HORIZONTAL OUTPUT BOARD

LDK 4808/00

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A. TECHNICAL DATA

| | |
|---|---|
| Input signal | : H-pulse, negative going, 3.5 Vpp with a duration of 5.5 µsec. High ohmic input. |
| Master Ampl. Control | : Adjustable from 75 % to 120 % |
| Individual Ampl. Control | : ≥ 2.5 % of the nominal value (100 %) |
| Master Lin. Control | : The range is ≥ 1.5 % |
| Individual Lin. Control | : The range is ≥ 1 % |
| Supply voltage | : -12.9 V |

C. SERVICE PARTS

1. Mechanical

| | | |
|---|---|---|
| | Spacer for transistors | 4822 255 40006 |

2. Electrical

| Item Pos. | Description | Code number |
|---|---|---|
| TS1-2-6-13-14-15-17 18-19-20-21-22-23 25-27 | BCY70 Silicon transistor PNP | 4822 130 40324 |
| TS3-8-9-10-12-16-20-24-26 | BCY56 Silicon transistor NPN | 4822 130 40325 |
| TS4-5-7-11 | BFY50 Silicon transistor NPN | 4822 130 40294 |
| GR1-5-7-9-11-13-15-16 | BA148 Silicon diode | 4822 130 30256 |
| GR2-3-4-6-8-10-12-14 | BAY38 Silicon diode | 4822 130 40256 |
| T1 | Transformer | 4822 158 30153 |
| T2 | Transformer | 4822 158 30154 |
| T3 | Transformer | 4822 158 30152 |
| T4 | Transformer | 4822 158 40064 |
| T5-7-9 | Transformer | 4822 158 30151 |
| T6-8-10 | Transformer | 4822 158 30155 |
| L1 | Coil | 4822 158 20309 |
| L2 | Coil | 4822 158 50036 |
| L3-6 | Coil | 4822 158 10288 |
| C1 | 0.1 µF 100 V Polyester | 4822 121 40036 |
| C2-9-22-26-32-38 | 2700 pF 125 V Polyester | 4822 121 50435 |
| C3-23 | 1200 pF 500 V Polyester | 4822 121 50188 |
| C4-29-35-41-45 | 680 pF 500 V Polyester | 4822 121 50181 |
| C5-44 | 10.000 pF 200 V Polyester | 4822 121 40088 |
| C6-21-43 | 150 µF 15 V Tantalum | 4822 124 10074 |
| C7-24-25-28-31-34-37-40-47 | 56 µF 6 V Tantalum | 4822 124 10044 |
| C8 | 12 K 63 V Polyester | 4822 121 50342 |
| C9-11-13 | 330 µF 6 V Tantalum | 4822 124 10081 |
| C10-12-14-15 | 27 µF 10 V Tantalum | 4822 124 10079 |
| C16 | 0,47 µF 35 V Tantalum | 4822 124 10098 |
| C18 | 33 K 250 V Polyester | 4822 121 40092 |

B. CIRCUIT DESCRIPTION

The negative control pulse is amplified by TS1 and applied to driver transistor TS4 via emitter follower TS3. During this pulse TS4 is conductive and C2 is charged by the base current. When the pulse disappears, C2 is discharged via TS4 and R4. However, R4 is short-circuited by TS2 and C2 discharges rapidly so that TS4 is immediately cut off. Via transformer T1 (input impedance of TS5 is very low) the pulse drives output transistor TS5.

Fig. 1 shows the basic diagram of the output stage.

The battery voltage is the emitter voltage of TS6.

Via capacitors C9-C11-C13, the deflection coils are parallel connected to L1.

When TS5 is bottomed (scan time), L1 is connected to earth. As a result the battery voltage will be present across L1; through L1 flows a linearly increasing negative current.

C9-C11-C13 also function as batteries for the deflection coils, so that also a linearly increasing negative current is obtained through the deflection coils. At the end of the scan TS5 is cut off. L1 and the deflection coils form a tuned circuit together with C8.

Fig. 2 shows the voltage across C8 and the current through L1.

Time t2 (flyback time) is determined by C8 and L1 and the deflection coils. At the end of t2, the voltages across C8 will become positive and also the voltage on the emitter of TS5.

The base-emitter diode of TS5 now becomes conductive.

The voltage across the coils is constant again and the current through the coils is again a negative, linearly increasing (t3) current. The amplitude of the deflection current depends on the battery voltage, in this case the emitter-voltage of TS6.

This is the amplitude control for the three deflection coils together (master ampl.).

Fig. 3 shows the simplified diagram of the circuit.

Because a deflection coil has an ohmic resistance, the current through the coil will not increase exactly linearly. To compensate for this non-linearity, a sawtooth voltage is applied in series, which is in anti-phase with the voltage drop across the coil resistance. This is effected via T2. The original sawtooth current flows via TS7 through the primary winding of T2 and the sawtooth voltage on the secondary winding is connected in series with the deflection coils. The amplitude of this sawtooth voltage determines the linearity of the deflection current.

