%	100V	CERAMIC
C7,10,17	4822 122 31081	100PF	1%	100V	CERAMIC
C14	4822 121 40232	220NF	10%	100V	FOIL
C15	4822 122 31069	39PF	2%	100V	CERAMIC
C16	4822 122 31067	33PF	2%	100V	CERAMIC
C31	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C33	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C34	4822 121 40232	220NF	10%	100V	FOIL
C35	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C38	4822 122 31045	4.7P	+-P25	100V	CERAMIC
C39/L	4822 122 31405	39P	+-2%	100V	CERAMIC
POTENTIOMETERS					
R12,18,52, 76	5322 101 14127	10K			TRIMMING, POTM
R16,42,67	5322 100 10118	22K			TRIMMING, POTM
R20,98,112	5322 101 14067	5K			TRIMMING, POTM
R22,24	5322 100 10117	20K			TRIMMING, POTM
R32	5322 101 14049	470E			TRIMMING, POTM
R130	5322 101 14072	100E			TRIMMING, POTM

Unit 16

Number	Ordering number	Type
TRANSISTORS		
TS 16-20	5322 130 40051	2N930

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	4822 122 31076	68PF	2%	100V	CERAMIC
C2	4822 122 31175	1NF	10%	500V	CERAMIC
C3	5322 124 24108	68UF	20%	6.3V	CERAMIC
C4	5322 124 24111	47UF	203	10V	ELECTYROLYTIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
POTENTIOMETERS					
R12,18,34					
40,58	5322 101 14067	5K			TRIMMING, POTM
R14,16	5322 101 14049	500R	20%	1/2W	TRIMMING, POTM
R27,38	5322 100 10118	20K	20%	1/2W	TRIMMING, POTM
R32,60,64	5322 100 10117	2.2K		0.5W	TRIMMING, POTM
R36	4822 100 10254	1k		0.5W	TRIMMING, POTM
R62	5322 101 14049	470E		0.5W	TRIMMING, POTM
R66	5322 101 14127	10K		0.15W	TRIMMING, POTM
R75	4822 100 10255	1k		0.5W	TRIMMING, POTM

Unit 17

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC4/L,		
5/L,6/L	5322 209 80864	74LS196
COILS		
L3/L	5322 156 24021	
L4/L	5322 156 24148	
TRANSISTORS		
TS4/L	5322 130 44261	2N2453A

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,13	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C2	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C3	5322 121 54049	3.3NF	1%	160V	FOIL
C4	4822 122 31081	100PF	2%	100V	CERAMIC
C5	4822 122 30055	330PF	10%	100V	CERAMIC
C6	4822 122 31058	15PF	2%	100V	CERAMIC
C7	4822 122 31085	150PF	2%	100V	CERAMIC
C8	4822 122 30093	120PF	2%	100V	CERAMIC
C9	5322 121 44025	33NF	10%	400V	FOIL
C10,23	4822 122 31175	1NF	10%	500V	CERAMIC
C11	4822 122 31069	39PF	2%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
C12	5322 121 54131	560PF	1%	630V	FOIL
C14,15,16	4822 122 30128	4.7NF	10%	100V	CERAMIC
C17	5322 121 40233	680NF	10%	100V	FOIL
C18/L	4822 122 31353	N33	+-2%	100V	CERAMIC
C19	4822 121 40232	220NF	10%	100V	FOIL
C20/L	5322 121 54131	N56	+-1%	630V	FOIL
C21	5322 121 40323	100NF	10%	100V	FOIL
C22	4822 122 31237	82PF	2%	100V	CERAMIC
C24,25,26	4822 122 30128	4.7NF	10%	100V	CERAMIC
POTENTIOMETERS					
R5,17	5322 101 14067	5K			TRIMMING, POTM
R8,11	5322 101 14127	10K			TRIMMING, POTM
R17,36	5322 101 14067	5K			TRIMMING, POTM

Unit 18

Number	Ordering number	Type
TRANSISTORS		
TS1,2	5322 130 44261	2N2453A
TRANSFORMERS		
TR1	5322 157 54158	
TR2	5322 157 54157	

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,4,7,10	4822 122 30093	120PF	2%	100V	CERAMIC
C2,5,8	4822 122 31074	56PF	2%	100V	CERAMIC
C3,6,9,12	4822 122 31063	22PF	2%	100V	CERAMIC
C11	4822 122 31072	47PF	2%	100V	CERAMIC
C13,14	4822 121 40232				
C15,19,2,26	5322 121 40323	100NF	10%	100V	FOIL
C16,17,18, 23,27	4822 121 40232	220NF	10%	100V	FOIL
C21,31	4822 122 31078	82PF	2%	100V	CERAMIC
C12/M	4822 122 30093	120PF	2%	100V	CERAMIC
C22	4822 122 30128	4.7NF	10%	100V	CERAMIC
C24,25	4822 122 31244	47PF	2%	100V	CERAMIC
C24,25/M	5322 122 34057	68PF	2%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
C28	5322 125 50051	2P0-18P			TRIMMER
C29	4822 122 31045	4.7PF	0.25PF	100V	CERAMIC
C30,39	4822 121 40232	220NF	10%	100V	FOIL
C31/M	4822 122 31081	100PF	2%	100V	CERAMIC
C33	4822 122 31063	22PF	2%	100V	CERAMIC
C33/M	4822 122 30045	27PF	2%	100V	CERAMIC
C34	4822 122 31067	33PF	2%	100V	CERAMIC
C34/M	4822 122 31074	56P	+-2%	100V	CERAMIC
C35	4822 122 31085	150PF	2%	100V	CERAMIC
C36	4822 122 30045	27PF	2%	100V	CERAMIC
C36/M	4822 122 31076	68PF	2%	100V	CERAMIC
C37	4822 122 31074	56P	+-2%	100V	CERAMIC
C37/M	4822 122 31081	100PF	2%	100V	CERAMIC
C40,43	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C41	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C42,47	4822 122 30128	4.7NF	10%	100V	CERAMIC
C43	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C44,45	5322 124 24008	15U	+-20%	10V	ELECTROLYTIC
C46	4822 121 40232	220N	+-10%	100V	FOIL

