



Limiter Amplifier

179-310B

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Draw.No.:

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The limiter amplifier is specially designed as a "safe-limiter" with very high input overload margin to be used in places, where great care should be taken not to overlad the subsequent equipment. Input limiter threshold level and recovery time (dual) can be selected on external switches connected to the 31-pole connector. On the circuit board-edge pre-emphasis and bypass can be switched on/off, and the output threshold level can be adjusted as well. Supply voltage to the limiter can be either symmetrical or unsymmetrical with either positive or negative terminal as reference.

Temperature range	:	0 to 60°C amb.temp.
Supply voltage	:	22V to 32V DC or ±11V to ±16V DC
Max. ripple voltage on supply	:	0.3V rms
Current consumption, at amb.temp. 25°C	:	
after heat-up	:	appr. 65 mA(±15V supply)
during heat-up	:	appr. 200 mA(±15V supply)
Input threshold level (fixed position)	:	+6dBu
(ext. switch)	:	from -10dBu to +10dBu (Note 4)
Output threshold level (factory ad-	:	+6dBu, $R_L = 60\Omega$ Ohms
justment)	:	
Output threshold level adjusting	:	from 0dBu to 10dBu (Note 1 + 4,
range	:	
Threshold level tolerances	:	±0.6dB
Input overload margin	:	≥ 30dB above thr.level
Frequency response (Fig. 1)	:	20 - 20kHz ±0.5dB
Signal to noise ratio	:	≥ 72dB weighted CCIR
Distortion 40-20000 Hz		468-1
a) at threshold	:	≤ 0.1%
b) from threshold to 30 dB's lim.	:	≤ 0.2%
Input impedance (balanced floating)	:	22kOhms ±10%
Output impedance (balanced floating)	:	≤ 21 Ohms
Minimum load resistance	:	200 Ohms
Input balance (CMRR) at 15kHz	:	≥ 60 dB
Pre-emphasis on threshold level		
(card edge switch)	:	50us (25us on request) (Fig. 2)

Control voltage slope	:	5dB/V (Note 2)
Attack time	:	1.5 ms (Note 3)
Recovery delay	:	50 ms $^{+60}_{-10\%}$
Recovery time (dual) or with	:	0.1s upon 20s
External switch T_1 (Fig. 6)	:	0.1-0.2-0.4-1-2-4s/20dB $^{\pm 20\%}$ (Note 4)
T_2 (Fig. 7,8 and 9)	:	1-2-4-10-20-off s/20dB $^{\pm 20\%}$ (Note 4)
Mechanical outlines (Fig. 5)	:	100x160 mm euroboard

Note 1:

Output reference level can be adjusted up to +21 dBu, however, technical specifications are only valid up to +10dBu.

Note 2:

The control voltage of two units may be linked together to obtain equal gain reduction the two stereo channels.

Note 3:

The attack time is the period of time it takes the control voltage to reach 90% of its ready-state value, measured with 5kHz tone-bursts. Peaks shorter than 1.5 ms will be limited by a full-wave smooth clipping circuit to a value approximately 3 dB higher than output threshold level with steady sinusoidal input-signal. Fig. 3 and Fig. 4: Attacktime increases linear up to approx. 10 ms by increasing R_{51} (179-3130-B-3).

Note 4:Note following details for using external switches:

One or more of the external switches can be used, but to prevent faults, when not using external switches, the shown straps on the schematic diagram are always on the circuitboard, when the unit leaves the factory. When using the external switches simply cut the straps and connect the switches. However, if you use the limiter with fixed parameters in some positions and with the external switches in other positions, it is possible to wire the limiter as shown in fig. 5 and get the function decided by the insert position.

Fig. 1. Relative frequency response.

Amplitude

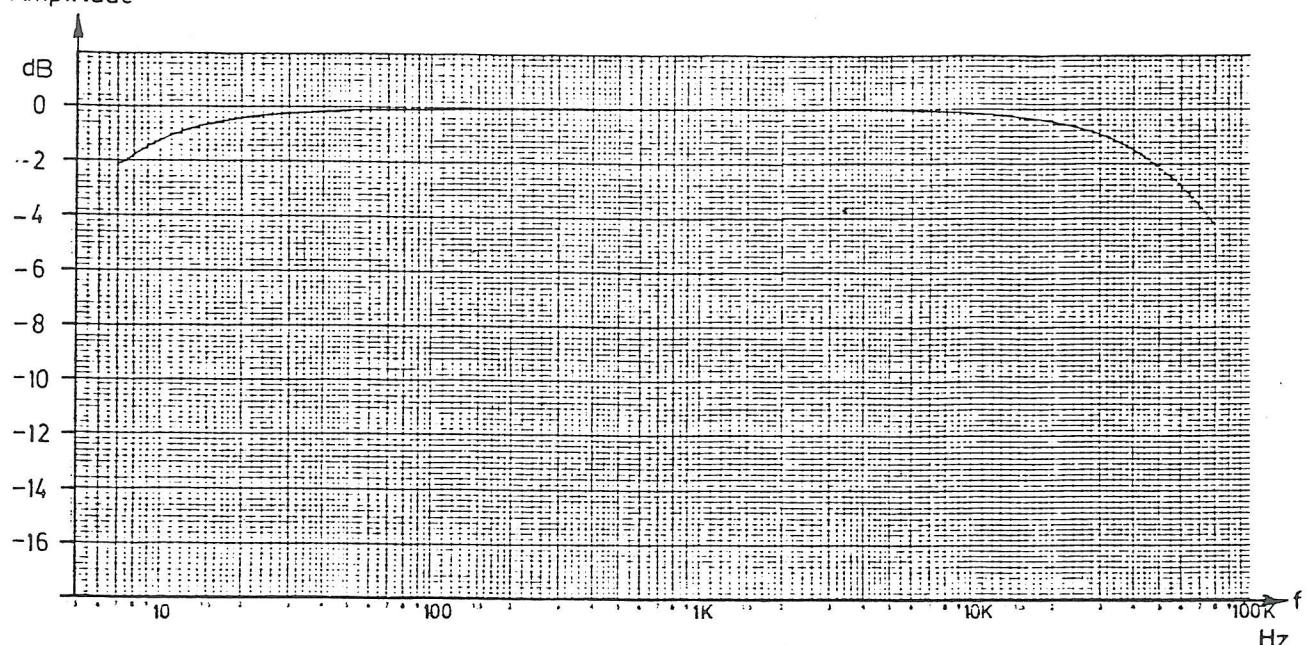
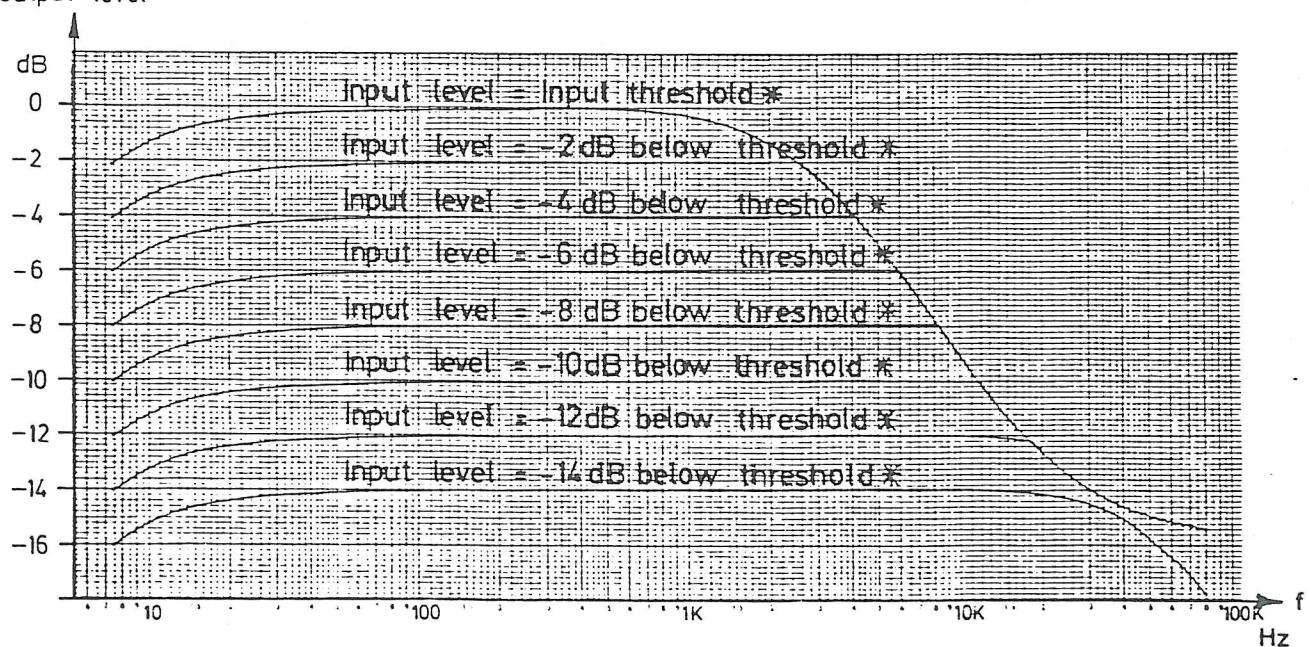