Now assume that the deflection current through the three deflection coils increases due to an increase of the emitter voltage of TS6. This is done with the master amplitude control, connected to the base of TS6. As a result, the non-linear sawtooth voltage across the deflection coil resistances increases. However, the increased deflection current also flows through the primary winding of T2.

Consequently the compensating sawtooth voltage across the secondary winding of T2 increases, so that the original linearit does not change.

With the master linearity control, the linearity can be varied over a small range. T5-T7 and T9 are the individual amplitude controls. Via these transformers, adjustable drive pulses can be applied in series with the deflection coils.

T6, T8 and T10 are the individual linearity controls.

Via these transformers adjustable sawtooth voltages can be applied in series with the deflection coils.

Let us now follow the details of the main diagram, Fig. 4.

The voltage for overall amplitude control is applied to point 21. Via TS8 this voltage determines the emitter voltage of TS6. The emitter impedance of TS6 is very low on account of TS7. For, when the current through TS6 increases, the current through TS7 will also increase, viz. with the gain factor.

A slight voltage variation on the emitter of TS6 will therefore result in a very strong current variation; consequently the impedance is very low. The sawtooth current which is to be applied to T2 for overall linearity control is supplied by circuit TS24, 25, 26, 27.

Transistor TS27 functions as a switch, which is operated by the pulse on its base. On the other end of L6 the direct voltage from the emitter of TS25 is present. Through L6 a sawtooth current flows: C45 determines the flyback time.

Via TS25-24 the sawtooth current reaches T2. The control voltage on point 3 determines the emitter voltage of TS25 and thus the amplitude of the sawtooth current. TS24 serves to provide a low emitter impedance for TS25. Of the individual controls only that for the red channel is described, as this is identical to those for green and blue.

TS13 is a switching transistor, and through T5 flows a sawtooth current whose amplitude depends on the emitter voltage of TS12.

Transformer T5 supplies the pulse voltage to the red deflection coil and thus determines the amplitude of the deflection current (compare Fig. 3).

TS15 is also a switching transistor. Through L3 a sawtooth current flows whose amplitude depends on the emitter voltage of TS14. The current through T6 is also sawtooth-shaped. R39 is very low ohmic; as a result the voltage across T6 will also be sawtooth-shaped. This voltage is applied in series with the red deflection coil and consequently determines the linearity of the deflection current. The circuits for overall and individual linearity as well as those for individual amplitude, are controlled by a pulse coming from T4.

A tertiary winding of T4 supplies rectifier GR3.

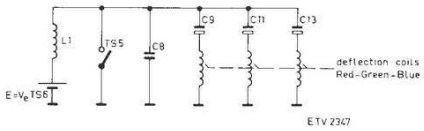
This rectifier delivers a low positive voltage for individual amplitude control.

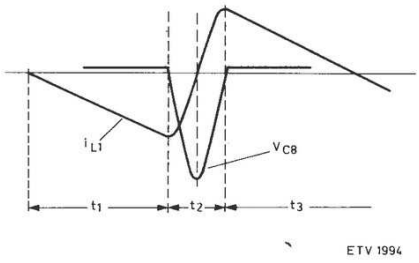
In the base circuits of the various transistors an RC filter has been included (e. g. C4-R8 for TS5). These filters improve the rise time of the drive pulse.

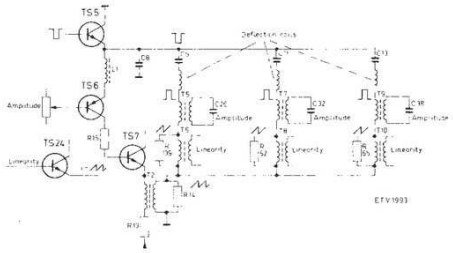
GR1 is conductive during the forward scan so that TS5 will have a low input impedance. R9 serves to discharge C4.