POTENTIOMETERS

R8,21,28,31	5322 101 14072	TRIMMING, POTM

Unit 18/L

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC2,3	5322 209 80964	MC10105
TRANSISTOR		
TS24/L	5322 130 44261	2N2453
COILS		
L1/L	5322 156 21304	
L2/L	5322 156 21305	
L3/L	5322 156 21306	
L5/L	5322 156 21303	
L6/L,9/L	5322 156 21304	
L7/L,8/L	5322 156 21306	

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1,2	5322 121 40197	1UF	10%	100V	FOIL
C3	5322 121 40233	680NF	10%	100V	FOIL
C4	5322 121 40308	22NF	10%	400V	FOIL
C5	4822 122 31081	100PF	2%	100V	CERAMIC
C6	5322 121 54078	470PF	1%	630V	FOIL
C7	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C8	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C10	4822 122 31058	15PF	2%	100V	CERAMIC
C11	4822 122 31069	39PF	2%	100V	CERAMIC
C12	4822 122 31168	270PF	10%	500V	CERAMIC
C13	4822 122 31049	6.8PF	0.25PF	100V	CERAMIC
C14,15	4822 122 30045	27PF	2%	100V	CERAMIC
C16,17	4822 122 31168	270PF	10%	500V	CERAMIC
C18	4822 122 31081	100PF	2%	100V	CERAMIC
C19	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C20	4822 121 50416	150PF	1%	630V	FOIL
C21	4822 122 31237	82PF	2%	100V	CERAMIC
C22	4822 122 31061	18PF	2%	100V	CERAMIC
C23	4822 122 31063	22PF	2%	100V	CERAMIC
C24	5322 121 40308	22NF	10%	400V	FOIL
C25	4822 122 30093	120PF	2%	100V	CERAMIC
C26	4822 122 30045	27PF	2%	100V	CERAMIC
C27,28,29	4822 122 31067	33PF	2%	100V	CERAMIC
C30	4822 122 30045	27PF	2%	100V	CERAMIC
C31	4822 122 30055	330PF	10%	100V	CERAMIC
C32	5322 121 40308	22NF	10%	400V	FOIL
C37,38	4822 122 30128	4.7NF	10%	100V	CERAMIC
C39,49	4822 121 40232	220NF	10%	100V	FOIL
C40	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C41	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C42	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C43	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C44	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C45,48	4822 122 30128	4.7NF	10%	100V	CERAMIC
C46,47	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
POTENTIOMETERS					
R46	5322 101 14067	5K			TRIMMING, POTM
R47	4822 100 10254	1K			TRIMMING, POTM
R51	5322 101 14049	470E			TRIMMING, POTM
R54	5322 101 14127	10K			TRIMMING, POTM
R57,80	4822 100 10254	1K			TRIMMING, POTM
R97	5322 100 10117	2K			TRIMMING, POTM

Unit 19

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1	5322 109 84073	SN7406N
TRANSISTORS		
TS3,10	4822 130 41448	BF324
TS7,14	5322 130 40051	2N930
TS21	5322 130 44261	2N2453
COILS		
L6,7	5322 156 24021	
L8,9	5322 156 24036	

