

Counter timer 80 MHz PM 6622

9446 066 220.1

Timer counter 520 MHz PM 6624

9446 066 240.1

Timer counter 1 GHz PM 6625

9446 066 250.1

Ordering number of this manual 9499 460 08611

760615/1



PHILIPS



PM 6622

9446 066 220.1

Operating manual



PM 6624

9446 066 240.1



PM 6625

9446 066 250.1

IMPORTANT

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

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I. INTRODUCTION

GENERAL INFORMATION

The counters in the PM 6620-series have frequency ranges from D.C. up to 80 MHz, 520 MHz and 1 GHz respectively for the PM 6622, PM 6624 and PM 6625.

All models can measure frequency, ratio, period, time interval and have a totalizing mode.

Optional accessories such as four different oscillators, a battery unit, a BCD output unit, a D/A converter and a BUS interface system extend the range of application.

II. TECHNICAL DATA

Properties expressed in numerical values with statement of tolerances are guaranteed. Numerical values without tolerances are intended for information purposes only and indicate the properties of an average instrument. The numerical values hold good for the nominal mains voltage.

A. MEASUREMENTS

Frequency

| | |
|------------|---|
| Range | DC ... 80 MHz. Input A. All models 50 ... 520 MHz. Input C. PM 6624 50 ... 1000 MHz. Input C. PM 6625 |
| Gate times | 10 ms, 100 ms, 1 s and 10 s. Input A |
| Resolution | 100 Hz, 10 Hz, 1 Hz and 0.1 Hz. All models |
| Accuracy | ± 1 count \pm time base error |

Single Period B

| | |
|-------------------|--|
| Range | 100 ns ... 10^5 s (DC ... 10 MHz) |
| Frequency counted | 10 MHz or 10 kHz |
| Time resolution | 100 ns or 100 μ s |
| Accuracy | ± 1 count \pm trigger error* \pm time base error |

Period average B

| | |
|----------------------|--|
| Range | 1 Hz ... 10 MHz |
| Frequency counted | 10 MHz |
| Number of averagings | $\rightarrow N = 10^2, 10^4$ and 10^6 |
| Time resolution | $\frac{100 \text{ ns}}{N}$ |
| Accuracy | ± 1 count \pm trigger error*/N \pm time base error |

Time interval A—B

| | Single | Average |
|-------------------------------|---|---|
| Range | 100 ns ... 10^5 s | 1 ns ... 1 s |
| Frequency counted | 10 MHz or 10 kHz | 10 MHz |
| Time resolution | 100 ns or 100 μ s | $\frac{100 \text{ ns}}{\sqrt{N}}$ |
| Number of averagings | | $N = 10^2, 10^4, 10^6$ |
| Min. time stop to start | | 250 ns |
| Accuracy | ± 1 count \pm trigger error** \pm time base error | ± 5 ns \pm time base error $\pm 100 \text{ ns} \pm \frac{\text{trigger error}^{**}}{\sqrt{N}}$ |
| Time interval repetition rate | max. 5 MHz | max. 4 MHz |

Count A

| | |
|-----------------------|--|
| Range | 1 to 999999999 |
| Mode | Accumulates pulses on channel A during time interval between start and stop signal or gate signal at input B |
| Pulse pair resolution | 12 ns |

Frequency ratio A/B or C/B

| | |
|------------|---|
| Range | fA: DC ... 80 MHz. All models fB: DC ... 10 MHz. All models fC: 50 ... 520 MHz. PM 6624 fC: 50 ... 1000 MHz. PM 6625 |
| Multiplier | $N = 10^4$ and 10^6 |
| Accuracy | $\pm 1 \text{ count} \pm \frac{\text{trigger error}^* \text{ of B}}{N}$ |

Check

HOLD OFF on
10 MHz internally applied to channel A and B
The hold off duration will be displayed if SINGLE PERIOD B is selected.
PM 6622.

Auxiliary functions

| | |
|---------------------------|--|
| Reset | Pushing RESET button resets the counter, releasing it starts new measurement. |
| Start/Stop and Gated by B | In function COUNT A the gate time is controlled either by start/stop or gate signal at input B. Mode of operation is selected by a slide switch at the front panel. |
| Display time | Continuously variable between 0.2 ... 5 s and infinite of display time knob is pulled. |
| Stand by | The switch is combined with display time control. Position STAND BY keeps an oven oscillator heated. |
| Memory | Switchable by push-button MEMORY |
| Trigger hold off | Active in the time-interval and the period mode. PM 6622. |
| Range | Approximately 10 ... 500 μs , 500 μs ... 100 ms if control knob is pulled. Hold off time is monitored at output gate open. |

* Trigger error is $\leq \pm 3 \times 10^{-3}$ for sine wave signals with signal to noise ratio of ≥ 40 dB.

** Trigger error for any wave shape is $\leq \pm \frac{2.5 \times 10^{-3}}{\text{Signal slope (V/ns)}} \text{ ns}$

B. INPUT CHARACTERISTICS**Input A and B**

| | | |
|-------------------------|---|---|
| Range | DC ... 80 MHz | } Input B is functionally limited to 10 MHz |
| DC coupled | 100 Hz ... 80 MHz | |
| AC coupled | Sine wave: 20 mV _{rms} | |
| Sensitivity | Pulses: 60 mV _{p-p} for pulse width ≥ 6 ns | |
| Impedance | 1 M Ω //25 pF | |
| Coupling | DC and AC | |
| Attenuation | $\times 1$ and $\times 10$ | |
| Trigger level | Preset 0 V or variable between ± 2.5 V with high resolution around 0 V. | |
| Safe overload | | |
| Attenuation $\times 1$ | ≤ 440 Hz: 250 V DC or 230 V _{rms} | |
| | > 440 Hz: falling to 12 V _{rms} at 1 MHz | |
| Attenuation $\times 10$ | Max. 250 V DC or 230 V _{rms} | |

Input C

(Not present in PM 6622)

Frequency range
Dynamic voltage rangeImpedance
VSWR
Coupling
Attenuation
Prescaling factor
Safe overload
AM tolerance**PM 6624**50 ... 520 MHz
10 mV_{rms} ... 12 V_{rms}
(-27 dBm ... +35 dBm)
50 Ω
<2
AC
by automatic PIN diode attenuator, maximum 62 dB.
8
12 V_{rms}
98 % at 5 kHz modulation frequency
30 % at 1 MHz modulation frequency**PM 6625**50 ... 1000 MHz
10 mV_{rms} ... 12 V_{rms}
(-27 dBm ... +35 dBm)
50 Ω
<2
AC
16
12 V_{rms}
All models**D OUT/IN 10 MHz**Range
Sensitivity
Coupling
Impedance
Safe overloadExternal oscillator input or internal oscillator output. Selectable by a switch at the rear panel.
1 kHz ... 10 MHz
500 mV_{rms}
AC
≈ 10 kΩ
50 V_{rms}**EXT. RESET/START**

Input current

0 V ±0.4 V applied to EXT. RESET input will reset the counter.
If DISPLAY TIME is set to position ∞ one new measurement will be initiated when the EXT. RESET is returned to > +2.4 V (max. 5.5 V) or the input is left open.
Max. 0.4 mA at 0.4 V* Above 960 MHz, the sensitivity of the PM 6625 might drop to 14 mV_{rms} (-24 dBm) at 1 GHz**C. OUTPUT CHARACTERISTICS****D OUT/IN 10 MHz**Output frequency
Signal level
Output impedance
CouplingInternal oscillator output or external oscillator input. Selectable by a switch at the rear panel.
Internal oscillator frequency, 10 MHz.
≈ 1 V_{rms}, open circuit.
≈ 200 Ω, short circuit proof.
DC**GATE OPEN**

Output level

< 0.4 V during main gate open
≈ 1.5 during hold off time. PM 6622
> 2.5 V during main gate closed.Output impedance
Delay≈ 400 Ω.
Internal delay between the signal inputs and the trigger monitor output is approximately 65 ns.**DISPLAY**9 digits.
In plane 7 segment gas discharge display with decimal point indication.**Gate lamp**Indicates that main gate is open and counting takes place.
In stand by position the Gate lamp indicates that mains or battery voltage is connected.**Unit annunciators**

kHz, MHz, ms and ns.

D. GENERAL CHARACTERISTICS

| | |
|--------------------------------------|--|
| Oscillator | See Chapter VIII. |
| Supply | |
| By mains | 100 ... 130 V or 200 ... 260 V, 50 ... 400 Hz max. 20 VA depending on options. |
| By external battery | + 11.5 to 28 V approximately 8 W. |
| By internal battery option | PM 9673 |
| Environmental characteristics | |
| Temperature | |
| Operating | 0° C ... 50° C 0° C ... 40° C with battery option PM 9673. |
| Storage | —40° C ... 70° C —40° C ... 50° C with battery option PM 9673. |
| Mains interference | Below CISPR (22/3, 29/2 and 40/1) |
| Altitude | 5000 m operating 15000 m storage. |
| Shock | Meets the requirements of the IEC 68 Eb recommendations. |
| Vibration | Meets the requirements of the IEC 68 F recommendations. |
| Dimensions | |
| Width | 210 mm |
| Height | 89 mm |
| Depth | 325 mm |
| Weight | Approximately 2.8 kg. |

III. ACCESSORIES

1. Standard accessories supplied with the instrument

| | |
|---------------------------|---|
| 1 mains cable | PM 9584 Resistive mixing piece, 50 Ω , 3 BNC sockets |
| 1 manual | |
| 1 1.6 A fuse, fast action | PM 9346 Active-probe power supply |
| 1 "115 V" label | |

2. Accessories to be ordered separately

2.1. Oscillators

| |
|--|
| PM 9677 Standard oscillator |
| PM 9678 TCXO |
| PM 9679 Oven-enclosed oscillator 1×10^{-7} /month |
| PM 9690 Oven-enclosed oscillator 1.5×10^{-9} /24 h. |

2.2. Output interface units

| |
|-------------------------|
| PM 9674 BCD output unit |
| PM 9675 D/A converter |

2.3. Input interface accessories

| |
|---|
| PM 9351 Passive measuring probe 10 M Ω ,/11 pF 220 MHz, attenuation 10 \times |
| PM 9353 FET probe, 1M Ω /3.5F, 220 MHz |

2.4. Coaxial cables

| |
|---|
| PM 9074 50 Ω , BNC to BNC, length 1 m |
| PM 9588 Set of 50 Ω cables, BNC to BNC: 5 cables, length 20.7 cm 4 cables, length 40.5 cm 3 cables, length 60.3 cm 3 cables, length 198.6 cm |

2.5. Mains cable

| |
|---------------------------------------|
| PM 9011 3-core detachable mains cable |
|---------------------------------------|

2.6. Rack mount adapter

| |
|--------------------------------|
| PM 9669 19" rack mount adapter |
|--------------------------------|

2.7. Battery unit

| |
|-------------------------------|
| PM 9673 Internal battery unit |
|-------------------------------|

2.8. Carrying case

| |
|--|
| PM 9672 Carrying case for the instrument |
|--|

IV. INSTALLATION

1. Mains voltage conversion

The instrument can be converted into two mains voltage ranges 100—130 V and 200—260 V. The frequency range is 50 to 400 Hz. At delivery the instrument is set to the 200 to 260 V range.

When changing to the 100 to 130 V range the connections of the mains transformer should be changed as shown in figure IV-1, and the label "230 V" covered with the "115 V" label supplied.

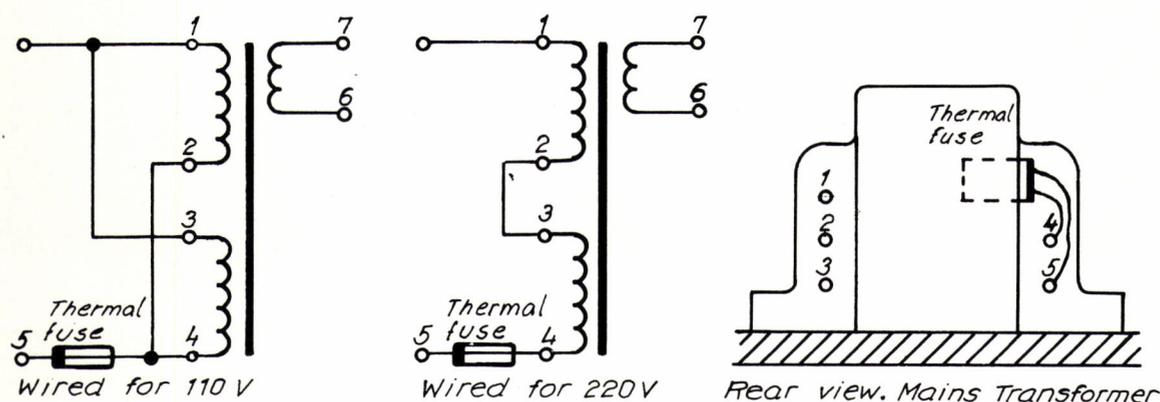


Figure IV-1. Mains transformer connections

2. Earthing

The local safety regulations prescribe how the instrument should be earthed. Two ways are possible:

1. Via the protective earth terminal at the rear panel.
2. Via the three core mains cable plugged into an outlet with protective earth contact.

NOTE: Use only **one** of these alternatives to avoid hum!

3. Fuses

A thermal fuse on the mains transformer and a 1.6 A fuse, fast action, on unit U1 are protecting the power supply.

4. Optional accessories

Refer to installation instruction given in manual for each type number.

V. CONTROLS, INDICATORS AND CONNECTORS

Front panel PM 6624 and PM 6625



1. Display time control

Potentiometer sets display time between 0.2 s and 5 s. Infinite display time when knob is pulled. With switch set to position STAND BY the counter is turned off except of the oven oscillator.

Warning: Primary voltage of power supply is on.

2. kHz, MHz, ms and ns

Unit annunciators.

3. Gate lamp

Indicates that main-gate is opened and counting takes place, in the stand-by position the gate lamp indicates that the line voltage or battery is connected for X-tal oscillator stabilization.

4. Monitor socket channel A

Output socket for set trigger level.

5. Trigger control channel A

Sets trigger level from -2.5 V to $+2.5\text{ V}$ when the attenuator is in position 20mV, and from -25 V to $+25\text{ V}$ when the attenuator is in position 200 mV. Knob pulled sets trigger level to 0 V.

6. Trigger lamp channel A

Tri-state control lamp for set trigger level. Blinking lamp indicates that the set trigger level matches the level of the input signal. Lamp permanently on indicates that the set trigger level is too high, and lamp turned off indicates that set trigger level is too low.

7. Trigger lamp channel B

Same as trigger lamp channel A.

8. Trigger control channel B

Same as trigger control channel A.

9. Monitor socket channel B

Same as monitor socket channel A.

10. Memory

In released position the measurement information is stored until next measurement cycle is completed. Depressed button makes display follow decade counters continuously.

11. Input C

Input socket for frequency and ratio measurement.

12. Start-Stop by B/Gated by B and Input A/Input C

In the upper position it sets counter to measure Count A Start-Stop by B, Frequency A, or Ratio A/B and in the lower position it sets counter to measure Count A Gated by B, Frequency C or Ratio C/B depending on how the Function Selector is set.

13. Frequency A and C

Sets counter to measure frequency at inputs A and C. 100 Hz, 10 Hz, 1 Hz and 0.1 Hz correspond to the resolution of the least significant digit.

14. Single

Sets counter to measure Single Period B or Single Time Interval A to B. Time resolution can be set to 0.1 ms or 0.1 μs .

15. Average

Sets counter to measure Multiple Period B or Time Interval Average A to B. 10^2 , 10^4 and 10^6 are number of averagings.

16. Ratio A/B or C/B

Combined with Input A/Input C switch it selects Ratio A/B or Ratio C/B measurement. 10^4 and 10^6 are multipliers.

17. Count A

Sets counter to accumulate pulses between Start to Stop or Gated by B measurements.

18. Function selector

Combined with the two slide switches it selects the different measuring modes.

19. Period B/Time interval A to B

Sets counter to measure Period B or Time interval A to B.

20. Self check

Connects 10 MHz from the internal oscillator to the input circuits of the counter.

21. Slope selector channel A

Sets counter to trigger on either positive or negative slope of the input signal.

22. Attenuator channel A

Provides $10\times$ attenuation of the input signal.

23. AC/DC selector channel A

Selects AC or DC coupling of the input signal.

24. Separate/Common via B

Connects channel A and B internally in position COM VIA B. In position SEP the input channels are separated.

25. AC/DC selector channel B

Same as AC/DC selector channel A.

26. Attenuator channel B

Same as attenuator channel A.

27. Slope selector channel B

Same as slope selector channel A.

28. Input A

Input socket for frequency, ratio and time interval measurement.

29. Input B

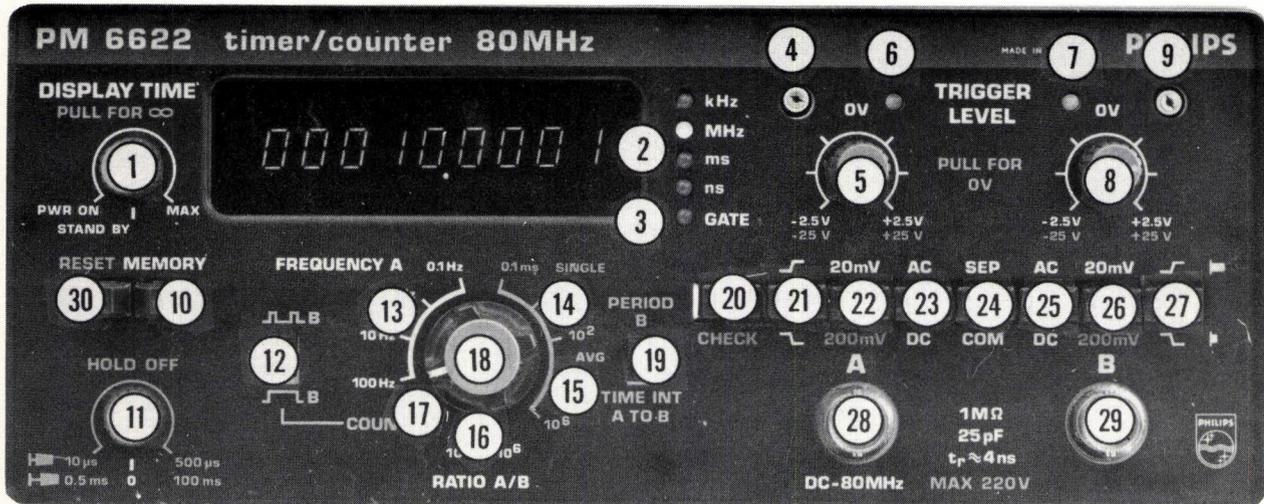
Input socket for period, ratio and time interval measurement.

30. Reset

Resets counter and display to zero.

V. CONTROLS, INDICATORS AND CONNECTORS

Front panel PM 6622



1. Display time control

Potentiometer sets display time between 0.2 s and 5 s. Infinite display time when knob is pulled. With switch set to position STAND BY the counter is turned off except of the oven oscillator.

Warning: Primary voltage of power supply is on.

2. kHz, MHz, ms and ns

Unit annunciators.

3. Gate lamp

Indicates that main-gate is opened and counting takes place, in the stand-by position the gate lamp indicates that the line voltage or battery is connected for X-tal oscillator stabilization.

4. Monitor socket channel A

Output socket for set trigger level.

5. Trigger control channel A

Sets trigger level from -2.5 V to $+2.5\text{ V}$ when the attenuator is in position 20mV, and from -25 V to $+25\text{ V}$ when the attenuator is in position 200 mV. Knob pulled sets trigger level to 0 V.

6. Trigger lamp channel A

Tri-state control lamp for set trigger level. Blinking lamp indicates that the set trigger level matches the level of the input signal. Lamp permanently on indicates that the set trigger level is too high, and lamp turned off indicates that set trigger level is too low.

7. Trigger lamp channel B

Same as trigger lamp channel A.

8. Trigger control channel B

Same as trigger control channel A.

9. Monitor socket channel B

Same as monitor socket channel A.

10. Memory

In released position the measurement information is stored until next measurement cycle is completed. Depressed button makes display follow decade counters continuously.

11. Hold off control

In Single Period and Single Time Interval this control disables retriggering of the main gate until the set hold off time is out.

12. Start/stop by B-Gated by B

In the upper position it sets counter to measure Count A Start-Stop by B, in the lower position counter will measure Count A Gated by B.

13. Frequency A

Sets counter to measure frequency at input A. 100 Hz, 10 Hz, 1 Hz and 0.1 Hz correspond to the resolution of the least significant digit.

14. Single

Sets counter to measure Single Period B or Single Time Interval A to B. Time resolution can be set to 0.1 ms or 0.1 μs .

15. Average

Sets counter to measure Multiple Period B or Time Interval Average A to B. 10^2 , 10^4 and 10^6 are number of averagings.

16. Ratio A/B

Sets counter to measure ratio between signals at input A and B. 10^4 and 10^6 are multipliers.

17. Count A

Sets counter to accumulate pulses between Start to Stop or Gated by B measurements.

18. Function selector

Combined with the two slide switches it selects the different measuring modes.

19. Period B/Time interval A to B

Sets counter to measure Period B or Time interval A to B.

20. Self check

Connects 10 MHz from the internal oscillator to the input circuits of the counter.

21. Slope selector channel A

Sets counter to trigger on either positive or negative slope of the input signal.

22. Attenuator channel A

Provides $10\times$ attenuation of the input signal.

23. AC/DC selector channel A

Selects AC or DC coupling of the input signal.

24. Separate/Common via B

Connects channel A and B internally in position COM VIA B. In position SEP the input channels are separated.

25. AC/DC selector channel B

Same as AC/DC selector channel A.

26. Attenuator channel B

Same as attenuator channel A.

27. Slope selector channel B

Same as slope selector channel A.

28. Input A

Input socket for frequency, ratio and time interval measurement.

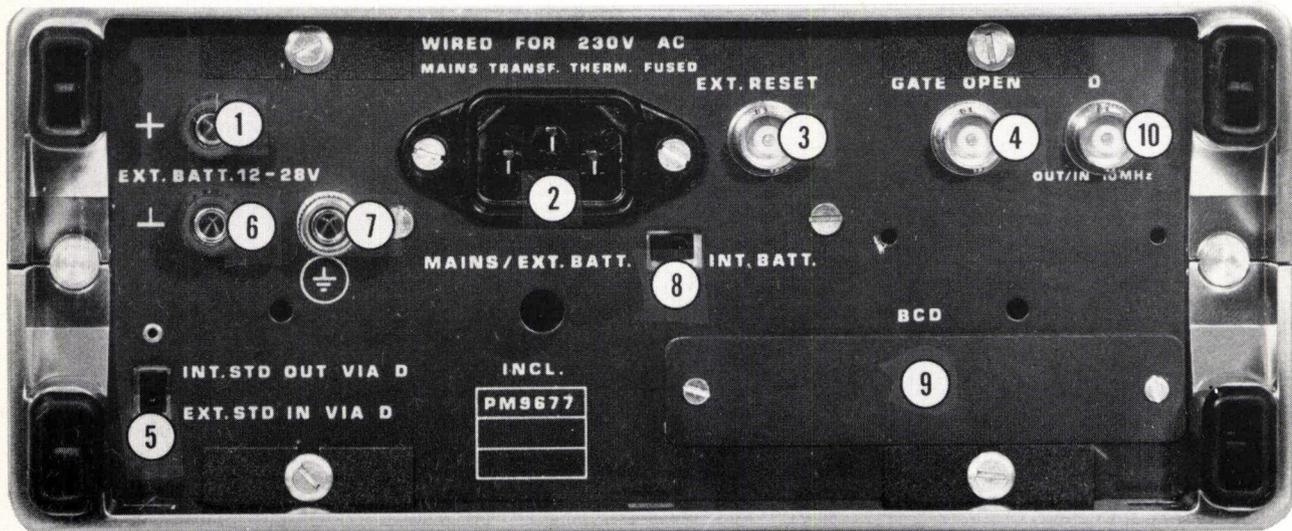
29. Input B

Input socket for period, ratio and time interval measurement.