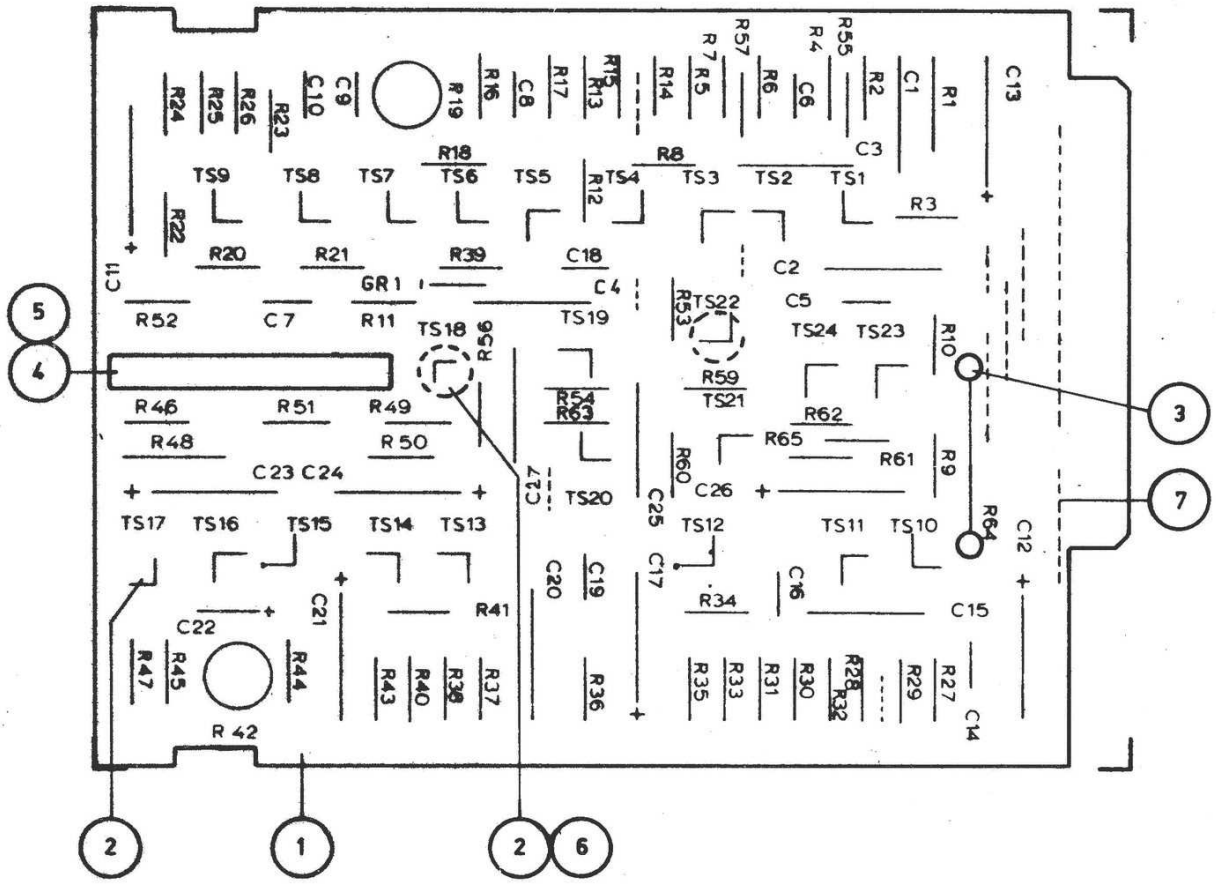
Filters C10-R20-C1-R21, C13-R22, C15-R23 are damping filters. They damp the oscillations arising on account of the flyback of the skew correction sawtooth voltages. The shift current through the deflection coils is supplied by L2, which

