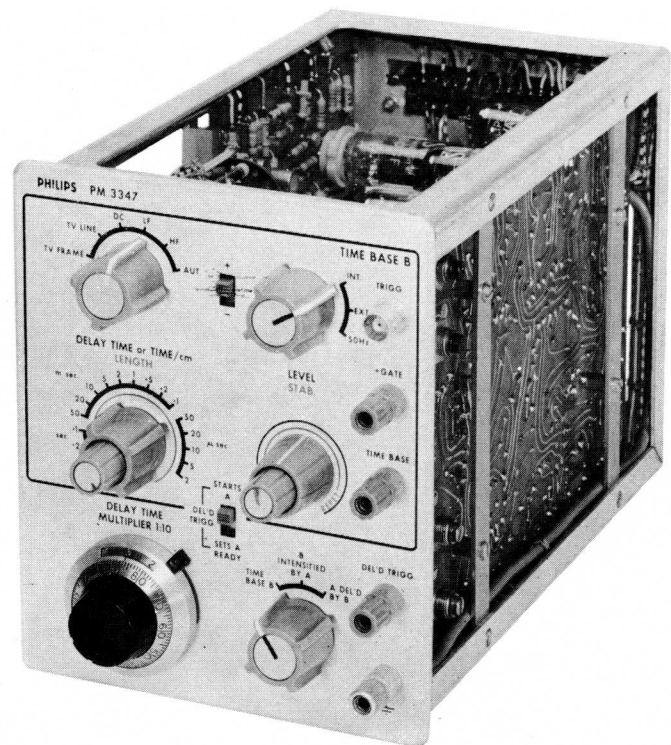


PHILIPS



PM 3347 SWEEP DELAY TIME BASE

IMPORTANT

In correspondence concerning this apparatus, please quote the type number and the serial number as given on the type plate at the rear of the apparatus.

GENERAL INFORMATION

Introduction



The PM 3347 is a trigger-delay plug-in unit for the basic oscilloscope PM 3330.

The unit can supply a sawtooth voltage for X-deflection (TIME-BASE B) as well as a delayed trigger pulse.

With this pulse, the time-base generator of the basic oscilloscope (TIME-BASE A) can be started.

Using this operating method, a selected part of the display can be magnified across the entire screen-width so that accurate measurements are possible.

Moreover, possible time-jitter in the magnified display can be eliminated.

Technical data

Properties, expressed in numerical values with statement of tolerances are guaranteed by the factory. Numerical values without tolerances are intended for information purposes only and indicate the properties

of an average apparatus. The numerical values hold good for nominal mains voltages unless otherwise stated.

TIME-BASE B

Time co-efficient	adjustable to 17 calibrated values: 2, 5, 10 etc. $\mu\text{sec./cm}$ up to 0.5 sec./cm tolerance: + or - 3 %. Magnification $\times 1$, $\times 2$ and $\times 5$ is possible on the basic oscilloscope.
Length of the time-base	continuously adjustable: 4 ... 10 cm.
Operation	triggered or free-running.

TRIGGERING

Source	internal, external, or internal by means of a voltage with the mains frequency (phase-adjustable on the basic oscilloscope).
Slope	+ or -
Mode	AUT. : 10 Hz ... 1 MHz. LEVEL and STAB. switched off. HF : RC-time: 82 μsec . $f_{3\text{dB}}$: \approx 2 kHz. LF : RC-time. 56 msec. $f_{3\text{dB}}$: 3 Hz. DC TV LINE : LEVEL and STAB. switched off. TV FRAME: LEVEL and STAB. switched off.
Required trace height for internal triggering	refer to the characteristics of the relevant Y-plug-in unit.
Band-width	1 MHz.
Required voltage for external triggering	0.5 $V_{\text{p-p}}$ for frequencies up to 1 MHz. in position "AUT.": 1 $V_{\text{p-p}}$. in positions "TV LINE" and "TV FRAME": 1 $V_{\text{p-p}}$ positive video.
Input impedance	1 M Ω //55 pF.

TRIGGER LEVEL

internal	adjustable over 6 cm trace height.
external	adjustable over 6 volts.
Time-base voltage on socket "TIME-BASE"	90 $V_{\text{p-p}}$ maximum, positive-going from zero level, adjustable with control "LENGTH".
Gate voltage on socket "+ GATE"	35 $V_{\text{p-p}}$, from zero level, synchronous with time-base voltage.

DELAY PULSE

Delay	2 μ sec. – 5 s, continuously adjustable by means of a 17 step-switch (accuracy 3 % of the front-plate value, \pm 200 nsec.) and a helical potentiometer (0.2 % of the final value).
Jitter	\leq 1 : 20.000
Output voltage on socket "DEL'D TRIGG."	3 V_{p-p} By means of the delay pulse, time-base A can optionally be directly started (STARTS A), or, released but not started (SETS A READY). In this case, time-base A is started by the next trigger pulse.
Mechanical data	width : 15 cm depth : 30 cm (knobs and plug included) height : 18 cm weight: 2 kg
Accessories	Manual

Description of the block diagram



(Fig. 1)

The PM 3347 contains a complete time-base generator (TIME-BASE B), which regarding the construction, largely resembles the time-base generator of the basic oscilloscope (TIME-BASE A).

Besides the time-base voltage, the PM 3347 supplies a delay pulse for starting time-base A at the basic oscilloscope.

For this, the sawtooth voltage of time-base generator B is compared with an accurately adjustable d.c. voltage (DELAY-TIME MULTIPLIER 1 : 10).

The output voltage of this comparator is applied to a bistable multivibrator, which supplies the delay pulse.

This delay pulse is applied to the time-base A generator via the output plug.

Starting of time-base A occurs at option, directly by the delay pulse (STARTS A) or by the trigger pulse (from the trigger unit of the basic oscilloscope) after time-base A has been released by the delay pulse (SETS A READY). The X-deflection voltage is selected by means of a 3 position-switch:

- 1 – time-base B
- 2 – time base B, while during the time that time-base A operates, the trace is intensified
- 3 – the delayed time-base A.

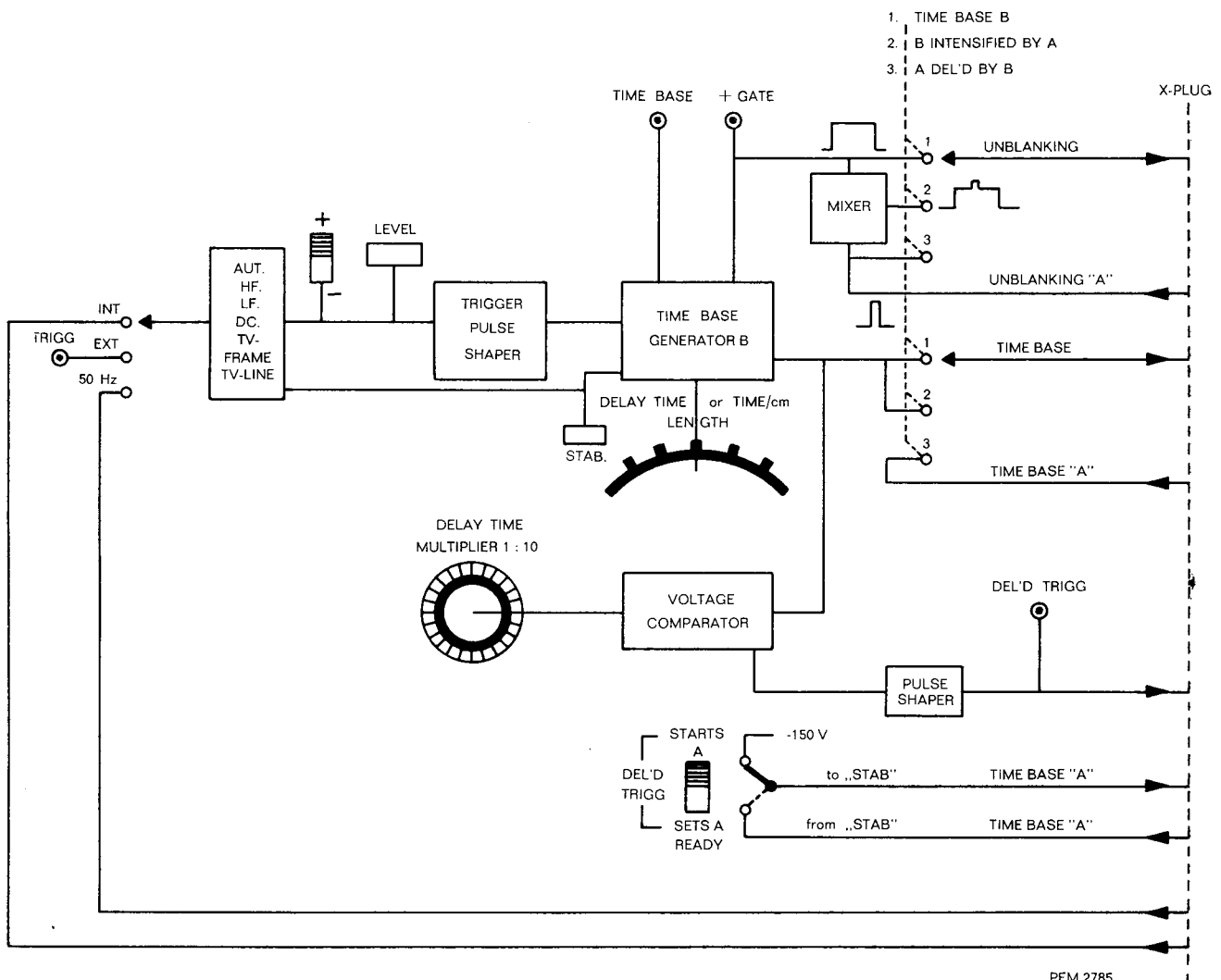


Fig. 1. Survey of the controls

DIRECTIONS FOR USE

Installation

IV

The PM 3347 should be plugged into the right-hand side plug-in compartment of basic oscilloscope PM 3330 (X-UNIT).

Switching-on is effected via the mains switch of the basic oscilloscope.

If the PM 3347 is used, the deflection switch in the X-DEFLECTION frame of the PM 3330 should be put into position "X-UNIT".



BU1: Input for external triggering
 BU2: Output with the pos. sweep gating signal
 BU3: Output with the time base "B" signal
 BU4: Output with the delayed triggering signal
 BU5: Earthing bush
 R1 : Sweeplength control
 R2 : Trigger level control
 R3 : Trigger stability control
 R4 : Trigger delay time control

SK1: Triggering mode selector
 SK2: Triggering slope selector
 SK3: Triggering source selector
 SK4: Selector of the X-deflection co-efficient or the trigger delay time (coarse)
 SK5: Preset trigger stability switch
 SK6: Start/release selector for time base "A"
 SK7: X-deflection mode selector.

Remark: At the picture, R2 and R3 were interchanged.

Controls and their functions



X-DEFLECTION

The X-deflection voltage is selected by means of the 3-position switch on the right-hand lower-side of the unit.

Time base B

The X-deflection voltage is then supplied by time-base generator B.

Adjustment of time-base B is effected in the same way as described for time-base A, in the manual of the basic oscilloscope.

The time co-efficient of time-base B can only be adjusted in steps.

The length of the time-base can be adjusted by means of the "LENGTH" control.

The time co-efficients are not influenced by this control.

B Intensified by A

In this position also, the X-deflection voltage is supplied by time-base generator B.

When switch "DEL'D TRIGG." is in position:

"STARTS A", the brightness-control voltage of time-base A together with that of time-base B will be applied to the Wehnelt cylinder of the CRT.

Consequently, the trace will be intensified during the running of time-base A. By means of this indication, that part of the trace can be selected, which must be examined in detail.

When using the PM 3347 as a trigger-delay unit, the trigger-mode switch of the basic oscilloscope may be in any position but "AUT."

A Delayed by B

In this position, time-base generator A supplies the deflection voltage. Time-base A is started in the same way as in position "B INTENSIFIED BY A". This means that the part of the trace which was intensified, is then displayed across the entire screen-width.

ADJUSTING THE DELAY

If the PM 3347 is used as a trigger-delay unit, the deflection switch should be set to position "B INTENSIFIED BY A", to adjust the delay.

Time-base B is adjusted in the normal way by means of the controls in the "TIME-BASE B" frame.