30. Reset

Resets counter and display to zero.

Rear panel PM 6622 . . . 25

**1. External battery socket**

Plus pole input socket for external battery.

2. Mains input

Input socket for the mains.

3. External reset input

Input socket for reset/start signal.

4. Monitor socket gate signal

Output socket for gate and hold off (PM 6622) signals.

5. Internal/External Standard switch

Sets operating mode of input D to either internal 10 MHz out or external 10 MHz in.

6. External battery socket

Minus pole input socket for external battery.

7. Chassis ground

Protective earth terminal.

8. Mains/Battery switch

Sets power supply to be fed from external or internal power source.

9. BCD and D/A connector

Output connector for the BCD and D/A units.

10. Internal/External Standard socket

10 MHz out or external 10 MHz in.

Top view PM 6622 . . . 25

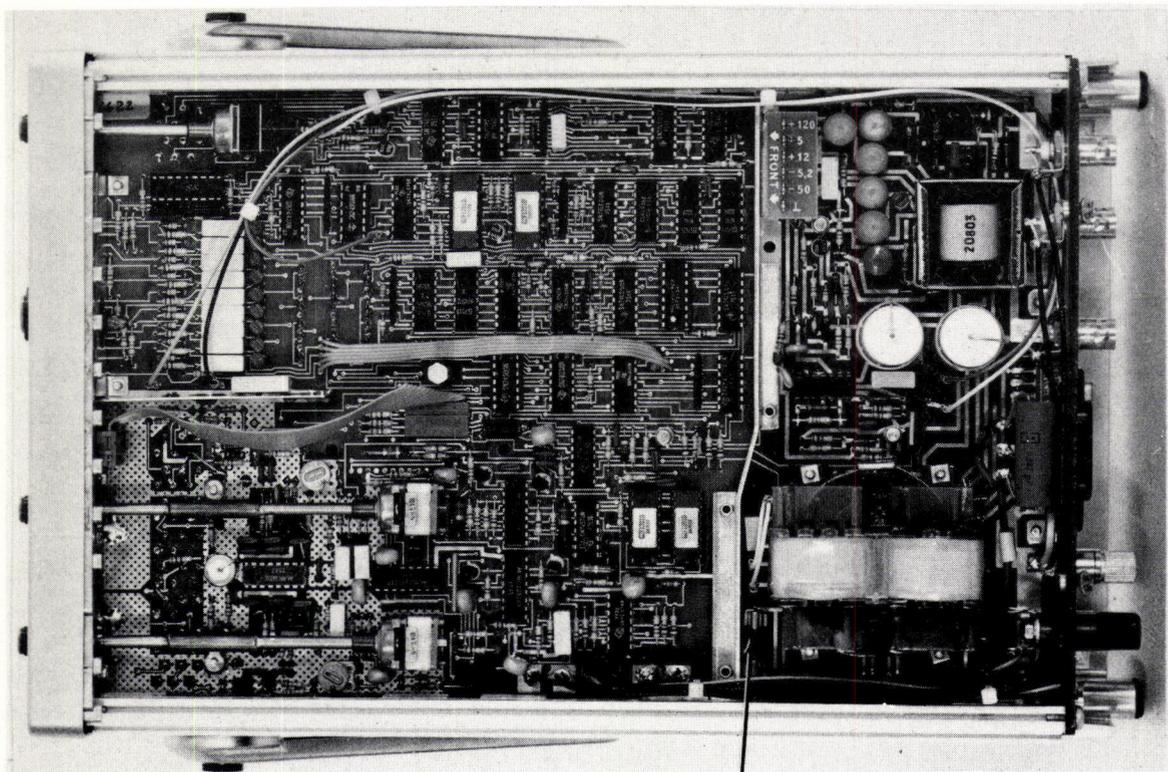


Fig. V-1. Top view of PM 6622 . . . 25

1.6 A fuse fast action.

Bottom view PM 6622 . . . 25

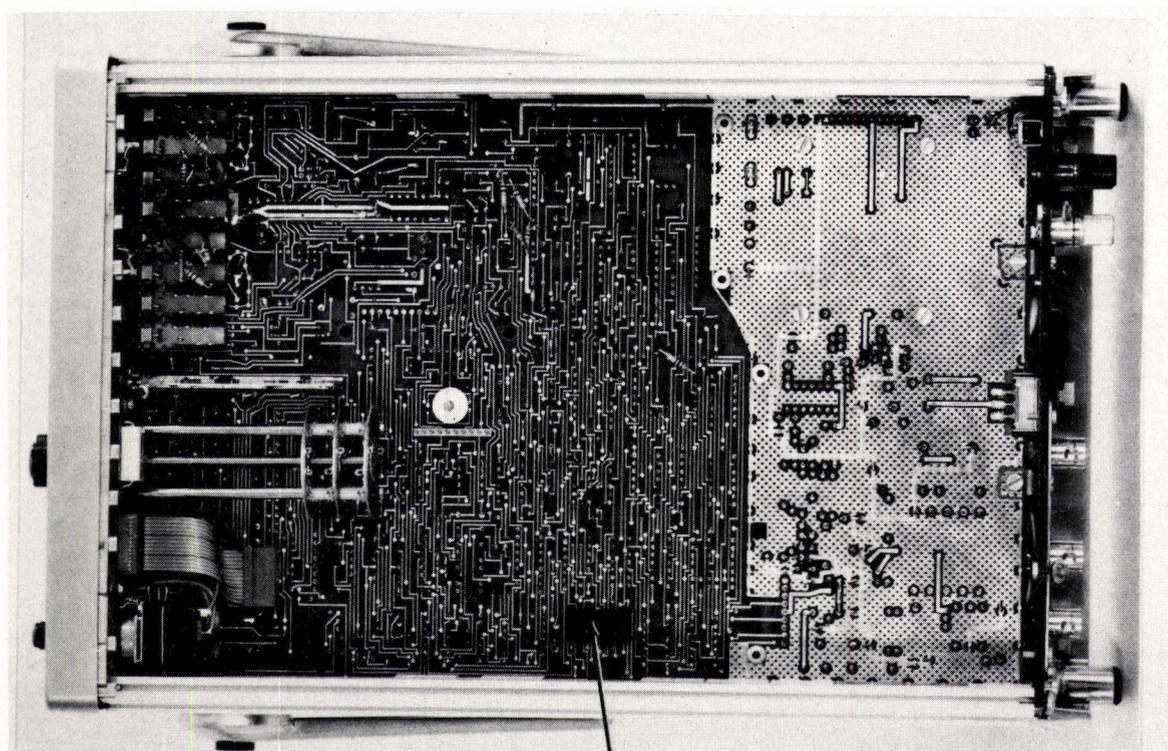


Fig. V-2. Bottom view of PM 6622 . . . 25

Connector for D/A and BCD unit.

VI. OPERATION

General Information

1. Switch on power

1.1. Mains

Before the counter is connected to the mains check that the mains transformer is wired for the local mains voltage as described in chapter IV.1. Mains voltage conversion

- Set switch MAINS EXT. BATT/INT. BATT on the rear panel to position MAINS EXT. BATT.
- Connect the mains cable to input socket for the mains at the rear panel.
- Set DISPLAY TIME control at the front panel to position ON.
- Check that display turns on indicating that power is on.

1.2. External battery

- Set switch MAINS EXT. BATT/INT. BATT at the rear panel to position MAINS EXT. BATT.
- Connect the cables from the external battery to sockets EXT. BATT. 12—28 V at the rear panel.
- Set DISPLAY TIME at the front panel control to position ON.
- Check that display turns on indicating that power is on.

1.3. Internal battery PM 9675

- Set switch MAINS EXT. BATT/INT. BATT. at the rear panel to position INT. BATT.
- Set DISPLAY TIME control at the front panel to position ON.
- Check that display turns on indicating that power is on. Blinking display indicates low voltages. Refer to manual PM 9673 for charging instructions.

2. Warm up time

The warm up time from the moment of mains connection is less than 7 minutes to an oscillator error of less than 10^{-7} for instruments equipped with the oven-enclosed oscillators PM 9679 and PM 9690. Instruments equipped with the oscillators PM 9677 or PM 9678 (TCXO) are ready for use at the moment of mains connection.

Normally the instrument is switched on from the STAND BY position. If so, no warm up time is needed, irrespective of which oscillator is employed.

3. External frequency standards

House standards or other frequency standards can be used instead of the internal 10 MHz oscillator.

If a time resolution of 100 ns is required, 10 MHz must be used. When using 1 MHz instead of 10 MHz the decimal point must be shifted one step to the left to interpret the display correctly. To set the counter to external standard the switch EXT. STD OUT VIA D/EXT. STD IN VIA D at the rear panel must be set to position EXT. STD IN VIA D.

4. Control settings

4.1. A, B and C inputs

The A and B amplifiers are identical in specification and provided with identical input controls.

The A input is normally used for frequency measurement and the B input for time measurement.

The C input is a prescaler input with automatic PIN-diode attenuator and mainly used for high frequency measurement.

4.2. AC and DC coupling

The AC/DC push-button controls the coupling of the input signal to the attenuator and the amplifier by switching a capacitor in series in the AC mode and by direct coupling in the DC mode.

A.C. coupling is normally used to block the d.c. component in signals which are superimposed on a d.c. voltage. The capacitor in series will, however, cause a falling sensitivity for low frequencies.

In waveforms where pulse width and repetition time vary the d.c. level will also vary. Change in the d.c. level will cause changes in the preset triggering level and make accurate time measurements impossible if A.C. coupled, in such cases the input should be D.C. coupled.

Normally frequency measurements are performed with an A.C. coupled input and time interval measurements with a D.C. coupled input.

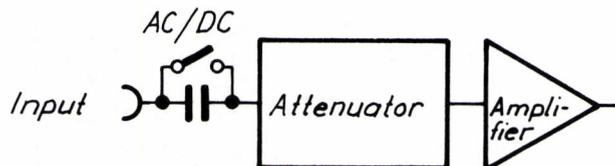


Fig. VI-1. AC/DC coupling

4.3. Attenuator and Trigger Level.

The TRIGGER LEVEL control allows continuous setting of the trigger level at any point of the input signal. For high amplitude signals the attenuator is used to expand the setting range.

However, input attenuation will decrease the sensitivity and cause bigger trigger errors.

For frequency measurements on sine wave and other symmetrical signals no level off-set is required. Pulled position of the TRIGGER LEVEL control sets the trigger level to 0 V for highest sensitivity.

However, for frequency measurement on narrow pulses a limited off-set voltage may be needed to obtain reliable triggering.

Time measurement requires continuously variable setting of the trigger level.

Monitor sockets for channel A and B provide the ability to measure the set trigger level.

If the attenuator is set to 200 mV the trigger level range is increased 10 times from ± 2.5 V to ± 25 V.

The name trigger level can be misleading, since triggering does not occur on the set trigger level but at the trigger point—see figure VI-2.

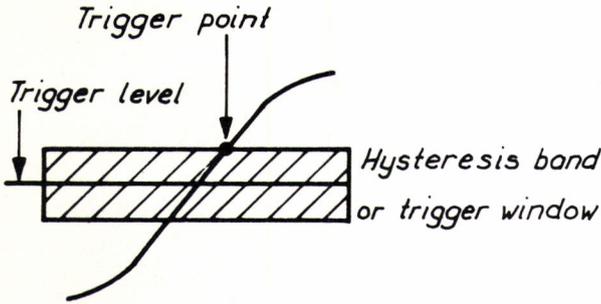


Fig. VI-2. Triggering

4.4. Separate and Common via B mode

In the SEP position the A and B inputs operate independently of each other in any operations irrespective of input sources. In the COM position the A input is disconnected from its attenuator and amplifier, and a signal connected to input B is coupled to both A and B attenuators and amplifiers.

All input specifications of input B will remain the same but the input impedance will be 500 kΩ shunted by 50 pF.

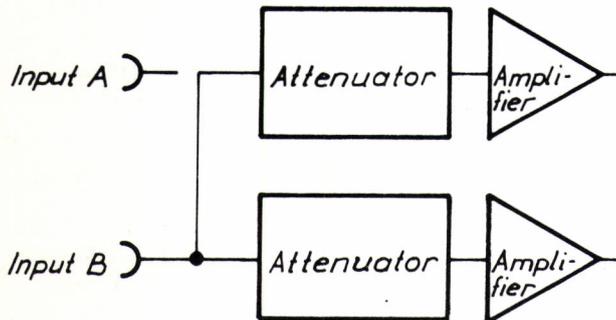


Fig. VI-3. COM via B mode

4.5. Positive and negative slope triggering

This push-button determines on which slope of the input signal the triggering will occur.

In released position the triggering will occur at the positive slope of the input signal and in depressed position it will occur on the negative slope.

Where on the slope the triggering will occur is determined by the TRIGGER LEVEL control.

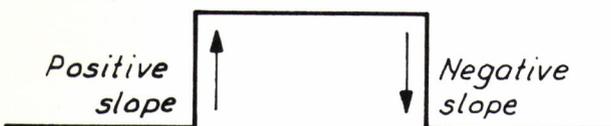


Fig. VI-4. Positive and negative slope triggering

A simple way to measure the pulse width of a positive pulse is achieved by setting input A to positive slope and input B to negative slope, connect the pulse to input B, set FUNCTION SELECTOR to any of the two SINGLE positions, slide switch PERIOD B/TIME INT. A TO B to position TIME INT. A TO B and SEP/COM to COM.

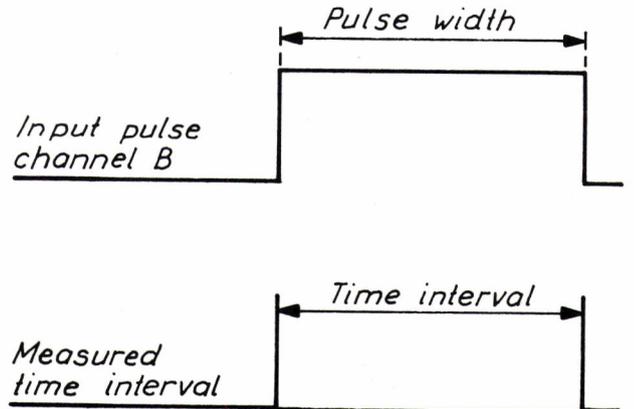


Fig. VI-5. Simple pulse width measurement

4.6. Hold off PM 6622

This control provides a delayed triggering of the instrument in single period and time interval measurement, this feature is used to avoid false triggering on noisy signals.

5. Basic measurements

5.1. CHECK PM 6622



Self check of the instrument.

- Depress CHECK push-button
- Rotate FUNCTION SELECTOR and read:

Frequency A

| | |
|--------|------------|
| 100 Hz | 00010.0000 |
| 10 Hz | 0010.00000 |
| 1 Hz | 010.000000 |
| 0.1 Hz | 10.0000000 |

— Set PERIOD B/TIME INT A TO B to PERIOD B

Period B

| | |
|-----------------|------------|
| 0.1 ms | 00000000.0 |
| 0.1 ns | 00000.0001 |
| 10 ² | 000000100 |
| 10 ⁴ | 0000100.00 |
| 10 ⁶ | 00100.0000 |

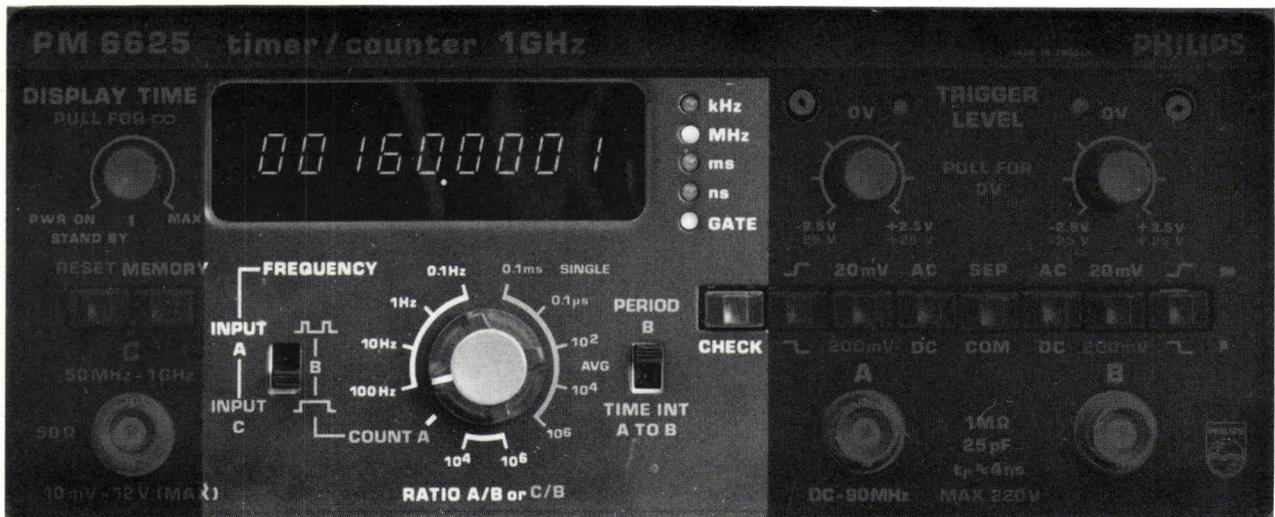
Ratio A/B

| | |
|-----------------|------------|
| 10 ⁶ | 001.000000 |
| 10 ⁴ | 00001.0000 |

Count A

| | |
|------------|-----------|
| Start/Stop | 000000002 |
| Gated | 000000001 |

5.2. CHECK PM 6624 . . . 25



Self check of the instrument.

- Depress CHECK push-button
- Set INPUT A/INPUT C to INPUT A
- Rotate FUNCTION SELECTOR and read:

FREQUENCY A

| | |
|--------|----------------|
| 100 Hz | 00010.0000 MHz |
| 10 Hz | 0010.00000 MHz |
| 1 Hz | 010000.000 kHz |
| 0.1 Hz | 10000.0000 kHz |

- Set PERIOD B/TIME INT A TO B to PERIOD B

PERIOD B

| | |
|-----------------|------------|
| 0.1 ms | 00000000.0 |
| 0.1 ns | 00000.0001 |
| 10 ² | 000000100 |
| 10 ⁴ | 0000100.00 |
| 10 ⁶ | 00100.0000 |

RATIO A/B

| | |
|-----------------|------------|
| 10 ⁶ | 001.000000 |
| 10 ⁴ | 00001.0000 |

- Set INPUT A/INPUT C to INPUT C

RATIO C/B PM 6624

| | |
|-----------------|------------|
| 10 ⁴ | 008.000000 |
| 10 ⁶ | 00008.0000 |

RATIO C/B PM 6625

| | |
|-----------------|------------|
| 10 ⁴ | 016.000000 |
| 10 ⁶ | 00016.0000 |

COUNT A

| | |
|------------|-----------|
| Start/Stop | 000000002 |
| Gated | 000000001 |

FREQUENCY C PM 6624

| | |
|--------|----------------|
| 100 Hz | 00080.0000 MHz |
| 10 Hz | 0080.00000 MHz |
| 1 Hz | 080000.000 kHz |
| 0.1 Hz | 80000.0000 kHz |

FREQUENCY C PM 6625

| | |
|--------|----------------|
| 100 Hz | 00160.0000 MHz |
| 10 Hz | 0160.00000 MHz |
| 1 Hz | 160000.000 kHz |
| 0.1 Hz | 60000.0000 kHz |

5.3. Frequency A. PM 6622 . . . 25



Simple frequency measurement on sine waves and other symmetrical waveforms.

- Set FUNCTION SELECTOR to desired resolution
 - Set INPUT A/INPUT C to INPUT A (only PM 6624 . . . 25)
 - Set AC/DC to AC
 - Pull TRIGGER LEVEL control
 - Set SEP/COM to SEP
 - Set 20 mV/200 mV to 200 mV if the amplitude of the input signal is higher than $1 V_{rms}$
 - Connect the input signal to input A
- Display will show frequency in kHz or MHz

5.4. FREQUENCY C PM 6624 . . . 25



Automatic frequency measurement.

- Set FUNCTION SELECTOR to desired resolution
 - Set INPUT A/INPUT C to INPUT C
 - Connect the input signal to input C
- Display will show frequency in MHz or kHz

5.5. PERIOD B PM 6622 . . . 25



Simple period measurement on sine waves and other symmetrical waveforms.

- Set FUNCTION SELECTOR to SINGLE or AVG measurement
- Set PERIOD B/TIME INT A TO B to PERIOD B
- Pull TRIGGER LEVEL
- Set AC/DC to AC
- Set 20 mV/200 mV to 200 mV if the amplitude of the input signal is higher than $1 V_{rms}$
- Select positive slope triggering
- Connect the signal to input B

Display will show period time in ms or ns

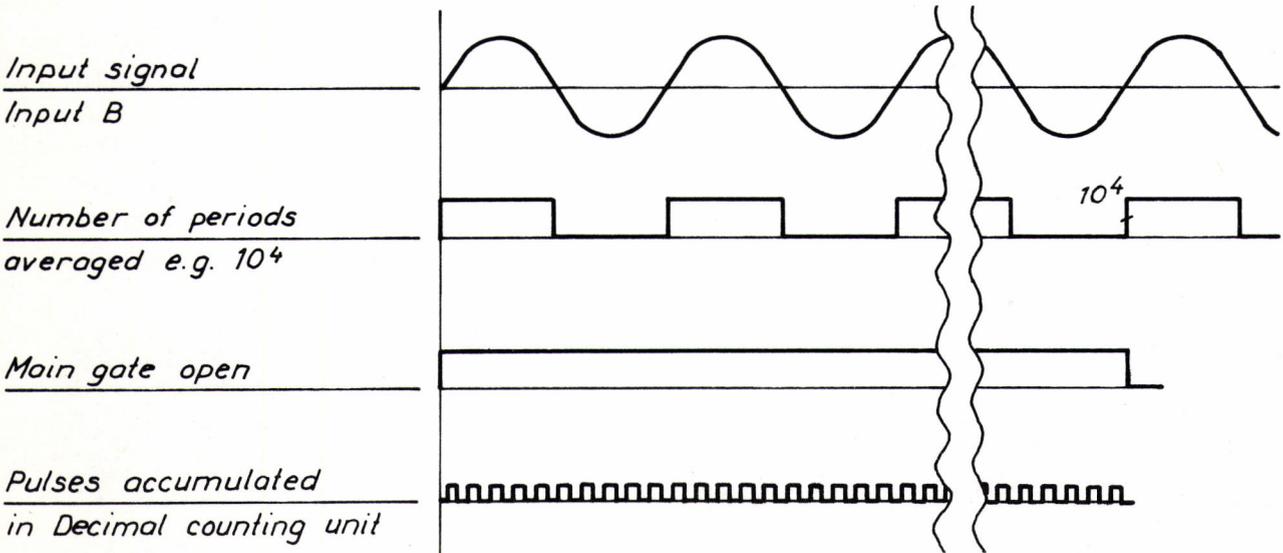


Fig. VI-6. Period average measurement

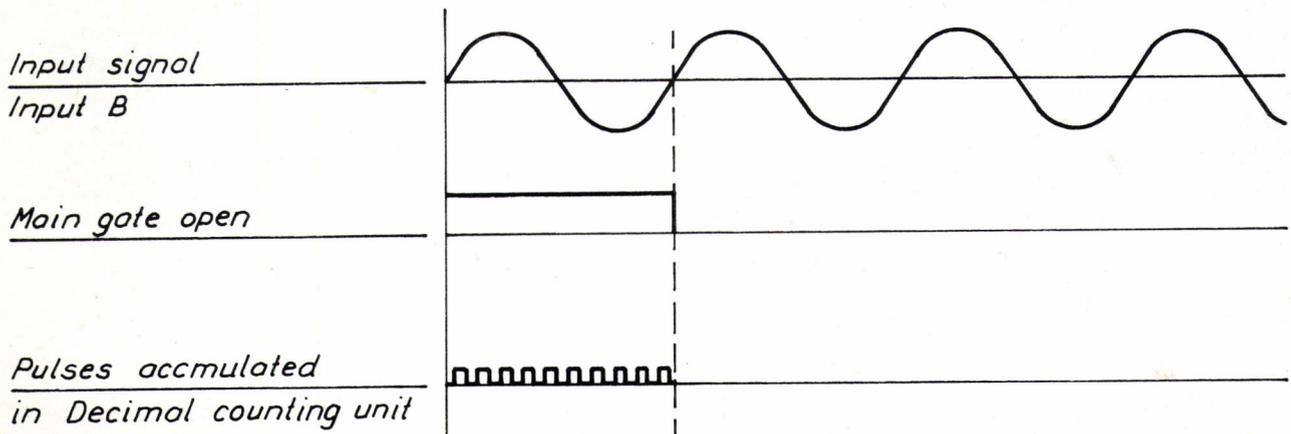


Fig. VI-7. Single period measurement

5.6. Time Interval A to B PM 6622 . . . 25



Simple measurement of time interval between pulses at input A and B from separate sources.