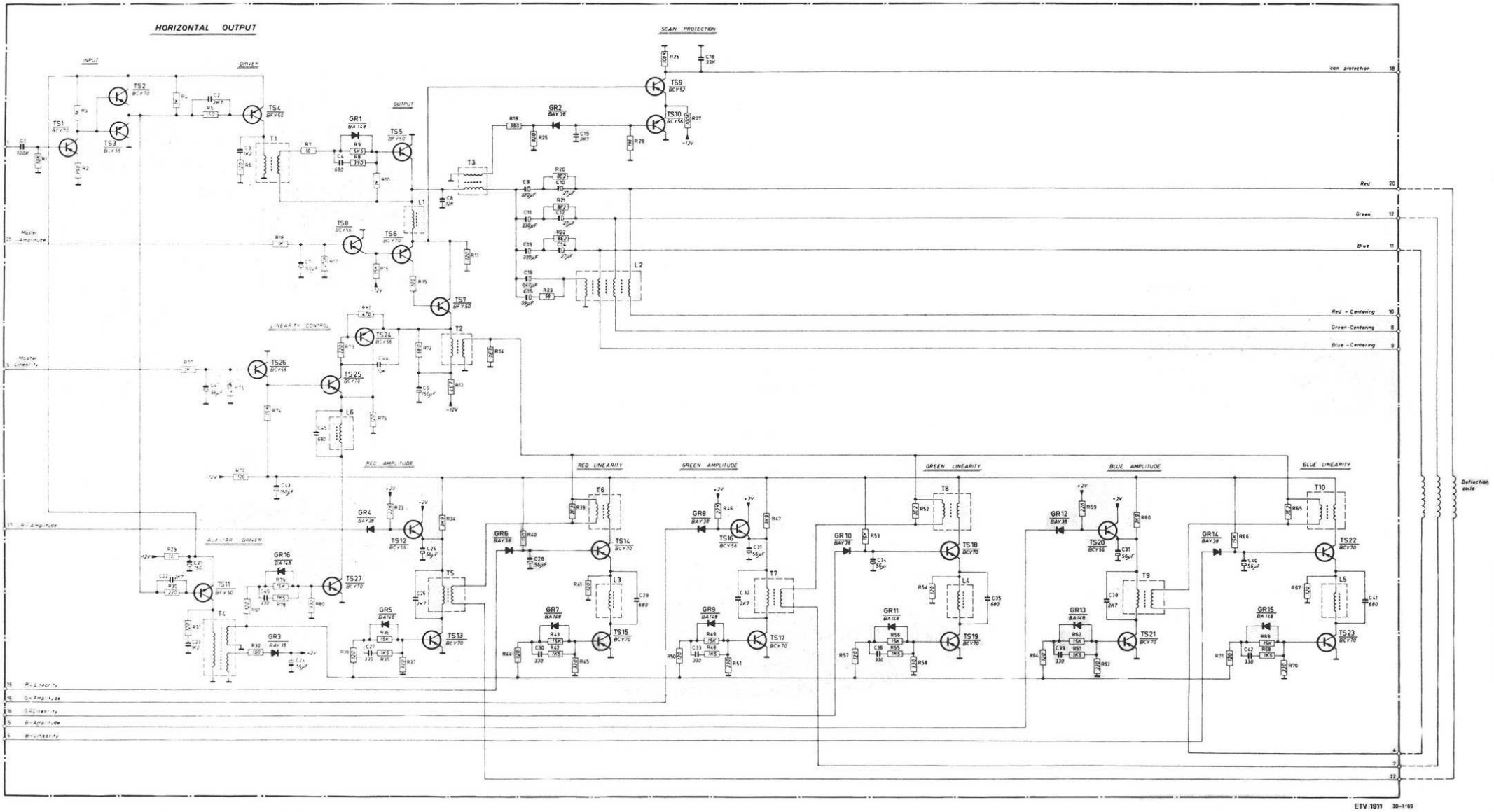
via points 8, 9, 10 receives direct voltages of adjustable value and polarity. Moreover, sawtooth voltages of vertical frequency are applied to these points for skew correction.
The windings of L2 serve as a choke. To increase their effect, a pulse is induced in three windings via C15-16 and a fourth winding. This pulse is in phase opposition with the pulse on the deflection coil. As a result, there will be no pulse on the sides of the windings to which the deflection voltages are applied; the windings then represent a very high self-inductance.
Protection against too low a deflection voltage is obtained with differential amplifier TS9-10. To TS9 the emitter voltage of TS6 is applied (amplitude control). Transformer T3 supplies a pulse to GR2; the amplitude of this pulse depends on the deflection current. GR2 is a rectifier; the rectified voltage controls TS10. At nominal deflection TS9 is conductive and TS10 is cut off. As a result, there will be a direct voltage of approx. -3 V on C18. When the amplitude is adjusted, both the base voltage of TS9 and that of TS10 will change to practically the same extent. The voltage on C18 remains almost constant. However, if one deflection coil cuts out, the pulse amplitude on GR2 will decrease approx. 30 %. The base of TS10 then becomes less negative so that this transistor is turned on. Via the emitter voltage TS9 is cut off and the voltage on C18 becomes 0 V. R19 has been selected so, that at minimum scanning the voltage on C18 remains practically constant ($\geq$ 3 V) on account of the amplitude control.