Fig. 2. Threshold level with 50 us pre-emphasis us.freqency and input level.

Output level



* refers to threshold level without pre-emphasis

Pre-emphasis time constant can be changed to 25 μs by cutting the marked printboard-lane between the solder points of C13a.

Fig. 3 + 4: Output level and control voltage with 5 kHz tone-burst and input amplitude 10 dB above threshold level.

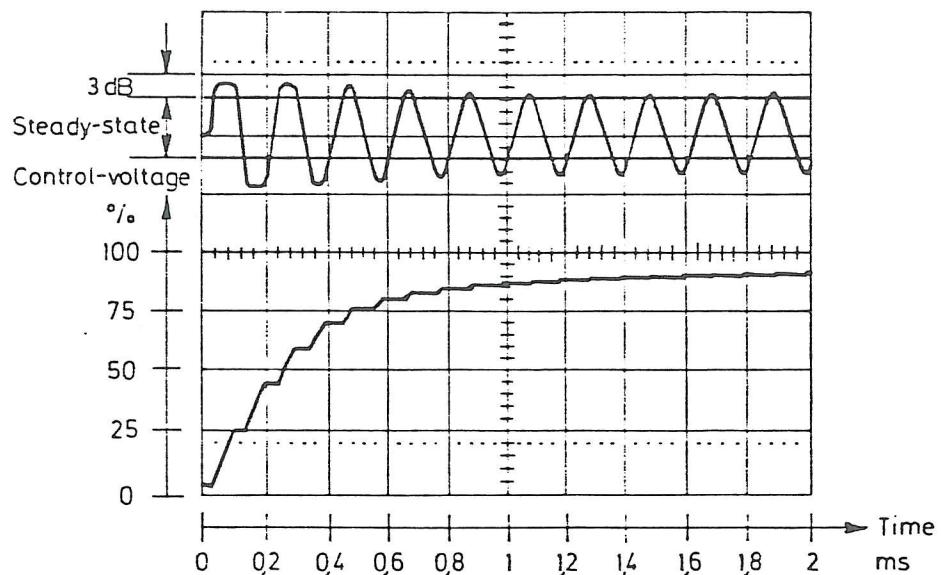
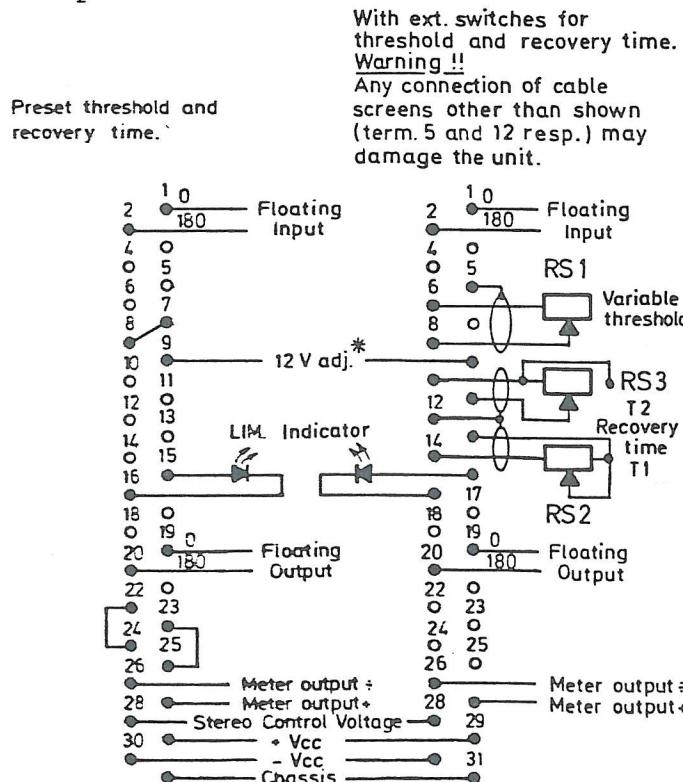
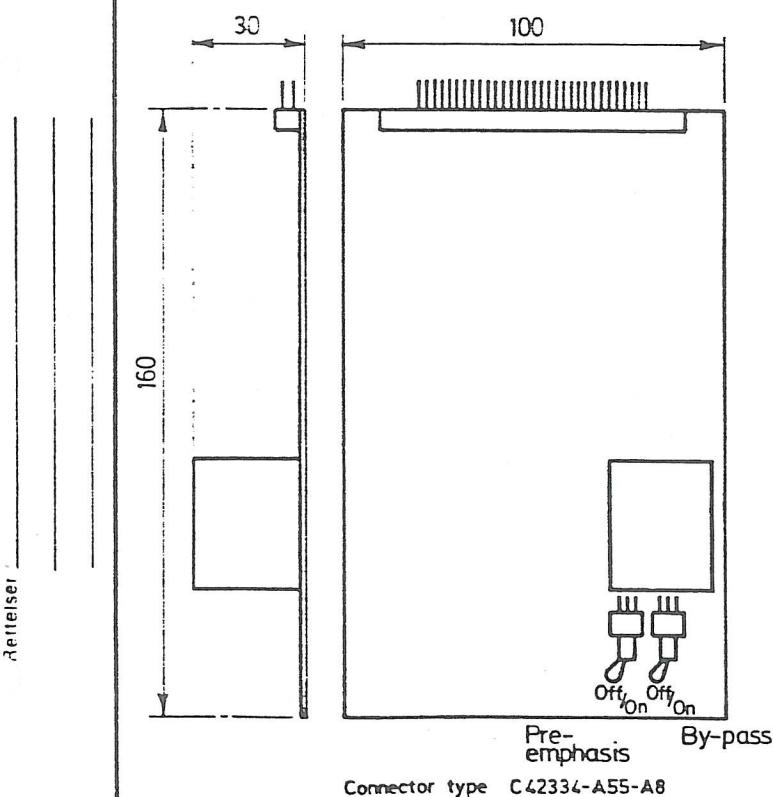


Fig. 5: Mechanical outlines and pin connections.