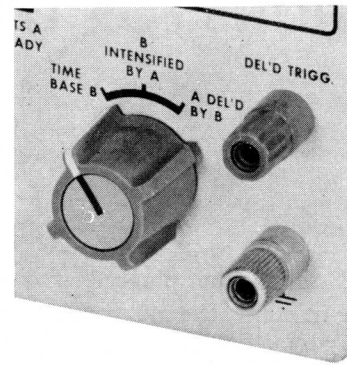


Fig. 2. X-Deflection

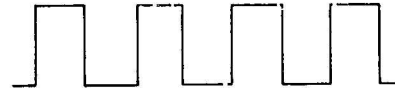


Fig. 3. Time-base B

Fig. 4a. B intensified by A

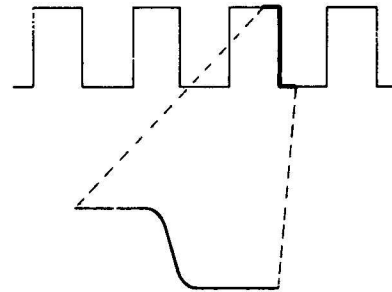


Fig. 4b. A delayed by B



Fig. 5. Calculating the delay time

If switch "DEL'D TRIGG." is in position "STARTS A" (this means that time-base A is triggered by the delay pulse), the delay time will be **equal** to the product of the values indicated by knobs "DELAY TIME" and "DELAY TIME MULTIPLIER". In Fig. 5 the delay time amounts to: $3.86 \times 50 \mu\text{sec.} = 193 \mu\text{sec.}$

The magnitude of the intensified part of the trace depends on the time co-efficient of time-base A and should consequently be adjusted by means of knob "TIME/cm" on the basic oscilloscope.

If switch "DEL'D TRIGG." is in position "SETS A READY", time-base A is released by the delayed trigger pulse. Time base A will be triggered by the next pulse, generated at the trigger unit of the basic oscilloscope.

The adjustment of time-base "A" then is effected in the same way as with normal use of this time-base (refer to manual PM 3330) with the restriction that position "AUT." of the "TRIGGER-MODE" switch may not be used.

Applications

VI

The PM 3347 is particularly used when details of a complicated, periodical signal are to be measured. Assume that the display (Fig. 6) is obtained in position "TIME-BASE B" of the deflection switch on the PM 3347.

Time-base B is then triggered by the clock-pulse, by which the pattern is always started.

In this example the clock-pulse has a higher amplitude than the other pulses. Consequently, the time-base may be internally triggered. If all pulses have the same amplitude, no stable display is obtained with internal triggering. In that case the time-base should be triggered by an external voltage.

When pulse P is to be accurately measured, the deflection switch should be set to position "B INTENSIFIED BY A" and switch "DEL'D TRIGG." should be set to position "STARTS A".

With aid of control "DELAY-TIME MULTIPLIER" and switch "TIME/cm" of the basic oscilloscope, part P of the display is intensified.

When the deflection switch is then set to position "A DEL'D BY B", the intensified part (magnified across the entire screen) is reproduced.

In this position, pulse-width, rise-time etc. can be accurately measured by means of the calibrated time coefficients of time-base A.

The time T (delay time of pulse P with respect to the clock-pulse) can be measured by adjusting knob

The adjusted value of the delay time is then **increased by an additional time**, which depends on the trigger signal of the basic oscilloscope. Consequently, the adjusted value of the knobs on the PM 3347 no longer applies.

LENGTH

If long delay times are used (time-coefficient of time-base A much smaller than the time coefficient of time-base B), time-base A will have a very short duty cycle. This means that the brightness of the trace in position "A DEL'D BY B" is very low with respect to the other positions.

By adjusting the length of the time-base in the position "B INTENSIFIED BY A", so that the intensified part of the trace just remains present, the repetition frequency of time-base B can be increased in many cases.

Consequently, the repetition frequency of time-base A is increased and the luminosity increases also.

"DELAY-TIME MULTIPLIER" so, that the leading edge of pulse P just coincides with the beginning of the time-base.

T is equal to the product of the values indicated by knobs "DELAY TIME MULTIPLIER" and "DELAY-TIME".

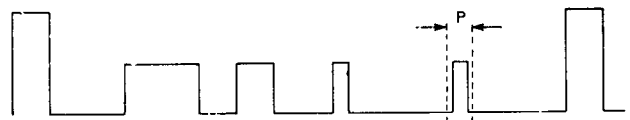


Fig. 6. Example of a display

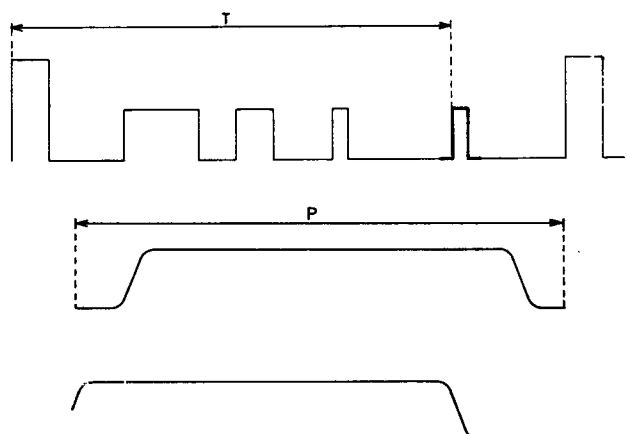


Fig. 7. Measuring time "T"

TIME JITTER

Possible time jitter of pulse P with respect to the clock-pulse causes a haze and can be measured in the position "A DEL'D BY B" by means of the calibrated time co-efficients of time-base A. (Fig. 8). If the measurements are impeded by time jitter, the latter can be eliminated by setting switch "DEL'D TRIGG." to position "SETS A READY" and by adjusting the controls of time-base A so, that time-base A is triggered.

The delay time, however, can in this case no longer be read in the above mentioned way.

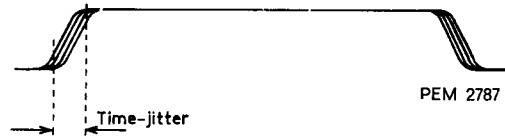


Fig. 8. Time jitter

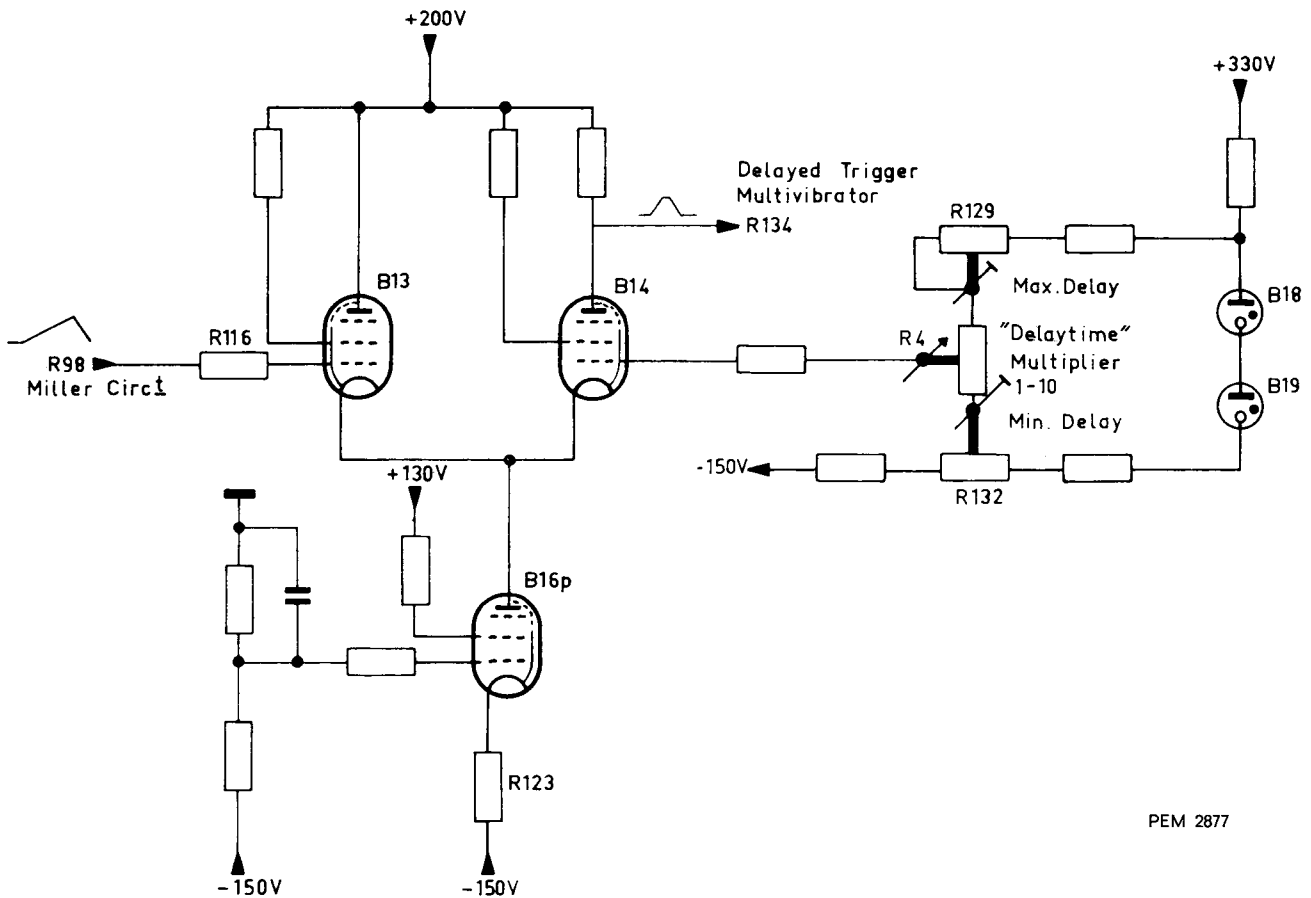


Fig. 9. Voltage comparator circuit

Remark: The cathode of B19 is earthed

SERVICE NOTES

Time base B

VII

This plug-in unit comprises a complete time-base generator, a trigger unit and a delay-pick-off circuit. The delay-pick-off circuit delivers a pulse, after an adjustable delay, to front-panel socket BU4 and to time-base A for delayed triggering (see Fig. 1).

Time-base B, like time-base A, is based on a Miller run-up circuit with the following modifications:

- the "Sweep-length" control is no longer a preset adjustment, but a front-panel control "Length". Continuous sweep speed control is not possible.
- the lock-out multivibrator (single-shot facility) is not duplicated.

The working of the time-base generator is not described due to its similarity with that of time-base A.

Delay pick-off circuit

VIII

Valves B13, B14 and B16p constitute a long-tailed pair circuit (Fig. 9) which acts as a voltage comparator.

In the quiescent state of the voltage comparator, B13 is cut off and the cathode voltage of B14 is approximately equal to the voltage applied to the grid of B14 from helical potentiometer (R4) "Delay time-multiplier 1-10".

The range of R4 is preset by means of potentiometers R129 and R132.

The ramp voltage from the output of time-base B is applied to the grid of B13, which will start to conduct when its cut-off voltage is reached.

However as B16p is a constant-current source, sup-

plying the cathodes of both B13 and B14, a rise in current through one (B13) will cause an equal drop in current through the other (B14). Furthermore, the use of a constant current source in their cathodes makes the current in B14 independent of the setting of R4 (the "Delay-time Multiplier 1-10"), which is used to determine the point at which the take-over of current by B13 from B14 occurs. In this way the output from B14 to the Schmitt trigger starts from a constant level and provides a constant amplitude step. The voltage rise of the anode of B14 is applied to the Schmitt trigger circuit, (Delayed trigger multivibrator) consisting of valves B17' and B17". (Fig. 10).

In the quiescent state B17' is cut-off and B17" is

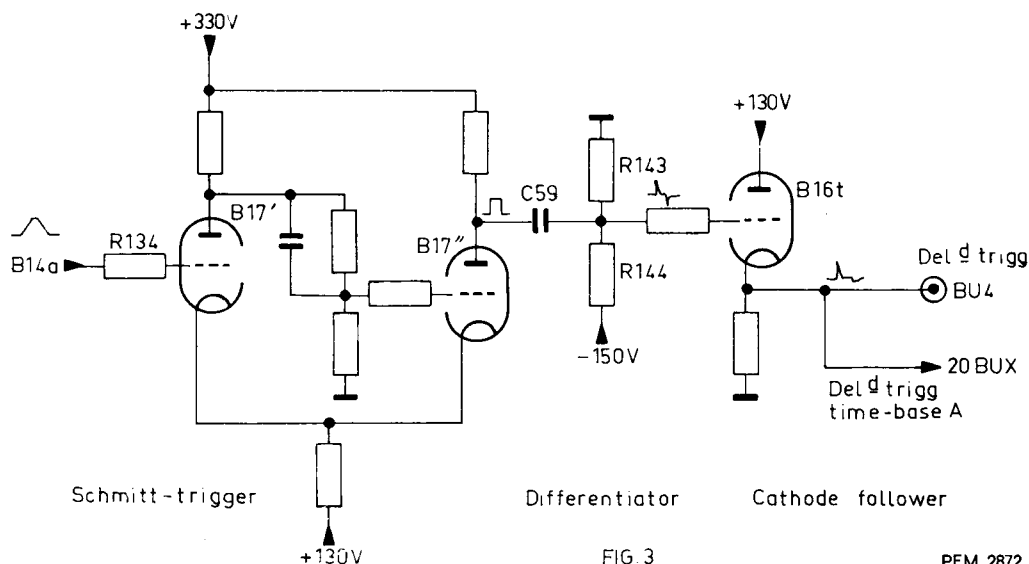


FIG. 3

PEM 2872

Fig. 10. Schmitt-Trigger, Differentiator and Cathode follower

conductive. When the anode-voltage of B14, applied to the grid of B17', rises above the switching level of the Schmitt trigger, the circuit switches over: B17' conductive and B17'' cut-off. The anode voltage of B17'' therefore rises abruptly.