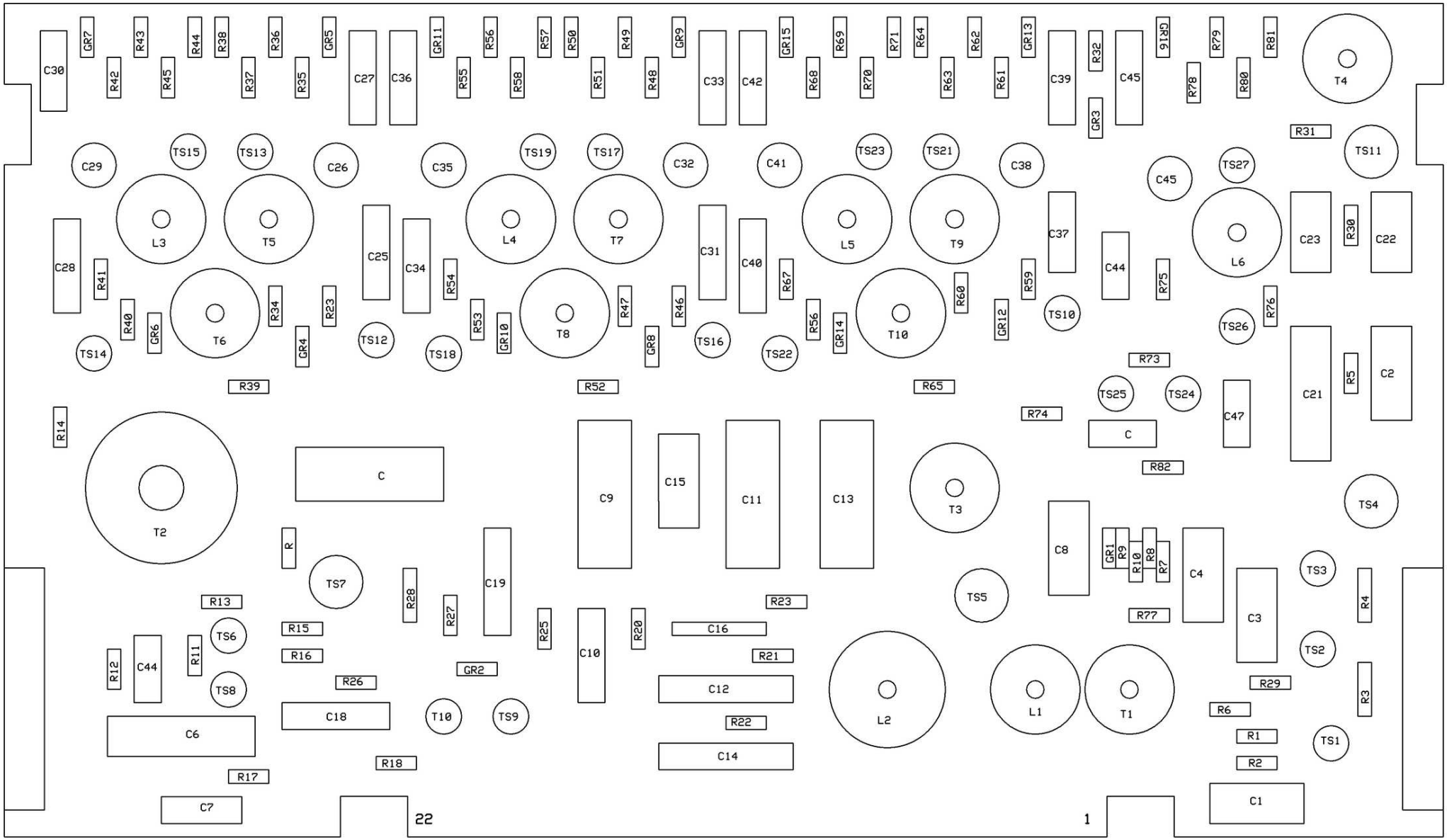


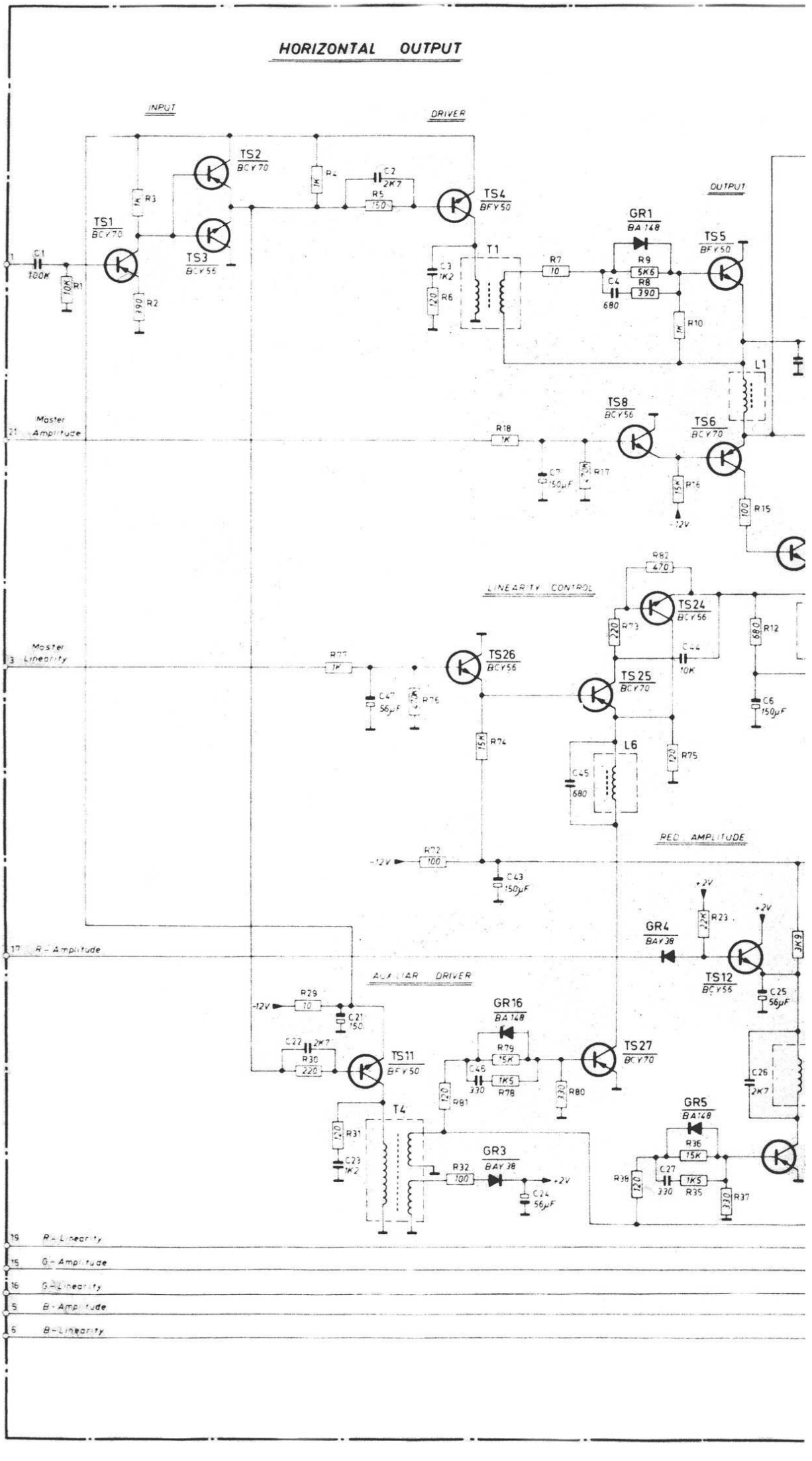



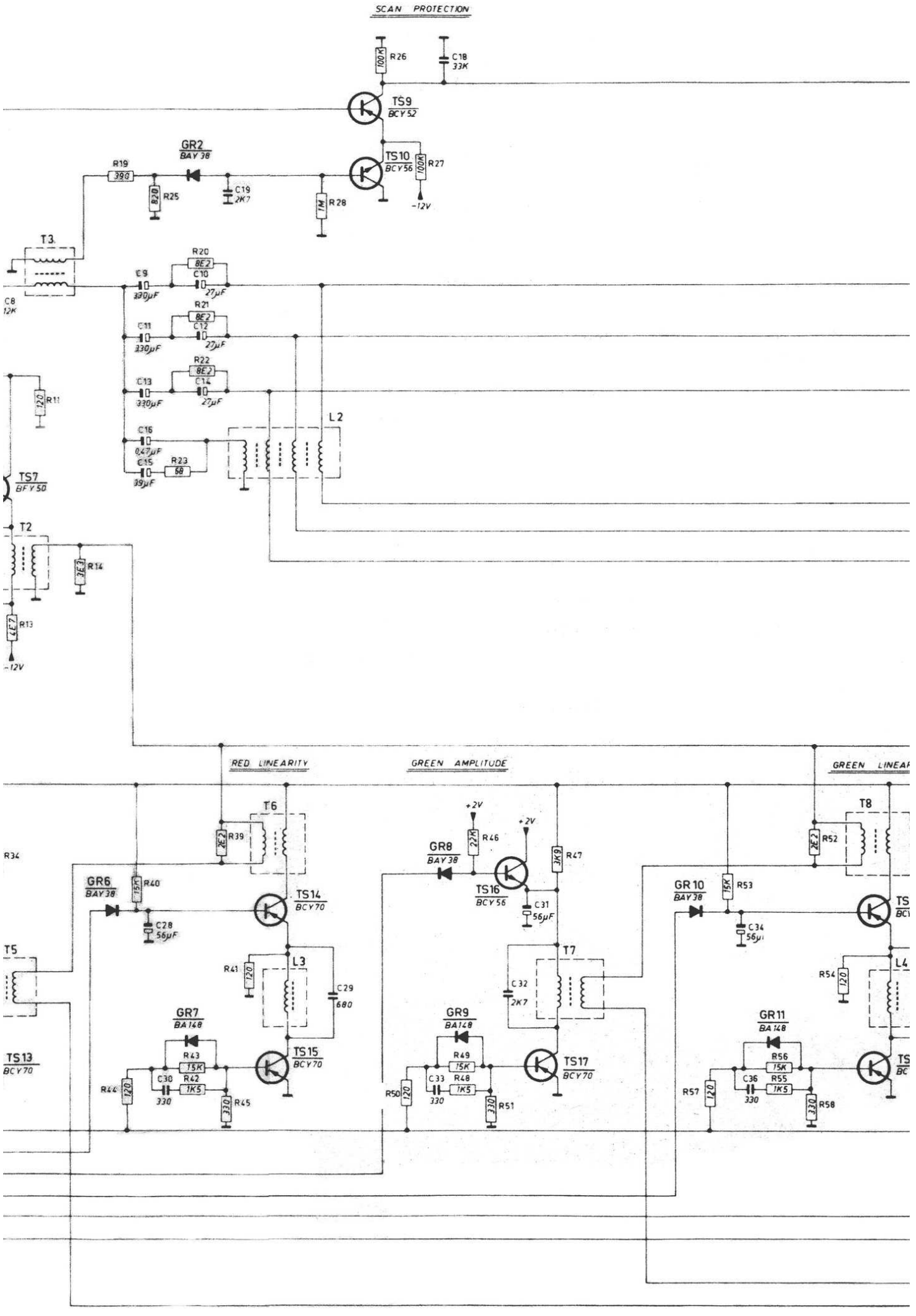

R57
R55
R7
R4
R5
R6
C6
R2
C1
R1
C13
C3
R24
R25
R26
R23
C10
C9
R19
R16
C8
R17
R13
R14
R18
R8
TS9
TS8
TS7
TS6
TS5
TS4
TS3
TS2
TS1
R3
R22
C11
R20
R21
R39
C18
C2
GR1
C4
C5
R52
C7
R11
TS18
TS19
R53
TS22
TS24
TS23
R10
R56
R59
TS21
R46
R51
R49
R54
R63
R62
R48
R50
R65
R61
R9
C23
C24
C27
TS20
R60
C25
C26
TS17
TS16
TS15
TS14
TS13
TS12
TS11
TS10
R64
C12
C22
C21
R41
C20
C19
C17
R34
C16
C15
R47
R45
R44
R43
R40
R38
R37
R36
R33
R31
R30
R28
R32
R29
R27
C14
R 42
5
4
3
7
2
1
2
6