- Set FUNCTION SELECTOR to SINGLE or AVG
- Set PERIOD B/TIME INT A TO B to TIME INT A TO B
- Set 20 mV/200 mV to 200 mV if the amplitude of the input signal is higher than $3 V_{p-p}$

- Set AC/DC to DC
 - Set SEP/COM to SEP
 - Select positive slope triggering
 - Set TRIGGER LEVEL potentiometer to suitable trigger level e.g. 50 % of the pulse amplitude
 - Connect the pulses to input A and B
- Display will show the time interval in ms or ns

5.7. Ratio A/B PM 6622 . . . 25



Simple ratio measurement on sine wave or other symmetrical waveforms.

- Set FUNCTION SELECTOR to 10^4 or 10^6
- Pull TRIGGER LEVEL control
- Set AC/DC to AC
- Set SEP/COM to SEP

- Set 20 mV/200 mV to 200 mV if the amplitude of the input signal is higher than $1 V_{rms}$
- Connect the signal with the highest frequency to input A and the other signal to input B

Display will show the ratio of the signal frequencies at input A and B

5.8. Ratio C/B PM 6624 . . . 25



Simple ratio measurement on sine wave and other symmetrical waveforms.

- Set FUNCTION SELECTOR to 10^4 or 10^6
- Set INPUT A/INPUT C to INPUT C
- Pull TRIGGER LEVEL control
- Set SEP/COM to SEP

- Set AC/DC to AC
 - Set 20 mV/200 mV to 200 mV if the amplitude of the input signal is higher than $1 V_{\text{rms}}$
 - Connect the signal with the highest frequency to input C and the other to input B
- Display will show the ratio of the signal frequencies at input C and B

5.9. Count A Start/Stop and Gated by B. PM 6622 . . . 25



Simple Start/Stop and Gated by B measurement on sine wave and other symmetrical waveforms.

- Set FUNCTION SELECTOR to COUNT A
- Pull TRIGGER LEVEL Control
- Set AC/DC to AC for channel A
- Set AC/DC to DC for channel B
- Set SEP/COM to SEP
- Set 20 mV/200 mV to 200 mV if the amplitude of the input signal is higher than 1 V_{rms}

- Select positive slope triggering
- Select Start/Stop by B (upper position) or Gated by B (lower position)
- Connect gating signal to input B and the other signal to input A

In Start/Stop operation the display will show the accumulated number of counts in the time interval between the Start/Stop signals, and in the Gated mode the accumulated number of counts during the positive and negative slopes of the Gating signal

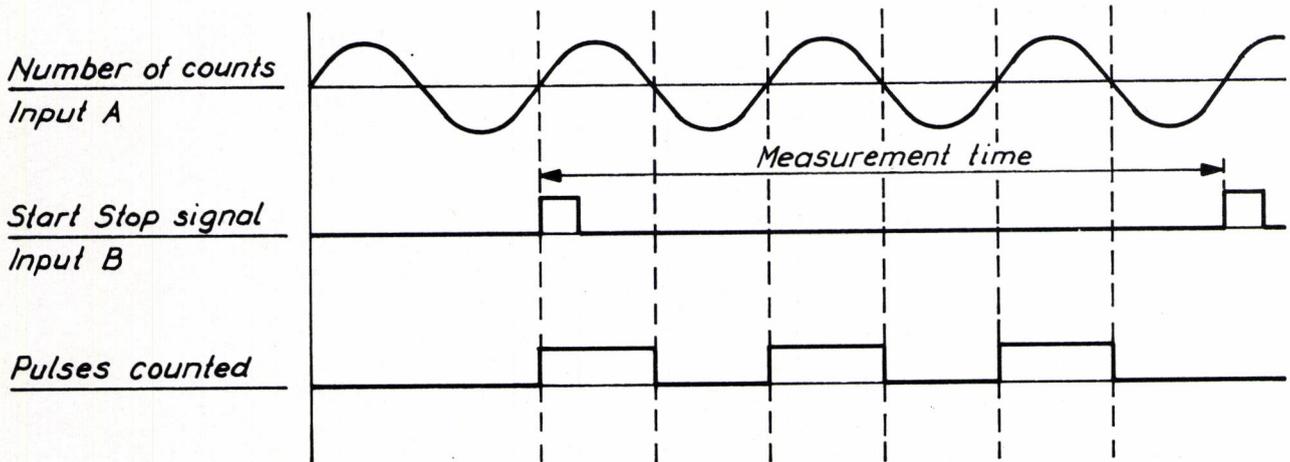


Fig. VI-8. Start/Stop by B measurement

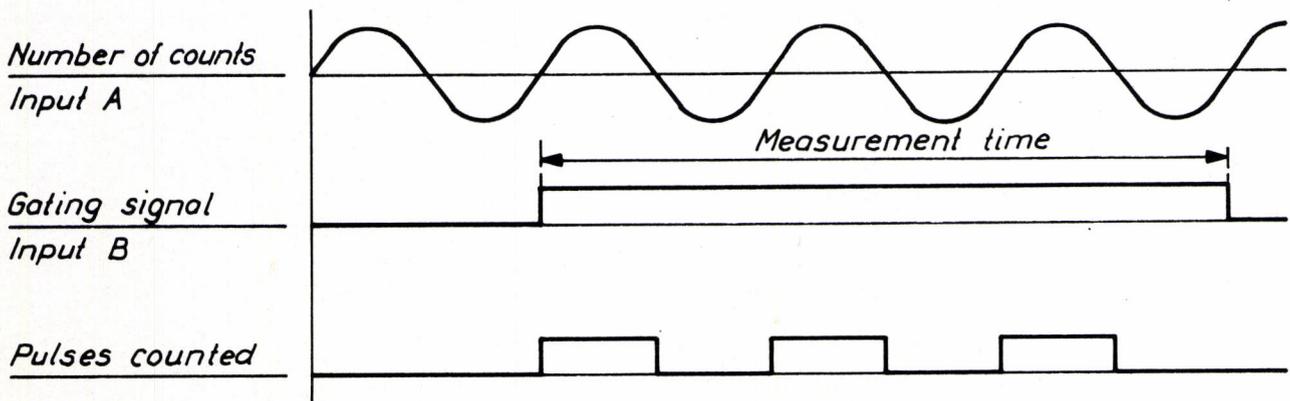


Fig. VI-9. Gated by B measurement

5.10. Hold off PM 6622



— Set FUNCTION SELECTOR to 0.1 μ s and rotate HOLD OFF control from fully CCW to fully CW position

— Read hold off time from 0.01 to 0.5 ms on the display with knob pushed and 0.5 ms to 100 ms with knob pulled

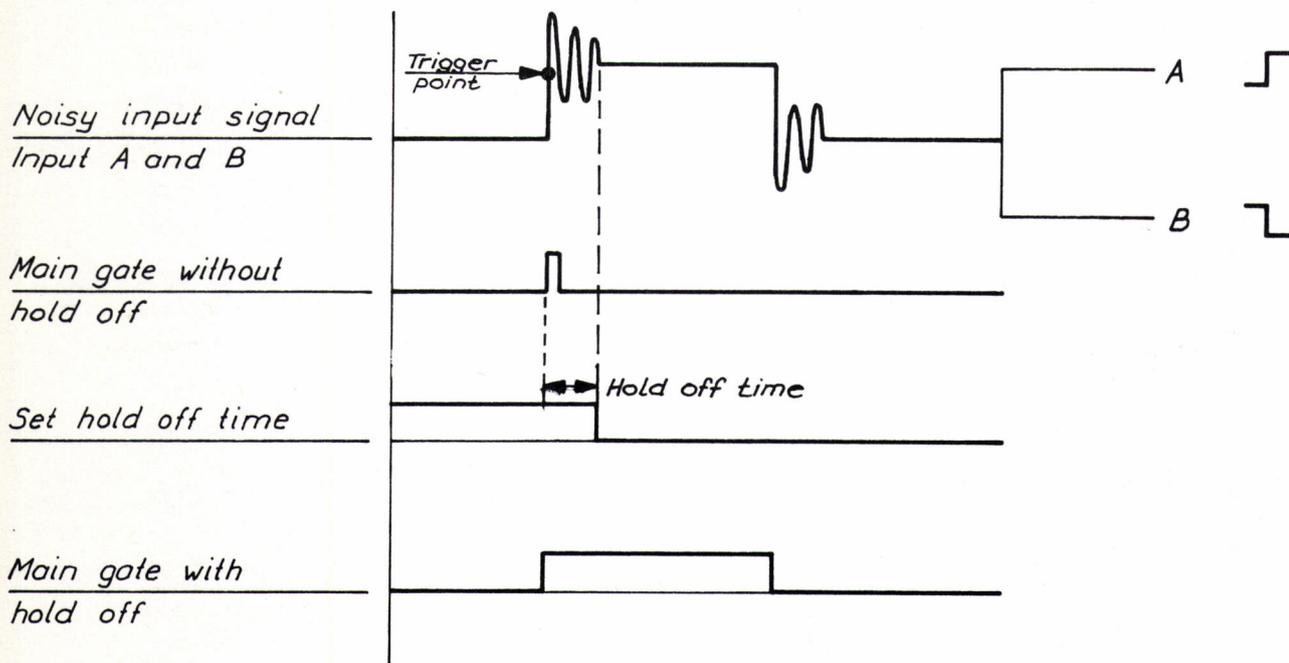


Fig. VI-10. Time interval measurement on noisy signals

VII. INTERNAL CHECKS AND ADJUSTMENTS

The tolerances mentioned in the following text apply to newly adjusted instruments only. The value may differ from those given in Chapter II Technical data.

Note: Always check the d.c. supply voltages before any adjustments are made.

1. Use figure X-2 to identify the location of trimmers and check points.

2. Test equipment

| Check point | Instrument | Required data | Recommended model |
|-------------|----------------|--|-------------------------------|
| 3 | Voltmeter | 5—150 V d.c. | Philips PM 2412 |
| 4 6 | Voltmeter | 1 V d.c. | Philips PM 2412 |
| 5 8 | Pulsegenerator | Frequency 10 kHz Amplitude 1 V Duty factor 0.5 | Philips PM 5715 or PM 5705 |
| 5 8 | Oscilloscope | Low frequency | Philips PM 3250 |
| 5 8 | Probe | Passive 10 M Ω /11 pF | Philips PM 9336 |

3. D.C. voltages

3.1 Connect the voltmeter to jumper connector BU 104 and check the d.c. voltages according to table below.

| Test point | Measured voltage |
|------------|------------------|
| +120 | 115 ... 130 V |
| +5.2 | 4.8 ... 5.2 V |
| +12 | 11.5 ... 13 V |
| -5.2 | -5 ... -5.4 V |
| -50 | -50 ... -60 V |

4. D.C. balance channel A.

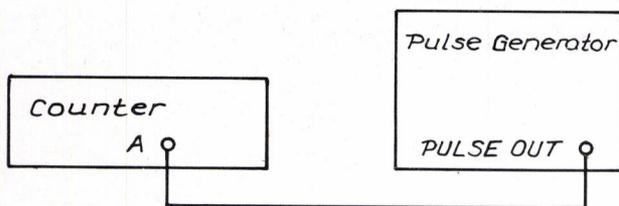
4.1 Disconnect all input signals, release all push-buttons and set the controls of the counter:

| | |
|-------------------|----------------|
| Start/Stop | upper position |
| Trigg. level pot. | pulled |

4.2 Connect the voltmeter to terminal 6 of IC 101 and adjust R 1104 until voltmeter shows 0 V.

5. Frequency compensation channel A

Test set up.



5.1 Set the controls of the counter:

| | |
|------------|-----------------|
| Attenuator | 200 mV position |
|------------|-----------------|

5.2 Set the controls of the pulse generator:

| | |
|-------------|--------------------|
| Frequency | 10 kHz |
| Amplitude | 3 V _{p-p} |
| Duty factor | 0.5 |

5.3 Connect the oscilloscope via a well adjusted 10 M Ω /11 pF probe to terminal 6 of IC 101 and adjust C 102 to minimum distortion of the displayed waveform.

6. D.C. balance channel B

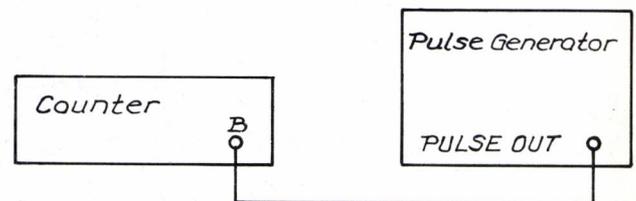
6.1 Disconnect all input signals, release all push-buttons and set the controls of the counter:

| | |
|------------------|----------------|
| Start/Stop | upper position |
| Trigg.level pot. | pulled. |

6.2 Connect the voltmeter to terminal 12 of IC 101 and adjust R 1044 until voltmeter shows zero.

7. Frequency compensation channel B

Test set up.



7.1 Set the controls of the counter:

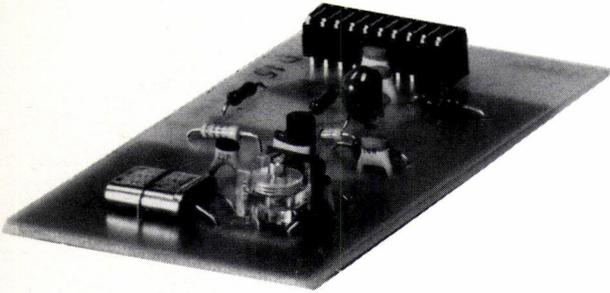
| | |
|------------|-----------------|
| Attenuator | 200 mV position |
|------------|-----------------|

7.2 Set the controls of the pulse generator:

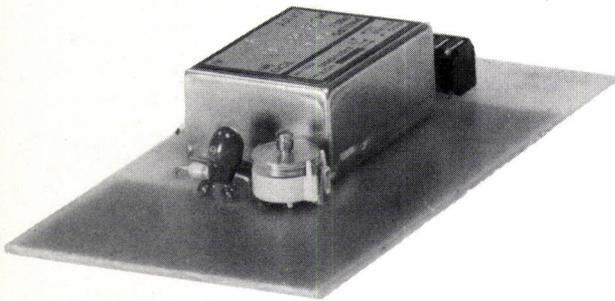
| | |
|-------------|--------------------|
| Frequency | 10 kHz |
| Amplitude | 3 V _{p-p} |
| Duty factor | 0.5 |

7.3 Connect the oscilloscope via a well adjusted 10 M Ω /11 pF probe to terminal 12 of IC 101 and adjust C 112 to minimum distortion of the displayed wave form.

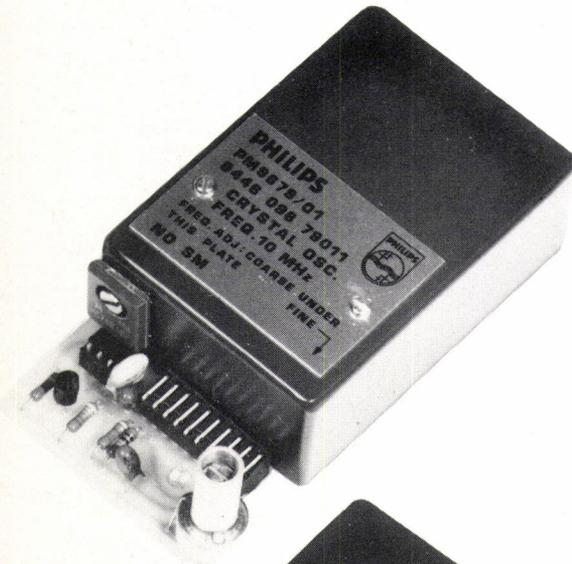
VIII. OSCILLATORS PM 9677, PM 9678, PM 9679 and PM 9690

**PM 9677**

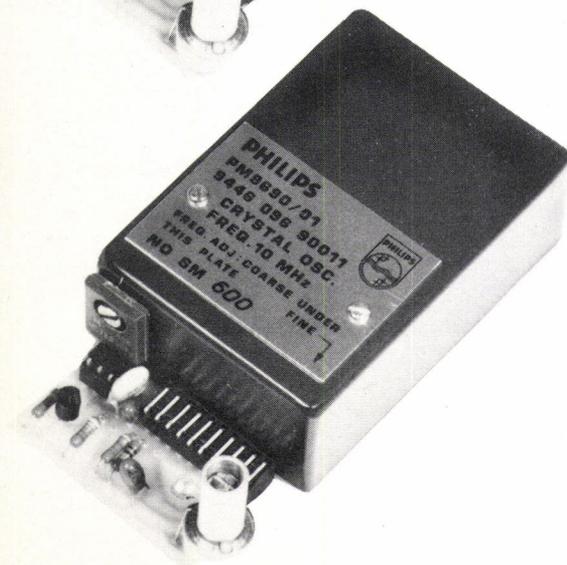
9446 096 770.1

**PM 9678**

9446 096 780.1

**PM 9679**

9446 096 790.1

**PM 9690**

9446 096 900.1

1. General

The oscillators are made as plug-in cards and have a nominal frequency of 10 MHz.

2. Technical data

| 2.1. Electrical | PM 9677 | PM 9678 | PM 9679 | PM 9690 |
|---|--|--------------------------------|---|--|
| Nominal frequency, MHz | 10.000 000 | 10.000 000 | 10.000 000 | 10.000 000 |
| Trimming range, Hz | > ± 200 | > ± 20 | +20*) -30 | +3*) -7 |
| Output voltage, mV (into 1 kohm) | > 300 | > 100 | > 150 | > 50 |
| Supply voltage, V | + 12 | + 12 | + 11.5 to 28 (from unregulated power supply) | + 11.5 to 28 (from unregulated power supply) |
| Power consumption (+25°C) | | | | |
| Continuous operation | < 100 mW | < 200 mW | < 100 mA | < 125 mA |
| Stand by | none | none | < 100 mA | < 125 mA |
| Warm up | none | none | < 400 mA | < 400 mA |
| Stability against: | | | | |
| Ageing | < 5×10 ⁻⁷ /month | < 1×10 ⁻⁷ /month**) | < 1×10 ⁻⁷ /month | < 1.5×10 ⁻⁹ /24 h (after 72 hours of continuous operation) |
| Temperature 0...50°C (ref. to +25°C) | < 1×10 ⁻⁵ | < 1×10 ⁻⁶ | < 1×10 ⁻⁷ | < 3×10 ⁻⁸ |
| Line voltage ± 10 % | < 1×10 ⁻⁸ | < 1×10 ⁻⁹ | < 1×10 ⁻⁹ | < 5×10 ⁻¹⁰ |
| Change of measuring mode and change between line, ext. and int. battery | < 3×10 ⁻⁷ | < 5×10 ⁻⁸ | < 1×10 ⁻⁸ | < 3×10 ⁻⁹ |
| Warm up time (to reach 1×10 ⁻⁷) | | | < 10 min | < 15 min |
| 2.2. Environmental | | | | |
| Temperature | | | | |
| Storage, °C | -40 to +70 | -40 to +70 | -40 to +70 | -40 to +70 |
| Operating, °C | 0 to +50 | 0 to +50 | 0 to +50 | 0 to +50 |
| Altitude | | | | |
| Storage, m | 15000 | 15000 | 15000 | 15000 |
| Operating, m | 5000 | 5000 | 5000 | 5000 |
| Humidity at 50°C | 10—90 % RH (26° dew point) | 10—90 % RH (26° dew point) | 10—90 % RH (26° dew point) | 10—90 % (26° dew point) |
| Shock | Meets the requirement of the IEC Eb recommendations | | | |
| Vibration | Meets the requirement of the IEC 68F recommendations | | | |
| } all oscillators | | | | |
| 2.3. Mechanical | | | | |
| Dimensions, mm | 93×50×20 | 93×50×15 | 100×52×35 | 100×52×35 |
| Weight, g | 50 | 25 | 100 | 100 |

*) The indicated values regard only the fine trimming range. A coarse trimmer is available on the PM 9679 and PM 9690 to adjust for an ageing of more than 10 years.

***) Trimming range will cover at least 10 years of operation since the ageing will decrease substantially after the first 6 months.

3. Frequency adjustment PM 9677

- 3.1. This adjustment requires a reference oscillator having an accuracy of $\leq 1 \times 10^{-6}$. The oven enclosed PHILIPS oscillators PM 9680*, PM 9681* and PM 9690* meet this requirement. The adjustment should preferably be made at an ambient temperature of $+25^\circ\text{C}$.
- 3.2. Remove the bottom cover of the counter.
- 3.3. Connect the reference signal available at socket 10 MHz OUT of the external counter to INPUT A of the counter to be adjusted.
- 3.4. Set the controls of the counter to be adjusted:
FUNCTION SELECTOR: FREQUENCY A 1 Hz
TRIGGER LEVEL A: pulled
- 3.5. Adjust trimming capacitor C 1 to 10000.000 kHz plus or minus 10 Hz.

4. Frequency adjustment PM 9678

- 4.1. This adjustment requires a reference oscillator having an accuracy of $\leq 1 \times 10^{-7}$. The oven enclosed PHILIPS oscillator PM 9680*, PM 9681* and PM 9690* meet this requirement. The adjustment should preferably be made at an ambient temperature of $+25^\circ\text{C}$.
- 4.2. Remove the bottom cover of the counter.
- 4.3. Connect the reference signal available at socket 10 MHz OUT of the external counter to INPUT A of the counter to be adjusted.
- 4.4. Set the controls of the counter to be adjusted:
FUNCTION SELECTOR: FREQUENCY A 1 Hz
TRIGGER LEVEL: pulled
- 4.5. Adjust trimming capacitor C 1 to 10000.000 kHz plus or minus 1 Hz.
- 4.6. Set FUNCTION SELECTOR to position 0.1 Hz and check that display read out is the same as before. If not, adjust C1 slightly to correct frequency.