* Note: 12V adj. shall be linked together in stereo-operation mode or tc referencepoint when using symmetrical supply voltage.

Fig. 10: Schematic diagram over input threshold switch

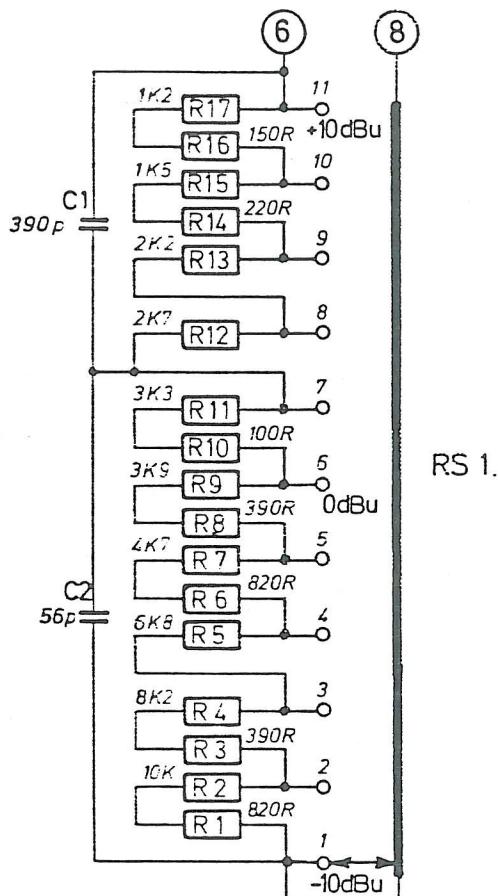


Fig. 11: Schematic diagram over Recovery time T_1 switch.

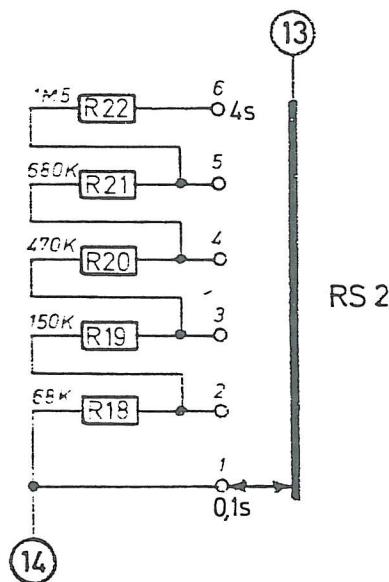
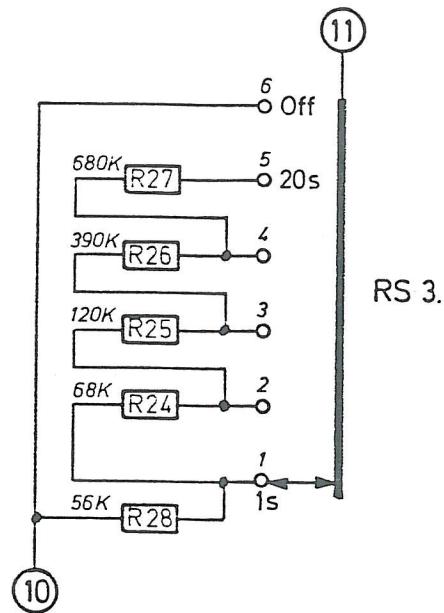


Fig. 12: Schematic diagram over Recoverytime T_2 switch.



Note following details for using external switches:

One or more of the external switches can be used, but to prevent falls, when not using external switches, the shown straps on the schematic diagram are always on the circuitboard, when the unit leaves the factory. When using the external switches simply cut the straps and connect the switches. However, if you use the limiter with fixed parameters in some positions and with the external switches in other positions, it is possible to wire the limiter as shown in Fig. 5 and get the function decided by the insert position.

Fig. 6. Recovery us time and settings of T_1 .

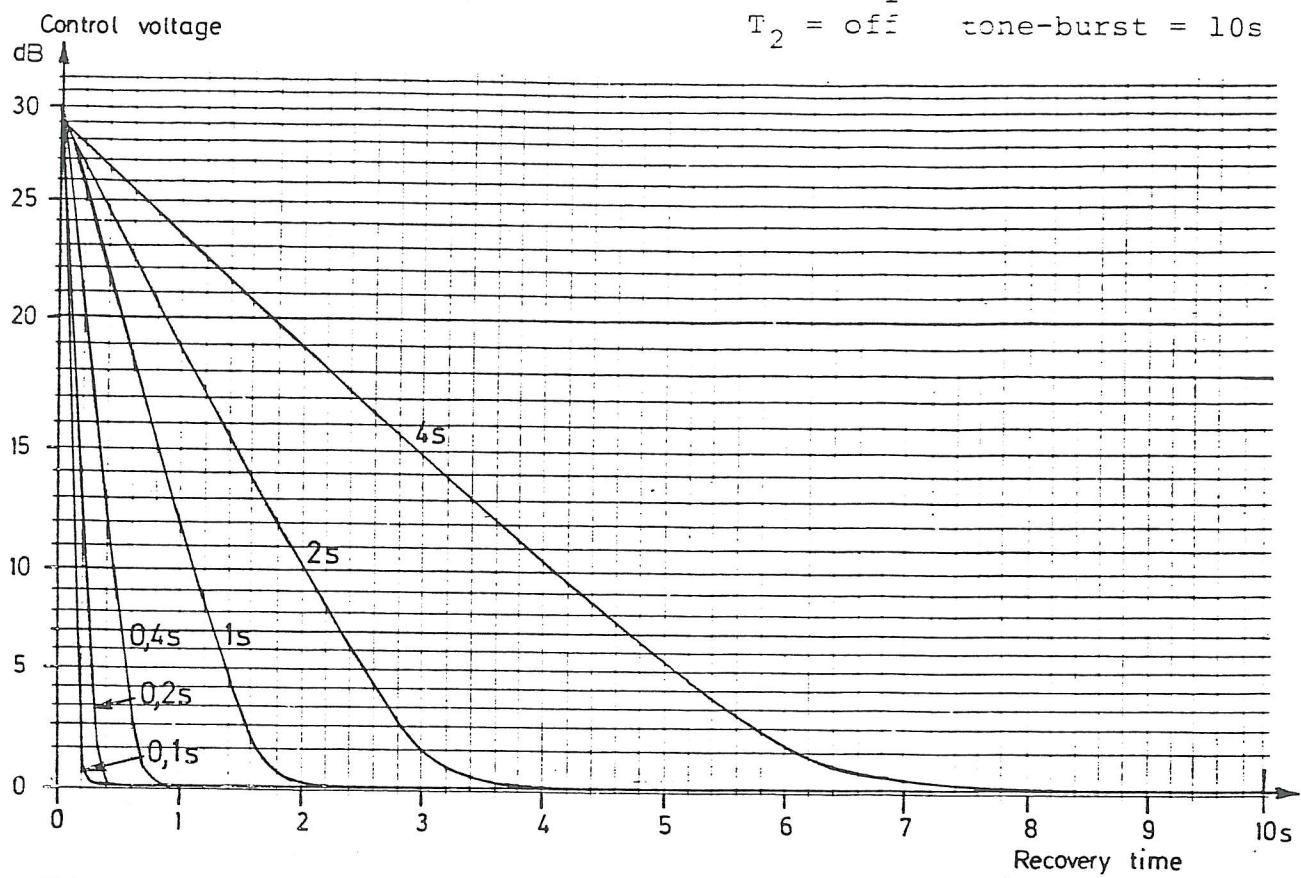


Fig. 7. Recovery us time and settings of T_2 .
(Incl. Recovery delay)