When the ramp-voltage drops below the cut-off level of B13 (during the fly-back interval) the anode voltage of B17'' returns to the quiescent value.

Thus a rectangular voltage wave-form is produced at the anode of B17''.

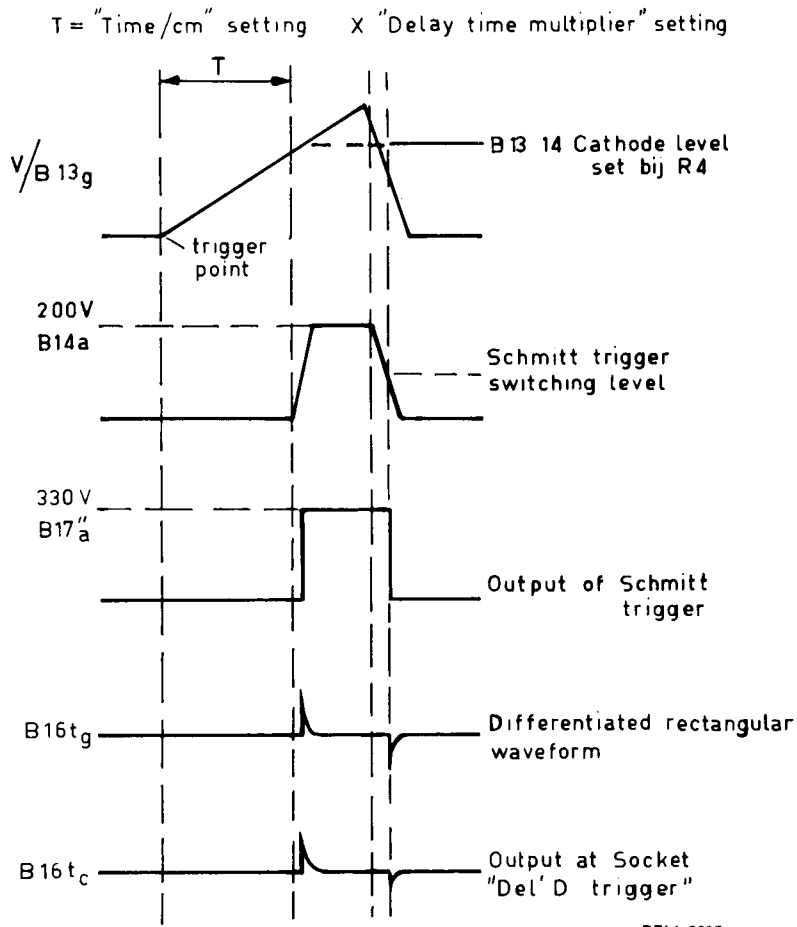
This voltage waveform is differentiated by capacitor C59 and resistor R143/R144, so that positive and negative spikes appear at the grid of trigger-amplifier valve B16t.

With no input signal present, B16t is biased beyond

cut-off and the positive spikes cause it to become conductive, thus producing positive output spikes at the cathode.

The negative spikes theoretically do not appear at the output; however, some effect may be evident in the output signal, see Fig. 11.

Thus, after time base B has been triggered, there follows a certain pre-determined time-delay before time base A can operate. The trigger pulse is also available at the socket "DELAYED TRIGG.". This delay can be set with controls "DELAY TIME or TIME/cm" and "DELAY TIME MULTIPLIER 1-10" and the actual time interval is the product of these two settings.



PEM 2895

Fig. 11. Generation of the delayed trigger pulse

Mode selector switch SK7



A. AT "TIME BASE B"

When the X-deflection switch on the main frame is at "X UNIT"* and switch SK17 on the time-base B unit at "TIME BASE B", the complete function of time-base A is taken over by time-base B. The relevant interconnections are as shown in Fig. 12.

Time-base B provides the unblanking pulse via 8 BUX.

The output of Miller circuit B drives the horizontal amplifier in the basic oscilloscope and the delay circuit.

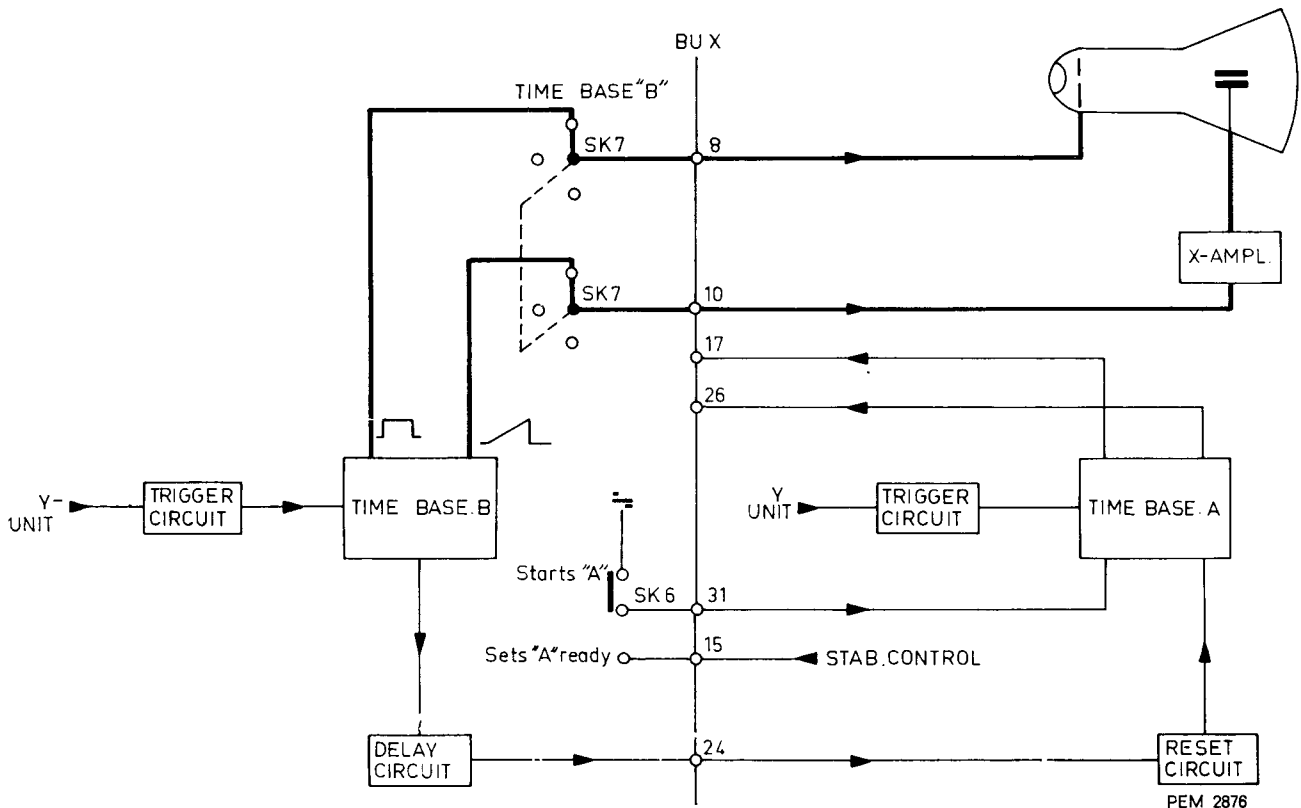


Fig. 12. Mode selector switch SK7 at "Time-base B"

B. AT "B INTENSIFIED BY A"

When the X-deflection switch at the main frame is at "X UNIT" and switch SK7 on the time-base B unit is at "B INTENSIFIED BY A" the relevant interconnections are shown in Fig. 13.

The output of time-base B drives the horizontal amplifier and the delay circuit.

* **Note** Remember that in this position, time-base A is operating via the reset circuit of the lock-out multivibrator.

The output of the delay circuit is fed to the lock-out multivibrator of Time-base A via the reset circuit.

Thus the Time-base A is brought into action i.e. it generates a sweep and an unblanking pulse.

This unblanking pulse supplements that delivered by Time-base "B" via an OR-gate. The relevant wave forms are shown in Fig. 14.

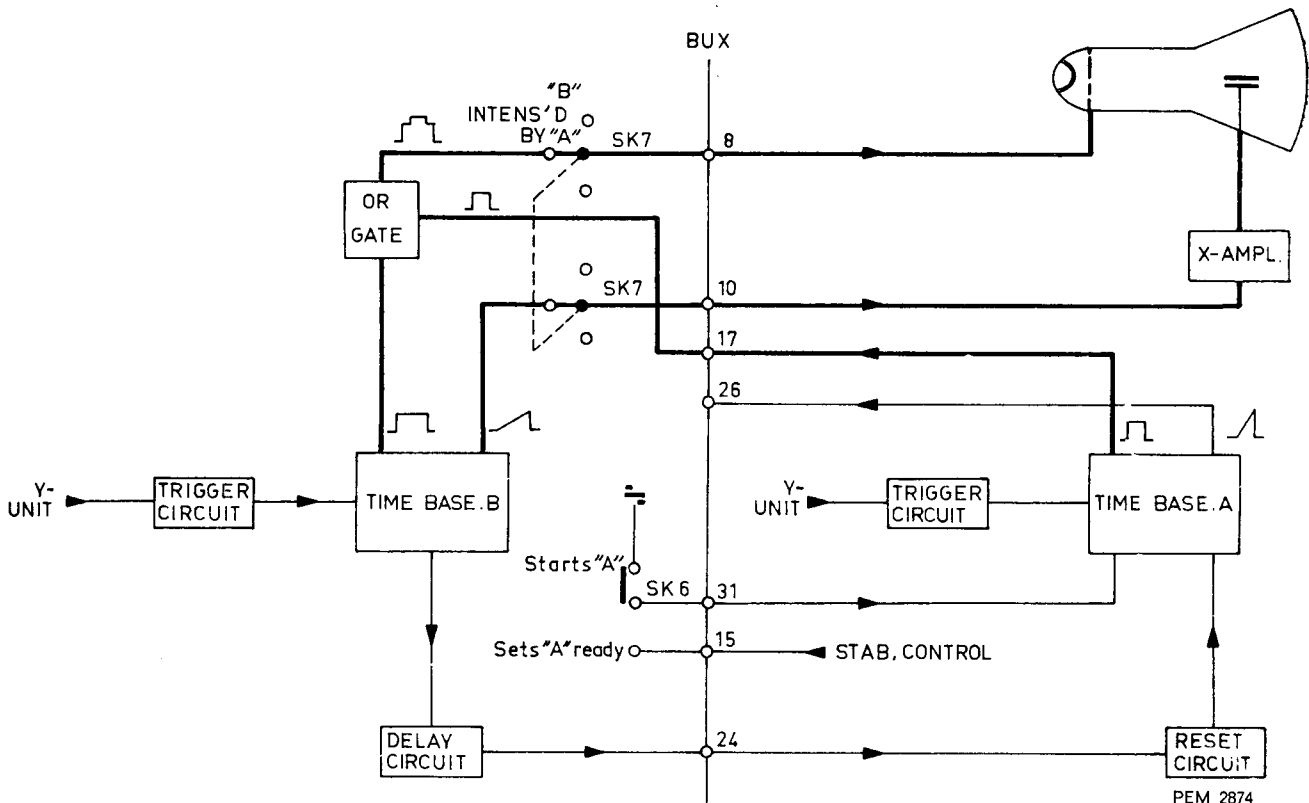


Fig. 13. Mode selector switch SK7 at "B" intensified by "A"