5. Frequency adjustment PM 9679

- 5.1. This adjustment requires a reference oscillator having an accuracy of $\leq 3 \times 10^{-8}$. The oven enclosed PHILIPS oscillators PM 9680*, PM 9681* and PM 9690* meet this requirement. The adjustment should preferably be made at an ambient temperature of 25°C and the oscillator must have been operating continuously 72 h before any adjustment is made.
- 5.2. Remove the bottom cover of the counter.
- 5.3. Connect the reference signal available at socket 10 MHz OUT of the external counter to socket EXT. TRIGG of oscilloscope PHILIPS PM 3250 or PM 3400.
- 5.4. Connect the oscillator signal available at socket 10 MHz OUT of the counter to be adjusted to INPUT A of the oscilloscope.
- 5.5. Set oscilloscope to 100 ns/div and adjust trimming potentiometer R 208 until waveform moves with a velocity of maximum 1 div./3 s (0.3 Hz). If the adjustment range of R 208 is too narrow perform the following steps 5.6 to 5.12.
- 5.6. Set trimming potentiometer R 208 to fully clockwise position.
- 5.7. Remove the two screws fixing the oscillator's text plate to the box.
- 5.8. Remove the small plastic cylinder beneath the text plate using a pair of tweezers.
- 5.9. Connect an external counter to socket 10 MHz OUT at the rear panel of the counter to be adjusted.
- 5.10. Adjust trimming capacitor C 108 until the display

- read out of the external counter is 10000020 Hz.
- 5.11. Refit the plastic cylinder and the text plate.
- 5.12. Perform steps 5.3 to 5.5.

6. Frequency adjustment PM 9690

- 6.1. This adjustment requires a reference frequency having an accuracy of $\leq 1 \times 10^{-9}$. Hewlett-Packard quartz frequency standard HP 105* meets this requirement. The adjustment should preferably be made at an ambient temperature of 25°C and the oscillator must have been operating continuously 72 h before any adjustment is made.
- 6.2. Remove the bottom cover of the counter.
- 6.3. Connect any of the three reference signals available at sockets 5 MHz, 1 MHz and 100 kHz of the HP 105 to socket EXT. TRIGG of oscilloscope PHILIPS PM 3250 or PM 3400.
- 6.4. Connect the oscillator signal available at socket 10 MHz OUT of the counter to be adjusted to INPUT A of the oscilloscope.
- 6.5. Set oscilloscope to 100 ns/div and adjust trimming potentiometer R 208 until waveform moves with a velocity of maximum 1 div/10 s (0.1 Hz). If the adjustment range of R 208 is too narrow perform the following steps 6.6 to 6.12.
- 6.6. Set trimming potentiometer R 208 to fully clockwise position.
- 6.7. Remove the two screws fixing the oscillator's text plate to the box.
- 6.8. Remove the small plastic cylinder beneath the text plate using a pair of tweezers.
- 6.9. Connect an external counter to socket 10 MHz OUT at the rear panel of the counter to be adjusted.
- 6.10. Adjust trimming capacitor C 108 until the display read out of the external counter is 10000003 Hz.
- 6.11. Refit the plastic cylinder and the text plate.
- 6.12. Perform steps 6.3 to 6.5.

7. Repair of oscillator PM 9679 and PM 9690

- 7.1. Repair of these oscillators may not be carried out by the local service organisations. In case of breakdown the complete sealed oscillator box has to be sent to the factory for repair.

Factory address:

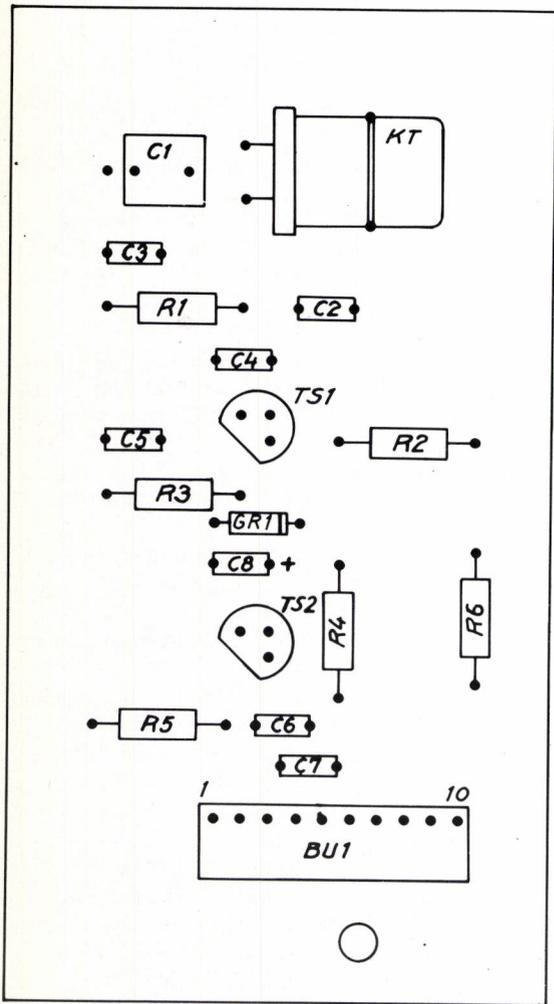
PHILIPS ELEKTRONIKINDUSTRIER AB
INDUSTRIAL OPERATIONS
FACK
S-175 20 JÄRFÄLLA
SWEDEN

8. Pin configuration

| | PM 9677 | PM 9678 | PM 9679 | PM 9690 |
|-----|------------|------------|----------------|------------|
| Pin | | | | |
| 1 | ⊥ | ⊥ | ⊥ | ⊥ |
| 2 | ⊥ | ⊥ | ⊥ | ⊥ |
| 3 | ⊥ | ⊥ | ⊥ | ⊥ |
| 4 | | | + 11.5 to 28 V | |
| 5 | 10 MHz out | 10 MHz out | 10 MHz out | 10 MHz out |
| 7 | + 12 V | + 12 V | | |

*To be checked against a frequency standard such as Droitwich or HBG.

9. Circuit diagram, component lay-out and spare parts list PM 9677



| | | |
|------|-----|-------|
| 4822 | 110 | 63161 |
| 4822 | 110 | 63116 |
| 4822 | 110 | 63107 |
| 4822 | 110 | 63107 |
| 4822 | 110 | 63107 |
| 4822 | 110 | 63107 |

| | | |
|------|-----|-------|
| 5322 | 125 | 54029 |
| 4822 | 122 | 31063 |
| 4822 | 122 | 31072 |
| 4822 | 122 | 31076 |
| 5322 | 122 | 34041 |
| 5322 | 122 | 34041 |
| 5322 | 122 | 34041 |
| 5322 | 124 | 14036 |

| | | |
|------|-----|-------|
| 5322 | 130 | 44418 |
| 5322 | 130 | 44418 |
| 5322 | 130 | 30766 |

| | | |
|------|-----|-------|
| 5322 | 242 | 74036 |
| 5322 | 267 | 64031 |

Spare parts PM 9677

RESISTORS

| | | | |
|------|---|------|----|
| 100K | 5 | CR25 | R1 |
| 2.2K | 5 | CR25 | R2 |
| 1K | 5 | CR25 | R3 |
| 1K | 5 | CR25 | R4 |
| 1K | 5 | CR25 | R5 |
| 1K | 5 | CR25 | R6 |

CAPACITORS

| | | | |
|-------|--------|-----|----|
| 2=18P | | 300 | C1 |
| 22P | 2 | 100 | C2 |
| 47P | 2 | 100 | C3 |
| 68P | 2 | 100 | C4 |
| 10N | =20+50 | 100 | C5 |
| 10N | =20+50 | 100 | C6 |
| 10N | =20+50 | 100 | C7 |
| 15M | =10+50 | 16 | C8 |

SEMI CONDUCTORS

| | |
|------------|-----|
| BF 256 A | TS1 |
| BF 256 A | TS2 |
| BZX79=C6V2 | GR1 |

MISCELLANEOUS

| | |
|---------------|-----|
| CRYSTAL 10MHZ | |
| CONNECTOR | BU1 |

Figure VIII-1. Component lay-out PM 9677

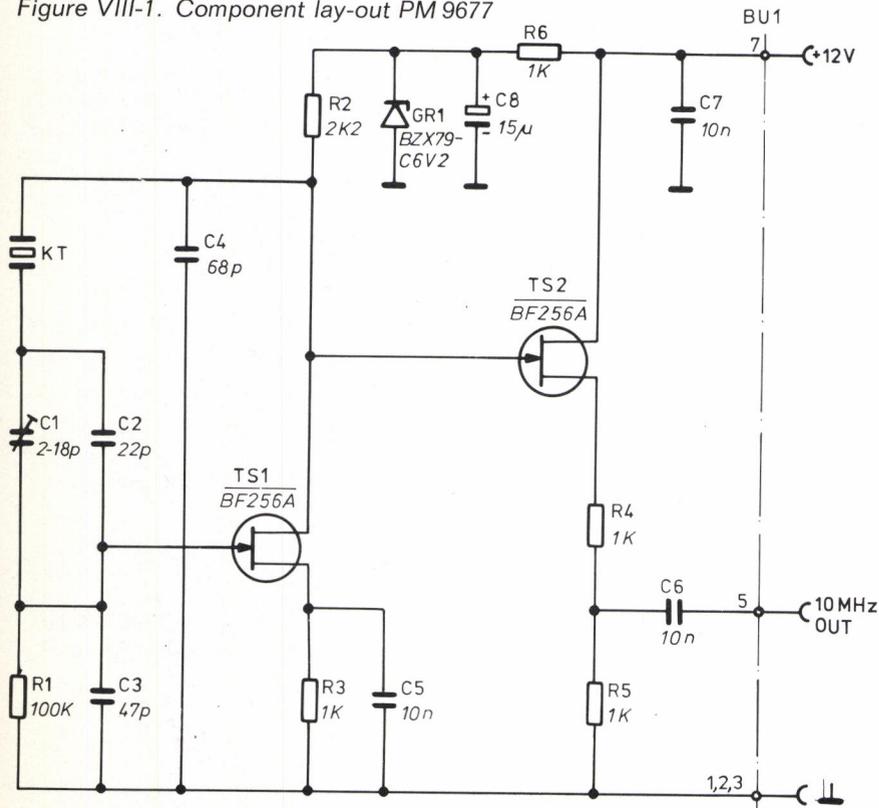


Figure VIII-2. Circuit diagram PM 9677

10. Circuit diagram, component lay-out and spare parts list PM 9678

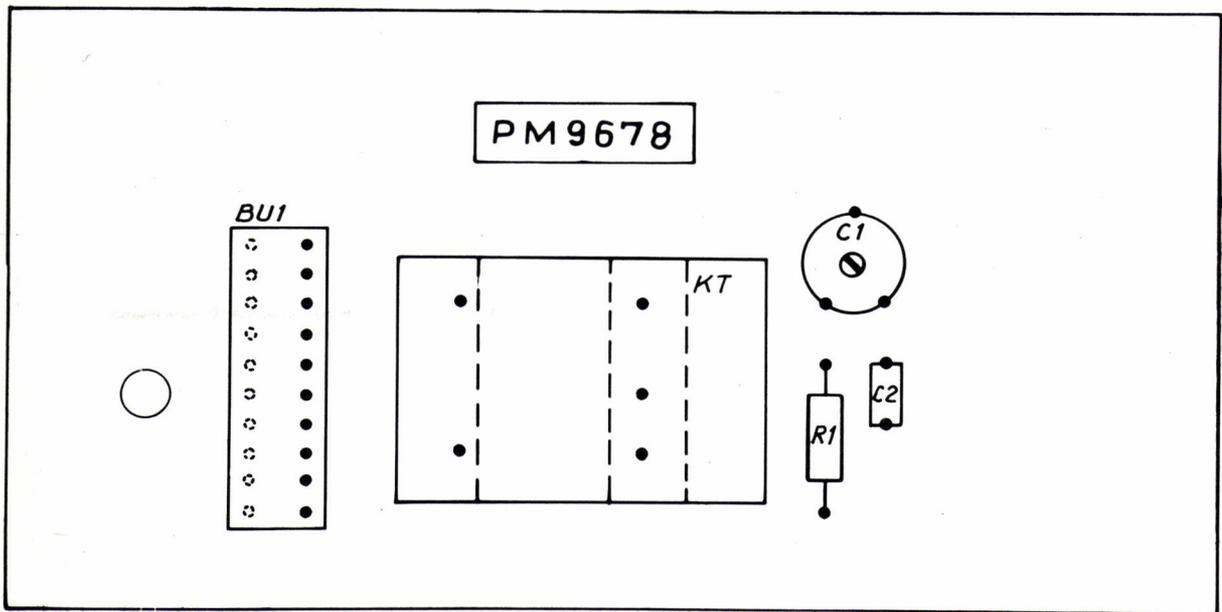


Figure VIII-3. Component lay-out PM 9678

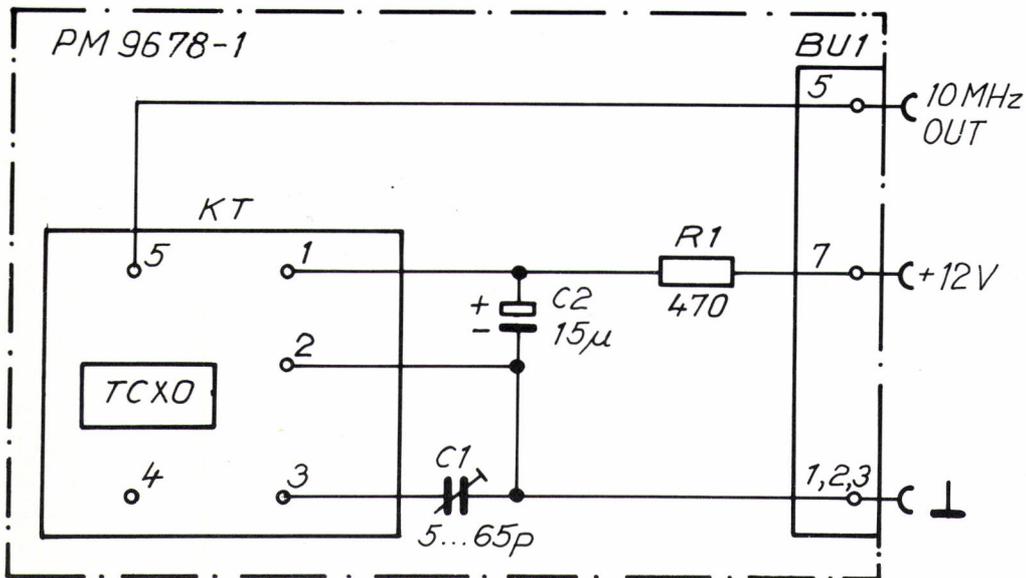


Figure VIII-4. Circuit diagram PM 9678

ORDERING NUMBER

| | | |
|----------------|----------------|-----------|
| 4822 110 63098 | 470 Ω 5 % | R 1 |
| 5322 125 50057 | 5-65 P | 100 V C 1 |
| 5322 124 14036 | 15 M -10 +50 % | 16 V C 2 |
| 5322 267 64031 | Connector | BU 1 |
| 5322 216 94047 | Crystal 10 MHz | |

Spare parts PM 9678

IX. REPLACING PARTS

1. Push-button switches

1.1. Loosen switch by bending the four tags securing the switch to the switch bracket.

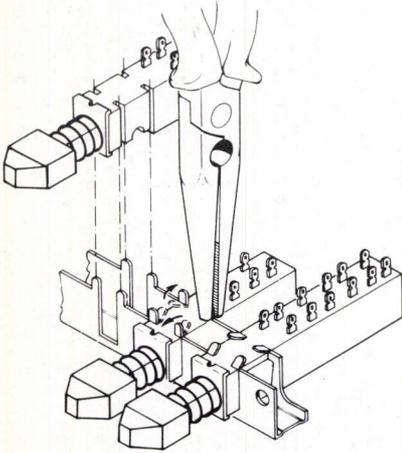


Fig. IX-1. Replacing push-button switch

1.2. Crush the switch by means of a pair of cutting pliers.

1.3. Unsolder the contact pins from the circuit board one by one. Use a sucking device to remove all tin solder from the contact holes in the circuit board before attaching the new switch.

2. Text plate and front rim

2.1. Remove the knobs for DISPLAY TIME, HOLD OFF (PM 6622), TRIGGER LEVEL and function selector.

2.2. Put a screw driver between the front rim and the front frame at points A.

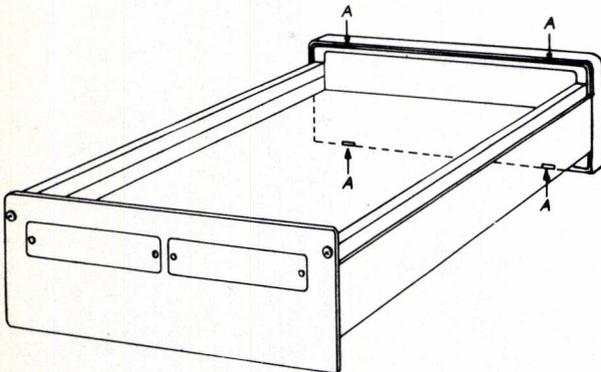


Fig. IX-2. Removing the front rim

2.3. Pry gently until front rim comes off.

2.4. Remove the text plate.

3. Handle

3.1. Remove the two plastic caps using a tiny screw driver or a pair of pliers.

3.2. Unscrew the two screws and pull out handle.

3.3. Before assembling grease, the tooth washer screwhole and teeth of the handle *very slightly* with vaseline.

4. Power supply

When replacing parts in the power supply, in particular IC150, always check the +5,0 V supply.

Proceed as follows :

4.1. Connect a voltmeter to BU107 pin +5,2 V and check that the voltage is 4.8—5.2 V. If the measured voltage does not reach 4.8—5.2 V unsolder R 1103 and select a resistor value that gives the desired voltage. The value of this resistor may be 1 k Ω to 33 k Ω . Typical value is 8 k Ω .

4.2. Check the d.c. voltages, refer to chapter VII section 3.

X. SPARE PARTS, CIRCUIT DESCRIPTION OF POWER SUPPLY AND PRESCALER UNITS, TEST CONDITIONS AND CIRCUIT DIAGRAMS

UNIT U1 ALL MODELS
FIXED RESISTORS

| Ordering number | Ohm | Tol(%) | Type | Item |
|-----------------|-------|--------|------|-------|
| 4822 110 63214 | 10M | 10 | CR25 | R1003 |
| 4822 110 63189 | 1.2M | 10 | CR25 | R1004 |
| 4822 110 63189 | 1.2M | 10 | CR25 | R1005 |
| 4822 110 63154 | 56 | 5 | CR25 | R1006 |
| 5322 116 54984 | 68 | 5 | PR37 | R1007 |
| 4822 110 63165 | 150K | 5 | CR25 | R1008 |
| 4822 110 63134 | 10K | 5 | CR25 | R1009 |
| 4822 110 63134 | 10K | 5 | CR25 | R1010 |
| 4822 110 63081 | 100 | 5 | CR25 | R1011 |
| 4822 110 60006 | 390 | 5 | CR25 | R1012 |
| 4822 110 63094 | 330 | 5 | CR25 | R1013 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1017 |
| 4822 110 63092 | 270 | 5 | CR25 | R1018 |
| 4822 110 63087 | 180 | 5 | CR25 | R1019 |
| 4822 110 63107 | 1.0K | 5 | CR25 | R1020 |
| 4822 110 63098 | 470 | 5 | CR25 | R1021 |
| 4822 110 63098 | 470 | 5 | CR25 | R1022 |
| 4822 110 63134 | 10K | 5 | CR25 | R1023 |
| 4822 110 63109 | 1.2K | 5 | CR25 | R1024 |
| 4822 110 63089 | 220 | 5 | CR25 | R1025 |
| 4822 110 63132 | 8.2K | 5 | CR25 | R1026 |
| 4822 110 63098 | 470 | 5 | CR25 | R1028 |
| 4822 110 63098 | 470 | 5 | CR25 | R1029 |
| 4822 110 63121 | 3.3K | 5 | CR25 | R1030 |
| 4822 110 63214 | 10M | 10 | CR25 | R1033 |
| 4822 110 63189 | 1.2M | 10 | CR25 | R1034 |
| 4822 110 63189 | 1.2M | 10 | CR25 | R1035 |
| 4822 110 63154 | 56 | 5 | CR25 | R1036 |
| 5322 116 54984 | 68 | 5 | PR37 | R1037 |
| 4822 110 63165 | 150K | 5 | CR25 | R1038 |
| 4822 110 63134 | 10K | 5 | CR25 | R1039 |
| 4822 110 63134 | 10K | 5 | CR25 | R1040 |
| 4822 110 63081 | 100 | 5 | CR25 | R1041 |
| 4822 110 60006 | 390 | 5 | CR25 | R1042 |
| 4822 110 63094 | 330 | 5 | CR25 | R1043 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1047 |
| 4822 110 63092 | 270 | 5 | CR25 | R1048 |
| 4822 110 63087 | 180 | 5 | CR25 | R1049 |
| 4822 110 63105 | 820 | 5 | CR25 | R1050 |
| 4822 110 63098 | 470 | 5 | CR25 | R1051 |
| 4822 110 63098 | 470 | 5 | CR25 | R1052 |
| 4822 110 63134 | 10K | 5 | CR25 | R1053 |
| 4822 110 63134 | 10K | 5 | CR25 | R1054 |
| 4822 110 63089 | 220 | 5 | CR25 | R1055 |
| 4822 110 63098 | 470 | 5 | CR25 | R1058 |
| 4822 110 63098 | 470 | 5 | CR25 | R1059 |
| 4822 110 63121 | 3.3K | 5 | CR25 | R1060 |
| 5322 116 50524 | 3.01K | 1 | MR25 | R1101 |
| 5322 116 54011 | 5.62K | 1 | MR25 | R1102 |
| SELECTED* | | | | |
| 4822 110 63107 | 1.0K | 5 | CR25 | R1103 |
| 4822 110 63121 | 3.3K | 5 | CR25 | R1104 |
| 4822 110 63107 | 1.0K | 5 | CR25 | R1105 |
| 4822 110 63107 | 1K | 5 | CR25 | R1106 |
| 4822 110 63109 | 1.2K | 5 | CR25 | R1107 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1108 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1109 |
| 4822 110 63169 | 220K | 5 | CR25 | R1110 |
| 4822 110 63089 | 220 | 5 | CR25 | R1111 |
| 4822 110 63063 | 22 | 5 | CR25 | R1112 |
| 4822 110 63089 | 220 | 5 | CR25 | R1113 |
| 4822 110 63032 | 1.5 | 5 | CR25 | R1114 |
| 5322 116 54963 | 0.18 | 10 | | R1115 |
| 4822 110 63098 | 470 | 5 | CR25 | R1116 |
| 4822 110 63089 | 220 | 5 | CR25 | R1117 |
| 4822 110 63072 | 47 | 5 | CR25 | R1118 |
| 4822 110 63169 | 220 | 5 | CR25 | R1119 |
| 4822 110 63107 | 1.0K | 5 | CR25 | R1120 |
| 4822 110 63098 | 470 | 5 | CR25 | R1121 |
| 4822 110 63081 | 100 | 5 | CR25 | R1122 |
| 4822 116 30114 | 4.7K | NTC | NTC | R1123 |
| 4822 113 60084 | 1.0 | 10 | | R1124 |
| 4822 110 63134 | 10K | 5 | CR25 | R1127 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1128 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1129 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1130 |
| 4822 110 63163 | 120K | 5 | CR25 | R1131 |

| | | | | |
|----------------|------|----|------|-------|
| 4822 110 63152 | 47K | 5 | CR25 | R1132 |
| 4822 110 63089 | 220 | 5 | CR25 | R1133 |
| 4822 110 63098 | 470 | 5 | CR25 | R1134 |
| 4822 110 63098 | 470 | 5 | CR25 | R1135 |
| 4822 110 63098 | 470 | 5 | CR25 | R1136 |
| 4822 110 63098 | 470 | 5 | CR25 | R1137 |
| 4822 110 63152 | 47K | 5 | CR25 | R1138 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R1139 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1140 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1141 |
| 4822 110 63134 | 10K | 5 | CR25 | R1142 |
| 4822 110 63152 | 47K | 5 | CR25 | R1143 |
| 4822 110 63152 | 47K | 5 | CR25 | R1144 |
| 4822 110 63152 | 47K | 5 | CR25 | R1145 |
| 4822 110 63152 | 47K | 5 | CR25 | R1146 |
| 4822 110 63134 | 10K | 5 | CR25 | R1147 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1150 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1151 |
| 4822 110 60006 | 390 | 5 | CR25 | R1152 |
| 4822 110 63214 | 10M | 10 | CR25 | R1153 |
| 4822 110 63143 | 22K | 5 | CR25 | R1154 |
| 4822 110 63123 | 3.9K | 5 | CR25 | R1156 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1157 |
| 4822 110 63089 | 220 | 5 | CR25 | R1158 |
| 4822 110 63134 | 10K | 5 | CR25 | R1160 |
| 4822 110 63134 | 10K | 5 | CR25 | R1161 |
| 4822 110 63187 | 1M | 5 | CR25 | R1162 |
| 4822 110 63134 | 10K | 5 | CR25 | R1163 |
| 4822 110 63107 | 1.0 | 5 | CR25 | R1164 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R1166 |
| 4822 110 63114 | 1.8K | 5 | CR25 | R1167 |
| 4822 110 63114 | 1.8K | 5 | CR25 | R1168 |
| 4822 110 63185 | 820K | 5 | CR25 | R1170 |
| 4822 110 63098 | 470 | 5 | CR25 | R1171 |
| 4822 110 63098 | 470 | 5 | CR25 | R1172 |
| 4822 110 63114 | 1.8K | 5 | CR25 | R1173 |
| 4822 110 63114 | 1.8K | 5 | CR25 | R1174 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1175 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R1176 |
| 4822 110 63143 | 22K | 5 | CR25 | R1177 |
| 4822 110 63129 | 6.8K | 5 | CR25 | R1178 |
| 4822 110 63138 | 15K | 5 | CR25 | R1180 |
| 4822 110 63138 | 15K | 5 | CR25 | R1181 |
| 4822 110 63138 | 15K | 5 | CR25 | R1182 |
| 4822 110 63138 | 15K | 5 | CR25 | R1183 |
| 4822 110 63138 | 15K | 5 | CR25 | R1184 |
| 4822 110 63138 | 15K | 5 | CR25 | R1185 |
| 4822 110 63138 | 15K | 5 | CR25 | R1186 |
| 4822 110 63138 | 15K | 5 | CR25 | R1187 |
| 4822 110 63138 | 15K | 5 | CR25 | R1188 |
| 4822 110 63098 | 470 | 5 | CR25 | R1189 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1190 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1191 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1192 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1193 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1194 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1195 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1196 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R1197 |