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	4822 122 31045	4.7P	+-P25	100V	CERAMIC
C2,7	4822 122 30128	4.7NF	10%	100V	CERAMIC
C4,5,6,26	4822 122 34067	22PF	2%	100V	CERAMIC
C8	4822 122 30093	120PF	2%	100V	CERAMIC
C8/M	4822 122 31085	150PF	2%	100V	CERAMIC
C9	5322 122 34064	18PF	2%	100V	CERAMIC
C9/M	4822 122 31058	15PF	2%	100V	CERAMIC
C10/M	4822 122 31058	15P	+-2%	100V	CERAMIC
C11	4822 122 31045	4.7PF	0.25PF	100V	CERAMIC
C11/M	4822 122 31052	8.2PF	0.25PF	100V	CERAMIC
C12	4822 122 31049	6.8PF	0.25PF	100V	CERAMIC
C13	4822 122 31067	33PF	2%	100V	CERAMIC
C20	5322 122 34139	33PF	2%	100V	CERAMIC
C13/M	4822 122 31069	39PF	2%	100V	CERAMIC
C14	4822 122 31054	10PF	2%	100V	CERAMIC
C14/M	4822 122 31061	18PF	2%	100V	CERAMIC
C15	4822 122 30045	27PF	2%	100V	CERAMIC
C16	4822 122 31056	12PF	2%	100V	CERAMIC
C16/M	4822 122 31058	15PF	2%	100V	CERAMIC
C17,18	4822 122 30128	4.7NF	10%	100V	CERAMIC
C19	4822 122 30105	1.5PF	0.25PF	100V	CERAMIC
C20/M	4822 122 31069	39PF	2%	100V	CERAMIC
C21	4822 122 31061	18PF	2%	100V	CERAMIC
C21/M	4822 122 31063	22PF	2%	100V	CERAMIC
C22,33	4822 122 31085	150PF	2%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
C23/M	4822 122 31081	100PF	2%	100V	CERAMIC
C24	4822 122 31521	56P	+-2%	100V	CERAMIC
C24/M	4822 122 31076	68PF	2%	100V	CERAMIC
C25/M	4822 122 31072	47PF	2%	100V	CERAMIC
C27,28	4822 122 31056	12PF	2%	100V	CERAMIC
C27/M	4822 122 31061	18PF	2%	100V	CERAMIC
C29,38	4822 122 30128	4.7NF	10%	100V	CERAMIC
C30	4822 122 30045	27PF	2%	100V	CERAMIC
C31,34	4822 122 31173	220PF	10%	500V	CERAMIC
C31/M	4822 122 31168	270PF	10%	500V	CERAMIC
C32,35	5322 121 54135	1.2NF	1%	630V	FOIL
C32,35/M	5322 121 54136	1.5NF	1%	630V	FOIL
C33	4822 122 31172	180PF	10%	500V	CERAMIC
C36/M	5322 122 34144	180PF	2%	100V	CERAMIC
C34/M	4822 122 31168	270PF	10%	500V	CERAMIC
C36	4822 122 31085	150PF	2%	100V	CERAMIC
C37	4822 122 30128	4.7NF	10%	100V	CERAMIC
C39	4822 121 40232	220NF	10%	100V	FOIL
C40	5322 124 24187	33UF	20%	25V	ELECTROLYTIC
C41,43,51	4822 122 40231	100NF	10%	100V	FOIL
C42	5322 124 24139	220UF	50%	25V	ELECTROLYTIC
C44	4822 122 31173	220PF	10%	500V	CERAMIC
C45	5322 124 24089	10UF	20%	16V	ELECTROLYTIC
C46	5322 124 24108	68UF	20%	6.3V	ELECTROLYTIC
C47,49,50,52	4822 122 30128	4.7NF	10%	100V	CERAMIC
C48	5322 124 24008	15UF	20%	10V	ELECTROLYTIC
C53	4822 122 31063	22PF	2%	100V	CERAMIC

POTENTIOMETERS

R8,33,87	5322 101 14049	470E		0.5W	TRIMMING, POTM
R36	4822 100 10359	220E		0.1W	TRIMMING, POTM

Part list for optional units

Unit 1

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1	4822 209 80782	SN74LS74N
IC2	4822 209 80918	SN74LS03N
IC3	5322 209 10002	HEF4013BP
TRANSISTORS		
TS1,2	4822 130 41447	2N2369
TS3	5322 130 40051	2N930
TS4	5322 130 44245	2N3962
TS5	5322 130 40516	BFW13
DIODES		
GR1,GR2	4822 130 30613	BAW62

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	4822 122 31175	1NF	10%	500V	CERAMIC
C2,3	4822 122 30027	1NF	10%	100V	CERAMIC
C4	4822 122 30055	330PF	10%	100V	CERAMIC
C5	4822 122 31081	100PF	2%	100V	CERAMIC
C6	4822 122 30128	4.7NF	10%	100V	CERAMIC
C8	4822 121 40232	220NF	10%	100V	FOIL

Unit 8

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1,4	5322 209 84823	74LS00
IC2,7	5322 209 84996	74LS10
IC3	5322 209 14068	4050
IC5,12	4822 209 80782	74LS74
IC6,22	5322 209 84998	74LS93
IC8,9	5322 209 84823	74LS00
IC10,13	5322 209 85507	74LS96
IC11,29	5322 209 84823	74LS00
IC14	5322 209 14104	4066
IC15	5322 209 14045	4001
IC16,17	5322 209 86059	74LS221
IC18,19	4822 209 10297	4017
IC21	5322 209 85407	85407
IC26	5322 209 14064	4518
IC27,30	4822 209 80782	74LS74
IC28	5322 209 85504	74LS12
IC31,32	5322 209 84823	74LS00
IC33	4822 209 80918	74LS03
IC34	5322 209 85505	74LS22
TRANSISTORS		
TS2	4822 130 41447	2N2369
DIODES		
GR1,2	4822 130 30013	BAW62
GR3	4822 130 34173	BZX79/C5V6
MINI CONNECTOR		
SW1/SW2	5322 267 34069	SKT 2P PLUG

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1	4822 122 31081	100PF	2%	100V	CERAMIC
C2,3,4	4822 122 31316	100PF	2%	100V	CERAMIC
C5	4822 122 31175	1NF	10%	500V	CERAMIC
C7	4822 122 31058	15PF	2%	100V	CERAMIC

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
C8	5322 124 24033	22UF	20%	6.3V	ELECTROLYTIC
C9	4822 122 31175	220PF	10%	500V	CERAMIC
C10	4822 122 31085	150PF	2%	100V	CERAMIC
POTENTIOMETERS					
R3,5,7	5322 101 14127	10K			TRIMMING, POTM
R5,15	5322 101 14067	5K			TRIMMING, POTM
R57	5322 101 14067	5K			TRIMMING, POTM