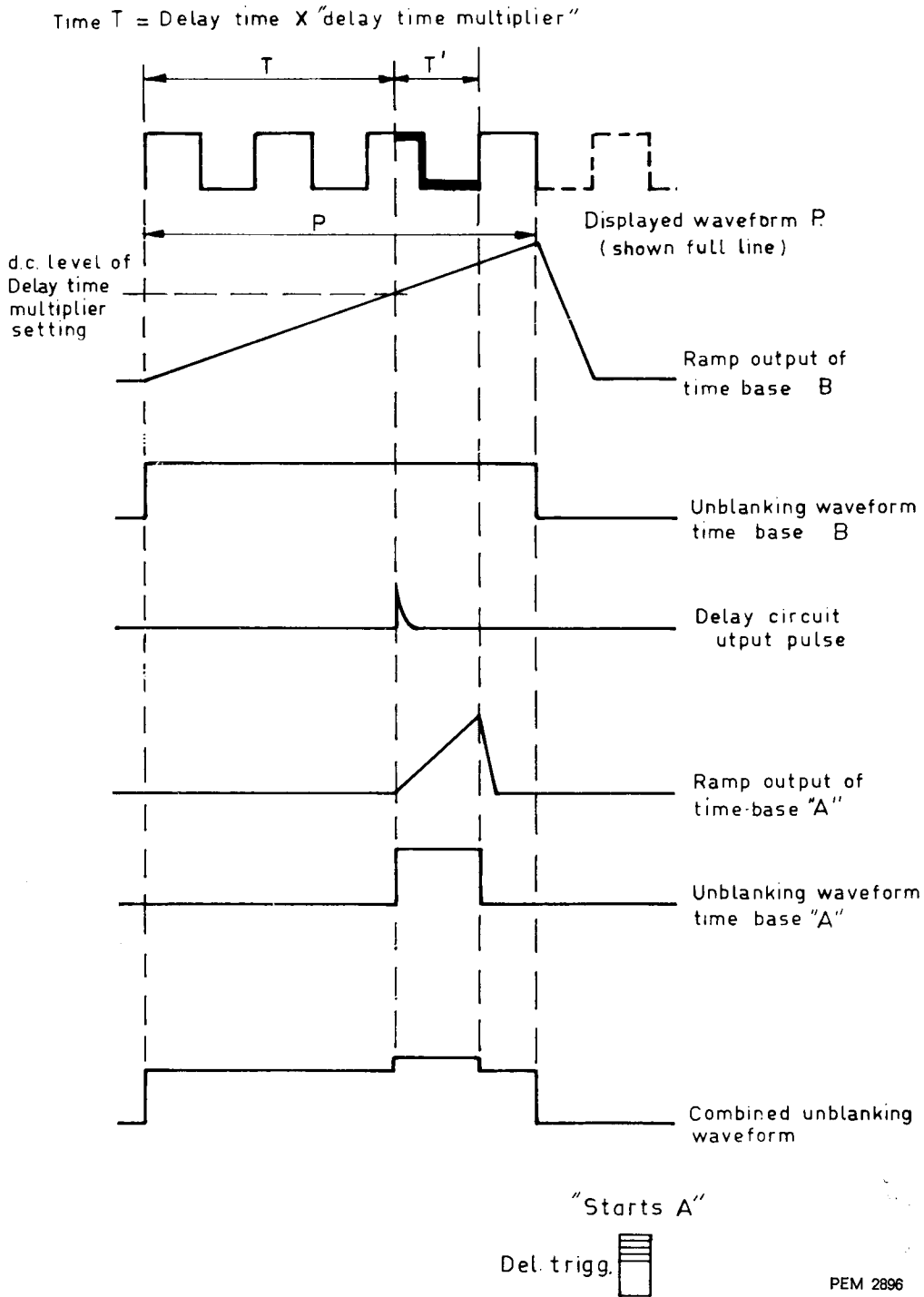


Fig. 14. Generation of the intensifying pulse

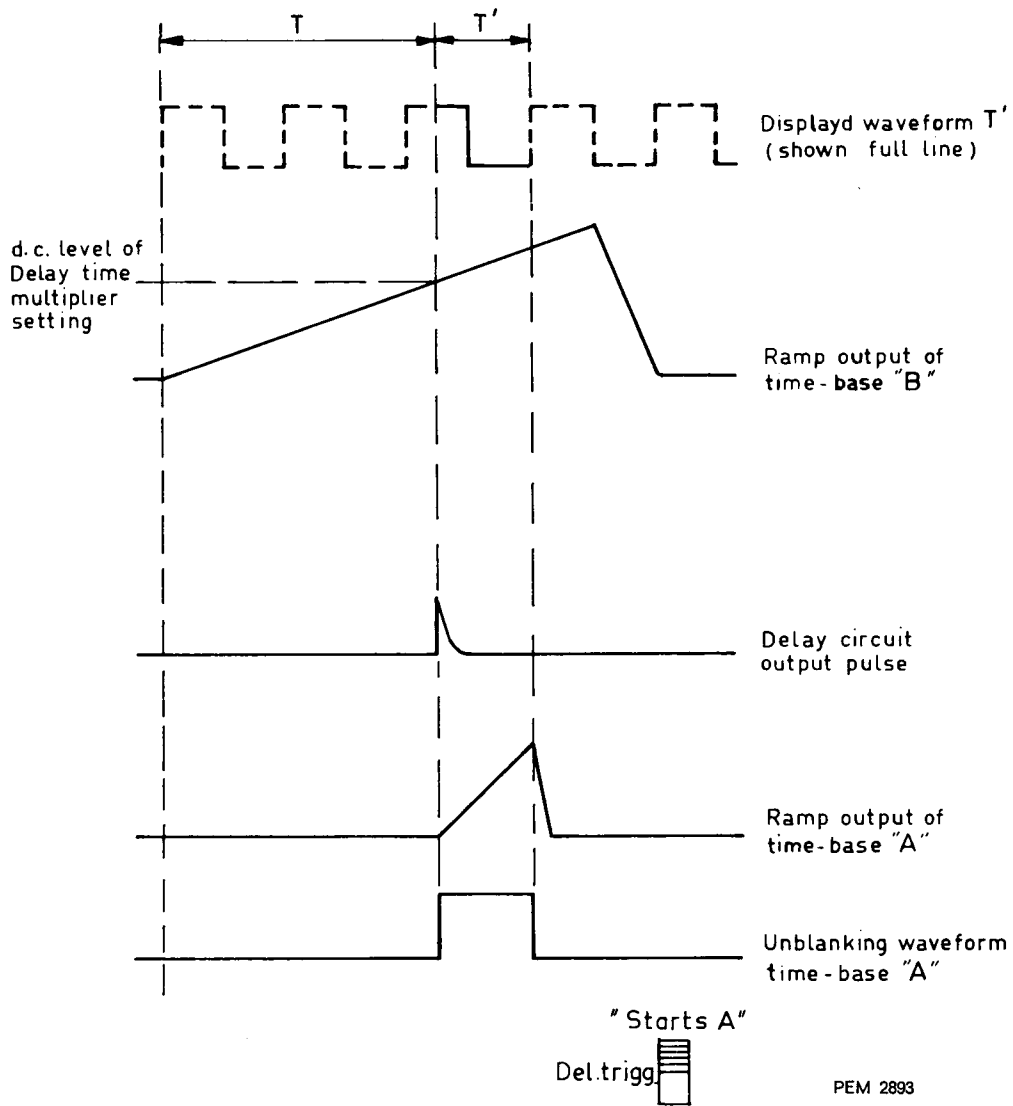


Fig. 16. Generation of the delayed time base A

Gated working of Time-Base A X

If SK6 is set to "STARTS A", the input of the S.G.M.V. of the Time-base A circuit is set below the lower hysteresis limit so that the time-base generator will start, regardless of the setting of the "Stab." control.

Thus when the delay pulse triggers Time-base A, the sweep starts immediately, see Fig. 14.
 If SK6 is set to "SETS A READY", the "STAB." control in Time-base A becomes operative so that

the S.G.M.V. input d.c. level can be set for triggered operation.

Thus, when the delay pulse triggers the lock-out multivibrator, the output of the latter is not sufficient to exceed the S.G.M.V. lower hysteresis limit.

The arrival of a further pulse from the trigger circuit A will therefore cause this hysteresis limit to be exceeded so that the Time-base A is locked to this pulse (Fig. 17).

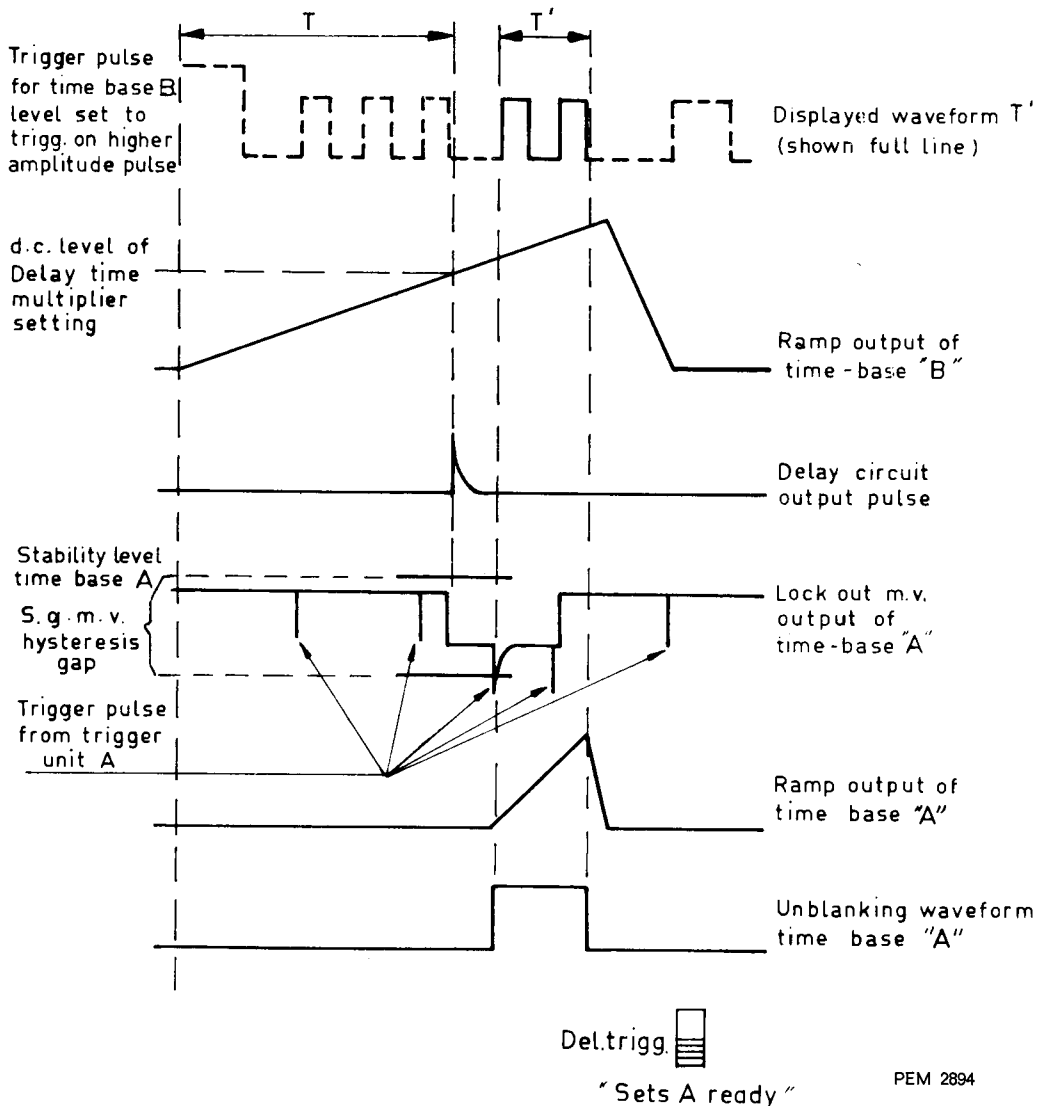


Fig. 17. Gated working of "A delayed by B"

Trigger circuit

XI

Compared with trigger unit A of the basic oscilloscope this trigger circuit is of a simpler design in that the trigger amplifier consists of a long-tailed pair circuit and the pulse shaper is a Schmitt-trigger. (Fig. 18)

The source selection, slope selection and mode selection as well as the TV synchronisation separator are identical to the ones of the basic oscilloscope (also see Fig. 43 and Fig. 44 of the basic oscilloscope).

The trigger signal can be derived from either the Y-deflection signal or the mains supply (via 27BU-X). In the first case the trigger signal is applied symmetrically to trigger amplifier B1'-B1"; in the two latter cases it is applied asymmetrically. The amplified signal is routed from the anode of B1' to the Schmitt-trigger. The latter switches when the applied signal reaches a certain level. Thus, a square wave originates at the anode of B3" which is differentiated by the C24-R66 network.

The resulting negative spikes will switch over the S.G.M.V. (B4"-B6') to start the time base generator, but the positive spikes are suppressed by diode GR7 to prevent undue resetting of the S.G.M.V.

The level at which the Schmitt-trigger will operate is set by potentiometer R59 "Trigger Sens". The moment at which the trigger signal will reach that level depends on the d.c. potential at the B1" control grid. When mode-switch SK1 is in position "DC", "LF" and "HF" this potential can be varied by means of "Level" potentiometer R2. In the "TV. Line" and "TV. Frame" positions this potential is determined by voltage divider R41 and R42; in the position "Aut.", the control grid is earthed via R43. The polarity of the trigger signal can be selected with switch SK2.

The mode of operation of the time-base generator is determined by the potential at the S.G.M.V. control grid (B4") i.e. the free-running operation or the triggered operation.

When switch SK1 is in the "DC", "LF" or "HF" position, the potential can be varied with "Stab." potentiometer R3. If the potential is low enough to underpass the S.G.M.V. lower hysteresis level the free-running mode of operation is obtained; otherwise the triggered mode of operation is obtained.

When the "Stab." control is in the "Preset" position, switch SK5 is thrown and the potential of the S.G.M.V. control-grid is determined by the setting of "Preset Stab." potentiometer R113. This also applies to the "TV. Line" and "TV. Frame" position of SK1.

When SK1 is in the "Aut." position, the potential is controlled by the automatic stability control circuit built around B2. If no trigger signal is present, the B2p anode voltage is made low enough to obtain the free-running mode of operation by adjusting the "Aut. Free-run" potentiometer R28. If a trigger signal is present, it is rectified by diodes GR2 and GR3.