UNIT U1 ALL MODELS
VARIABLE RESISTORS

| Ordering number | Ohm | Description | Item |
|-----------------|-----|-------------|-------|
| 5322 101 14011 | 100 | TRIMM POTM | R1014 |
| 5322 101 64017 | 47K | SK109 | R1015 |
| 5322 101 14011 | 100 | TRIMM POTM | R1044 |
| 5322 101 64017 | 47K | SK119 | R1045 |
| 5322 101 94007 | 1M | SK101 SK102 | R1165 |

*refer. to chapter IX Section 4

UNIT U1 ALL MODELS
FIXED CAPACITORS

Ordering number Farad Tol.(%) Volts Item

| | | | | | | |
|------|-----|-------|------|--------|-----|------|
| 4822 | 121 | 40407 | 22N | 10 | 630 | C101 |
| 4822 | 122 | 31076 | 68P | 2 | 100 | C103 |
| 4822 | 122 | 31168 | 270P | 2 | 500 | C104 |
| 4822 | 122 | 31072 | 47P | 2 | 100 | C105 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C106 |
| 5322 | 121 | 40323 | 100N | 10 | 100 | C107 |
| 5322 | 124 | 14053 | 33M | -10+50 | 10 | C108 |
| 4822 | 121 | 40407 | 22N | 10 | 630 | C111 |
| 4822 | 122 | 31076 | 68P | 2 | 100 | C113 |
| 4822 | 122 | 31168 | 270P | 2 | 500 | C114 |
| 4822 | 122 | 31072 | 47P | 2 | 100 | C115 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C116 |
| 5322 | 121 | 40323 | 100N | 10 | 100 | C117 |
| 5322 | 124 | 14053 | 33M | -10+50 | 100 | C118 |
| 4822 | 122 | 31081 | 100P | 2 | 100 | C119 |
| 5322 | 124 | 14053 | 33M | -10+50 | 10 | C121 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C122 |
| 5322 | 124 | 14053 | 33M | -10+50 | 10 | C123 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C124 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C125 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C126 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C127 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C128 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C129 |
| 4822 | 121 | 40407 | 22N | 10 | 630 | C130 |
| 4822 | 122 | 31036 | 2.2P | 2 | 100 | C131 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C132 |
| 5322 | 124 | 14053 | 33M | -10+50 | 10 | C133 |
| 5322 | 124 | 14053 | 33M | -10+50 | 10 | C134 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C136 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C137 |
| 4822 | 124 | 10197 | 47M | -10+50 | 6.3 | C139 |
| 4822 | 124 | 10197 | 47M | -10+50 | 6.3 | C140 |
| 4822 | 121 | 40232 | 220N | 10 | 100 | C141 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C144 |
| 4822 | 122 | 30113 | 180P | 2 | 100 | C146 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C147 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C150 |
| 4822 | 122 | 31081 | 100P | | | C151 |
| 4822 | 124 | 20534 | 680M | -10+50 | 40 | C152 |
| 4822 | 121 | 40104 | 150N | 10 | 250 | C153 |
| 4822 | 124 | 20586 | 150M | -10+50 | 16 | C154 |
| 4822 | 124 | 20589 | 220M | -10+50 | 10 | C155 |
| 4822 | 124 | 20589 | 220M | -10+50 | 10 | C156 |
| 4822 | 124 | 20589 | 220M | -10+50 | 10 | C157 |
| 4822 | 124 | 20499 | 22M | -10+50 | 63 | C160 |
| 4822 | 124 | 20534 | 680M | -10+50 | 40 | C161 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C162 |
| 5322 | 124 | 24116 | 1M | | | C163 |
| 4822 | 122 | 31165 | 330P | 10 | 100 | C164 |
| 5322 | 124 | 14075 | 1M | -10+50 | 25 | C165 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C166 |
| 4822 | 121 | 40232 | 220N | 10 | 100 | C167 |
| 5322 | 124 | 14066 | 10M | -10+50 | 6.3 | C168 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C169 |
| 4822 | 122 | 31081 | 100P | 2 | 100 | C170 |
| 5322 | 121 | 40323 | 100N | 10 | 100 | C172 |
| 5322 | 121 | 40323 | 100N | 10 | 100 | C176 |
| 4822 | 122 | 30114 | 2.2N | 10 | 100 | C178 |
| 5322 | 122 | 34041 | 10N | -20+50 | 100 | C179 |
| 4822 | 121 | 41156 | 68N | 10 | 250 | C180 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C181 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C182 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C183 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C184 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C185 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C186 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C187 |
| 5322 | 121 | 44137 | 68N | 10 | 250 | C188 |
| 4822 | 121 | 40104 | 150N | 10 | 250 | C189 |

UNIT U1 ALL MODELS
VARIABLE CAPACITORS

Ordering number Farad Volts Item

| | | | | | |
|------|-----|-------|------|-----|------|
| 5322 | 125 | 54024 | 2-9P | 300 | C102 |
| 5322 | 125 | 54024 | 2-9P | 300 | C112 |

UNIT U1 ALL MODELS
INTEGRATED CIRCUITS

Ordering number Type Item

| | | | | |
|------|-----|-------|-------------------|-------|
| 5322 | 209 | 85408 | MC1651L | 1C101 |
| 5322 | 209 | 84643 | MC10102P | 1C102 |
| 5322 | 209 | 85409 | GXB10110 | 1C103 |
| 5322 | 209 | 84825 | MC10216P | 1C104 |
| 5322 | 209 | 84183 | SN74S74N | 1C125 |
| 5322 | 209 | 84183 | SN74S74N | 1C126 |
| 5322 | 209 | 84304 | SN75107AN | 1C127 |
| 5322 | 209 | 85406 | N74LS54A | 1C128 |
| 5322 | 209 | 84628 | N7403A | 1C129 |
| 5322 | 209 | 84528 | SN7400N | 1C130 |
| 5322 | 209 | 84722 | GZF1201P MOS | 1C131 |
| 5322 | 209 | 84722 | GZF1201P MOS | 1C132 |
| 5322 | 209 | 85001 | SN74LS157N | 1C133 |
| 5322 | 209 | 84996 | SN74LS10N | 1C134 |
| 5322 | 209 | 84183 | SN74LS74N | 1C135 |
| 5322 | 209 | 84724 | SN74S64N | 1C136 |
| 5322 | 209 | 85407 | N74S02A | 1C137 |
| 5322 | 209 | 84655 | 723PC | 1C150 |
| 5322 | 209 | 85085 | F34049PC SELECTED | 1C151 |
| 5322 | 209 | 84983 | SN74LS00N | 1C152 |
| 5322 | 209 | 85412 | CD4093BE MOS | 1C153 |
| 5322 | 209 | 84983 | SN74LS00N | 1C154 |
| 5322 | 209 | 84993 | SN74LS02N | 1C155 |
| 5322 | 209 | 84993 | SN74LS02N | 1C156 |
| 5322 | 209 | 84976 | F34001PC | 1C157 |
| 5322 | 209 | 84983 | SN74LS00N | 1C158 |
| 5322 | 209 | 84984 | SN74LS04N | 1C159 |
| 5322 | 209 | 85411 | 82S90A | 1C174 |
| 5322 | 209 | 80059 | SN7475N | 1C175 |
| 5322 | 209 | 84529 | SN7403N | 1C176 |
| 5322 | 209 | 84722 | GZF1201P MOS | 1C177 |
| 5322 | 209 | 84722 | GZF1201P MOS | 1C178 |
| 5322 | 209 | 80072 | SN7490AN | 1C179 |
| 5322 | 209 | 80142 | SN7442AN | 1C180 |
| 5322 | 209 | 84723 | DM8884AN | 1C181 |
| 5322 | 111 | 94015 | 6X1.0K | 1C190 |
| 5322 | 111 | 94015 | 6X1.0K | 1C191 |
| 5322 | 111 | 94031 | 6X47K | 1C192 |
| 5322 | 111 | 94031 | 6X47K | 1C193 |
| 5322 | 111 | 94012 | 6X6.8K | 1C194 |
| 5322 | 111 | 94012 | 6X6.8K | 1C195 |
| 5322 | 111 | 94031 | 6X47K | 1C196 |
| 5322 | 111 | 94012 | 6X6.8K | 1C197 |
| 5322 | 111 | 94026 | 6X470K | 1C198 |

UNIT U1 ALL MODELS
TRANSISTORS

Ordering number Type Item

| | | | | |
|------|-----|-------|----------------|-------|
| 5322 | 130 | 44578 | E411 SILICONIX | TS101 |
| 5322 | 130 | 44578 | E411 SILICONIX | TS102 |
| 5322 | 130 | 44435 | 2N5770 | TS103 |
| 5322 | 130 | 44435 | 2N5770 | TS104 |
| 5322 | 130 | 44197 | BC558B | TS105 |
| 5322 | 130 | 44197 | BC558B | TS106 |
| 5322 | 130 | 40407 | 2N2369 | TS142 |
| 4822 | 130 | 40855 | BC337 | TS146 |
| 5322 | 130 | 24035 | BT100A-02 | TS150 |
| 5322 | 130 | 40482 | BRY39 | TS151 |

| | | | | |
|------|-----|-------|--------|-------|
| 4822 | 130 | 40855 | BC337 | TS152 |
| 5322 | 130 | 44417 | BDX35 | TS153 |
| 5322 | 130 | 40482 | BRY39 | TS154 |
| 5322 | 130 | 44418 | BF256A | TS155 |
| 4822 | 130 | 40937 | BC548B | TS156 |
| 5322 | 130 | 44256 | BC557 | TS177 |
| 5322 | 130 | 44247 | BSS68 | TS180 |
| 5322 | 130 | 44247 | BSS68 | TS181 |
| 5322 | 130 | 44247 | BSS68 | TS182 |
| 5322 | 130 | 44247 | BSS68 | TS183 |
| 5322 | 130 | 44247 | BSS68 | TS184 |
| 5322 | 130 | 44247 | BSS68 | TS185 |
| 5322 | 130 | 44247 | BSS68 | TS186 |
| 5322 | 130 | 44247 | BSS68 | TS187 |
| 5322 | 130 | 44247 | BSS68 | TS188 |

UNIT U1 ALL MODELS
DIODES

| Ordering number | Type | Item |
|-----------------|-----------|------------------|
| 5322 | 130 30392 | BZY88-C3V3 GR101 |
| 5322 | 130 30613 | BAW62 GR102 |
| 5322 | 130 30613 | BAW62 GR103 |
| 5322 | 130 30392 | BZY88-C3V3 GR104 |
| 5322 | 130 34563 | BZX79-C2V7 GR105 |
| 5322 | 130 30613 | BAW62 GR106 |
| 5322 | 130 34563 | BZX79-C2V7 GR107 |
| 5322 | 130 30613 | BAW62 GR108 |
| 5322 | 130 30392 | BZY88-C3V3 GR111 |
| 5322 | 130 30613 | BAW62 GR112 |
| 5322 | 130 30613 | BAW62 GR113 |
| 5322 | 130 30392 | BZY-C3V3 GR114 |
| 5322 | 130 34563 | BZX79-C2V7 GR115 |
| 5322 | 130 30613 | BAW62 GR116 |
| 5322 | 130 34563 | BZX79-C2V7 GR117 |
| 5322 | 130 30613 | BAW62 GR118 |
| 5322 | 130 30613 | BAW62 GR121 |
| 5322 | 130 34047 | BZX75-C1V4 GR122 |
| 5322 | 130 30613 | BAW62 GR125 |
| 5322 | 130 30613 | BAW62 GR138 |
| 5322 | 130 30613 | BAW62 GR139 |
| 5322 | 130 30613 | BAW62 GR140 |
| 5322 | 130 30613 | BAW62 GR141 |
| 5322 | 130 30613 | BAW62 GR142 |
| 5322 | 130 30613 | BAW62 GR143 |
| 5322 | 130 30613 | BAW62 GR144 |
| 5322 | 130 30613 | BAW62 GR145 |
| 5322 | 130 30774 | BZX79-C10 GR151 |
| 5322 | 130 30594 | BAV10 GR152 |
| 5322 | 130 34401 | BZX70-C56 GR153 |
| 5322 | 130 30392 | BZY88-C3V3 GR154 |
| 4822 | 130 30868 | BY210-600 GR155 |
| 4822 | 130 30868 | BY210-400 GR156 |
| 4822 | 130 30868 | BY210-400 GR157 |
| 4822 | 130 30868 | BY210-400 GR158 |
| 4822 | 130 30868 | BY210-400 GR159 |
| 5322 | 130 30759 | BZX79-C5V6 GR160 |
| 4822 | 130 30868 | BY210-400 GR161 |
| 5322 | 130 30192 | BY126 GR163 |
| 5322 | 130 30414 | BY164 GR167 |
| 5322 | 130 30613 | BAW62 GR170 |
| 5322 | 130 34049 | BZX75-C2V1 GR171 |
| 5322 | 130 30613 | BAW62 GR172 |
| 5322 | 130 30613 | BAW62 GR173 |
| 5322 | 130 30613 | BAW62 GR175 |
| 5322 | 130 34189 | BAW20 GR180 |
| 5322 | 130 34189 | BAW20 GR181 |
| 5322 | 130 34189 | BAW20 GR182 |
| 5322 | 130 34189 | BAW20 GR183 |
| 5322 | 130 34189 | BAW20 GR184 |
| 5322 | 130 34189 | BAW20 GR185 |
| 5322 | 130 34189 | BAW20 GR186 |
| 5322 | 130 34189 | BAW20 GR187 |
| 5322 | 130 34189 | BAW20 GR188 |
| 5322 | 130 34166 | BZX79-C51 GR189 |

UNIT U1 ALL MODELS

INDUCTANCES

| Ordering number | Description | Item | Qty. |
|-----------------|-------------|-------------------|--------|
| 5322 | 158 10289 | INDUCTANCE 0.68MH | L101 1 |
| 5322 | 158 10289 | INDUCTANCE 0.68MH | L102 1 |
| 5322 | 158 10243 | INDUCTANCE 100MH | L103 1 |
| 5322 | 158 10284 | INDUCTANCE 47MH | L104 1 |
| 5322 | 158 10284 | INDUCTANCE 47MH | L105 1 |
| 5322 | 158 10052 | CHOKE | L150 1 |
| 4822 | 526 10097 | FXC BEAD | L151 1 |
| 5322 | 158 10052 | CHOKE | L152 1 |

UNIT U1 ALL MODELS
MECHANICAL PARTS

| Ordering number | Description | Item | Qty. |
|-----------------|-------------|--------------------|------------|
| 5322 | 256 34031 | FUSEHOLDER | VL150 2 |
| 5322 | 255 44107 | IC HOLDER 16 PINS | D.I.L 2 |
| 5322 | 255 44112 | IC HOLDER 18 PINS | D.I.L 5 |
| 5322 | 255 40089 | TRANSISTOR HOLDER | TO 18-3 11 |
| 5322 | 255 40089 | TRANSISTOR HOLDER | TO 18-4 2 |
| 5322 | 265 54006 | TRANSISTOR HOLDER | TS153 1 |
| 5322 | 265 54006 | FEMALE CONNECTOR | BU 102 1 |
| 5322 | 265 54018 | MALE CONNECTOR | BU 102 1 |
| 5322 | 265 44064 | MALE CONNECTOR | BU103 1 |
| 5322 | 265 44064 | MALE CONNECTOR | BU104 1 |
| 5322 | 265 44064 | MALE CONNECTOR | BU105 1 |
| 5322 | 255 44107 | FEMALE CONNECTOR | BU106 1 |
| 5322 | 265 54006 | FEMALE CONNECTOR | BU107 1 |
| 5322 | 101 94007 | COMBINED SWITCH | SK101 1 |
| 5322 | 101 94007 | COMBINED SWITCH | SK102 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK103 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK104 1 |
| 5322 | 273 74008 | ROTARY SWITCH | SK105 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK106 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK107 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK108 1 |
| 5322 | 101 64017 | COMBINED SWITCH | SK109 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK110 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK116 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK117 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK118 1 |
| 5322 | 101 64017 | COMBINED SWITCH | SK119 1 |
| 5322 | 276 14117 | PUSH BUTTON SWITCH | SK120 1 |
| 5322 | 277 24006 | SLIDE SWITCH | SK121 1 |

UNIT U1 ALL MODELS
MISCELLANEOUS

| Ordering number | Description | Item | Qty. |
|-----------------|-------------|-------------------|-----------|
| 5322 | 146 14079 | MAINS TRANSFORMER | T101 1 |
| 5322 | 142 64027 | DC-DC TRANSFORMER | T102 1 |
| 4822 | 253 20022 | FUSE 1.6A FAST | VL150 1 |
| 4822 | 252 20001 | THERMAL FUSE | VL101 1 |
| 5322 | 131 94042 | DISPLAY | B101 1 |
| 5322 | 462 34127 | GUIDE RAIL | FOR U1 14 |

FRONT PANEL ALL MODELS

| Ordering number | Description | Item | Qty. |
|-----------------|-------------|---------------------|-----------|
| 5322 | 456 14054 | TEXT PLATE | PM6622 1 |
| 5322 | 456 14055 | TEXT PLATE | PM6624 1 |
| 5322 | 456 14056 | TEXT PLATE | PM6625 1 |
| 5322 | 450 64059 | WINDOW | 1 |
| 5322 | 414 34076 | FUNCTION KNOB | SK105 1 |
| 5322 | 414 74019 | COVER FUNCTION KNOB | SK105 1 |
| 5322 | 414 34091 | DISPLAY KNOB | SK101 1 |
| 5322 | 414 74015 | COVER DISPLAY KNOB | SK101 1 |
| 5322 | 414 34091 | HOLD OFF KNOB | SK403 1 |
| 5322 | 414 74015 | COVER HOLD OFF KNOB | SK403 1 |
| 5322 | 414 34091 | TRIGGER KNOBS | 2 |
| 5322 | 414 74015 | COVER TRIGGER KNOBS | 2 |
| 5322 | 414 14011 | PUSH BUTTON KNOBS | 10 |
| 5322 | 267 10004 | INPUT SOCKETS A B | BU1 BU2 2 |

REAR PANEL ALL MODELS

| Ordering number | Description | Item |
|-----------------|---------------------|------|
| 5322 267 34059 | EXT BATTERY SOCKET | BU21 |
| 5322 267 34059 | EXT BATTERY SOCKET | BU22 |
| 5322 265 30066 | MAINS INPUT SOCKET | BU23 |
| 5322 267 10004 | INPUT D-10MHZ OUT | BU24 |
| 5322 267 10004 | EXT. RESET | BU25 |
| 5322 267 10004 | GATE OPEN | BU27 |
| 5322 277 24017 | INT EXT STD SWITCH | SK22 |
| 5322 121 44092 | CAPACITOR 47NF 250V | C1 |

CABINET ALL MODELS

| Ordering number | Description | Item |
|-----------------|------------------|------|
| 5322 498 54048 | HANDLE ARM | 2 |
| 5322 498 54054 | HANDLE PROFILE | 1 |
| 5322 520 34164 | BEARING BUSH | 2 |
| 5322 414 64053 | CAP HANDLE ARM | 2 |
| 5322 447 84467 | TOP COVER | 1 |
| 5322 447 84466 | BOTTOM COVER | 1 |
| 5322 466 85335 | FRONT ORNAMENT | 1 |
| 5322 459 24054 | REAR ORNAMENT | 1 |
| 5322 462 44181 | REAR FOOT | 4 |
| 5322 462 44179 | BOTTOM FOOT | 4 |
| 4822 462 70497 | PLUG BOTTOM FOOT | 4 |

UNIT U3 ALL MODELS

| Ordering number | Description | Item |
|-----------------|----------------|----------|
| 5322 321 24389 | CABLE COMPLETE | U3 TO U1 |
| 5322 268 24073 | TEST SOCKET | BU302 |
| 5322 268 24073 | TEST SOCKET | BU303 |
| 5322 130 34562 | LD35/II | GR301 |
| 5322 130 34562 | LD35/II | GR302 |
| 5322 130 34562 | LD35/II | GR303 |
| 5322 130 34562 | LD35/II | GR304 |
| 5322 130 34562 | LD35/II | GR305 |
| 5322 130 34562 | LD35/II | GR306 |
| 5322 130 34562 | LD35/II | GR307 |

UNIT U4 ALL MODELS

| Ordering number | Description | Item |
|-----------------|--------------------------|----------|
| 5322 321 24391 | CABLE COMPLETE | U4 TO U1 |
| 5322 277 24006 | SLIDE SWITCH | SK401 |
| 5322 277 24006 | SLIDE SWITCH | SK402 |
| 5322 101 54008 | COMBINED SK403-SK404R401 | |
| 5322 121 54118 | CAPACITOR 150NF 63V | C401 |