Unit 20

Number	Ordering number	Type
INTEGRATED CIRCUITS		
IC1	5322 209 14049	4049
IC2,3	5322 209 14433	40097
IC4,5	5322 209 14433	40097
IC6,7,8	4822 209 10247	4011
IC9,10	5322 209 14487	14566
IC11	5322 209 84508	4022
IC12	5322 209 84823	74LS00
IC13,14	5322 209 14487	14566
IC15,21	5322 209 14487	14566
IC16	4822 209 10265	4070
IC17,19	4822 209 10247	4011
IC20	5322 209 14186	4093
IC22	5322 209 54311	1108
TRANSISTORS		
TS1	5322 130 40051	2N930
DIODES		
GR1	5322 130 30392	BZY88/C3V3
GR2	5322 130 30613	BAW62
GR3	5322 209 85714	TIL112
CRYSTAL		
X-TAL	5322 242 74112	4.194304Hz

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
CAPACITORS					
C1-12	4822 122 30128	4700P	+-10%	100V	CERAMIC
C13,14	4822 122 30045	27P	+-2%	100V	CERAMIC
C15,18	4822 122 31081	100P	+-2%	100V	CERAMIC
C17	4822 122 31063	22P	+-2%	100V	CERAMIC
C19-22	4822 122 31054	10P	+-2%	100V	CERAMIC
POTENITOMETERS					
R26/I	5322 100 10117	2K			TRIMMING, POTM
MINI CONNECTOR					
	5322 267 34069	SKT 2P	PLUG		

PM8507 Test-card

List of mechanical parts

Number	Ordering number	Quant	Description
SK1-SK7	5322 276 74025	1	Push button unit
SK1-SK7	5322 414 24885	7	Knob for switch

List of electrical parts

Number	Ordering number	Type
TS1	5322 130 44245	2N3962
TS2	5322 130 40051	2N930
IC1	4822 209 80617	LM741

Number	Ordering number	Value	Tol (%)	Volt/Watt	Description
R3	5322 116 54591	3.92K	1%	MR25	METAL FILM
R4,5	5322 116 54549	1.00K	1%	MR25	METAL FILM
R6	5322 116 54005	3.32K	1%	MR25	METAL FILM
R7	5322 116 50482	33.2K	1%	MR25	METAL FILM
R9	5322 116 50274	1.00K	1/4%		METAL FILM

31. Recommended spare part list

DESCRIPTION	QUANTITY	ORDERING NUMBER
Fuse 500mA slow 220V	3	4822 253 30017
Fuse 1.0A slow 110V	3	4822 253 30021
Toggleswitch 250V 3A 2 pole	2	5322 277 14248
Push button switch 1X	1	5322 276 14322
Push button switch 4X	1	5322 276 44073
Slide switch 1 X TS1	1	5322 277 24057
Slide switch 1 X TS2	2	5322 277 24058
Mains transformer	1	5322 146 34092
Rect. bridge 100V AC/0.8A DC Type 2	2	5322 130 34645
Rect. bridge 100V AC/10A DC Type 3	1	5322 130 54063
Elco 3300U -10+30% 25V	1	4822 124 40371
Elco 2200U -10+30% 40V	2	4822 124 40277
Photo coupler 6 lead DIL	1	5322 209 85714
Crystal 10.000000MHz G,L,M,N	1	5322 242 74163
Crystal 10.06993MHz M-NTSC	1	5322 242 74159
Crystal 8.8125MHz L	1	5322 242 74387
Crystal 7.159090MHz M-NTSC	1	5322 242 74143
Crystal 8.867237MHz G/I/PAL	1	5322 242 74144
Crystal 7.1641125MHz N/PAL	1	5322 242 74383
Crystal 7.151223MHz M/PAL	1	5322 242 74384
Conn. female jumper	5	5322 263 50101
Potentiometer 10K lin	1	4822 101 20299
Lamp 6V 60mA	1	5322 134 44061

INTEGRATED CIRCUITS

10105 (L-only)	1	
1496 (Not-L)	1	
1702A525 Line	1	
1702A625 Line	1	
74LS00	3	5322 209 84823
74LS02	2	5322 209 85312
74LS03	1	5322 209 85265
74LS04	2	5322 209 85486
74LS10	2	5322 209 84996
74LS112	2	5322 209 84971

DESCRIPTION	QUANTITY	ORDERING NUMBER
74LS161	1	5322 209 85005
74LS164	2	5322 209 85002
74LS193	2	5322 209 85405
74LS196 (L-only)	1	5322 209 85198
74LS197	1	5322 209 85612
74LS20	2	5322 209 85569
74LS221	2	5322 209 85508
74LS30	1	5322 209 84985
74LS37	1	5322 209 85345
74LS51	1	5322 209 85837
74LS74	2	5322 209 84986
74LS86N	2	5322 209 84997
CA3140S	2	5322 209 85576
HEF4001BP (Not-L)	1	5322 209 14045
HEF4011BP	1	4822 209 10247
HEF4013BP	2	5322 209 10002
HEF4017BP	2	4822 209 10297
HEF4022BP	1	5322 209 84508
HEF4049BP	1	5322 209 14049
HEF4050BP	1	5322 209 14068
LM301AN (Not-L)	1	5322 209 84691
LM311N	1	5322 209 85503
LM361N	1	5322 209 85528
LM723CN	3	5322 209 85889
OQ5502	1	5322 209 85573
OQ5506	1	
SN7406N-00	1	5322 209 84073
SN74121N-00	1	5322 209 84017
SN7425N-00	1	
SN74S124	1	5322 209 85181
UA741	2	4822 209 80617