A negative voltage then arises at the B2p control grid, which causes the anode potential to rise slightly so that a triggered mode of operation is obtained.

The B2p anode voltage is clamped in the positive-going direction by diode GR4 to a d.c. level, present at the cathode of cathode-follower B2t and which is adjusted by "Aut. Trigg. Level" potentiometer R33. This is to keep the time base generator in the triggered mode when the amplitude of the trigger signal ahead of the control grid of B2p increases.

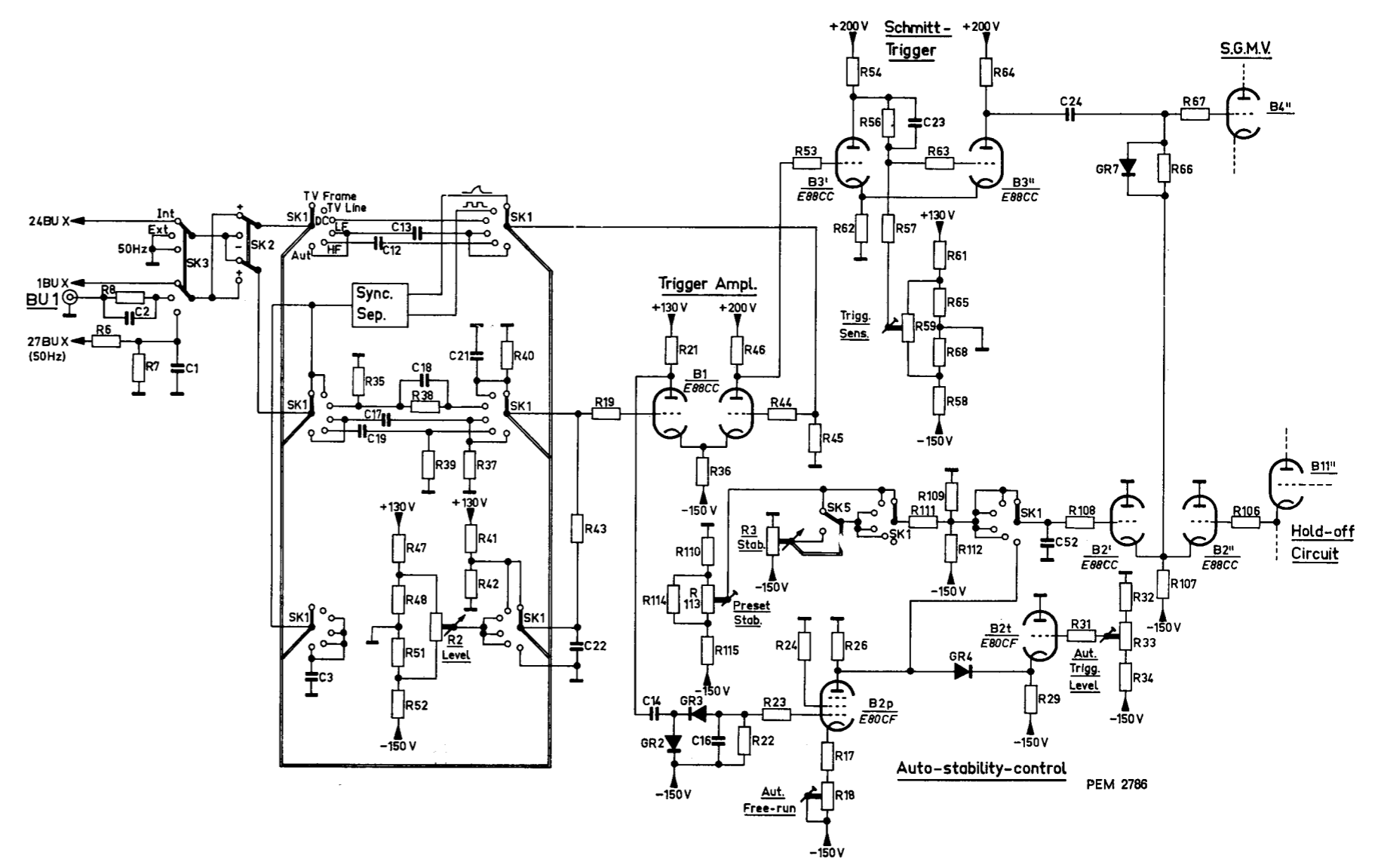


Fig. 18. Trigger Circuit

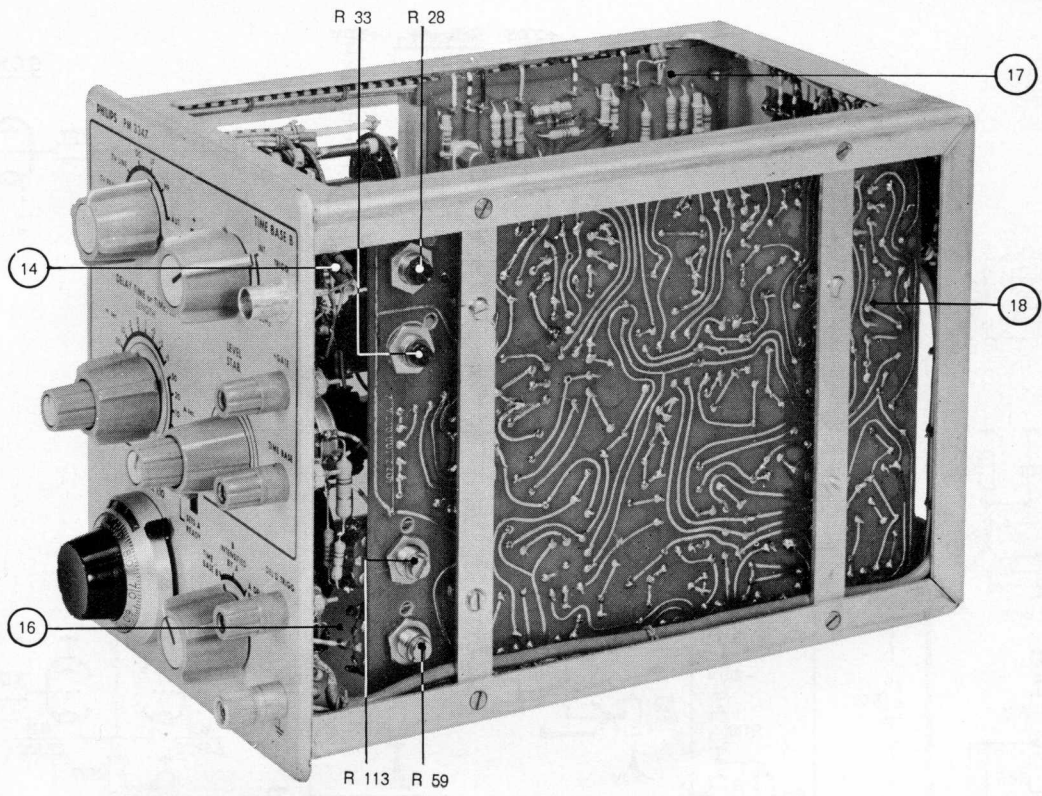


Fig. 19. Right-hand side

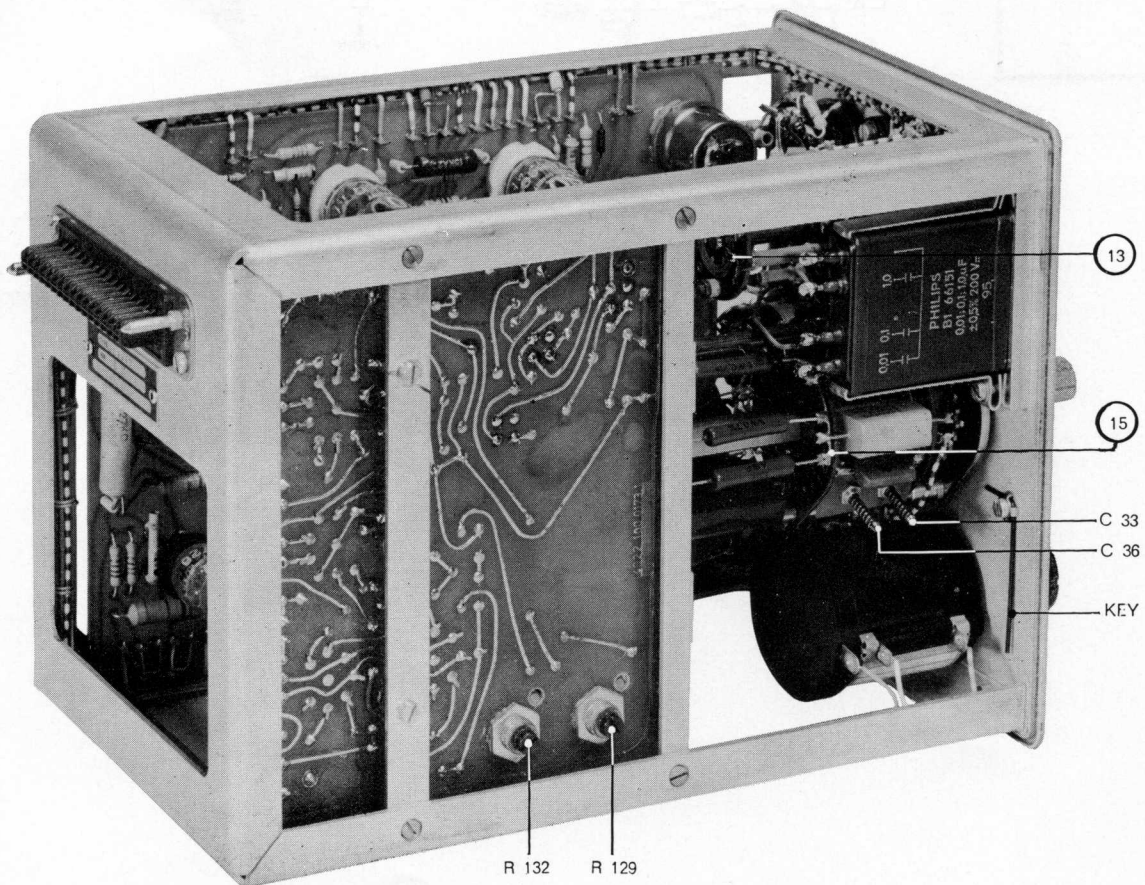


Fig. 20. Left-hand side

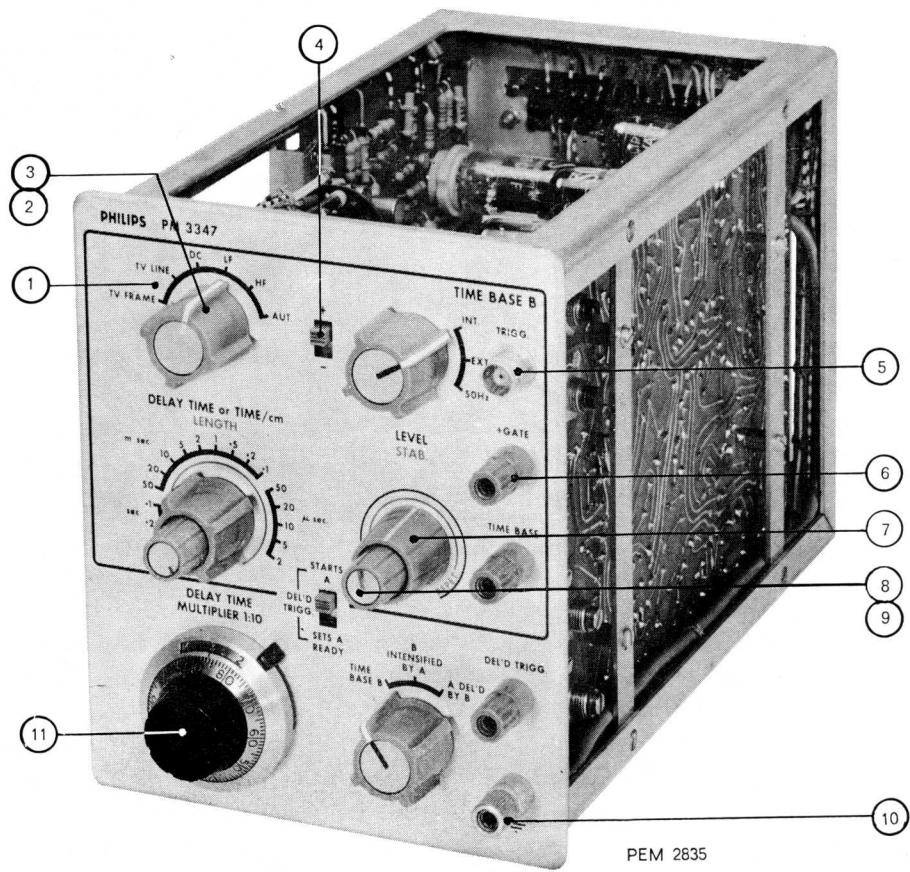


Fig. 21. Front view

Checking and adjusting



A. GENERAL INFORMATION

With the aid of these data, it is possible to carry out all the adjustments of the delay time base PM 3347 and to check the proper working of the plug-in unit. For this, the unit should be inserted into the X-plug-in compartment of a correctly-adjusted basic oscilloscope PM 3330.