UNIT U2 PM6624

FIXED RESISTORS

| Ordering number | Ohm | Tol.(%) | Type | Item |
|-----------------|------|---------|------|------|
| 4822 116 51142 | 150 | 5 | PR37 | R201 |
| 5322 116 54396 | 68 | 5 | PR52 | R202 |
| 5322 116 54396 | 68 | 5 | PR52 | R203 |
| 5322 116 50417 | 162 | 5 | MR25 | R204 |
| 4822 111 30328 | 330 | 5 | CR16 | R205 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R206 |
| 4822 110 63147 | 33K | 5 | CR25 | R207 |
| 4822 110 63107 | 1K | 5 | CR25 | R208 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R209 |
| 4822 110 63152 | 47K | 5 | CR25 | R210 |
| 4822 110 63107 | 1K | 5 | CR25 | R211 |
| 4822 110 63138 | 15K | 5 | CR25 | R212 |
| 4822 111 30067 | 33 | 5 | CR16 | R213 |
| 4822 110 63134 | 10K | 5 | CR25 | R214 |
| 4822 110 63141 | 18K | 5 | CR25 | R215 |
| 4822 110 63101 | 560 | 5 | CR25 | R216 |
| 4822 111 30264 | 2.7K | 5 | CR16 | R217 |
| 4822 111 30323 | 270 | 5 | CR16 | R218 |
| 4822 111 30272 | 680 | 5 | CR16 | R219 |
| 4822 111 30245 | 47 | 5 | CR16 | R220 |
| 4822 111 30347 | 10 | 5 | CR16 | R221 |
| 4822 110 63161 | 100K | 5 | CR25 | R222 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R223 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R224 |
| 4822 110 63134 | 10K | 5 | CR25 | R225 |
| 4822 110 63098 | 470 | 5 | CR25 | R226 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R227 |
| 4822 110 63054 | 10 | 5 | CR25 | R228 |
| 4822 111 30272 | 680 | 5 | CR25 | R229 |
| 4822 110 63098 | 470 | 5 | CR25 | R230 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R231 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R238 |

UNIT U2 PM6624
FIXED CAPACITORS

| Ordering number | Farad | Tol.(%) | Volts | Item |
|-----------------|-------|---------|-------|------|
| 4822 122 31177 | 470P | 10 | 100 | C201 |
| 4822 122 31177 | 470P | 10 | 100 | C202 |
| 4822 122 31177 | 470P | 10 | 100 | C203 |
| 4822 122 31177 | 470P | 10 | 10 | C204 |
| 4822 122 30043 | 10N | -20+80 | 63 | C205 |
| 5322 122 34043 | 47P | 2 | 50 | C206 |
| 4822 122 31175 | 1N | 10 | 100 | C207 |
| 5322 124 14079 | 68M | | 6.3 | C208 |
| 4822 122 31043 | 3.9P | 2 | 63 | C209 |
| 4822 122 31173 | 220P | 10 | 100 | C211 |
| 4822 122 30094 | 220P | 10 | 100 | C212 |
| 4822 122 31177 | 470P | 10 | 100 | C213 |
| 4822 122 30043 | 10N | -20+80 | 63 | C214 |
| 5322 124 14036 | 15M | | 16 | C215 |
| 4822 122 31175 | 1N | 10 | 100 | C216 |
| 5322 122 34043 | 47P | 2 | 100 | C217 |
| 4822 122 31072 | 47P | 10 | 100 | C218 |
| 4822 122 30043 | 10N | -20+80 | 63 | C219 |
| 4822 122 31175 | 1N | 10 | 100 | C220 |
| 5322 122 34043 | 47P | 2 | 50 | C221 |
| 4822 122 31175 | 1N | 10 | 100 | C222 |
| 4822 122 31175 | 1N | 10 | 100 | C223 |
| 5322 124 14079 | 68M | | 6.3 | C224 |
| 4822 122 30043 | 10N | -20+80 | 63 | C225 |
| 4822 122 31072 | 47P | 10 | 100 | C226 |
| 4822 122 31173 | 220P | 10 | 100 | C227 |

UNIT U2 PM6624
INTEGRATED CIRCUITS

| Ordering number | Type | Item |
|-----------------|----------|-------|
| 5322 209 85414 | OM334 | IC201 |
| 5322 209 85414 | OM334 | IC202 |
| 5322 209 84721 | SP670B | IC203 |
| 5322 209 84163 | SN72741P | IC204 |
| 5322 209 84163 | SN72741P | IC205 |
| 5322 209 84165 | SN7474N | IC206 |
| 5322 209 84165 | SN7474N | IC207 |

UNIT U2 PM6624
TRANSISTORS

| Ordering number | Type | Item |
|-----------------|--------|-------|
| 4822 130 40937 | BC548B | TS201 |
| 5322 130 40348 | BC178B | TS202 |
| 5322 130 44179 | BFR90 | TS203 |
| 4822 130 40937 | BC548B | TS204 |
| 5322 130 40343 | BC108B | TS205 |

UNIT U2 PM6224
DIODES

| Ordering number | Type | Item |
|-----------------|-------------|-------|
| 5322 130 34364 | BA379 | GR201 |
| 5322 130 34364 | BA379 | GR202 |
| 5322 130 34283 | HP5082-2835 | GR203 |
| 5322 130 34283 | HP5082-2835 | GR204 |
| 5322 130 34364 | BA379 | GR205 |
| 5322 130 34364 | BA379 | GR206 |
| 5322 130 34364 | BA379 | GR207 |
| 5322 130 30613 | BAW62 | GR208 |
| 5322 130 34283 | HP5082-2835 | GR209 |
| 5322 130 34283 | HP5082-2835 | GR210 |
| 5322 130 30666 | BZX79-C7V5 | GR211 |

UNIT U2 PM6624
INDUCTANCES

| Ordering number | Description | Item |
|-----------------|------------------|------|
| 5322 158 14119 | COIL | L201 |
| 5322 158 14119 | COIL | L202 |
| 5322 158 10276 | INDUCTANCE 4.7MH | L203 |
| 5322 158 14119 | COIL | L204 |
| 4822 526 10025 | FXC BEAD | L205 |
| 4822 526 10025 | FXC BEAD | L207 |
| 4822 526 10025 | FXC BEAD | L208 |
| 4822 526 10025 | FXC BEAD | L209 |
| 4822 526 10025 | FXC BEAD | L210 |
| 5322 526 14019 | BEAD | L211 |

UNIT U2 PM6624
MECHANICAL PARTS

| Ordering number | Description | Item | Qty |
|-----------------|-------------------|--------|-----|
| 5322 265 54006 | FEMALE CONNECTOR | BU201 | 1 |
| 5322 265 54018 | MALE CONNECTOR | BU201 | 1 |
| 5322 535 94711 | DISTANCE PIECE | FOR U2 | 2 |
| 5322 462 34054 | GUIDE RAIL | FOR U2 | 2 |
| 5322 255 44122 | IC HOLDER 14 PINS | DIL | 1 |
| 5322 255 40089 | TRANSISTOR HOLDER | T018-3 | 2 |

UNIT U2 PM6625
FIXED RESISTORS

| Ordering number | Ohm | Tol(%) | Type | Item |
|-----------------|------|--------|------|------|
| 5322 116 54393 | 150 | 5 | PR52 | R201 |
| 5322 116 54396 | 68 | 5 | PR52 | R202 |
| 5322 116 54396 | 68 | 5 | PR52 | R203 |
| 5322 116 50417 | 162 | 5 | MR25 | R204 |
| 4822 111 30328 | 330 | 5 | CR16 | R205 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R206 |
| 4822 110 63147 | 33K | 5 | CR25 | R207 |
| 4822 110 63107 | 1K | 5 | CR25 | R208 |
| 4822 110 63125 | 4.7K | 5 | CR25 | R209 |
| 4822 110 63152 | 47K | 5 | CR25 | R210 |
| 4822 110 63107 | 1K | 5 | CR25 | R211 |
| 4822 110 63138 | 15K | 5 | CR25 | R212 |
| 4822 111 30348 | 27 | 5 | CR16 | R213 |
| 4822 110 63134 | 10K | 5 | CR25 | R214 |
| 4822 110 63141 | 18K | 5 | CR25 | R215 |
| 4822 110 63094 | 330 | 5 | CR25 | R216 |
| 4822 111 30265 | 2.2K | 5 | CR16 | R217 |
| 4822 111 30331 | 470 | 5 | CR16 | R218 |
| 4822 111 30312 | 4.7K | 5 | CR16 | R219 |
| 4822 111 30327 | 220 | 5 | CR16 | R220 |
| 4822 111 30347 | 10 | 5 | CR16 | R221 |
| 4822 110 63161 | 100K | 5 | CR25 | R222 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R223 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R224 |
| 4822 110 63134 | 10K | 5 | CR25 | R225 |
| 4822 110 63098 | 470 | 5 | CR25 | R226 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R227 |
| 4822 110 63054 | 10 | 5 | CR25 | R228 |
| 4822 111 30272 | 680 | 5 | CR16 | R229 |
| 4822 110 63098 | 470 | 5 | CR25 | R230 |
| 4822 110 63116 | 2.2K | 5 | CR25 | R231 |
| 4822 111 30324 | 100 | 5 | CR16 | R233 |
| 4822 111 30328 | 330 | 5 | CR16 | R234 |
| 4822 111 30328 | 330 | 5 | CR16 | R235 |
| 4822 110 63098 | 470 | 5 | CR16 | R236 |
| 4822 110 63069 | 39 | 5 | CR16 | R237 |
| 4822 110 63125 | 4.7K | 5 | CR16 | R238 |

UNIT U2 PM6625
FIXED CAPACITORS

| Ordering number | Farad | Tol.(%) | Volts | Item |
|-----------------|-------|---------|-------|------|
| 5322 122 34071 | 470P | 20 | 50 | C201 |
| 5322 122 34071 | 470P | 20 | 50 | C202 |
| 5322 122 34071 | 470P | 20 | 50 | C203 |
| 5322 122 34071 | 470P | 20 | 50 | C204 |
| 4822 122 30043 | 10N | -20+80 | 63 | C205 |
| 5322 122 34043 | 47P | 10 | 50 | C206 |
| 4822 122 31175 | 1N | 10 | 100 | C207 |
| 5322 124 14079 | 68M | -10+50 | 6.3 | C208 |
| 5322 122 34043 | 47P | 10 | 50 | C209 |
| 4822 122 31173 | 220P | 10 | 100 | C210 |
| 4822 122 31173 | 220P | 10 | 100 | C211 |
| 4822 122 31173 | 220P | 10 | 100 | C212 |
| 5322 122 34071 | 470P | 10 | 50 | C213 |
| 4822 122 30043 | 10N | -20+80 | 63 | C214 |
| 5322 124 14036 | 15M | -10+50 | 16 | C215 |
| 4822 122 31175 | 1N | 10 | 100 | C216 |
| 5322 122 34071 | 470P | 20 | 50 | C217 |
| 5322 122 34042 | 12P | 10 | 50 | C218 |
| 4822 122 30043 | 10N | -20+80 | 63 | C219 |
| 4822 122 31175 | 1N | 10 | 100 | C220 |
| 4822 122 30043 | 10N | -20+80 | 63 | C221 |
| 5322 122 34043 | 47P | 10 | 50 | C222 |
| 5322 122 34071 | 470P | 20 | 50 | C223 |
| 5322 124 14079 | 68M | -10+50 | 6.3 | C224 |
| 5322 122 34071 | 470P | 10 | 50 | C225 |
| 4822 122 31072 | 47P | 2 | 100 | C226 |
| 5322 122 34071 | 470P | 20 | 50 | C227 |
| 4822 122 31072 | 47P | 2 | 100 | C228 |
| 4822 122 30043 | 10N | -20+80 | 63 | C229 |
| 5322 122 34043 | 47P | 10 | 50 | C230 |
| 4822 122 31054 | 10P | 2 | 100 | C231 |

UNIT U2 PM6625
 INTERGRATED CIRCUITS

| Ordering number | Type | Item |
|-----------------|----------|-------|
| 5322 209 85414 | OM334 | 1C201 |
| 5322 209 85414 | OM334 | 1C202 |
| 5322 209 84725 | SP8616B | 1C203 |
| 5322 209 84165 | SN72741P | 1C204 |
| 5322 209 84165 | SN72741P | 1C205 |
| 5322 209 84165 | SN7474N | 1C206 |
| 5322 209 84165 | SN7474N | 1C207 |
| 5322 209 84729 | SP8600B | 1C208 |

 UNIT U2 PM6625
 TRANSISTORS

| Ordering number | Type | Item |
|-----------------|--------|-------|
| 4822 130 40937 | BC548B | TS201 |
| 5322 130 40348 | BC178B | TS202 |
| 5322 130 44179 | BFR90 | TS203 |
| 4822 130 40937 | BC548B | TS204 |
| 5322 130 40343 | BC108B | TS205 |
| 5322 130 44435 | 2N5770 | TS206 |

 UNIT U2 PM6625
 DIODES

| Ordering number | Type | Item |
|-----------------|-------------|-------|
| 5322 130 34364 | BA379 | GR201 |
| 5322 130 34364 | BA379 | GR202 |
| 5322 130 34283 | HP5082-2835 | GR203 |
| 5322 130 34283 | HP5082-2835 | GR204 |
| 5322 130 34364 | BA379 | GR205 |
| 5322 130 34364 | BA379 | GR206 |
| 5322 130 34364 | BA379 | GR207 |
| 5322 130 30613 | BAW62 | GR208 |
| 5322 130 34283 | HP5082-2835 | GR209 |
| 5322 130 34283 | HP5082-2835 | GR210 |
| 5322 130 30666 | BZX79-C7V5 | GR211 |
| 5322 130 34364 | BA379 | GR212 |
| 5322 130 30666 | BZX79-C7V5 | GR213 |
| 5322 130 30411 | BZX79-C3V9 | GR214 |
| 5322 130 30411 | BZX79-C3V9 | GR215 |

 UNIT U2 PM6625
 INDUCTANSES

| Ordering number | Description | Item |
|-----------------|------------------|------|
| 5322 158 14119 | COIL | L201 |
| 5322 158 14119 | COIL | L202 |
| 5322 158 10276 | INDUCTANCE 4.7MH | L203 |
| 5322 158 14119 | COIL | L204 |
| 5322 158 14119 | COIL | L205 |
| 5322 158 14119 | COIL | L206 |
| 5322 158 14119 | COIL | L207 |
| 5322 158 14119 | COIL | L208 |
| 5322 157 44024 | COIL | L209 |
| 4822 526 10025 | FXC BEAD | L210 |
| 4822 526 10025 | FXC BEAD | L211 |
| 4822 526 10025 | FXC BEAD | L212 |
| 4822 526 10025 | FXC BEAD | L214 |

 UNIT U2 PM6625
 MECHANICAL PARTS

| Ordering number | Description | Item | Oty. |
|-----------------|-----------------------|--------|------|
| 5322 265 54006 | FEMALE CONNECTOR | BU201 | 1 |
| 5322 265 54018 | MALE CONNECTOR | BU201 | 1 |
| 5322 535 94711 | DISTANCE PIECE | FOR U2 | 2 |
| 5322 255 44122 | 1C HOLDER 14 PINS DIL | | 1 |
| 5322 255 40089 | TRANSISTOR HOLDER | T018-3 | 2 |
| 5322 462 34054 | GUIDE RAIL | | 2 |

5. Circuit description prescaler units and power supply

5.1. Prescaler PM 6624

Unit U2 contains the 520 MHz amplifier and prescaler circuits, and also two D flip-flops IC 206 and IC 207 dividing the time base signal generated on unit U1.

The signal to be measured enters the input amplifier at socket BU 2. After AC coupling capacitor C 201, a resistive attenuator network R 201 . . . R 204 is incorporated which maintains the VSWR of the input and also serves as a series impedance for the PIN diode attenuator GR 201 and GR 202. Schottky diodes GR 203 and GR 204 are clipping the signal but generate also current to the PIN diodes which provide automatically the proper attenuation of high-amplitude signals.

At low amplitude the signal passes this first PIN diode attenuator unchanged to the next PIN diode attenuator GR 205 . . . GR 207. Here the amplitude is reduced further before the signal is entering the input amplifier.

After input conditioning, the measuring signal is applied to two cascade wide-band amplifiers IC 201 and IC 202. The signal level at IC 202 is detected by GR 209, GR 210 controlling the AGC amplifier IC 204 and Schmitt trigger IC 205.

When the detected level is sufficient, IC 204 starts controlling the PIN diode attenuator GR 205 . . . GR 207. Transistor TS 201 ensures a linear attenuator response within the input signal range.

Via R 213, C 213 and amplifier TS 203 the signal is fed to input 10 of divide-by-eight circuit IC 203. Output 1 provides the divided signal to the 80 MHz input amplifier, BU 201

The detected signal from GR 209, 210 is also fed to operational amplifier IC 205 performing a Schmitt trigger function. When no measuring signal is present or at a low detected level, output IC 205:6 is positive. TS 204 is then turned on, shorts the output line to earth.

When the detected signal from GR 209, 210 has reached a sufficient level, IC 205:6 goes LOW and TS 204 is turned off.

TS 202 is controlled by switch SK 401. When the switch is set to position INPUT A the level at BU 201:5 PRESCALER, goes HIGH which turns TS 202 off. Via R 230 and GR 211, also TS 205 is switched off. No supply voltage for the amplifier is present until switch SK 401 is set to position INPUT C and BU 201:5 goes LOW.

The two D flip-flops of IC 206 and one D flip-flop of IC 207 provide the division by 8 of the time base frequency TB 1.

5.2. Prescaler PM 6625

The input conditioning section of the 1 GHz amplifier up to IC 201 and the AGC and Schmitt trigger circuits are principally the same as in the 520 MHz amplifier of PM 6624. Refer to that description.

After input conditioning, the measuring signal is applied to two cascade wide-band amplifiers IC 201 and IC 202. The signal level at IC 202:7 is detected by GR 209, GR 210 controlling the AGC amplifier IC 204 and Schmitt trigger IC 205.

Via R 213, C 213 and amplifier TS 203, the signal is fed to input 4 of divide-by-four circuit IC 203. The complementary outputs 10 and 11 of this circuit provide the signal to the next 4-divider IC 208 via zeners GR 214, GR 215. These diodes are interfacing the +1 V output of IC 203 with the -3 V input requirement of IC 208. The measuring signal frequency now divided by 16, is fed via TS 206 to the output line BU 201:1 which is connected with BU 102:1 to the 80 MHz input amplifier.

TS 202 is controlled by switch SK 401. When the switch is set to position INPUT A the level at BU 201:5, PRESCALER, goes HIGH which turns TS 202 off. Via R 230 and GR 211 also TS 205 is switched off. No supply voltage for the amplifier is present until SK 401 is set to position INPUT C and BU 201:5 goes LOW.

The four D flip-flops of IC 206 and IC 207 provide the division by 16 of the time base frequency TB 1.

5.3. Power supply

The power supply operates from 115 V AC or 230 V AC 50 to 400 Hz or from the internal battery PM 9673 or from an external battery with an output voltage of 12 to 28 V. It provides five stabilised and overload-protected voltages of +120 V, +12 V, +5 V, -5 V and -50 V.

The power supply may be divided into the *power input circuit* mainly consisting of the mains transformer T 101 and rectifier GR 167, the *over-voltage protection circuit* mainly consisting of thyristors TS 150, TS 151 and zener diode GR 160, the *voltage regulation circuit* mainly consisting of voltage regulator IC 150, thyristor TS 154, the *DC-to-DC converter* mainly consisting of primary side of transformer T 102, driver TS 152 and switch TS 153.

Power input circuit

When the power supply operates from the *mains*, the 115 V AC or 230 V AC is transformed to 20 V AC by transformer T 101, rectified in the diode-bridge GR 167, filtered by C 152 and C 161 and fed to the power supply circuits via switch SK 121 and SK 102.

When the power supply operates from an *external battery* the current to the power supply circuits is fed from BU 21 at the rear panel via protecting diode GR 164 and switches SK 121 and SK 102.

When the internal battery is used the current is fed from pin 8 of BU 105 via SK 121 and SK 102 to the power supply circuits.

Over-voltage protection

The over-voltage protection circuit consists mainly of thyristors TS 150, TS 151 and zener diode GR 160.

The anode of GR 160 is connected to the +5 V output from the power supply. If this voltage increases to 5.6 V... 5.8 V, the zener diode GR 160 will start to conduct and a current will flow through resistor R 1121. The voltage drop across R 1121 is fed to the gate of thyristor TS 151 via resistor R 1120. The anode is connected to the +5 V output voltage via resistor R 1118.

The thyristor will switch on and a voltage drop arises across resistor R 1122. This voltage is fed to the gate of thyristor TS 150, whose anode is connected to the d.c. input voltage. The thyristor will switch on and blow fuse VL 150, or, if the counter is operating in the internal battery mode, fuse VL 1 in the battery unit PM 9673. The capacitor across the gate and cathode of thyristor TS 151 prevents transients from the mains to blow fuse VL 150 accidentally.

DC to DC converter

The DC to DC converter is basically a blocking oscillator consisting mainly of switch transistor TS 153 and terminals 4—9 of the transformer T 102. When switch SK 102 is set to position ON, the DC voltage from the power input circuit is fed to the transistor TS 155 which works as a constant current source of approximately 1 mA (I_1).

The current I_1 will cause switch transistor TS 153 to start conducting and the linearly increasing current I_2 to flow.

This current I_2 will cause a voltage across terminals 3—8 of the transformer and the current I_3 will start to flow.

This will cause drive transistor TS 152 to saturate switch transistor TS 153. When the transistor no longer can saturate, current I_3 will stop to increase and the induced voltage at terminal 3 of transformer T 102 will disappear.

This will cause TS 153 to switch off and the collector voltage to rise to the same level as the supply voltage. At this moment the magnetic flux will discharge through the secondary windings of T 102 and diodes GR 155—159.

Output voltage regulation circuit

The output voltage regulation circuit consists mainly of voltage regulator IC 150 and thyristor TS 154.

The purpose of the thyristor TS 154 is to switch off the drive transistor TS 152 in order to regulate the output voltage. The switching moment of thyristor TS 154 is determined by a voltage at the gate of the thyristor which is the sum of a DC regulation voltage from terminal 10 of IC 150 and a sawtooth voltage caused by the emitter current of TS 153 through resistor R 1114/R 1115.

The voltage regulator IC 150 is fed at terminal 12 with the supply voltage and at terminal 7 with a negative voltage, via GR 161, from winding 3—8 of transformer T 102.

IC 150 contains a differential amplifier with inputs at terminals 4 and 5.

The input at terminal 5 is grounded via R 1104 and the

input at terminal 4 is connected to a voltage divider that consists of the reference output at terminal 6 and the negative voltage from winding 3—8 of transformer T 102 at terminal 7.

The differential amplifier is in balance when the voltage at terminal 7 is -5 V. When the supply voltage across windings 4—9 of transformer T 102 increases, the voltage at the differential amplifier at terminal 7 of IC 150 will go more negative, the DC regulation voltage at terminal 10 of IC 150 will go positive and turn on thyristor TS 154. This will connect the base of driver transistor to the ground and cause switch transistor TS 153 to switch off. The stored magnetic flux will then discharge in the secondary windings of T 102 and diodes GR 155—GR 159.

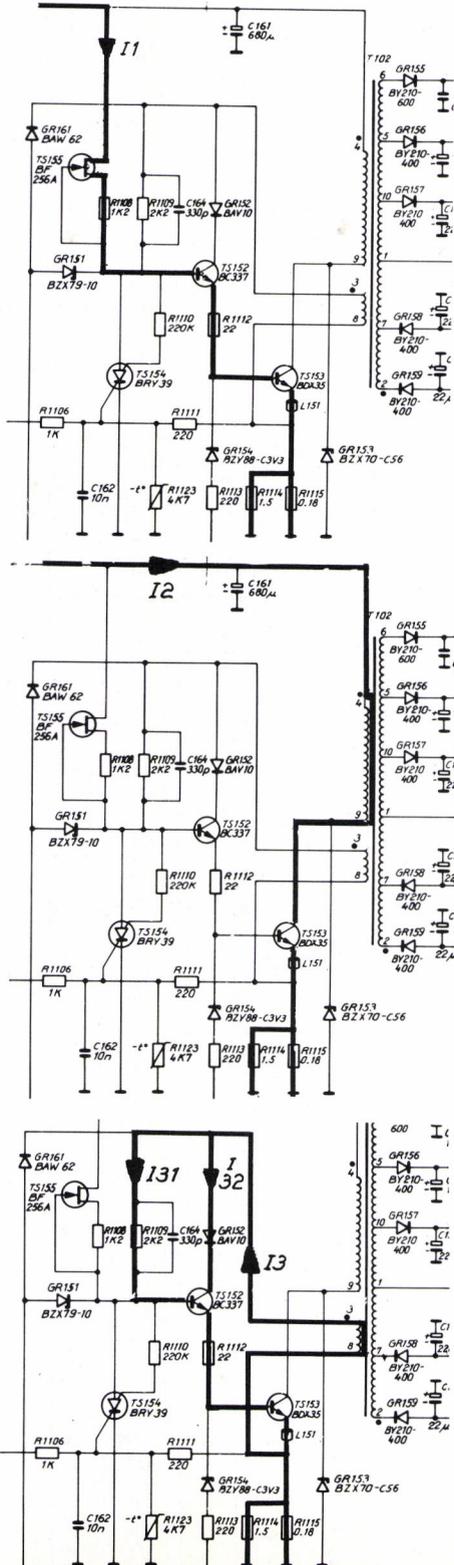


Fig. X-1. Current paths in DC-to-DC converter

6. Test conditons

6.1. DC voltages.

The d.c. voltages in the circuit diagrams are typical and may vary slightly between instruments.