$T_1 = 0,1s$ tone-burst = 10s

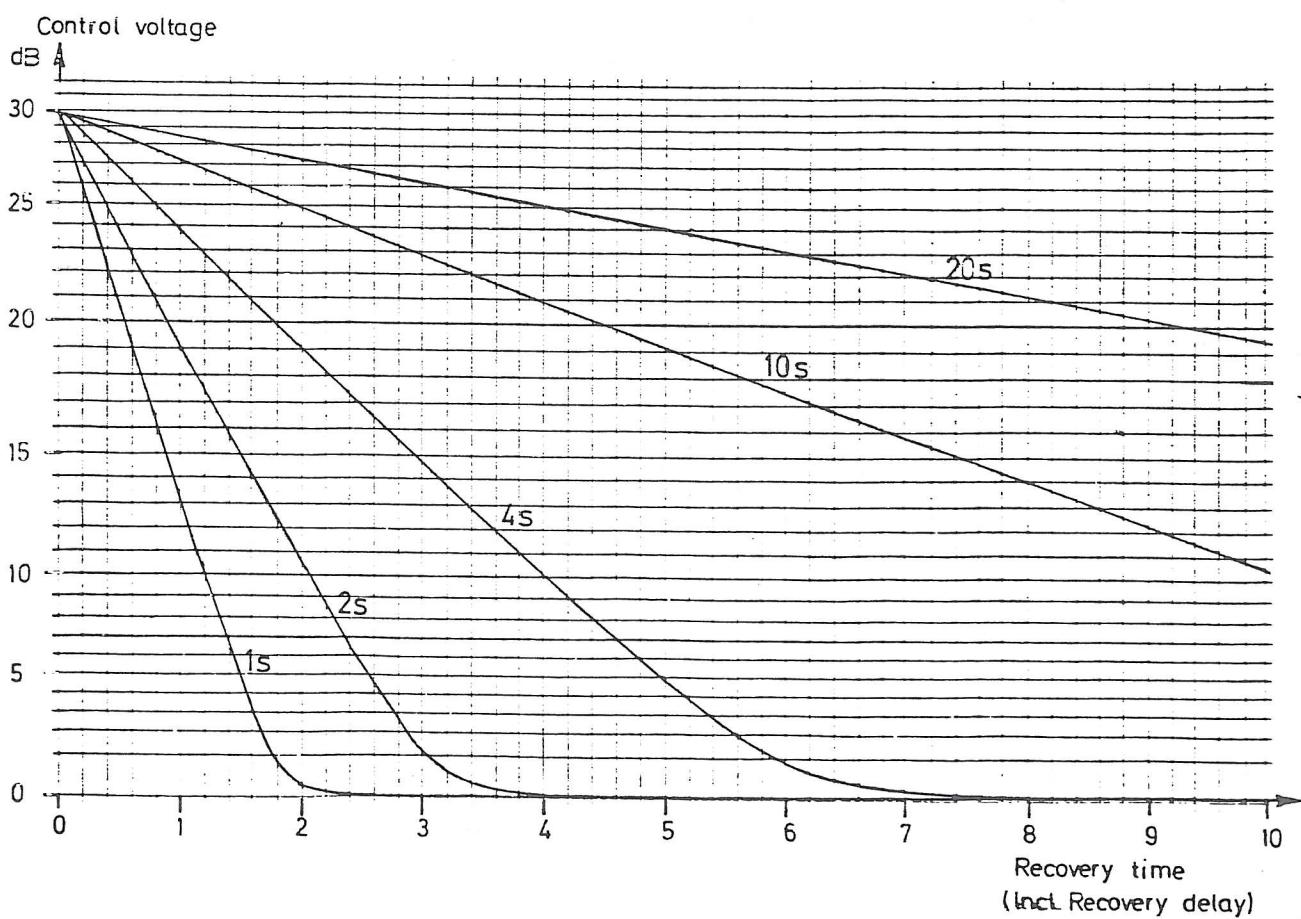


Fig. 8. Recovery us time and tone-burst length.