To adjust the time co-efficients and the delay, a number of time-marker signals with accurately known time-intervals is required.

For the checking and adjusting of the trigger unit and the time-base generator B, a Y-plug-in unit PM 3333 or another single channel plug-in unit is required.

Some of the adjusting elements are on the left-hand side of the unit and are not directly accessible. When these elements must be adjusted, the unit should be connected to the basic oscilloscope via an extension plug (codenumber 4822 263 70009).

For a complete adjustment of the instrument the sequence as described in this chapter is to be preferred.

B. TIME BASE B AND TRIGGERING

For the next checking and adjusting points set the below mentioned knobs to the following positions:

Unit PM 3347

"TRIGG. MODE" (SK1) to "H.F."
 "TRIGG. SOURCE" (SK3) to "INT."
 SK7 to "TIME BASE B"
 LENGTH (R1) clockwise

Basic oscilloscope PM 3330

"X-DEFLECTION" to "X-UNIT"
 "MAGNIFIER" to "×1"

1. Stability

- Set "LEVEL" (R2) to its centre position and "STABILITY" (R3) to "PRESET".
- Apply a sine-wave voltage with a frequency of 10 kHz to the PM 3333 and adjust the trace height to 3 cm.
- Set "TIME/cm" (SK4) to position "20 μ sec./cm" and turn "PRESET STAB." (R113) fully clockwise.

- Turn R113 so far anti-clockwise that a well-triggered display is obtained.
- Check the triggering at different time co-efficients. The time-base generator should not stop and no double trace should be displayed; if necessary, slightly readjust R113.
- Turn "STAB." (R3) fully clockwise; the time-base generator should then be free running.
- When R3 is turned anti-clockwise, a triggered display should be obtained. When R3 is turned still further anti-clockwise while SK5 is not yet switched over, the time-base generator should stop and no time-base line should be visible.

2. Trigger sensitivity

- Set "STAB." (R3) to "PRESET".
- Switch off the level control by short-circuiting the cursor of "LEVEL" (R2) to earth.
- Apply such a voltage to Y-plug-in unit PM 3333, that the trace height is 1 mm. The easiest way to obtain this result is to apply the .2 V calibration voltage to the input of the amplifier, the deflection factor of which has been adjusted to "2 V/cm".
- Adjust potentiometer "TRIGG. SENS." (R59) for a well-triggered display.
- Remove the earthing connection of the cursor of R2.

3. Trigger slope and level

- Apply a sine-wave voltage with a frequency of 10 kHz to Y-plug-in unit PM 3333 and adjust for a trace height of 6 cm.
- Set "TRIGG. SLOPE" (SK2) to position "+". The time-base generator should then start on the positive-going edge of the sine wave.
- With "TRIGG. SLOPE" (SK2) to position "—", the time-base generator should start on the negative-going edge.
- It should be possible to shift the starting point continuously over the edge of the sine wave across the entire trace height of 6 cm, by means of "LEVEL" (R2).
- With "LEVEL" (R2) fully clockwise and anti-clockwise, the time-base generator should not operate.

4. Internal triggering

T.V. FRAME

- Set "TRIGG. MODE" (SK1) to "T.V. FRAME" and "TRIGG. SLOPE" (SK2) to "—".

- Connect a positive video signal to Y-plug-in unit PM 3333.
- At a minimum trace height of 2 cm, check that a display is obtained, which is triggered on the frame-synchronization pulse.
In this case, the trace will start with a frame-synchronization pulse.
- In position "T.V. FRAME", "LEVEL" and "STABILITY" should have no influence on the display.

T.V. LINE

- Set "TRIGG. MODE" (SK1) to "T.V. LINE" and "TRIGG. SLOPE" (SK2) to "—".
- Apply a positive video signal to Y-plug-in unit PM 3333.
- At a minimum trace height of 2 cm, check that a display is obtained which is triggered on the line-synchronization pulse.
In this case the trace will start with a line-synchronization pulse.
- In position "T.V. LINE", "LEVEL" and "STABILITY" should have no influence on the display.

D.C.

- Set "TRIGG. MODE" (SK1) to "D.C.".
- Adjust the time-base generator to its free-running position and place the time-base line to the centre of the screen with the Y-shift control.
- Apply a sine-wave voltage with a frequency of 10 kHz to the Y-plug-in unit and adjust for a trace-height of 3 mm.
- Set "STAB." (R3) to position "PRESET".
- Check that after correct adjustment of "LEVEL" (R2), the time-base generator is triggered by the input voltage.
- Increase the trace height to 3 cm.
When shifting the trace in vertical direction the starting point of the time-base line should continuously shift across the edge of the sine wave, but stay at the same place on the screen.

L.F.

- Set "TRIGG. MODE" (SK1) to "L.F.".
- Apply a sine-wave voltage with a frequency of 3 Hz to plug-in unit PM 3333 and adjust for a trace height of 3 mm.
- Check that after correct adjustment of "LEVEL" (R2), the time-base generator is triggered by the input voltage.
"LEVEL" (R2) can easily be preset with a higher frequency of the input signal. The vertical shift on the plug-in unit should have no influence on the trigger level which has been adjusted with "LEVEL" (R2).

H.F.

- Set "TRIGG. MODE" (SK1) to "H.F.".
- Apply a sine-wave voltage with a frequency of 3 Hz to plug-in unit PM 3333 and adjust for a trace-height of 1 cm.
- It should be impossible to trigger the time-base generator with this L.F. voltage.
- Increase the frequency of the input voltage to 2 kHz and 1 MHz resp. and adjust for a trace height of 3 mm.
After correct adjustment of "LEVEL" (R2), the time-base generator should be triggered with the input voltage.

AUT.

- Set "TRIGG. MODE" (SK1) to "EXT.".
- Turn potentiometers "AUT. TRIGG. LEVEL" (R33) and "AUT. FREE RUN." (R28) fully clockwise.
- Without any input voltage on Y-plug-in unit PM 3333, turn "AUT. FREE RUN." (R28) anti-clockwise until the time-base line just appears, and turn R28 15° further anti-clockwise.
- Apply a voltage with a frequency of 10 kHz to the Y-plug-in unit and adjust for a trace height of 3 cm.
- Adjust "AUT. TRIGG. LEVEL" (R33) so, that the time-base generator is triggered with his voltage.
- Vary the trace height from 0 to 6 cm.
From a minimum trace-height of 5 mm to 6 cm, the time-base generator should be triggered with the input signal.
With a trace height of less than the trigger limit, the time-base generator should remain free-running.
- Check that the time-base generator is triggered at a minimum trace-height of 8 mm at frequencies of 10 Hz and 1 MHz respectively.
- In position "AUT.", "LEVEL" and "STAB." should have no influence on the display.

5. External triggering

- Set "TRIGG. SOURCE" (SK3) to "EXT.".
- Apply a sine-wave voltage of 0.4 V_{p-p} from the same voltage source as connected to the Y-plug-in unit, to EXT. (BU1).
- Adjust the frequency of the input voltage to 1 kHz and adjust "TRIGG. MODE" (SK1) to "H.F.".
- After correct adjustment of "LEVEL" (R2), the time-base generator should be triggered with the external voltage on BU1.
- Remove the voltage from BU1; the time-base

generator should not be triggered any longer, so the time-base line should not be visible.

6. Triggering 50 Hz

- Set "TRIGG. SOURCE" (SK3) to 50 Hz and "TRIGG. MODE" (SK1) to "L.F."
- Apply a sine-wave voltage with the mains frequency to the Y-plug-in unit.
- After correct adjustment of "LEVEL" (R2), the time-base generator should be triggered by an internal voltage with the mains frequency.
- It should be possible to shift the starting point of the time-base line across the sine-wave by means of control "50 Hz PHASE" of the basic oscilloscope.

7. Time co-efficients

To adjust the time co-efficients, trimmers C33 and C36, which are located on the left-hand side of the unit, should be adjusted.

To gain access to these trimmers, the unit to be measured should be connected to the basic oscilloscope via the extension plug.

- Set the below mentioned knobs to the following positions:

UNIT PM 3347

"TIME/cm" (SK4) to "20 μ sec./cm".
"LENGTH" (R1) clockwise.

BASIC OSCILLOSCOPE

"Magnifier" to " $\times 1$ ".

- Apply a time-marker signal with a time interval of 20 μ sec. to a Y-plug in unit (PM 3333).
- Adjust "LEVEL" (R2) for a triggered display and, with C36, adjust the time co-efficient so that 8 periods have a width of 8 cm; tolerance 1 %.
Measure the time co-efficient across 8 cm (symmetrical around the centre of the screen).
- Change the time interval to .2 msec. and set "TIME/cm" (SK4) to ".2 msec."
- Adjust "LEVEL" (R2) for a triggered display and with C33 adjust the time co-efficient so, that 8 periods have a width of 8 cm; tolerance 1 %.
- Check the time co-efficients in all not yet mentioned positions of "TIME/cm" (SK4). Select the time marker signals so that they correspond with the time co-efficient selected with "TIME/cm" (SK4).
- Measure the time co-efficient across 8 periods; the periods should have a width of 8 cm; tolerance $2\frac{1}{4}$ %.

8. Sweep length

- With "LENGTH" (R1) turned fully clockwise check the length of the time-base line. In all positions of "TIME/cm" (SK4), the time-base line should be longer than 10 cm. If necessary, select a different value for R102.
- With "LENGTH" (R1) turned fully anti-clockwise and "TIME/cm" (SK4) to "1 msec./cm", the length of the time-base line should not exceed 4 cm.

C. DELAY

Before carrying out this measurement, it is necessary to check that the time co-efficients are correctly adjusted (see point B7).

The delay is adjusted by means of the adjusting potentiometers "MIN. DELAY" (R132) and "MAX. DELAY" (R129).

These potentiometers are found on the left-hand side of the plug-in unit. To gain access to the potentiometers, the unit to be measured should be connected to the basic oscilloscope via the extension plug.

1. Adjustment of the counter knob "Delay-time multiplier"

- Turn knob "DELAY-TIME MULTIPLIER" (R4) fully anti-clockwise and check that the counter indicates 0.00 in this position.
- If it should be necessary to readjust the knob, it can be unscrewed by means of the small key which is found behind the frontplate (see Fig. 23).
- Turn the shaft of R4 fully anti-clockwise.
- Replace the counter knob on the shaft and tighten the knob by means of the fixing screw.

2. Min. delay and max. delay

- Set the below mentioned knobs to the following positions:

UNIT PM 3347

"TRIGG. MODE" (SK1) to "AUT."
"TRIGG. SLOPE" (SK2) to "+"
"TRIGG. SOURCE" (SK3) to "INT."
"DELAY TIME" (SK4) to ".2 msec."
"DEL'D TRIGG." (SK6) to "STARTS A"
"DEFLECTION" (SK7) to "B INTENSIFIED BY A"
"LENGTH" (R1) fully clockwise
"DELAY-TIME MULTIPLIER" (R4) to "2.00"
BASIC OSCILLOSCOPE PM 3330
"TRIGG. MODE" to "H.F."
"TIME/cm" to ".5 μ sec./cm"
"X-DEFLECTION" to "X-UNIT"
"MAGNIFIER" to " $\times 1$ "

- Apply a time-marker signal with a time-interval of .2 msec.
A triggered display should then be obtained.
- With "INTENS" (R6) of the basic oscilloscope, adjust the intensity so, that at the initial part of the oscillogram an extra intensified part is obtained.
- It should be possible to shift this intensified part with "DELAY-TIME MULTIPLIER".
- Set R4 to position "1.00".
- With "MIN. DELAY" (R132) adjust the delay time to ".2 msec."; in this case, the start of the intensified part should exactly coincide with the start of the second period.
- Turn R4 to position "9.00".
- With "MAX. DELAY" (R129), adjust the delay time to "1.8 msec." by making the start of the intensified part coincide with the start of the 10th period.
- Because the adjustments of "MIN. DELAY" and "MAX. DELAY" influence each other, it is necessary to repeat the adjustments several times.
For this, set R4 to position "1.00" again and adjust R132 so, that the intensified parts coincide again with the start of the second period.
- Set SK7 to position "A DEL'D BY B".
Across the entire width of the screen, that part of the signal that was indicated by the extra intensity, should be visible.
In these positions of SK7, the "MIN. DELAY" can be accurately determined, because the start of the time-base line should coincide with the start of the second period; if necessary, slightly readjust R132.
- Set R4 to position "9.00" and readjust "MAX. DELAY" (R129) so, that the start of the time-base line coincides with the start of the 10th period.
- Repeat the adjustments of R132 and R129 until the delay times are accurate in the positions "1.00" and "9.00" of R4.

3. Delay-time multiplier 1 : 10

After adjustment of "MIN. DELAY" and "MAX. DELAY" (point C2), check the intermediate positions of R4.

- For this, set SK7 to position "A DELAYED BY B" and always adjust R4 so, that the start of the time-base line coincides with the start of the 3rd to 9th period.
- The indication of the counter knob should lie between the values mentioned in the next table.