Unless otherwise stated the voltages are positive related to earth and measured without input signal. The test instrument can be analogue or digital with an input impedance of at least 40 k Ω /V.

NOTE. When measuring d.c. voltages in the input amplifier of the prescaler use sampling oscilloscope PM 3400 and FET probe PM 9353.

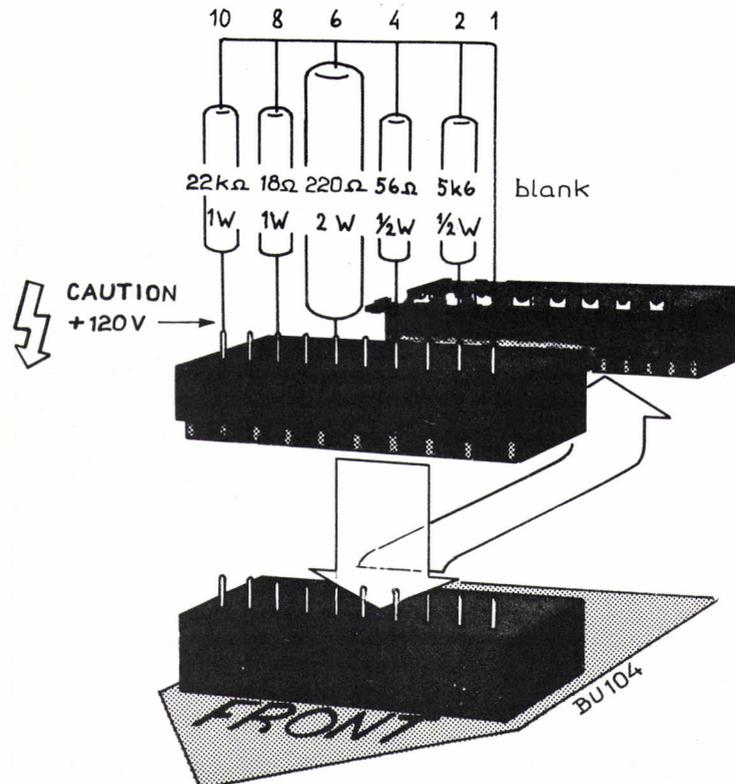
6.2. Troubleshooting the power supply section

A fault in the power supply can be isolated easier if the counter circuits are disconnected by removing

10-pins connector BU 107. However, to simulate the load, a dummy load has to be fitted as shown in the figure. The dummy load can be assembled of the following components:

| | |
|---|----------------|
| 1 female connector 10 pins | 5322 267 54102 |
| 1 carbon resistor 22 Ω , 1 W | 4822 110 23143 |
| 1 carbon resistor 220 Ω , 1 W | 4822 110 23089 |
| 1 carbon resistor, 18 Ω , 2 W | 4822 110 10061 |
| 1 carbon resistor, 56 Ω , 0.5 W | 4822 110 53074 |
| 1 carbon resistor, 5.6 k Ω , 0.5 W | 4822 110 53127 |

CAUTION: + 120 V at pin 10 of the connector!



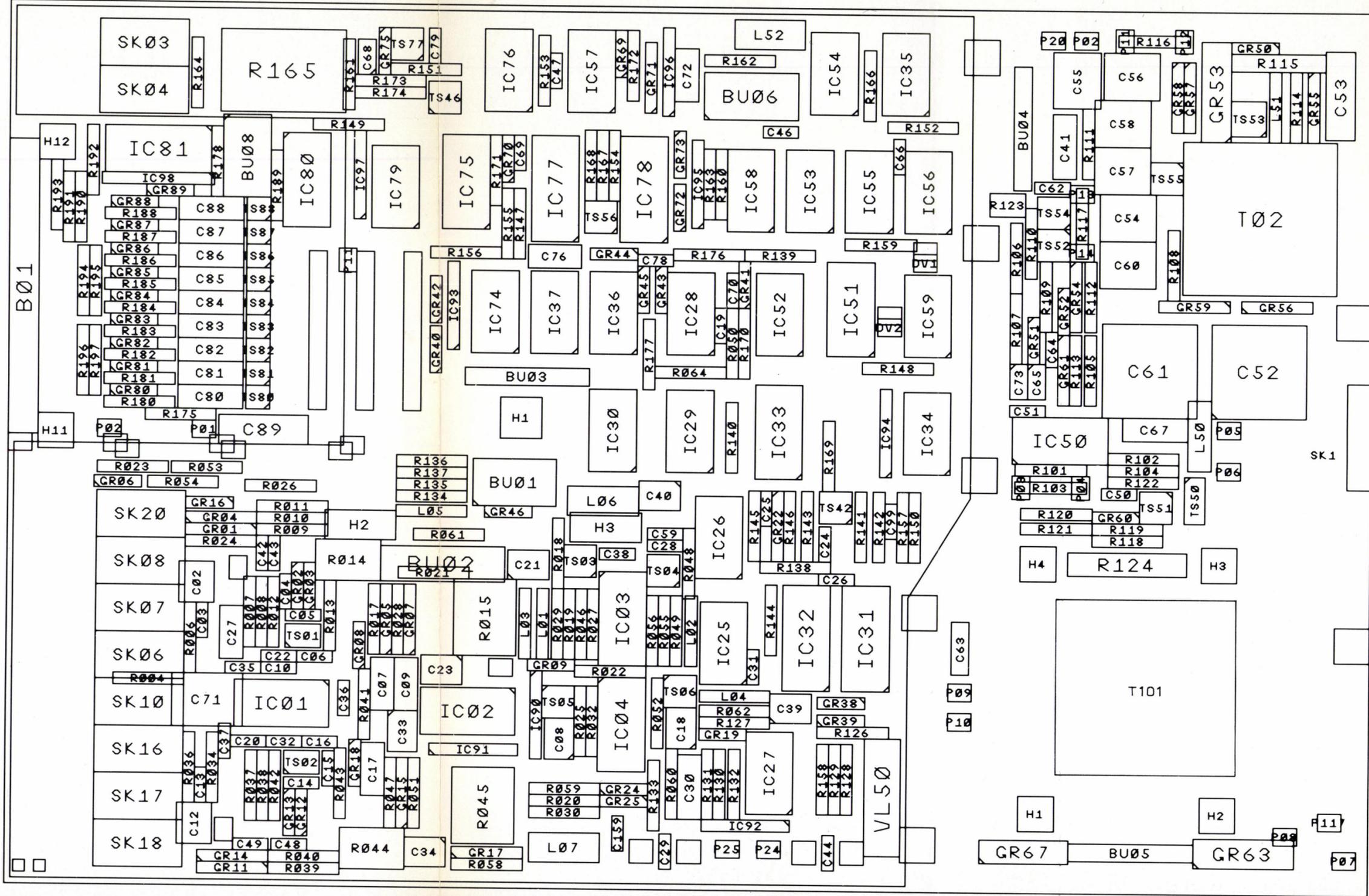
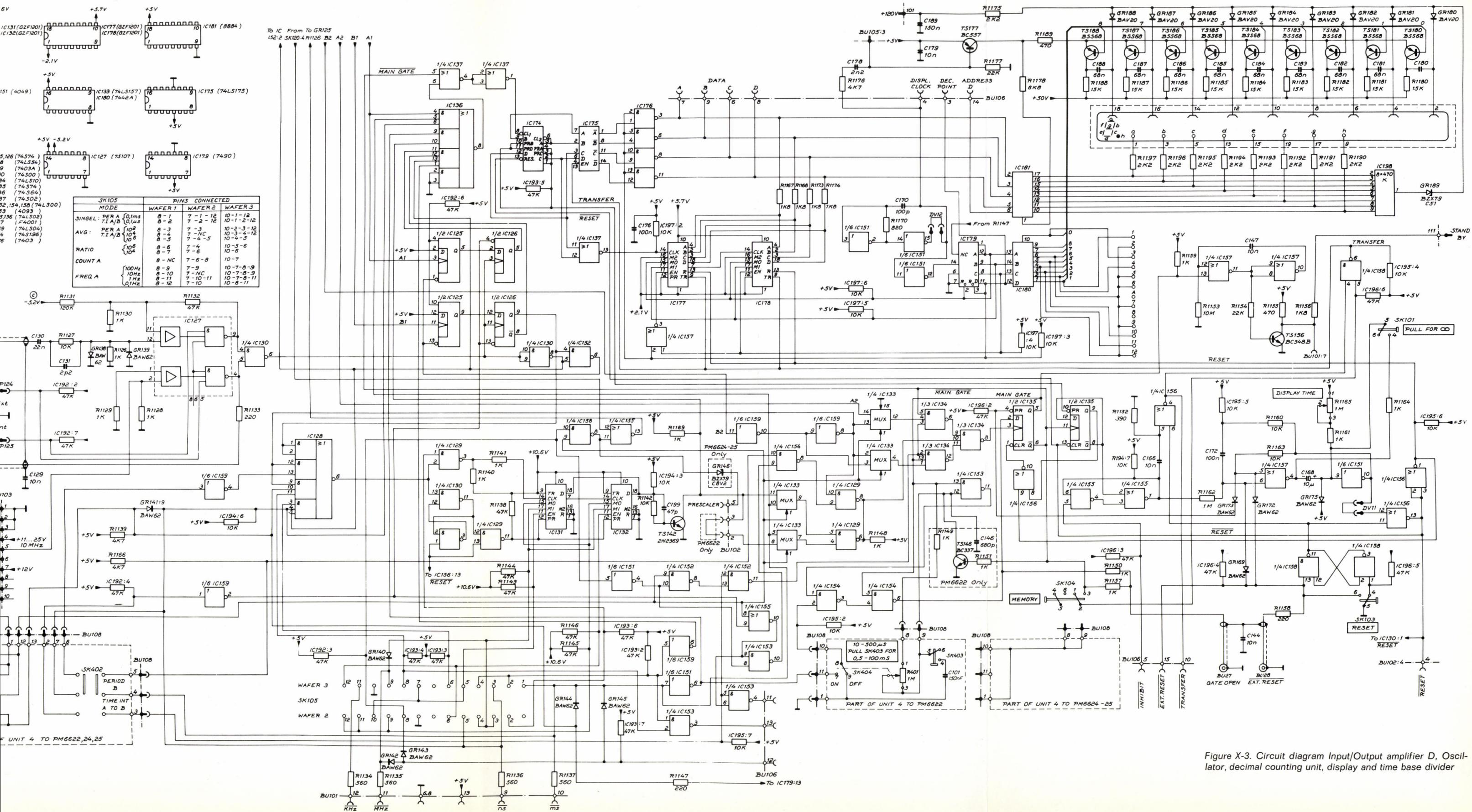


Figure X-2. Component layout U1



| SK105 MODE | PINS CONNECTED | | |
|----------------------------|----------------|---------|-----------|
| | WAFER 1 | WAFER 2 | WAFER 3 |
| SINGEL: PER A 0.1ms | 8-1 | 7-1-12 | 10-1-12 |
| T I A/B 0.1ms | 8-2 | 7-2-12 | 10-1-2-12 |
| AVG: PER A 10 ² | 8-3 | 7-3 | 10-2-3-12 |
| T I A/B 10 ² | 8-4 | 7-NC | 10-3-4-12 |
| J O 7-4-5 | 8-5 | 7-4-5 | 10-4-5 |
| RATIO 10 ⁶ | 8-6 | 7-4 | 10-5-6 |
| J O 4 | 8-7 | 7-6 | 10-6 |
| COUNT A | 8-NC | 7-6-8 | 10-7 |
| 100Hz | 8-9 | 7-9 | 10-7-8-9 |
| 10Hz | 8-10 | 7-NC | 10-7-8-9 |
| 1Hz | 8-11 | 7-10-11 | 10-7-8-11 |
| 0.1Hz | 8-12 | 7-10 | 10-8-11 |

Figure X-3. Circuit diagram Input/Output amplifier D, Oscillator, decimal counting unit, display and time base divider

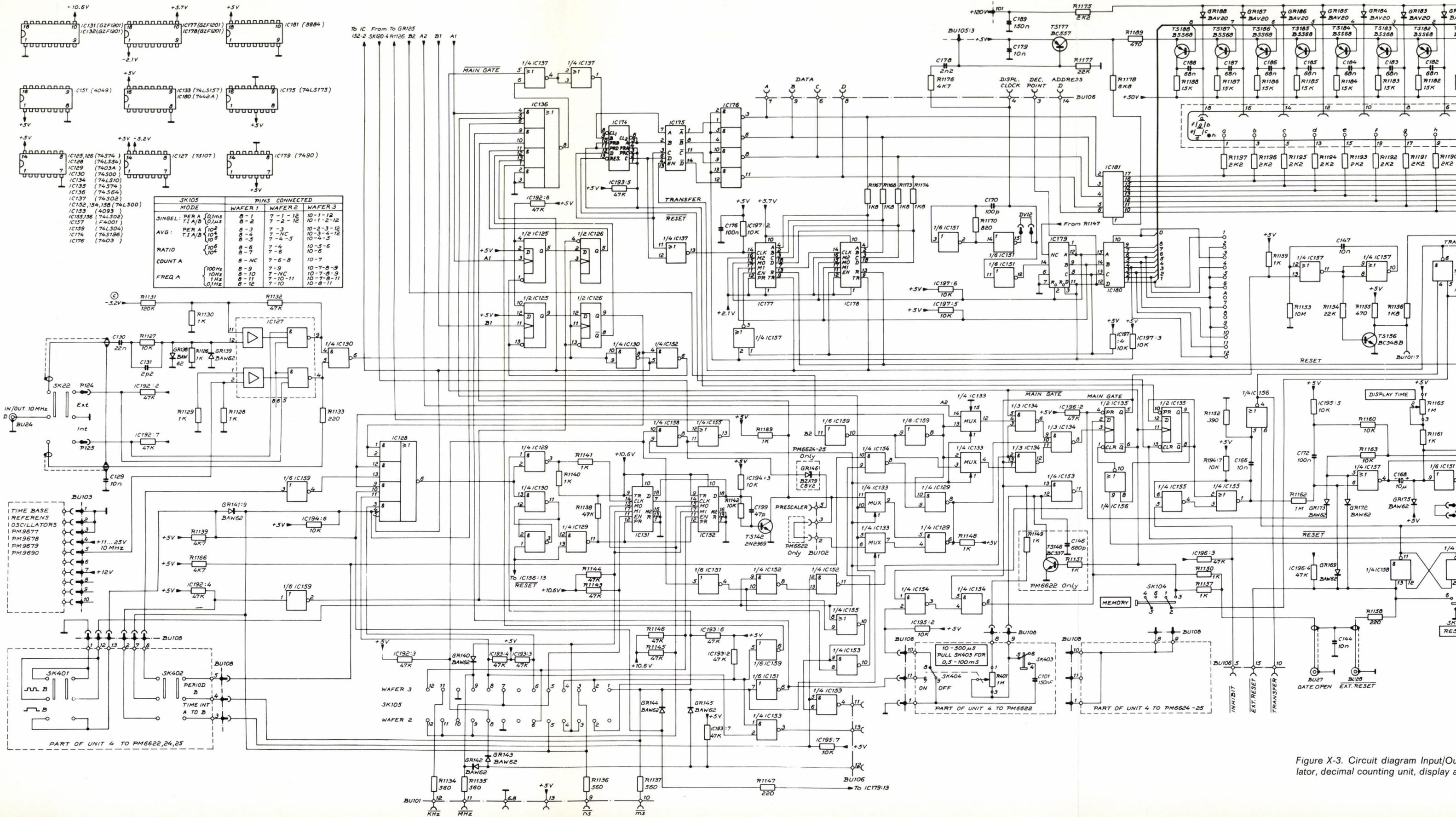


Figure X-3. Circuit diagram Input/Output, decimal counting unit, display and

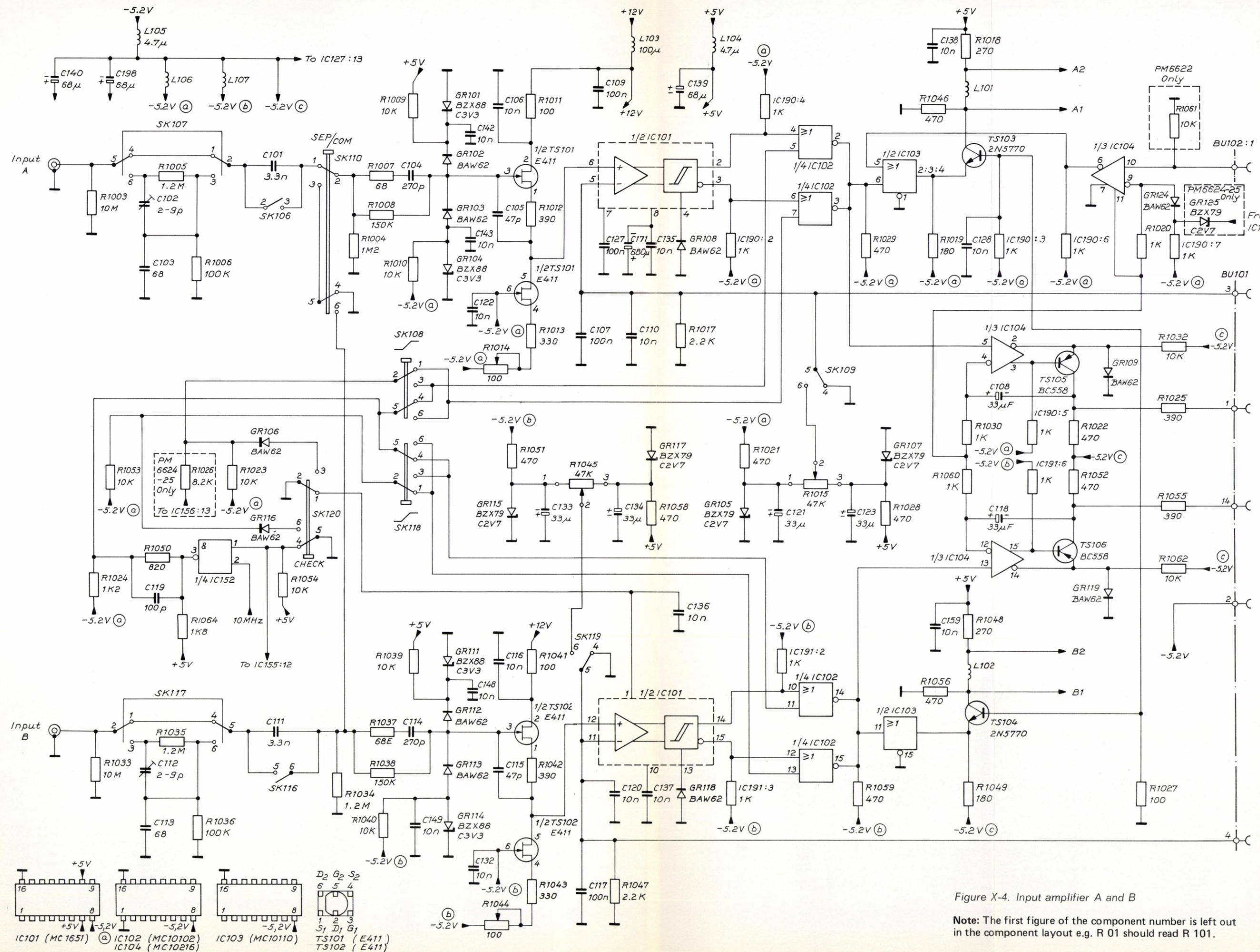


Figure X-4. Input amplifier A and B

Note: The first figure of the component number is left out in the component layout e.g. R 01 should read R 101.