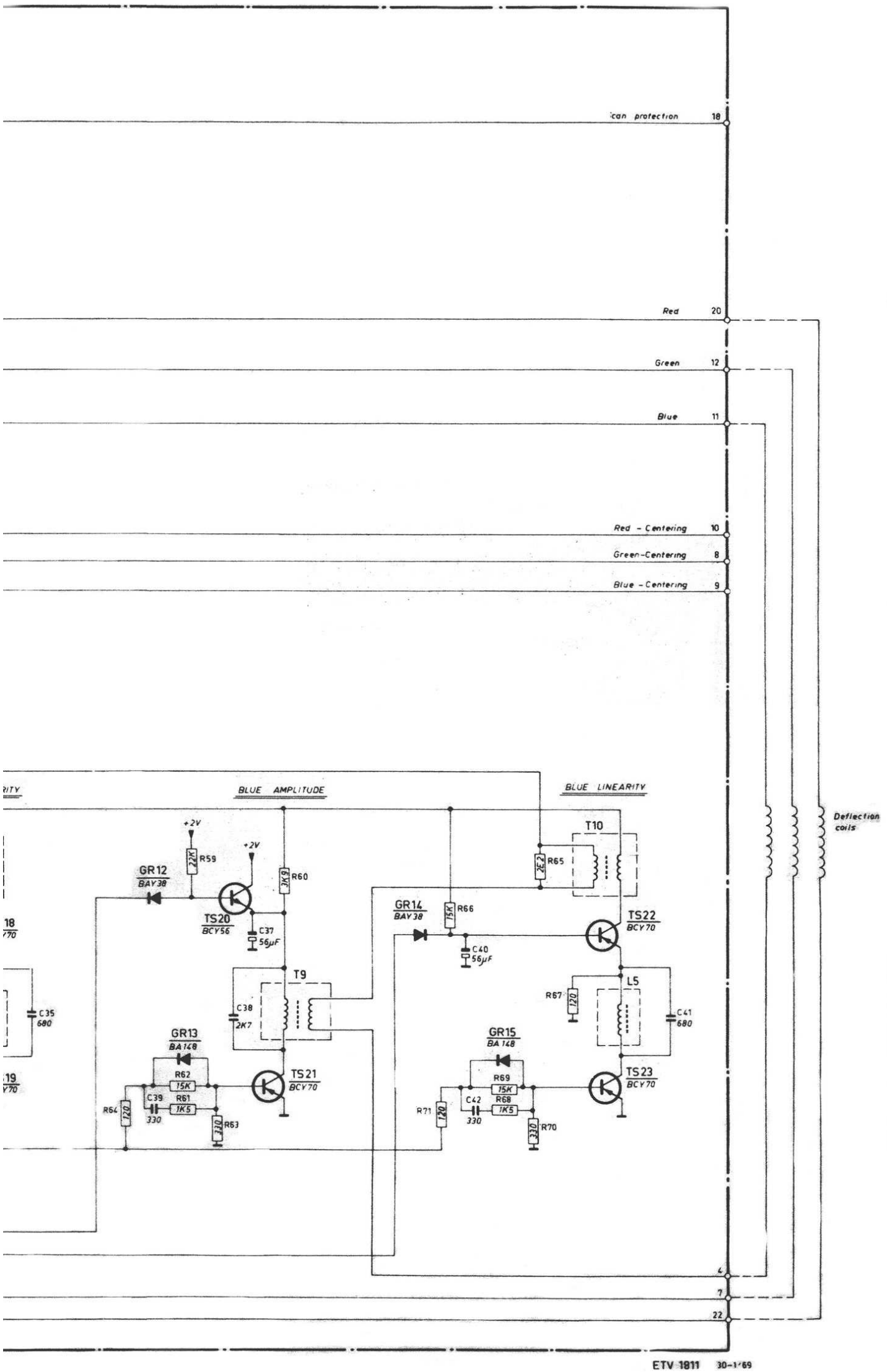

HORIZONTAL OUTPUT
SCAN PROTECTION
INPUT
DRIVER
OUTPUT
LINEARITY CONTROL
RED AMPLITUDE
RED LINEARITY
GREEN AMPLITUDE
GREEN LINEARITY
BLUE AMPLITUDE
BLUE LINEARITY
ALARM DRIVER
Master Amplitude
Master Linearity
R-Amplitude
R-Linearity
G-Amplitude
G-Linearity
B-Amplitude
B-Linearity
Icon protection
Red
Green
Blue
Red - Centering
Green-Centering
Blue - Centering
Deflection coils
ETV 1811 30-1-'69




HORIZONTAL OUTPUT BOARD LAYOUT


HORIZONTAL OUTPUT
INPUT
DRIVER
OUTPUT
TS1 BCY70
TS2 BCY70
TS3 BCY56
TS4 BFY50
TS5 BFY50
TS6 BCY70
TS8 BCY56
GR1 BA148
T1
L1
C1 100K
R1 10K
R2 190
R3 1K
R4 1K
C2 2K7
R5 150
R6 120
C3 1K2
R7 10
C4 680
R8 390
R9 5K6
R10 1K
R18 1K
C7 150µF
R17 2K7
R16 15K
-12V
R15 100
1 Master Amplitude
21 Master Amplitude
LINEARITY CONTROL
TS24 BCY56
TS25 BCY70
TS26 BCY56
R82 470
R73 220
C44 10K
R12 680
C6 150µF
R77 1K
C47 56µF
R76 2K7
R74 15K
L6
C45 680
R75 120
3 Master Linearity
RED AMPLITUDE
R72 100
C43 150µF
+2V
R23 22K
GR4 BAY38
TS12 BCY56
C25 56µF
3K9
17 R-Amplitude
AUXILIAR DRIVER
R29 10
C21 150
C22 2K7
R30 220
TS11 BFY50
GR16 BA148
R79 15K
C46 330
R78 1K5
TS27 BCY70
R81 120
R80 330
C26 2K7
T4
R31 120
C23 1K2
GR3 BAY38
R32 100
C24 56µF
GR5 BA148
R36 15K