TRANSISTORS

2N2219	1	5322 130 40496
2N2222A	3	5322 130 44115
2N2369	9	5322 130 40407
2N2453	1	5322 130 44023
2N2453A	1	5322 130 44261
2N3209	6	5322 130 44609

DESCRIPTION	QUANTITY	ORDERING NUMBER
2N3962	3	5322 130 44245
2N930	6	5322 130 40051
BDX65A	3	4822 130 40997
BF324	2	5322 130 44396
BFW13	1	5322 130 40516
BSV78	1	5322 130 44093
BSV79	2	5322 130 44017
BSV81	1	5322 130 44041
U257	1	5322 130 44608

DIODES

1N3716	1	5322 130 30066
BAV20	1	5322 130 34189
BAW62	13	5322 130 30613
BB809	4	5322 130 31684
BZX79-C12	1	5322 130 34197
BZX79-C3V3	1	
BZX79-C4V7	1	5322 130 34174
BZX79-C5V1	1	5322 130 34233
BZX79-C5V6	1	5322 130 34173
BZX79-C6V2	1	5322 130 34167
Led, RED	1	

PTV TYPE NO	Oscilloscope PM3240X	Voltmeter PM2528	Counter/Timer PM6612/05	Current TracerHP547A	Video level meter PM5548	Test signal gen. PM5570	TV signal gen. PM5630	Vectorscope PM5567	Function gen. PM5134	Monitor LDH6150/00	Power supply PE1542	Monitor LDH6200
PM5533	★	★	★	★	★			★		★		
PM5534	★	★	★	★	★	★		★		★		
PM5537	★	★	★	★	★	★		★		★		
PM5538	★	★	★									
PM5539	★	★	★	★			★					
PM5545	★	★	★				★	★				
PM5546	★	★		★	★		★			★		
PM5548	★	★		★			★					
PM5549	★	★	★		★			★			★	
PM5560	★	★	★		★	★		★	★		★	
PM5565	★	★			★	★		★				
PM5567	★	★				★	★					
PM5570	★	★	★	★	★	★		★	★			
PM5575	★	★	★	★	★	★	★					
PM5576	★	★	★	★	★	★	★					
PM5578	★	★	★	★	★	★		★			★	
PM5580	★	★	★			★	★			★	★	
PM5581	★	★								★		
PM5582	★	★								★		
PM5583	★	★	★									
PM5588	★	★	★				★		★			
PM5597	★	★				★			★	★		
PM5598	★	★				★			★	★		
PM5630	★	★	★	★	★	★		★		★		
PM5631	★	★	★	★	★	★		★		★		
PM5632	★	★	★	★	★	★						★
PM5634	★	★	★	★	★			★	★	★		
PM5645	★	★	★	★								
PM5651	★	★	★	★	★	★		★				
PM5669	★				★	★						
PM5671	★	★				★			★			
PM5672	★	★				★			★			
PM5673	★	★				★			★			
PM5691		★									★	
PM5693		★									★	
PM5694		★									★	
PM8501/02	★	★	★			★						
PM8503	★	★	★	★							★	
PM8504	★	★	★	★							★	
PM8515	★	★	★							★		
PM8519	★	★										
PM8521												
PM8522												