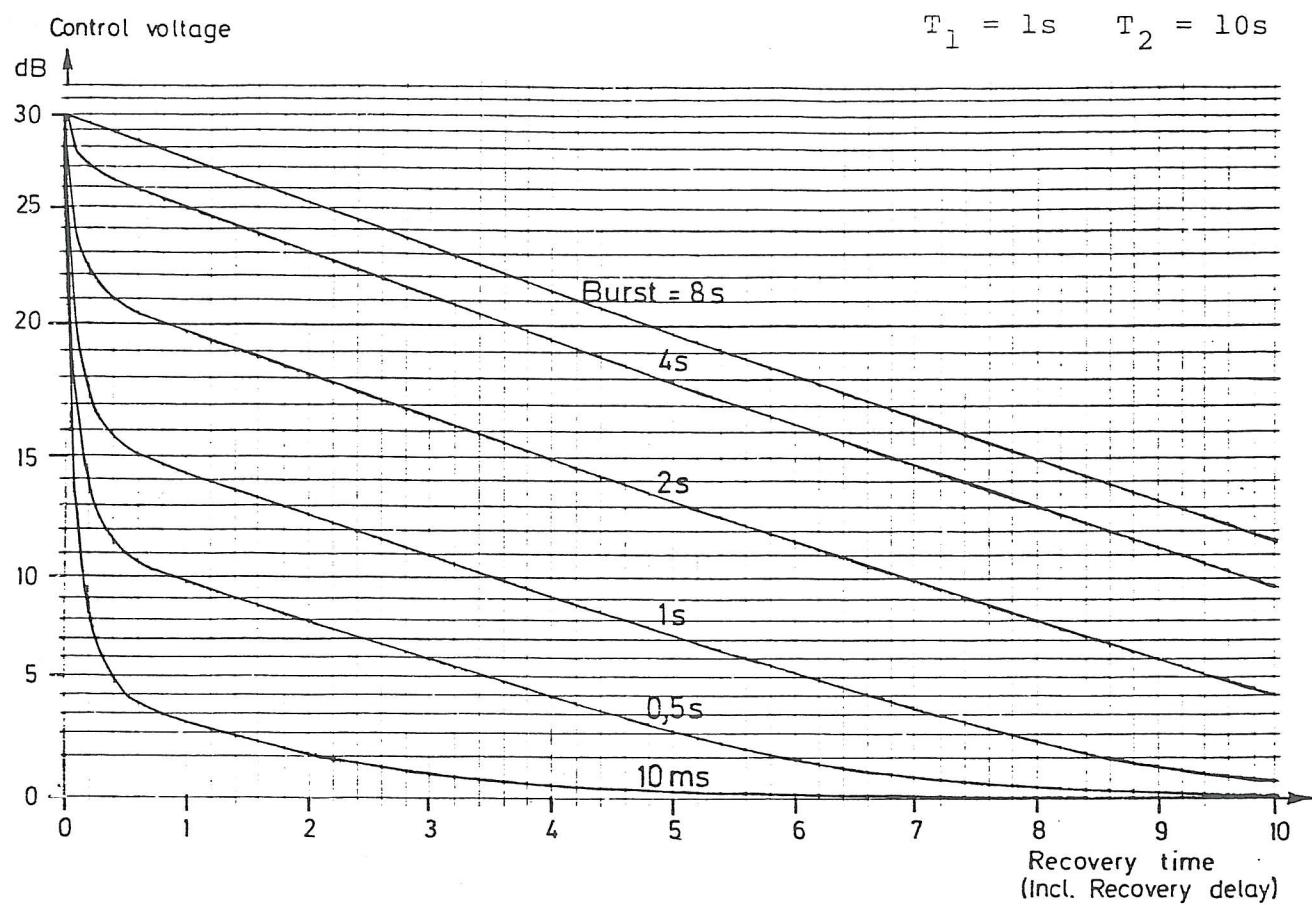
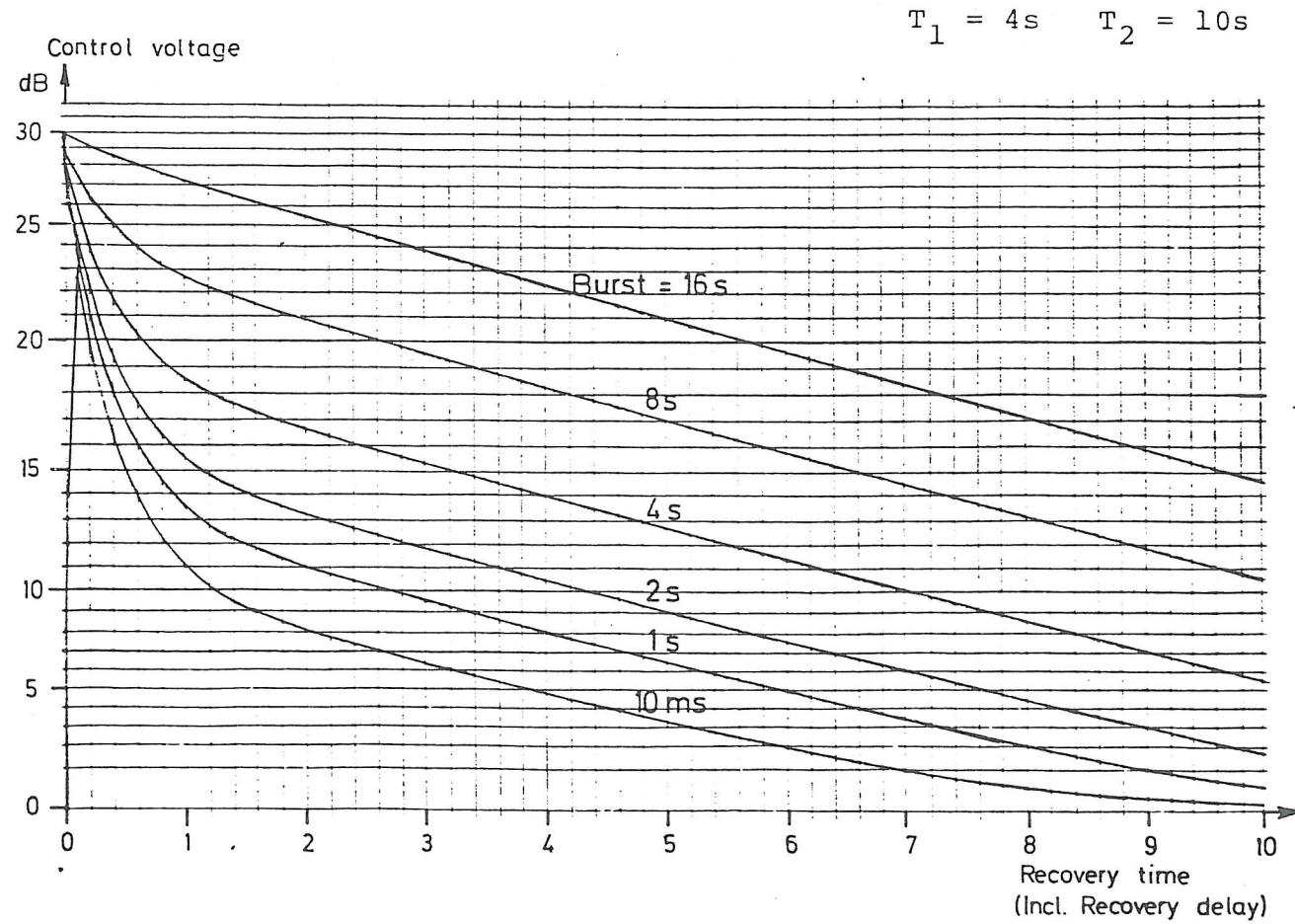


Fig. 9. Recovery us time and tone-burst length.