C27 330
R35 1K5
R38 120
R37 330
19 R-Linearity
15 G-Amplitude
16 G-Linearity
5 B-Amplitude
6 B-Linearity


SCAN PROTECTION
R26
100K
C18
33K
TS9
BCY52
TS10
BCY56
R27
100K
-12V
GR2
BAY38
R19
390
R20
820
R25
C19
2K7
1M
R28
T3
R20
8E2
C9
330µF
C10
27µF
C8
12K
R21
8E2
C11
330µF
C12
27µF
R22
8E2
C13
330µF
C14
27µF
R11
120
C16
0,47µF
C15
39µF
R23
68
L2
TS7
BFY50
T2
3E3
R14
4E7
R13
-12V
RED LINEARITY
GREEN AMPLITUDE
GREEN LINEAR
T6
2E2
R39
R34
GR6
BAY38
15K
R40
TS14
BCY70
C28
56µF
T5
R41
120
L3
C29
680
GR7
BA148
R43
15K
C30
330
R42
1K5
R44
120
330
R45
TS13
BCY70
TS15
BCY70
+2V
+2V
GR8
BAY38
22K
R46
3K9
R47
TS16
BCY56
C31
56µF
T7
C32
2K7
GR9
BA148
R49
15K
C33
330
R48
1K5
R50
120
330
R51
TS17
BCY70
T8
2E2
R52
GR10
BAY38
15K
R53
C34
56µ
R54
120
L4
GR11
BA148
R56
15K
C36
330
R55
1K5
R57
120
330
R58


Scan protection 18
Red 20
Green 12
Blue 11
Red - Centering 10
Green-Centering 8
Blue - Centering 9
BLUE AMPLITUDE
BLUE LINEARITY
Deflection coils
+2V
+2V
GR12
BAY38
R59
22K
R60
3K9
TS20
BCY56
C37
56µF
T9
C38
2K7
GR13
BA148
R62
15K
C39
330
R61
1K5
R64
120
330
R63
TS21
BCY70
C35
680
T10
R65
2K2
GR14
BAY38
15K
R66
C40
56µF
TS22
BCY70
L5
R67
120
C41
680
GR15
BA148
R69
15K
R68
1K5
C42
330
R71
120
330
R70
TS23
BCY70
4
7
22