- IC101 (MC 1651)
- IC102 (MC10102)
- IC103 (MC10110)
- IC104 (MC10216)
- TS101 (E411)
- TS102 (E411)

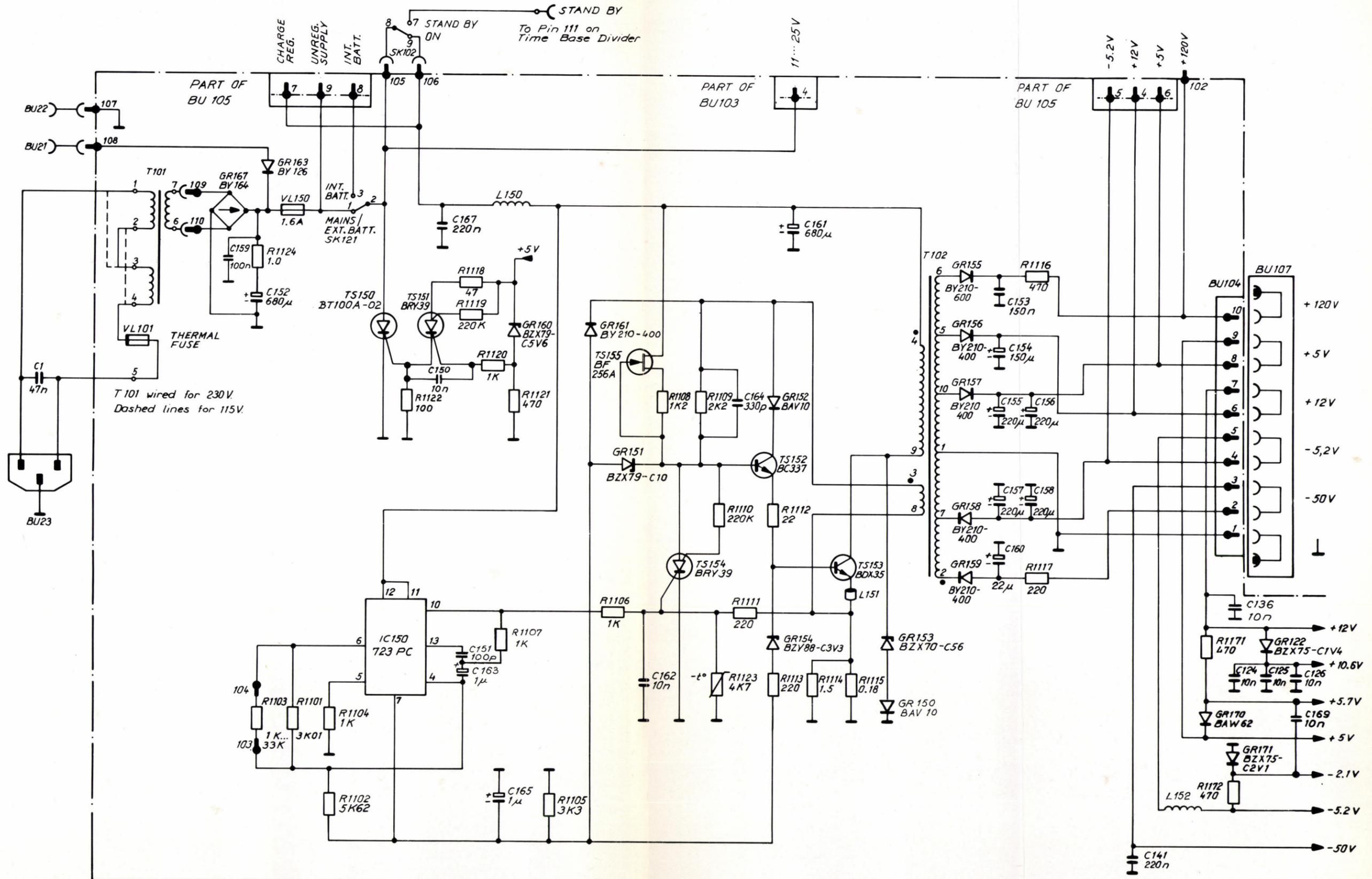


Figure X-5. Power supply

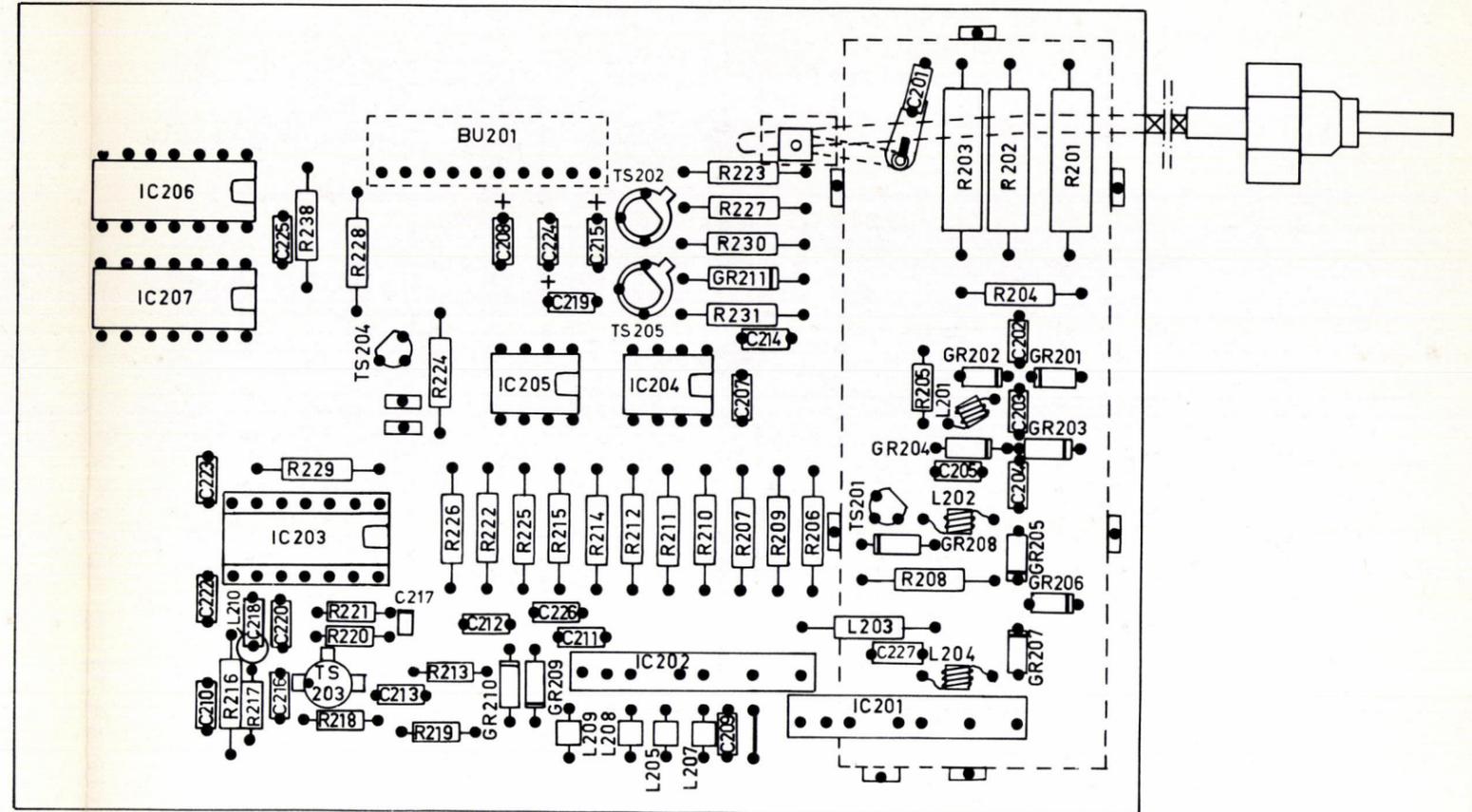


Figure X-6. Component layout prescaler PM 6624, Component side

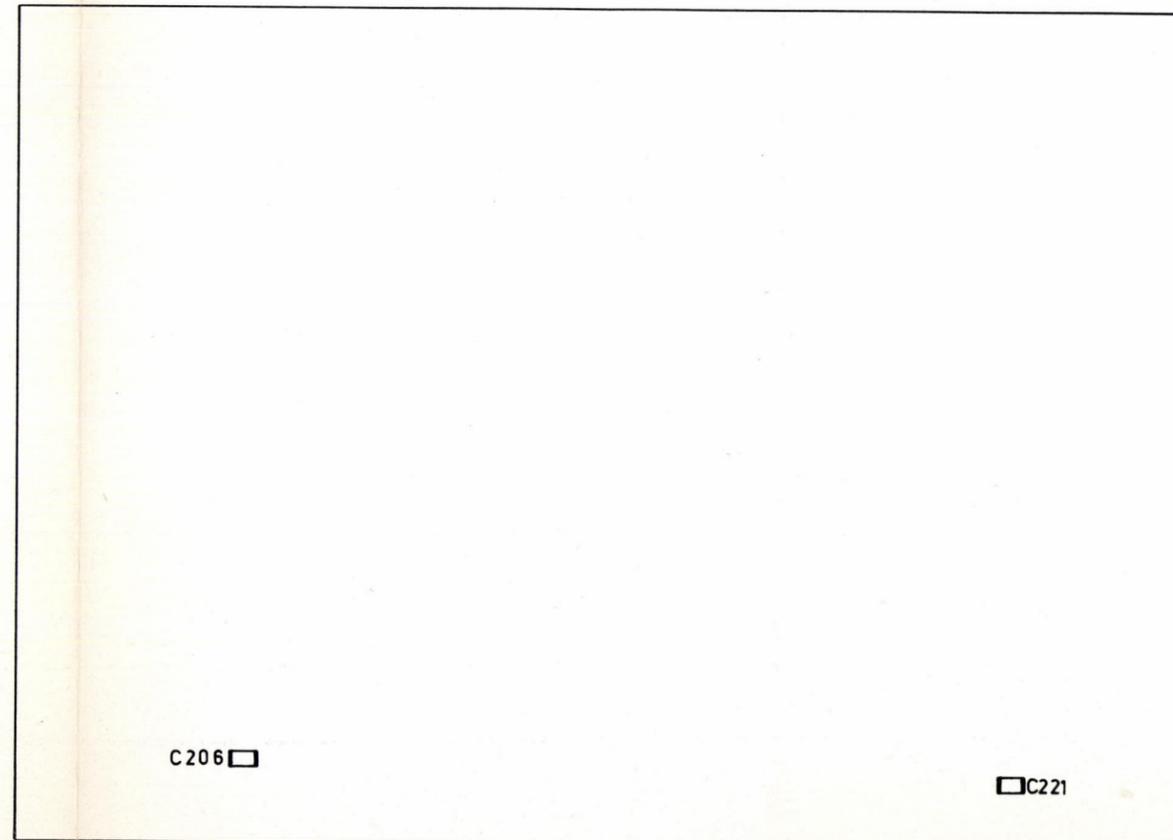


Figure X-7. Component layout prescaler PM 6624, Soldering side

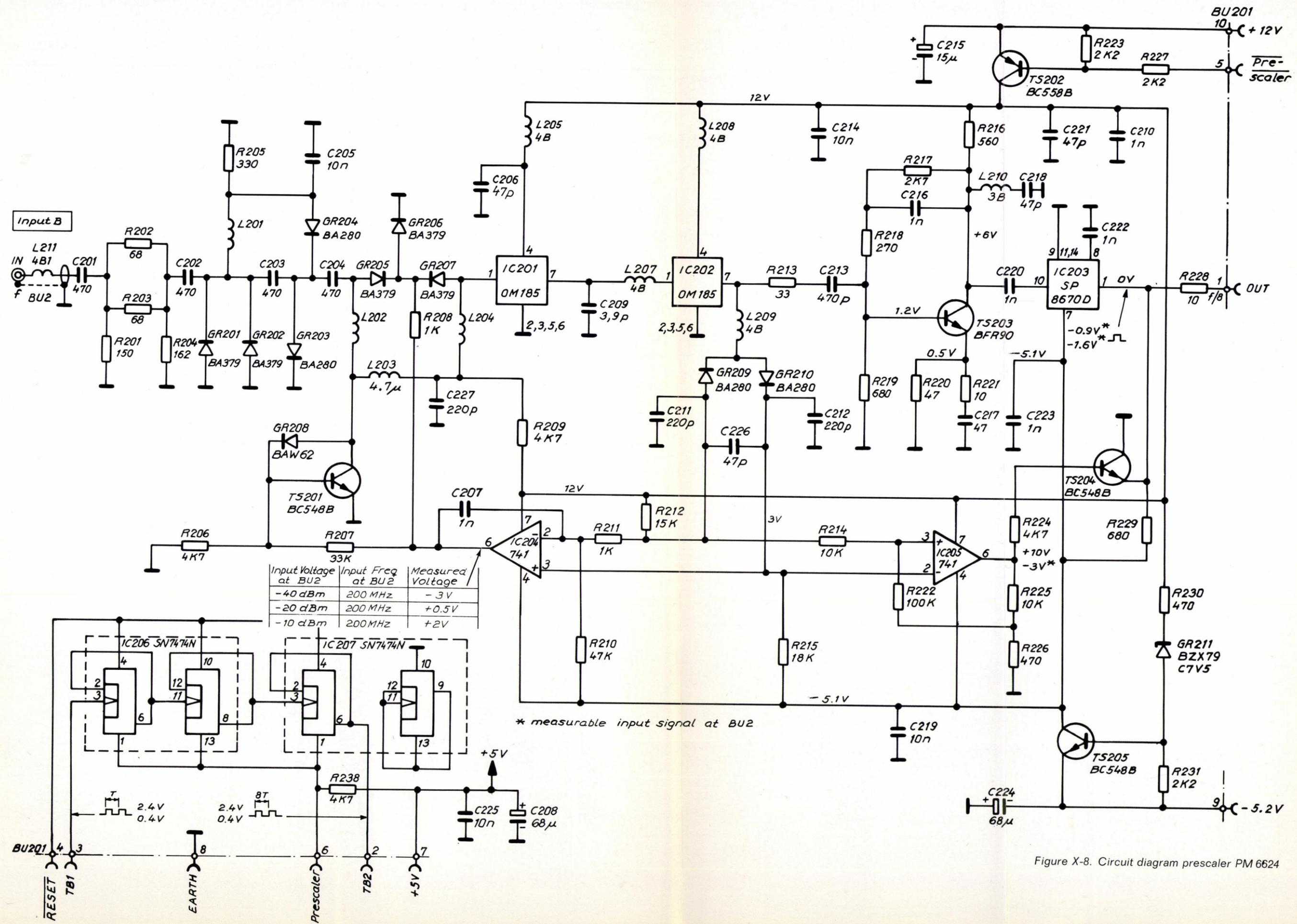


Figure X-8. Circuit diagram prescaler PM 6624

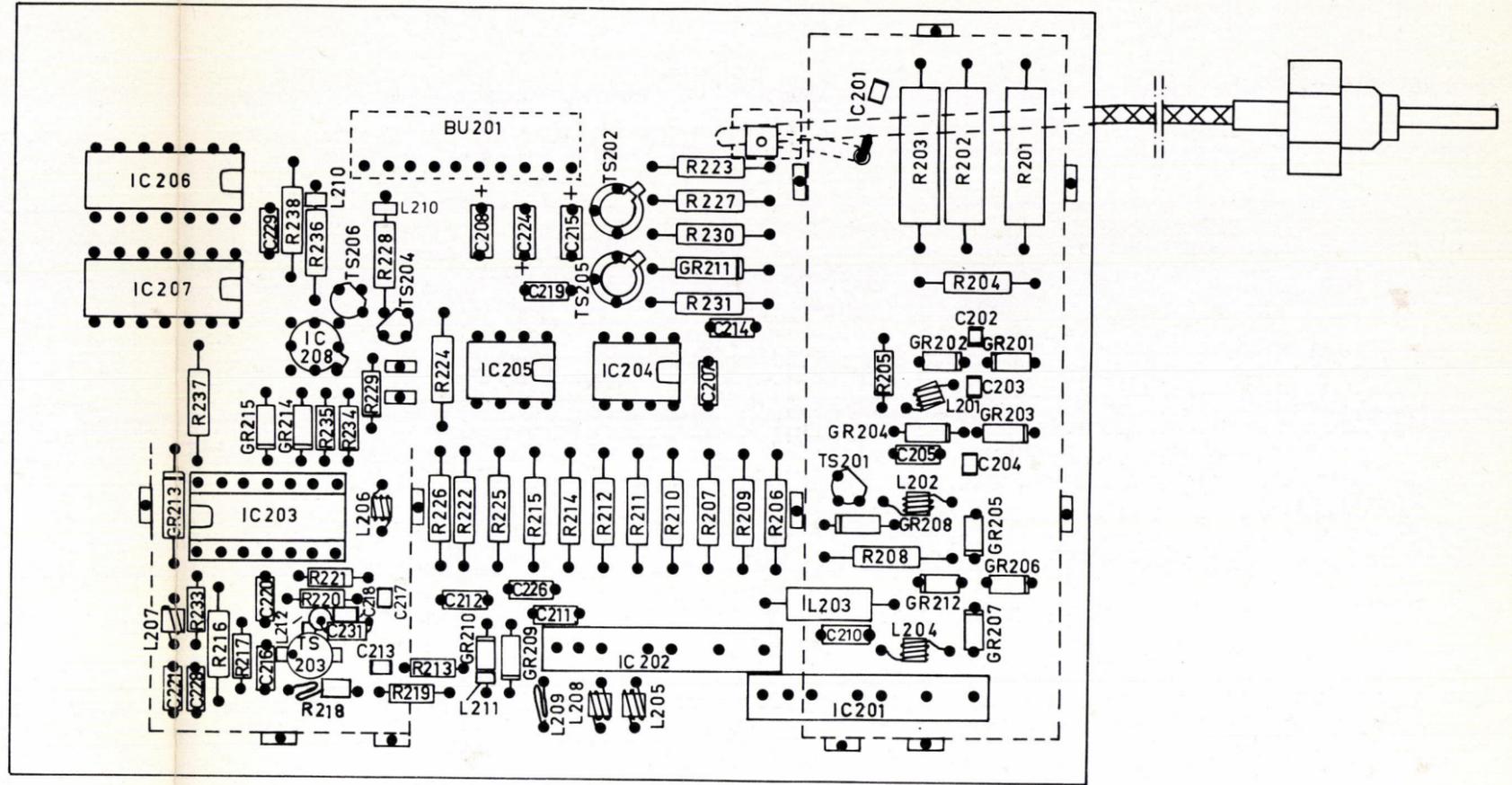


Figure X-9. Component layout prescaler PM 6625, Component side

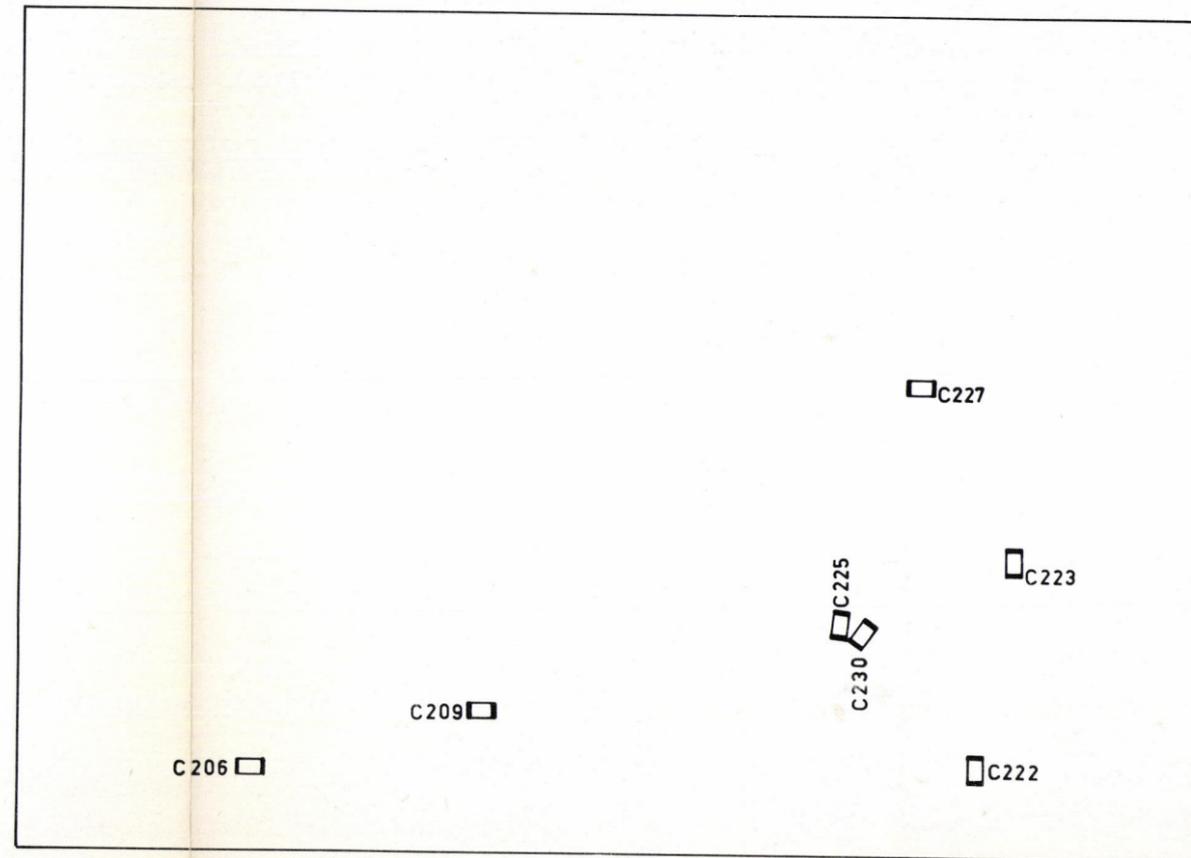


Figure X-10. Component layout prescaler PM 6625, Soldering side

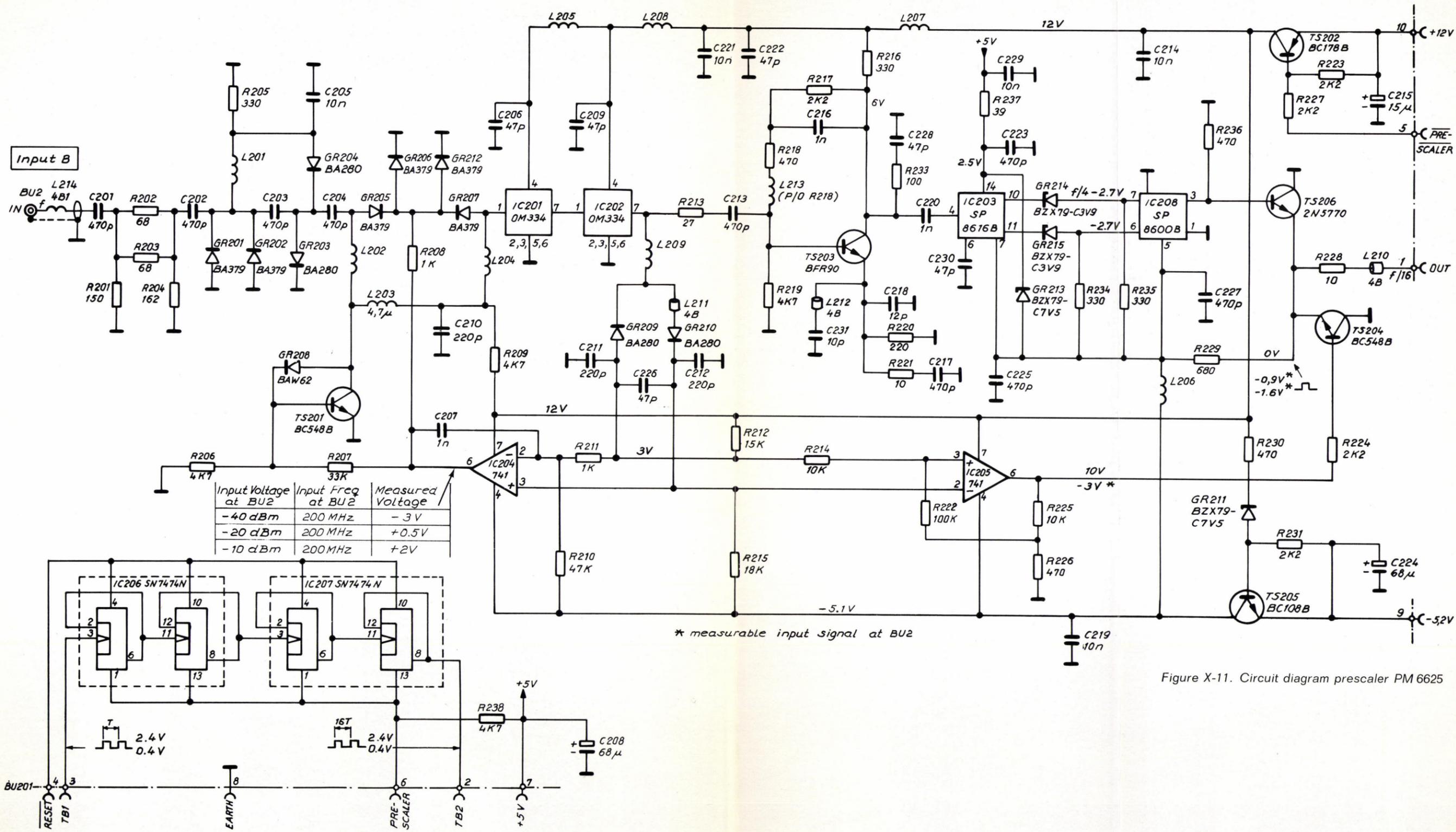


Figure X-11. Circuit diagram prescaler PM 6625

QUALITY REPORTING

CODING SYSTEM FOR FAILURE DESCRIPTION

The following information is meant for Philips service workshops only and serves as a guide for exact reporting of service repairs and maintenance routines on the workshop charts.

For full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for Test and Measuring Instruments).

LOCATION

Unit number

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

or: Type number of an accessory (only if delivered with the equipment)

e.g. 9051 or 9532 (for PM 9051 or PM 9532)

or: Unknown/Not applicable
0000

CATEGORY

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

COMPONENT/SEQUENCE NUMBER

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

| | |
|--------|-------------------------------|
| GR1003 | Diode GR1003 |
| TS0023 | Transistor TS23 |
| IC0101 | Integrated circuit IC101 |
| RO.... | Resistor, potentiometer |
| CO.... | Capacitor, variable capacitor |
| BO.... | Tube, valve |
| LA.... | Lamp |
| VL.... | Fuse |
| SK.... | Switch |
| BU.... | Connector, socket, terminal |
| TO.... | Transformer |
| LO.... | Coil |
| XO.... | Crystal |
| CB.... | Circuit block |
| RE.... | Relay |
| BA.... | Battery |
| TR.... | Chopper |

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 |

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