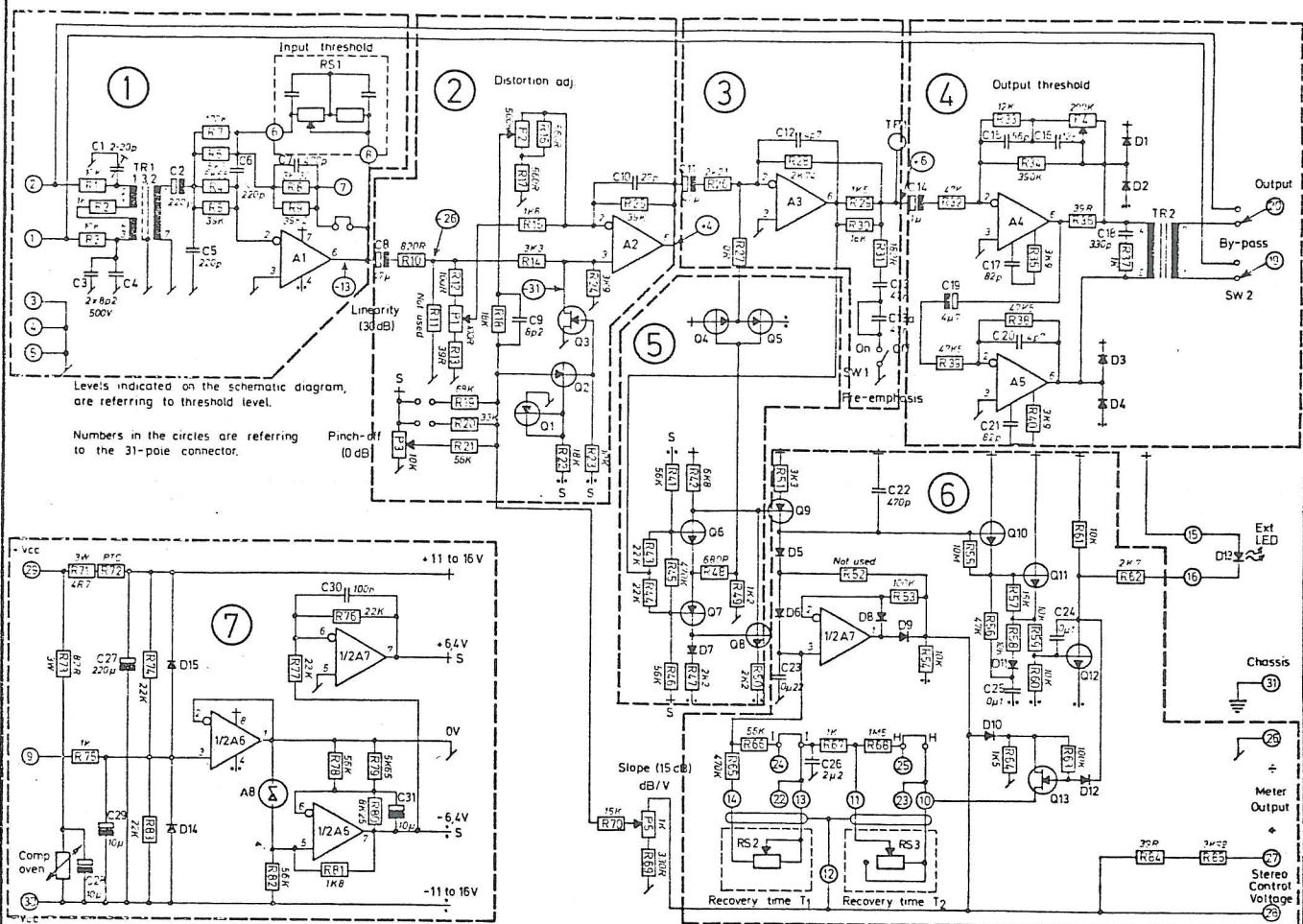
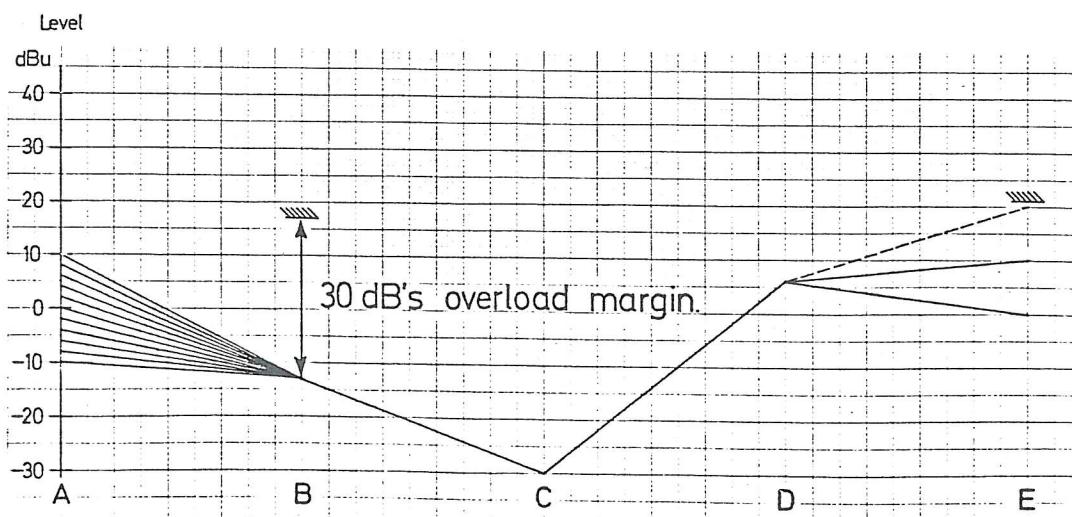


Fig. 10: Schematic diagram divided into subcircuits:

- 1 input circuit, 2 voltage controlled amplifier,
- 3 pre-emphasis amplifier, 4 main output stage,
- 5 rectifier, 6 timing and recovery delay, 7 supply stage.



1. Input Stage.

The input stage has variable gain and is designed with high input overload margin (30 dB). The stage is operating as an inverting 2nd order low-pass filter, where the input transformer is placed in the "summing" point of the filter. Therefore only a very small voltage will occur across the transformer, and thereby the distortion is kept at a low value at high input levels and low frequencies. The variable capacitor C₁ adjusts the input balance of the transformer.

2. Voltage Controlled Amplifier.

The voltage controlled amplifier is using a bridge balance principle, when the source-drain resistance of a Field-Effect-Transistor is used at one of the balancing resistors. The gain can therefore be altered by changing the gate-source voltage of the FET. P₁ and P₃ adjust the operating point of the FET, and P₂ adjusts the harmonic distortion to minimum. Harmonic distortion adjustment is necessary due to the nonlinearity of the FET.

3. Pre-Emphasis Amplifier.

The pre-emphasis amplifier has two outputs. One output delivers signal to the rectifier/peak limiter circuit (6), and one output is feeding the output stages (4). The lastmentioned output is the feedback point of the amplifier, and the signal at this point therefore will be unaffected, when the pre-emphasis switch is closed, while the other output signal which is fed to the rectifier will be increased at higher frequencies and thereby making the threshold level frequency dependable. See fig. 2 in technical specifications.

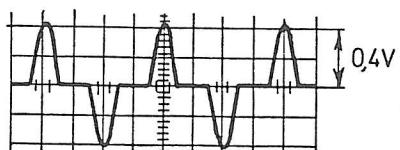
4. Output Stage.

The output stage is a symmetrical driven transformer coupled stage which gives the highest grade of output symmetry, output overload level and low current consumption. The output transformer is driven with a pre-distorted voltage swing which compensates the internal voltage drop across the copper resistance of the output transformer. This pre-distortion reduces the transformer output resistance and the distortion at low frequencies.

5. Rectifier.

The rectifier consists of two reversed biased transistors which are brought into its active region by the applied audio signal. When this threshold is reached, current starts to flow through the common emitter resistor and through resistor R_{49} . The voltage across R_{42} now will have the shape of a double rectified voltage. The transistor Q_9 will then start to charge the timing capacitors in the timing circuit. See part 7.

Fig. 12: Waveform of emitter voltage



The common emitter resistor is designed as a voltage divider, where the lower voltage is fed to the bases of two transistors, whose emitters are in the feed-back loop of A_3 . If the base voltage exceeds approx. 0.3V, the transistors become active and will cause limiting of the peak amplitude of the output. Because the gain of this feedback loop is less than one, and the voltage/current function of the transistor has logarithmic relations, the clipping of the output voltage will be smooth.

6. Timing- and Recovery Delay Circuit.

The collector current of Q_9 changes the timing capacitors C_{23} and C_{26} , and the voltage across C_{23} is sensed by a FET-input operational amplifier, whose output is the control voltage. The discharge will be linear and dependable of the settings of controls T_1 and T_2 . The discharge voltage which causes the discharge current, is the voltage drop over D_{10} , and the FET Q_{13} serves as a switch for incoupling of recovery delay. The transistor Q_{10} serves as a low input current buffer amplifier for changing the recovery delay timing capacitor C_{25} . Recovery delay time is determined by the resistance R_{57} which in conjunction with Q_{11} forms a constant current discharge circuit.

7. Supply Stage.

The input current to the unit flows through R_{71} and R_{72} which is a low resistance PTC resistor. In case of heavy current consumption, for instance due to a fault, inside the unit, the maximum current will be limited to the "hot current" of the PTC. R_{71-72} and C_{27} furthermore form a ripple filter for the supply line. The unit can be operated on either symmetrical or unsummetrical supply voltage and has an internal voltage splitter which produces center reference voltage half of the external supply voltage (A_6 pin 3). A positive and a negative reference voltage is produced by A_7 and A_6 .

Normally the limiter amplifier will stay correctly adjusted, except when component has failed and has been replaced; then it may be necessary to make certain adjustments. The function of the trimpotentiometers and the variable capacitor is as follows:

- P₁ Linearity adjustment of the Field-Effect-Transistor
(control voltage linearity)
- P₂ Adjustment for minimum distortion of the FET.
- P₃ Compensates for individual Pinch-off voltages of the FET
(input threshold level adjustm.)
- P₄ Adjusts the output threshold level.
- P₅ Compensates for individual controlvoltage sensitivity of the
FET.
- C₁ Input balance adjustment.