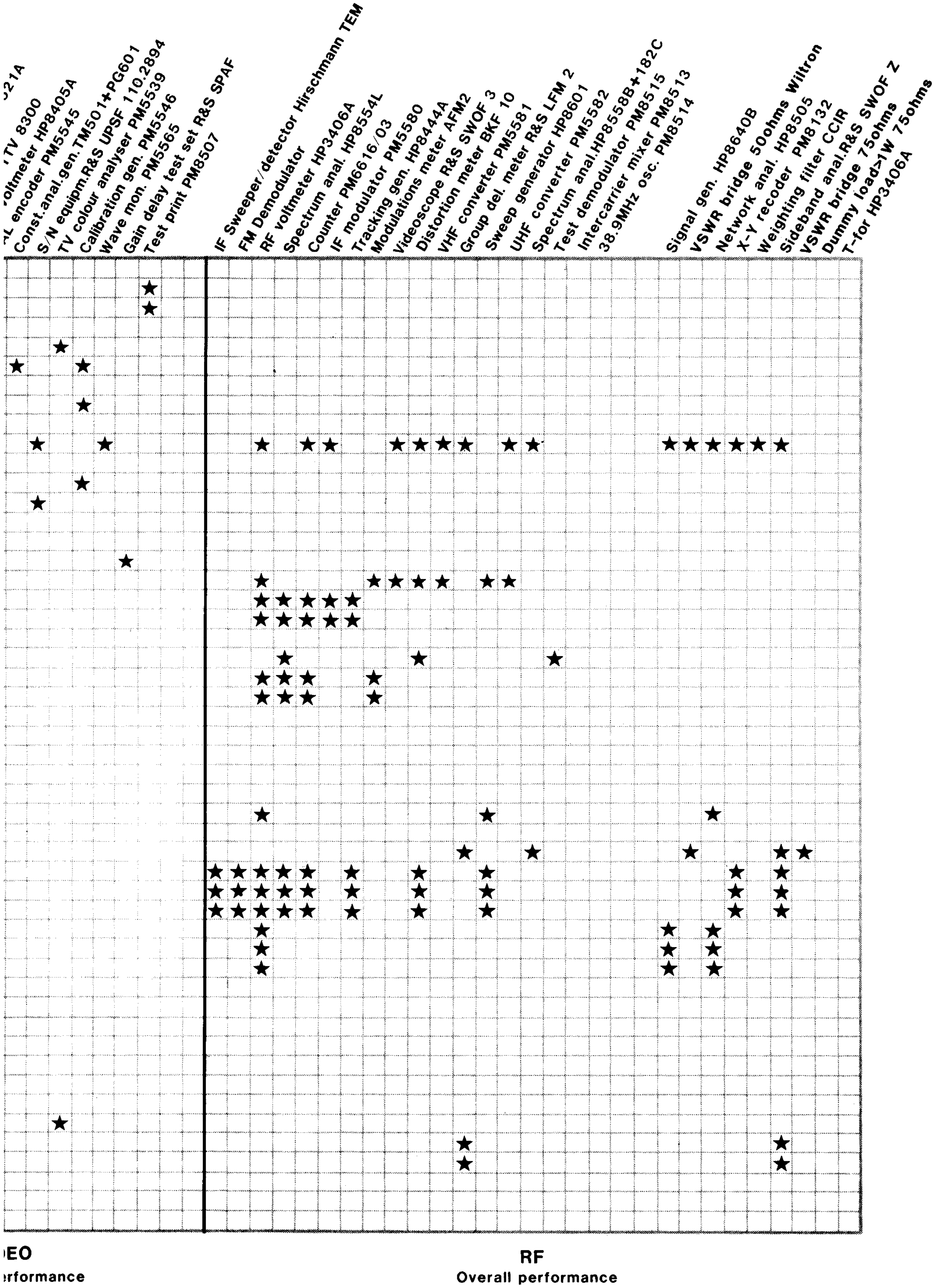
PTV TYPE NO	CTV W/Teletext decoder	ITS Generator PM5576	Spectrum anal. HP8557+1121A	ITS analyser PM5578	Modulator PM5597/98	Vectorscope Tektronix 521A	CTV K40	Vecamscope TTV 8300	Vector voltmeter HP8405A	PAL encoder PM5545	Const.anal.gen.TM501+PG601	S/N equipm.R&S UPSF 110.2894	TV colour analyser PM5539	Calibration gen. PM5546	Wave mon. PM5565	Gain delay test set R&S SPAF	Test print PM8507
PM5533																	
PM5534								★									★
PM5537			★					★									★
PM5538					★												
PM5539					★		★			★			★				
PM5545									★		★			★			
PM5546																	
PM5548														★			
PM5549			★														
PM5560												★			★		
PM5565																	
PM5567										★				★			
PM5570			★									★					
PM5575			★	★		★											
PM5576			★	★		★											
PM5578																★	
PM5580																	
PM5581																	
PM5582																	
PM5583																	
PM5588																	
PM5597																	
PM5598																	
PM5630																	
PM5631																	
PM5632								★									
PM5634																	
PM5645	★				★												
PM5651			★														
PM5669																	
PM5671		★		★													
PM5672		★		★													
PM5673		★		★													
PM5691																	
PM5693																	
PM5694																	
PM8501/02																	
PM8503																	
PM8504																	
PM8515																	
PM8519							★						★				
PM8521																	
PM8522																	

PTV TYPE NO	IF Sweeper/detector Hirschmann TEM	FM Demodulator	RF voltmeter HP3406A	Spectrum anal. HP85	Counter PM66	IF mod	Tr
PM5560			★		★	★	
PM5580			★				
PM5581			★	★	★	★	★
PM5582			★	★	★	★	★
PM5588				★			
PM5597			★	★	★		
PM5598			★	★	★		
PM5645			★				
PM5671	★	★	★	★	★		★
PM5672	★	★	★	★	★		★
PM5673	★	★	★	★	★		★
PM5691			★				
PM5693			★				
PM5694			★				

BASIC EQUIPMENT

VIDEO
Overall performance

32. Recommended test equipment



LIST OF STANDARD COMPONENTS

Integrated circuits

Digital - IC's
COS/MOS Circuits

Type	Ordering number
HEF4001BP	5322 209 14045
HEF4002BP	5322 209 14069
HEF4011BP	4822 209 10247
HEF4012BP	4822 209 10294
HEF4013BP	5322 209 10002
HEF4014BP	4822 209 10296
HEF4017BP	4822 209 10297
HEF4018BP	5322 209 14118
HEF4022BP	5322 209 84508
HEF4023BP	5322 209 14065
HEF4025BP	4822 209 10254
HEF4027BP	5322 209 14055
HEF4028BP	5322 209 14056
HEF4035BP	5322 209 14512
HEF4042BP	5322 209 14071
HEF4043BP	4822 209 10304
HEF4046BP	5322 209 14126
HEF4051BP	5322 209 14212
HEF4053BP	5322 209 14121
HEF4066BP	5322 209 14104
HEF4068BP	5322 209 14117
HEF4070BP	4822 209 10265
HEF4071BP	5322 209 14053
HEF4073BP	5322 209 14066
HEF4075BP	5322 209 14067
HEF4081BP	5322 209 14054
HEF4089BP	5322 209 14826
HEF4093BP	5322 209 14186
HEF4510BP	5322 209 14075
HEF4516BP	5322 209 14561
HEF4518BP	5322 209 14064
HEF4520BP	5322 209 14189