<i>Period</i>	<i>Indication counter knob</i>
2nd	"1.00"
3rd	"1.98" – "2.02"
4th	"2.98" – "3.02"
5th	"3.98" – "4.02"
6th	"4.98" – "5.02"
7th	"5.98" – "6.02"
8th	"6.98" – "7.02"
9th	"7.98" – "8.02"
10th	"9.00"

4. "Del'd Trigg." (SK6)

- Set the knobs to the positions indicated under C2.
- With SK6 in positions "STARTS A", the intensified part should shift continuously across the trace when varying the delay time by means of the "DELAY-TIME MULTIPLIER" (R4).
- Set SK6 to position "SETS A READY".
- On the basic oscilloscope, set the "TRIGG. SOURCE" to "INT." and "STAB." to "PRESET".
- On the basic oscilloscope, adjust "LEVEL" so that the intensified part becomes visible.
- When the "DELAY TIME" is varied, the intensified part should repeatedly jump one period.

5. Jitter

The jitter should amount to maximum .005 % of the final value of the selected delay time.

With "DELAY TIME" (SK4) to position "2 msec.", this corresponds to 100 nsec.

- Set SK7 to position "A DEL'D BY B" and "TIME/cm" on the basic oscilloscope to ".2 μ sec./cm"; set the other knobs to the positions indicated in section C2.
- The basic oscilloscope: check that knob "AMPL. CAL." (SK13) is set to "OFF"; set "TRIGGER SOURCE" (SK3) to position "EXT".
- Apply a time marker signal with a time-interval of 100 μ sec. and adjust "DELAY TIME MULTIPLIER" (R4) so that the leading edge of the 3rd pulse becomes visible. The indication of the counterknob is then about 2.00.
- The maximum jitter may amount to $(2.00 \times 2 \text{ msec.}) : 20000 = 200 \text{ nsec.}$
In connection with the "TIME/cm" setting of Time-base A, this corresponds to a maximum shift of 1 cm on the screen.

D. OUTPUT TERMINALS

- Adjust time-base B to its free-running position, with a time co-efficient of ".1 msec./cm".
- On the output terminals "+ GATE" (BU2), "TIME BASE" (BU3) and "DEL'D TRIGG." (BU4), synchronous voltages should be available, as shown in Fig. 11 and Fig. 26.

Parts list**A. MECHANICAL**

<i>Item</i>	<i>Fig.</i>	<i>Qty</i>	<i>Code number</i>	<i>Description</i>
1	21	1	4822 455 80036	Text plate
2	21	4	4822 413 40112	Knob 23 Ø
3	21	3	4822 413 70037	Cover
4	21	2	4322 277 20014	Sliding switch
5	21	1	4322 265 10004	BNC connector
6	21	3	4822 290 40011	Terminal
7	21	1	4822 413 40211	Control knob 23 Ø
8	21	2	4822 413 30085	Control knob 14.5 Ø
9	21	2	4822 413 70039	Cover
10	21	1	4822 413 30082	Terminal
11	21	1	4822 413 90008	Counter knob
12	29	1	4822 265 60002	32-pole plug
13	29	1	4822 273 80037	Switch SK1
14	19	1	4822 273 40081	Switch SK3
15	29	1	4823 273 60022	Switch SK4
16	19	1	4822 273 50038	Switch SK7
17	19	1	4822 216 50107	Unit 5
18	19	1	4822 216 50033	Unit 6

B. ELECTRICAL — ELEKTRISCH — ELEKTRISCH — ELECTRIQUE — ELECTRICOS




















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

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

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

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

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

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



For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.

Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.

Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.

Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS.

Para piezas universales y standard consulte el Catálogo de Servicio PHILIPS.

RESISTORS

<i>Nr.</i>	<i>Code number</i>	<i>Value</i>	<i>Watts</i>	<i>%</i>	<i>Description</i>
R1	4822 101 20109	10 kΩ			Potentiometer
R2	4822 102 20011	2 × 100 kΩ			Duo potentiometer
R3	see R2				
R4	4822 103 40006	50 kΩ	5		Helipotentiometer
R28	4822 103 20091	4.7 kΩ	3		Potentiometer
R33	4822 103 20094	10 kΩ	3		Potentiometer
R59	4822 101 20112	47 kΩ			Potentiometer
R72	4822 116 50074	56 kΩ	1	1	Carbon
R73	4822 116 50423	39 kΩ	1	1	Carbon
R84	4822 116 50071	750 kΩ	0.5	0.5	Metal film
R85	4822 116 50069	300 kΩ	0.5	0.5	Metal film
R89	4822 116 60028	82 kΩ	2	5	Carbon
R113	4822 101 20113	100 kΩ			Potentiometer
R128	4822 116 50073	27 kΩ	0.5	1	Metal film
R129	4822 103 20094	10 kΩ	3		Potentiometer
R132	4822 103 20094	10 kΩ	3		Potentiometer
R133	4822 116 50074	56 kΩ	0.5		Metal film

CAPACITORS

<i>Nr.</i>	<i>Code number</i>	<i>Value</i>	<i>Volts</i>	<i>%</i>	<i>Description</i>
C28		$\left\{ \begin{array}{l} 1 \mu\text{F} \\ 100 \text{ nF} \\ 10 \text{ nF} \end{array} \right.$			Sweep time capacitor
C29	4822 111 30192				
C31					
C32	4822 123 10203	976 pF	250	5	Mica
C34	4822 120 60078	82 pF	500	1	Mica
C44	4822 121 40071	680 nF	250	10	Polyester

VALVES

<i>Item</i>	<i>Type number</i>	<i>Description</i>
B1, B3, B4 B6, B11, B12 B17	E88CC	Duo triode
B2, B8, B16 B7	E80CF 5726	Triode-penthode Duo diode
B9	ZA1004	Neon tube
B13, B14	5654	Penthode
B18, B19	ZZ1000	Neon voltage stabiliser

SEMI CONDUCTORS

<i>Item</i>	<i>Type number</i>	<i>Description</i>	<i>Ordering number</i>
GR1, GR10	BAY38	Diode	4822 130 40256
GR2, GR3	OA200	Diode	4822 130 30139
GR4	OA70 ¹⁾	Diode	4822 130 30221
GR5, GR7	AAZ17	Diode	4822 130 30283
GR6	OA85	Diode	4822 130 30225
GR8, GR9	AAZ15	Diode	4822 130 30229
TS1, TS2, TS3	ASZ20 ²⁾	Transistor	4822 130 40485

1) May be replaced by AAZ17 4822 130 30283

2) May be replaced by ASY76 4822 130 40259

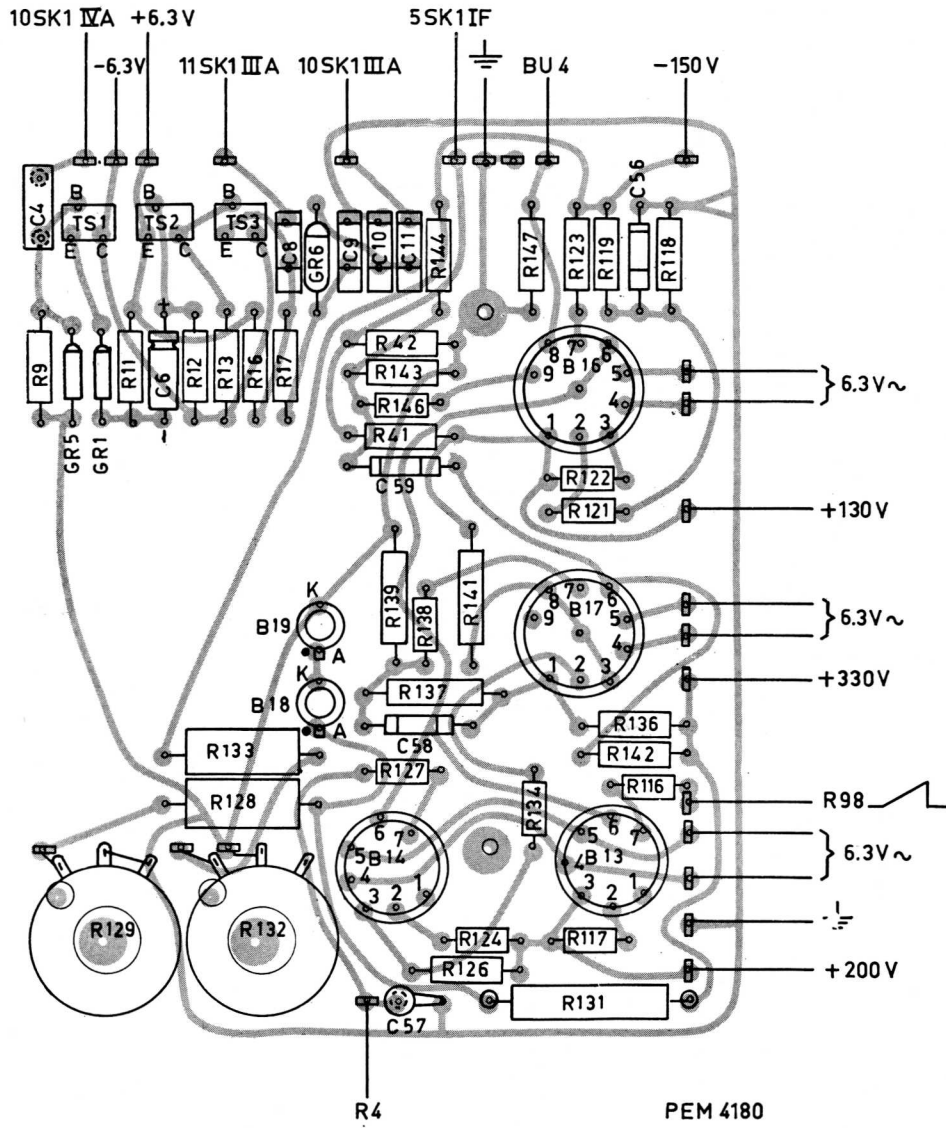
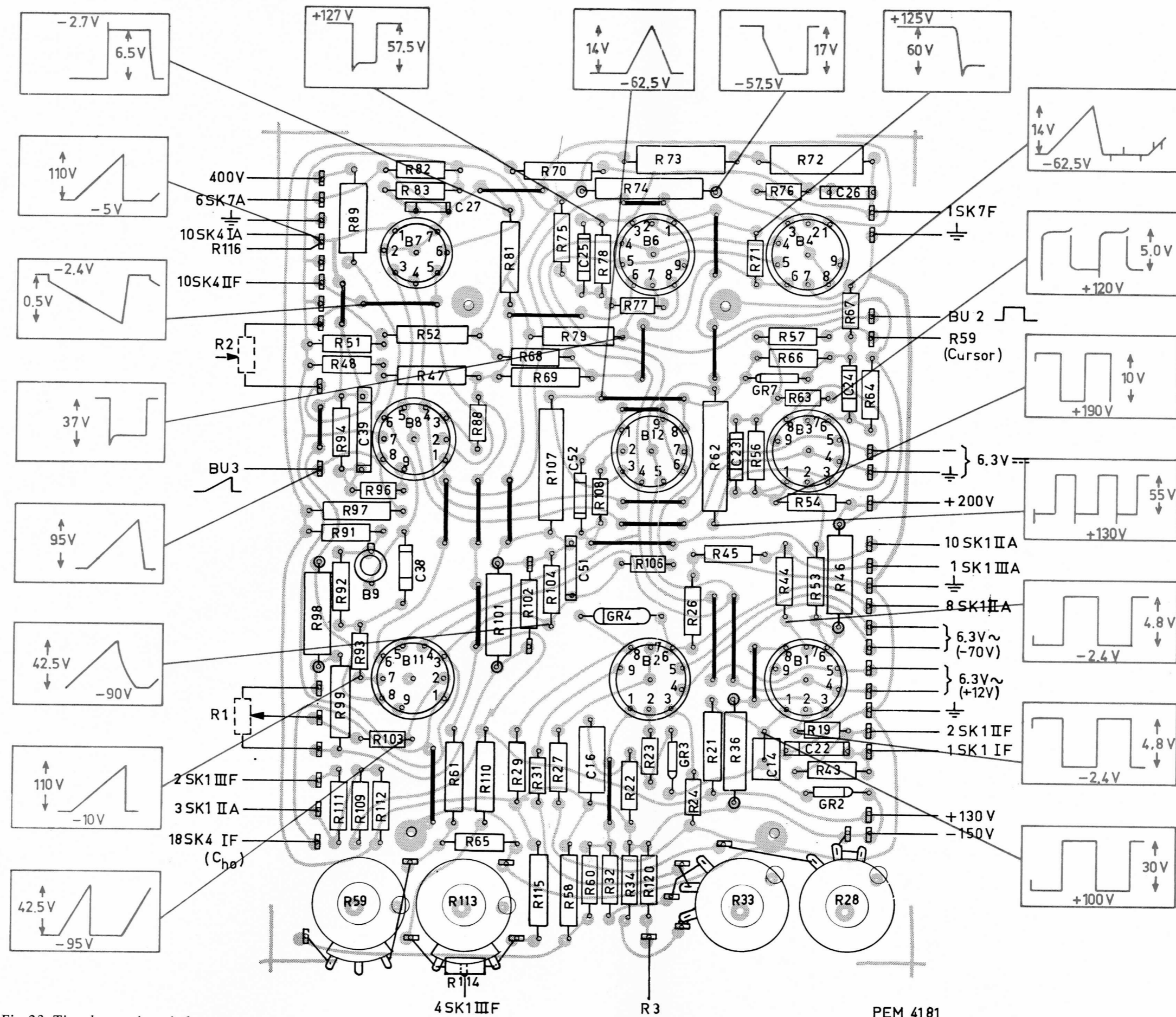