Do not attempt to make any adjustment, until the current consumption has fallen to a steady level (60-90mA) after 1 minute.

Correct sequence of adjustments is as follows:

a. Pinch-off adjustment of P₃

Conditions: input threshold level +6dBu, input level
+6dBu, f=1kHz.

P₃ is adjusted, until the LED indicator (external mounted) is at the on/off threshold. The adjustment range can be altered by connecting or disconnecting R₁₉ and/or R₂₀.

b. Slope dB/V adjustment of P₅ and linearity adjustment of P₁

Conditions: As stated under position a.

A floating external DC-source (0-6V) is connected between terminal 28 and 26, terminal 28 positive. The DC voltage is set to 3.0V, and P₅ is adjusted, so that the output level is attenuated 15dB. Now the DC voltage is set to 6.0V, and P₁ is adjusted, so that the output level is attenuated 30dB. Because of mutual dependence between P₅ and P₁, repeat the adjustments, until correct reading is obtained.

c. Distortion adjustment pf P_2 .

Conditions: input level +20dBu, f=1kHz.

P_2 is adjusted to minimum distortion. Because of interaction between P_2 and the other adjustments repeat the adjustments under position a and b once more.

d. Output threshold adjustment P_4 .

Conditions: input level +20dBu, f=1kHz.

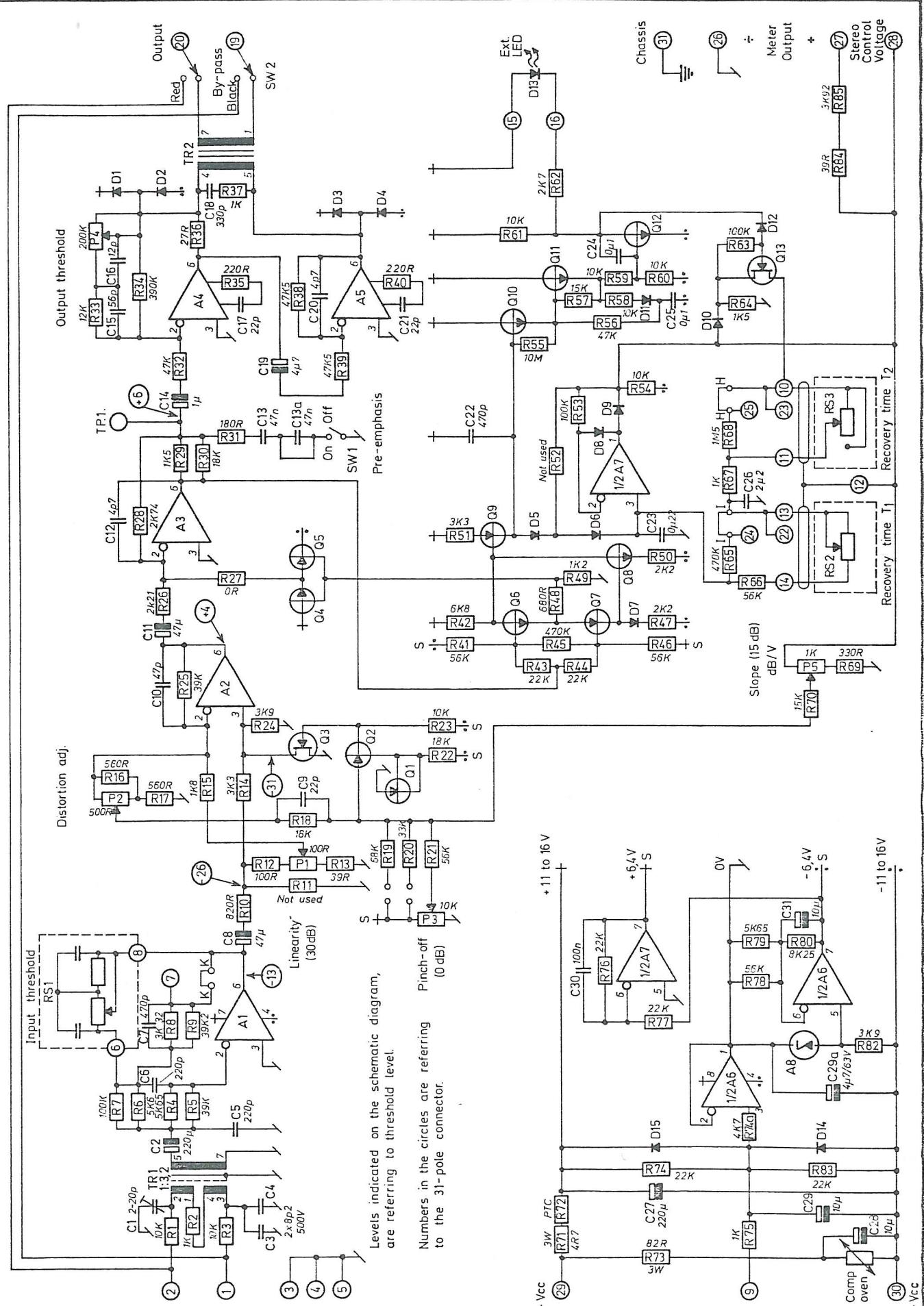
Adjust P_4 , until the wanted output threshold level is reached. (Factory adjusted to +6dBu, $R_L=600$ Ohms).

e. Input balance adjustment C_1 .

Conditions: Input threshold level +6dBu, input level +20dBu, f=15kHz.

Connect the two input terminals together, and apply the audiosignal between the two and negative supply line.

Adjust C_1 to minimum output signal.



Målestok :	
Konstruktør :	KH.
Tegnet :	3. 8. 79. JS
Godkendt :	KH.
Revideret :	3.