Low Power Schottky

Type	Ordering number
SL74LS00N	5322 209 84823
SN74LS02N	5322 209 85407
SN74LS03N	4822 209 80918
SL74LS04N	4822 209 80783
SN74LS10N	5322 209 84996
SN74LS20N	5322 209 85569
SN74LS30N	5322 209 84985
SN74LS51N	5322 209 85837
SN74LS74N	4822 209 80782
SN74LS86N	5322 209 84997
SN74LS112N	5322 209 84971
SN74LS122N	5322 209 85563
SN74LS161N	5322 209 85005
SN74LS164N	5322 209 81487
SN74LS193N	5322 209 85405
SN74LS221N	5322 209 86059
SN74LS393N	4822 209 80447

Schottky TTL

Type	Ordering number
SN74S00N	5322 209 84167
SN74S112N	5322 209 85741

Linear IC's

Type	Ordering number
LM301AN	5322 209 84691
LM311N	5322 209 85503
LM361N	5322 209 85528
LM723N	5322 209 85889
LM741N	4822 209 80617
CA3140S	5322 209 86219
7805UC	5322 209 84841
TCA240	4822 209 80629

PROMS

Type	Ordering number
N82S141N	5322 209 54674

Transistors

Transistors NPN/PNP

Type	Ordering number
2N2219	5322 130 40496
2N2222A	5322 130 44115
2N2369	4822 130 41447
2N3055	4822 130 40132
2N6103	5322 130 44702
BC547B	4822 130 40959
BC557B	4822 130 44568
BF480	5322 130 44582
BF450	4822 130 44237
BFR90/02	5322 130 44909
BFR91/02	5322 130 41668
BFR94	5322 130 44532
BFR96/02	5322 130 44911
2N2905	5322 130 40021
2N3209	5322 130 44609
2N3962	5322 130 44245

Transistors MOS

Type	Ordering number
BSV81	5322 130 44041

FET

Type	Ordering number
BFW11	4822 130 40408
BSV79	5322 130 44017

Dual FET

Type	Ordering number
U257	5322 130 44608

Optoelectronics

Light Emitting Diodes

Type	Ordering number
LED-RED	5322 130 34387
LED-GREEN	4822 130 30923

Diodes

Small Signal Diodes

Type	Ordering number
BAW62	4822 130 30613
BAV20	4822 130 34189
HP5082-2811	5322 130 30655

Reference Diodes

Type	Ordering number
BZX88-C3V3	5322 130 31504
BZX79-C3V9	5322 130 34916
BZX79-C4V7	4822 130 34174
BZX79-C5V1	4822 130 34233
BZX79-C5V6	4822 130 34173
BZX79-C6V2	4822 130 34167
BZX79-C6V8	4822 130 34278
BZX79-C7V5	4822 130 30861
BZX79-C8V2	4822 130 34382
BZX79-C9V1	4822 130 30862
BZX79-C12	4822 130 34197
BZX79-C15	4822 130 34281

Tuner Diodes

Type	Ordering number
BA482	5322 130 34955
HP5082-3379	5322 130 34399
BB809	5322 130 31684

Rectifier Diodes

Type	Ordering number
BYW95B	4822 130 32058

Bridge Diodes

Type	Ordering number
Type 1 100V AC 0.4A	5322 130 34815
Type 2 100V AC 0.8A	5322 130 34645
Type 3 100V AC 10A	5322 130 34587