Fig. 22. Delay unit; unit 5



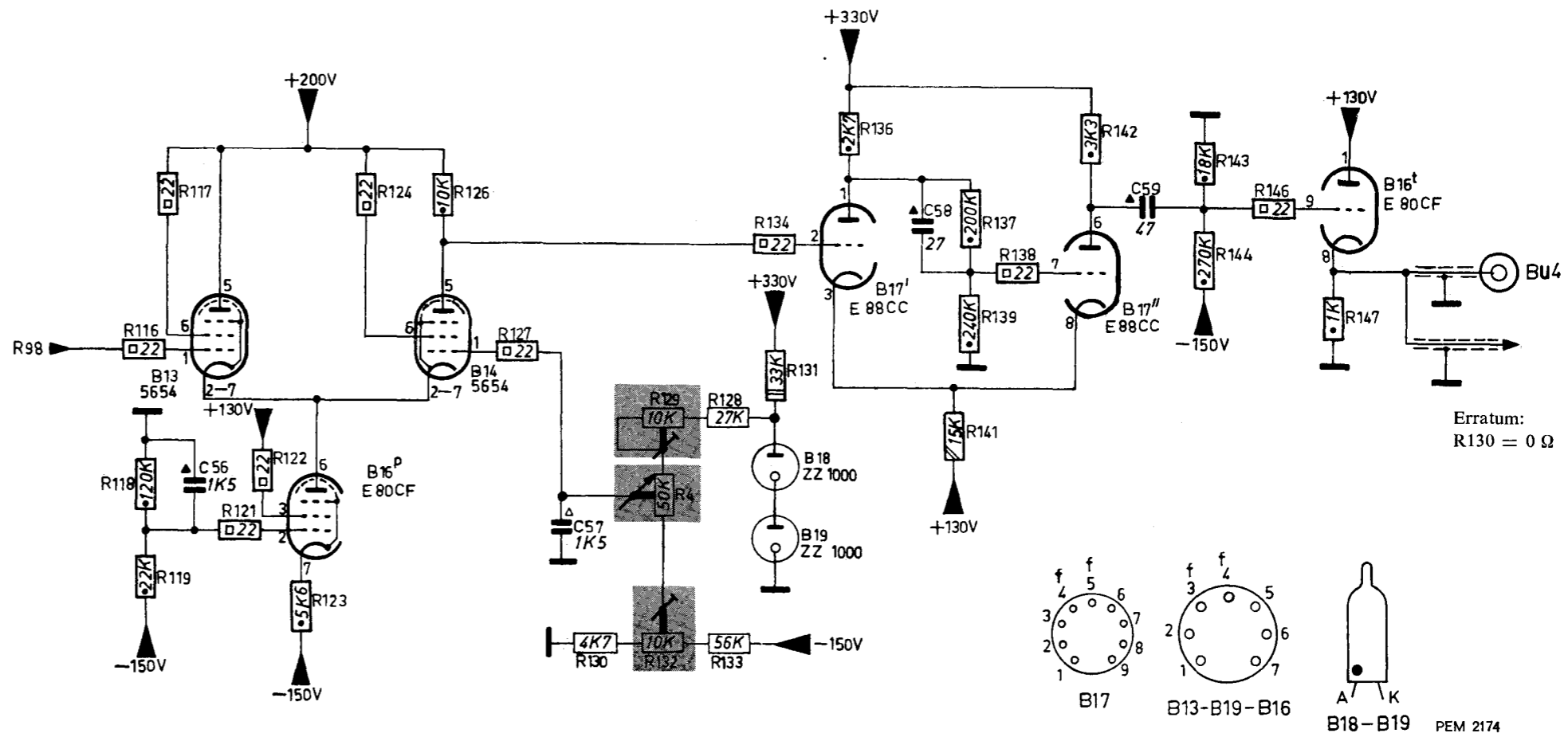


Fig. 24. Delay circuit

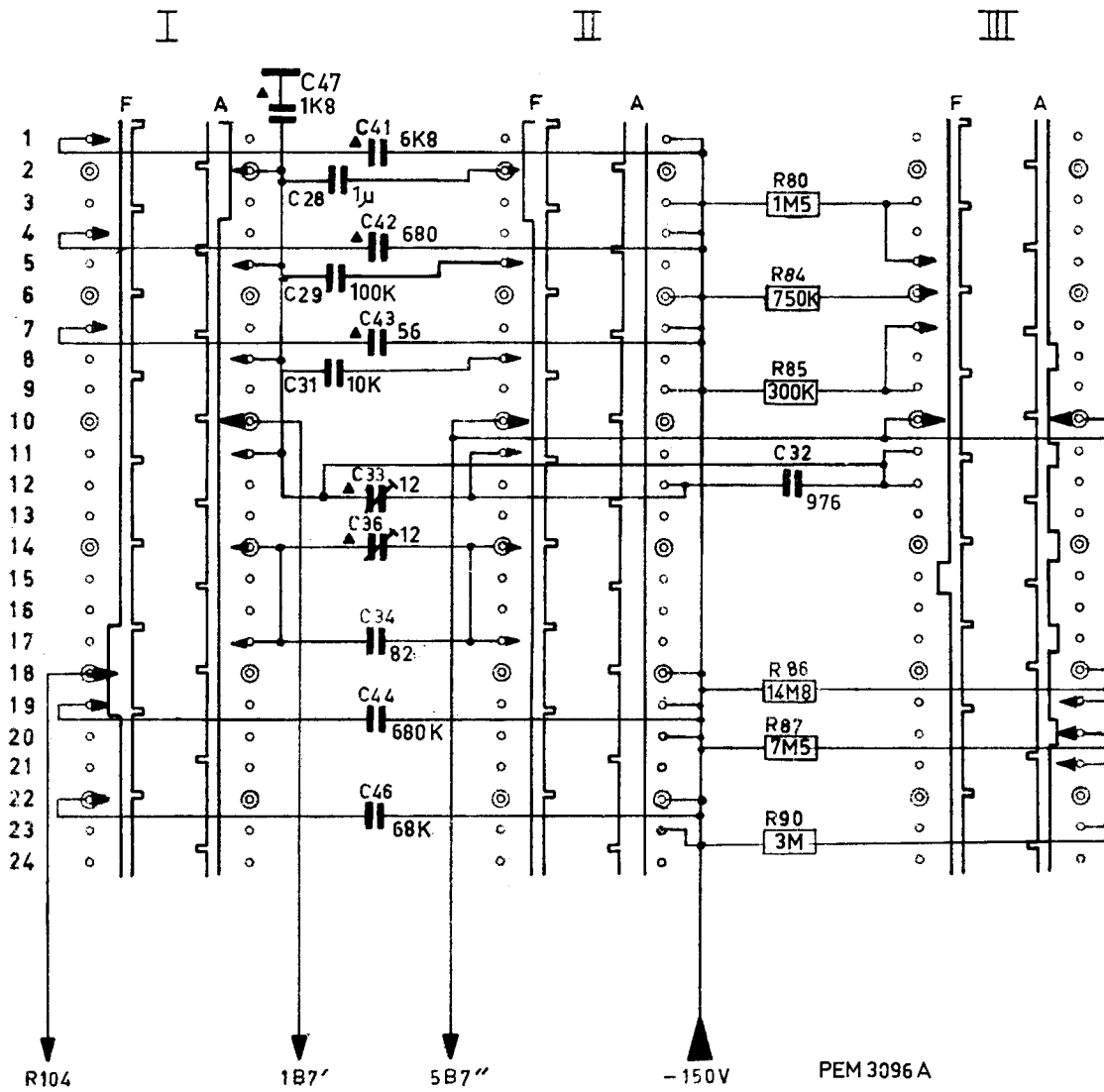
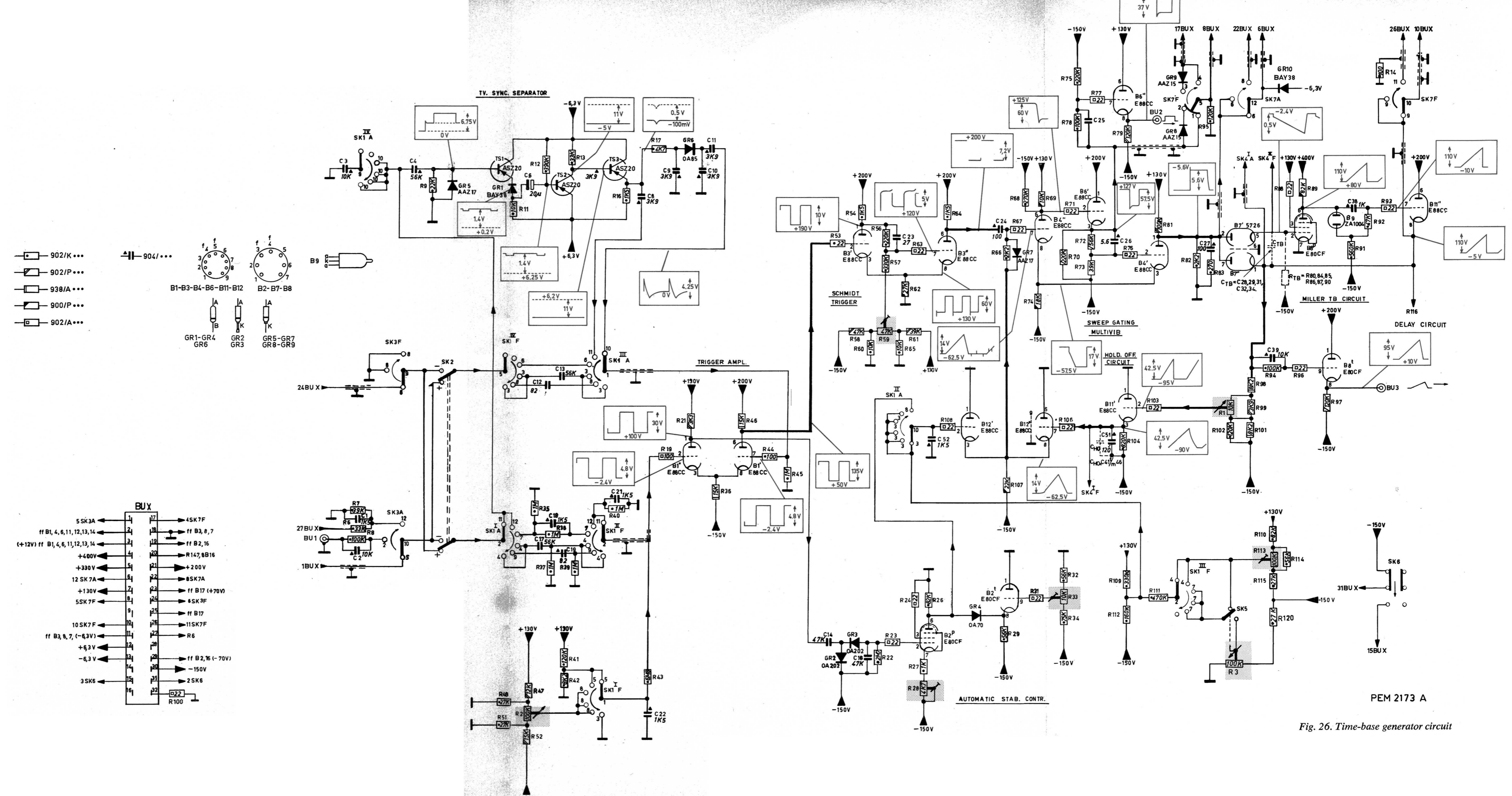


Fig. 25. Time coefficient switch



- 902/K ...
 - 902/P ...
 - 938/A ...
 - 900/P ...
 - 902/A ...
- 904/...
- B1-B3-B4-B6-B11-B12 B2-B7-B8
- GR1-GR4 GR2 GR5-GR7
GR6 GR3 GR8-GR9

BUX

5 SK3A	17	4 SK7F
ff B1, 4, 6, 11, 12, 13, 14	21	ff B3, 8, 7
(+12V) ff B1, 4, 6, 11, 12, 13, 14	22	ff B2, 16
+400V	23	R147, 8B16
+330V	24	+200V
12 SK7A	25	8 SK7A
+130V	26	ff B17 (+70V)
5 SK7F	27	8 SK3F
10 SK7F	28	ff B17
ff B3, 8, 7, (-6.3V)	29	11 SK7F
+6.3V	30	R6
-6.3V	31	ff B2, 16 (-70V)
3 SK6	32	2 SK6
		R100

Fig. 26. Time-base generator circuit