Resistors

MR25 = 0.4W 1% METAL FILM RESISTOR

Type	Value	Ordering number	Type	Value	Ordering number
MR25	10	5322 116 50452	MR25	3.57K	5322 116 54586
MR25	11	5322 116 54059	MR25	3.92K	5322 116 54591
MR25	12.1	5322 116 54069	MR25	4.32K	5322 116 54594
MR25	13	5322 116 54082	MR25	4.75K	5322 116 54008
MR25	15	4822 116 51221	MR25	5.11K	5322 116 54595
MR25	16.2	5322 116 54431	MR25	5.62K	4822 116 51281
MR25	18.2	5322 116 54083	MR25	6.19K	5322 116 55426
MR25	20	5322 116 51048	MR25	6.81K	4822 116 51252
MR25	22.1	5322 116 50983	MR25	7.50K	5322 116 54608
MR25	24.3	5322 116 54435	MR25	8.25K	5322 116 54558
MR25	26.7	5322 116 54067	MR25	9.09K	4822 116 51284
MR25	30.1	5322 116 50904	MR25	10K	4822 116 51253
MR25	33.2	5322 116 50527	MR25	11K	5322 116 54623
MR25	35.7	5322 116 54439	MR25	12.1K	5322 116 50572
MR25	39.2	5322 116 54087	MR25	13K	5322 116 50522
MR25	43.2	5322 116 50519	MR25	15K	4822 116 51255
MR25	47.5	5322 116 50952	MR25	16.2K	5322 116 55361
MR25	51.1	5322 116 54442	MR25	18.2K	5322 116 54638
MR25	56.2	5322 116 54446	MR25	20K	5322 116 54642
MR25	61.9	5322 116 54451	MR25	22.1K	4822 116 51257
MR25	68.1	5322 116 54455	MR25	24.3K	5322 116 54647
MR25	75	5322 116 54459	MR25	26.7K	5322 116 54652
MR25	82.5	5322 116 54462	MR25	30.1K	5322 116 54655
MR25	90.9	5322 116 54466	MR25	33.2K	4822 116 51259
MR25	100	5322 116 55549	MR25	35.7K	5322 116 54662
MR25	110	5322 116 54474	MR25	39.2K	4822 116 51262
MR25	121	5322 116 54426	MR25	43.2K	5322 116 54667
MR25	130	5322 116 54481	MR25	47.5K	5322 116 54671
MR25	150	5322 116 54486	MR25	51.1K	5322 116 50672
MR25	162	5322 116 50417	MR25	56.2K	4822 116 51264
MR25	182	5322 116 54493	MR25	61.9K	5322 116 50872
MR25	200	5322 116 54496	MR25	68.1K	4822 116 51266
MR25	221	4822 116 51223	MR25	75K	4822 116 51267
MR25	267	5322 116 54503	MR25	82.5K	5322 116 55374
MR25	301	5322 116 55366	MR25	90.9K	5322 116 54694
MR25	332	4822 116 51226	MR25	100K	4822 116 51268
MR25	357	5322 116 50603	MR25	110K	5322 116 54701
MR25	392	5322 116 54006	MR25	121K	5322 116 54704
MR25	432	5322 116 54522	MR25	130K	5322 116 54707
MR25	475	5322 116 54007	MR25	150K	4822 116 51269
MR25	511	4822 116 51282	MR25	162K	5322 116 54716
MR25	562	4822 116 51231	MR25	182K	5322 116 54722
MR25	619	4822 116 51232	MR25	200K	4822 116 51286
MR25	681	4822 116 51233	MR25	221K	4822 116 51272
MR25	750	4822 116 51234	MR25	243K	5322 116 54733
MR25	825	5322 116 54541	MR25	267K	5322 116 54737
MR25	909	5322 116 55278	MR25	301K	5322 116 54743
MR25	1K	4822 116 51235	MR25	332K	4822 116 51184
MR25	1.10K	4822 116 51236	MR25	357K	5322 116 51767
MR25	1.21K	5322 116 54557	MR25	392K	5322 116 51768
MR25	1.30K	5322 116 50526	MR25	432K	5322 116 51769
MR25	1.50K	4822 116 51239	MR25	475K	4822 116 51275
MR25	1.62K	5322 116 55359	MR25	511K	5322 116 55258
MR25	1.82K	5322 116 54568	MR25	562K	4822 116 51169
MR25	2K	5322 116 54572	MR25	619K	5322 116 55315
MR25	2.21K	4822 116 51245	MR25	681K	5322 116 55284
MR25	2.43K	5322 116 54004	MR25	750K	5322 116 55532
MR25	2.67K	5322 116 54578	MR25	825K	5322 116 51398
MR25	3.01K	4822 116 51246	MR25	909K	5322 116 55533
MR25	3.32K	5322 116 54005	MR25	1M	5322 116 55535

CODING SYSTEM OF FAILURE REPORTING FOR QUALITY ASSESSMENT OF T & M INSTRUMENTS
(excl. potentiometric recorders)

The information contents of the coded failure description is necessary for our computerized processing of quality data.

Since the reporting of repair and maintenance routines must be complete and exact, we give you an example of a correctly filled-out PHILIPS SERVICE Job sheet.

① *Country*	② *Day Month Year*	③ *Typenumber /Version*	④ *Factory/Serial no.*
3 2	1 5 0 4 7 5	0 P M 3 2 6 0 0 2	D 0 0 0 7 8 3

CODED FAILURE DESCRIPTION ⑥

⑤ *Nature of call*	*Location*	*Component/sequence no.*	*Category*
☐ Installation		T S 0 6 0 7	5
☐ Pre sale repair		R 0 0 6 3 1	2
☐ Preventive maintenance	0 0 2 1	9 9 0 0 0 1	4
☒ Corrective maintenance			
☐ Other			

⑦ *Job completed* ☒

Working time ⑧ 1 2 Hrs

Detailed description of the information to be entered in the various boxes:

①Country: 3 2 = Switzerland

②Day Month Year 1 5 0 4 7 5 = 15 April 1975

③Type number/Version 0 P M 3 2 6 0 0 2 = Oscilloscope PM 3260, version 02 (in later oscilloscopes this number is placed in front of the serial no)

④Factory/Serial number D 0 0 0 7 8 3 = DO 783 These data are mentioned on the type plate of the instrument

⑤Nature of call: Enter a cross in the relevant box

⑥Coded failure description

Location

☐☐☐☐

These four boxes are used to isolate the problem area. Write the code of the part in which the fault occurs, e.g. unit no or mechanical item no of this part (refer to 'PARTS LISTS' in the manual).

Example: 0001 for Unit 1
000A for Unit A
0075 for item 75

If units are not numbered, do not fill in the four boxes; see Example Job sheet.

Component/sequence no.

☐☐☐☐☐☐

These six boxes are intended to pinpoint the faulty component.

A. Enter the component designation as used in the circuit diagram. If the designation is alfa-numeric,the letters must be written (starting from the left) in the two left-hand boxes and the figures must be written (in such a way that the last digit occupies the right-most box) in the four right-hand boxes.

B. Parts not identified in the circuit diagram:

- 990000 Unknown/Not applicable
- 990001 Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
- 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

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 (of transistor, resistor, etc.)
- 6 Cleaning and/or lubrication
- 7 Operator error
- 8 Missing items (on pre-sale test)
- 9 Environmental requirements are not met

⑦Job completed: Enter a cross when the job has been completed.

⑧Working time: Enter the total number of working hours spent in connection with the job (excluding travelling, waiting time, etc.), using the last box for tenths of hours.

☐☐ 1 2 = 1,2 working hours (1 h 12 min.)

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