Limiter Amplifier 179-310B

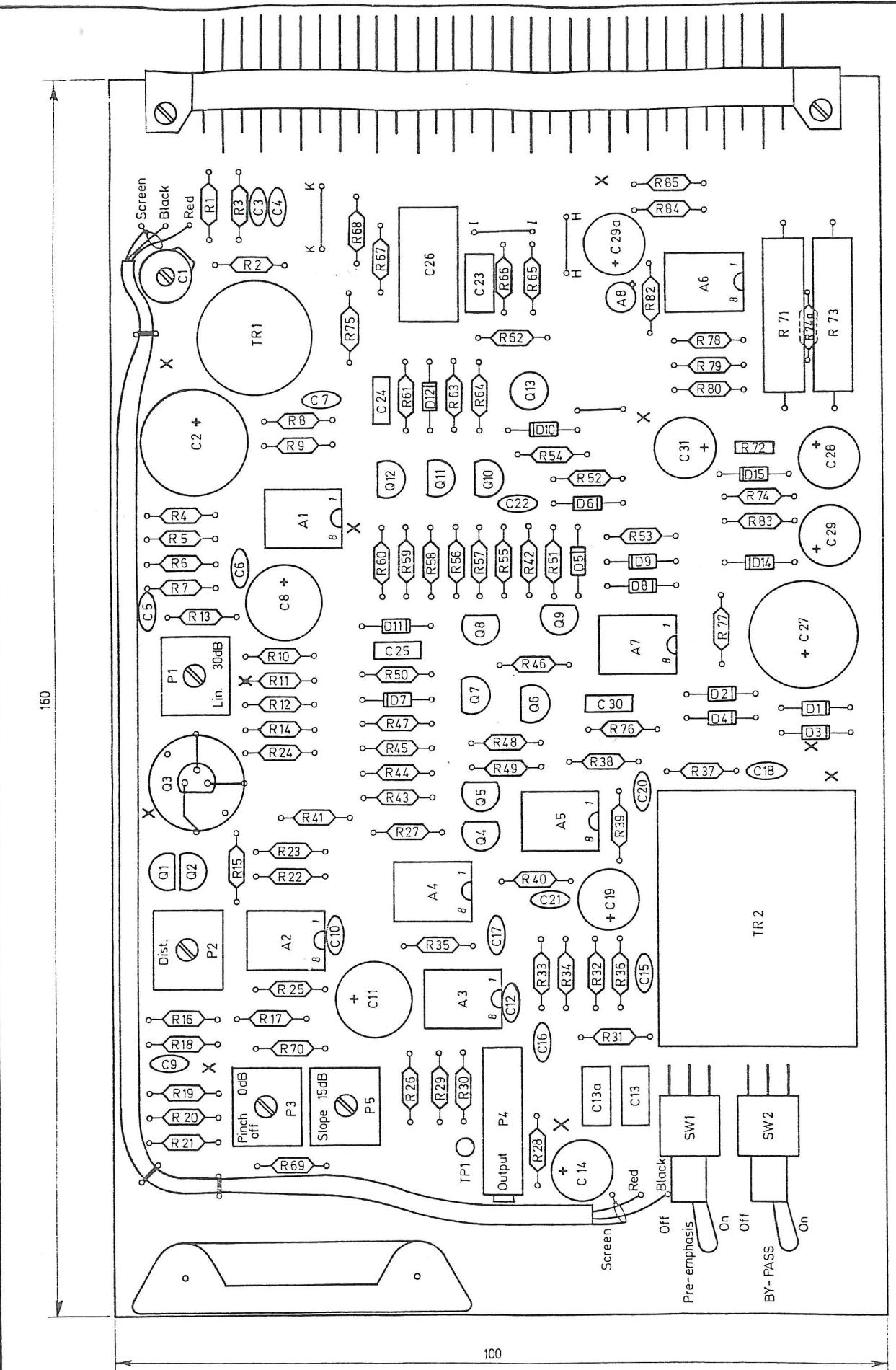
Schematic Diagram

NTP
NTP ELEKTRONIK A/S

179-3130-B-3

160

100



Målestok :

Konstruktør : KH.

Tegnet : 3.8.79 JS

Godkendt : KH.

Revideret : 5.

Limiter Amplifier 179-310B

Components Lay-out.

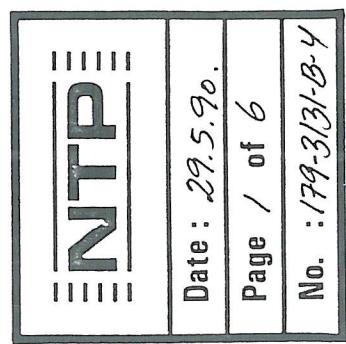
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179 - 3141 - B - 3

NTP 179-310B LIMITER AMPLIFIER

PARTS LIST

REF. NO.	NTP-ID.	DESCRIPTION	QTY	PART NO.	MANUFACT/DRW.NO.
PARTS LIST					
R 13	RCA-2390	RESISTOR CARBON 39R 0.66W 5%	1	MBB 0207	39R
R 36	RCA-2390	RESISTOR CARBON 39R 0.66W 5%	1	MBB 0207	39R
R 84	RCA-2390	RESISTOR CARBON 39R 0.66W 5%	1	MBB 0207	39R
R 12	RCA-3100	RESISTOR CARBON 100R 0.66W 5%	1	MBB 0207	100R
R 31	RCA-3180	RESISTOR CARBON 180R 0.66W 5%	1	MBB 0207	180R
R 35	RCA-3220	RESISTOR CARBON 220R 0.66W 5%	1	MBB 0207	220R
R 40	RCA-3220	RESISTOR CARBON 220R 0.66W 5%	1	MBB 0207	220R
R 69	RCA-3330	RESISTOR CARBON 330R 0.66W 5%	1	MBB 0207	330R
R 16	RCA-3560	RESISTOR CARBON 560R 0.66W 5%	1	MBB 0207	560R
R 17	RCA-3560	RESISTOR CARBON 560R 0.66W 5%	1	MBB 0207	560R
R 48	RCA-3680	RESISTOR CARBON 680R 0.66W 5%	1	MBB 0207	680R
R 10	RCA-3820	RESISTOR CARBON 820R 0.66W 5%	1	MBB 0207	820R
R 2	RCA-4100	RESISTOR CARBON 1K 0.66W 5%	1	MBB 0207	1K
R 37	RCA-4100	RESISTOR CARBON 1K 0.66W 5%	1	MBB 0207	1K
R 67	RCA-4100	RESISTOR CARBON 1K 0.66W 5%	1	MBB 0207	1K
R 75	RCA-4100	RESISTOR CARBON 1K 0.66W 5%	1	MBB 0207	1K
R 49	RCA-4120	RESISTOR CARBON 1K2 0.66W 5%	1	MBB 0207	1K2
R 29	RCA-4150	RESISTOR CARBON 1K5 0.66W 5%	1	MBB 0207	1K5
R 64	RCA-4150	RESISTOR CARBON 1K5 0.66W 5%	1	MBB 0207	1K5
R 15	RCA-4180	RESISTOR CARBON 1K8 0.66W 5%	1	MBB 0207	1K8
R 47	RCA-4220	RESISTOR CARBON 2K2 0.66W 5%	1	MBB 0207	2K2
R 50	RCA-4220	RESISTOR CARBON 2K2 0.66W 5%	1	MBB 0207	2K2
R 62	RCA-4270	RESISTOR CARBON 2K7 0.66W 5%	1	MBB 0207	2K7
R 14	RCA-4330	RESISTOR CARBON 3K3 0.66W 5%	1	MBB 0207	3K3
R 51	RCA-4330	RESISTOR CARBON 3K3 0.66W 5%	1	MBB 0207	3K3
R 24	RCA-4390	RESISTOR CARBON 3K9 0.66W 5%	1	MBB 0207	3K9
R 82	RCA-4390	RESISTOR CARBON 3K9 0.66W 5%	1	MBB 0207	3K9
R 74a	RCA-4470	RESISTOR CARBON 4K7 0.66W 5%	1	MBB 0207	4K7
R 6	RCA-4560	RESISTOR CARBON 5K6 0.66W 5%	1	MBB 0207	5K6
R 42	RCA-4680	RESISTOR CARBON 6K8 0.66W 5%	1	MBB 0207	6K8
R 1	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K
R 3	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K
R 23	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K

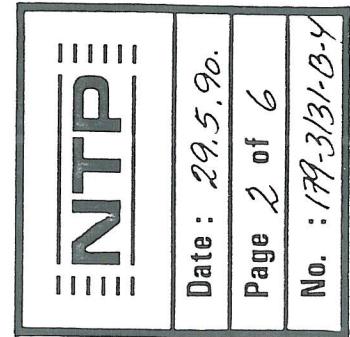


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No. : 179-310-B-4

REF. NO	NTP-ID.	DESCRIPTION	QTY	MANUFACTURER/DRW.NO.	PART NO.
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R 58	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K
R 59	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K
R 60	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K
R 61	RCA-5100	RESISTOR CARBON 10K 0.66W 5%	1	MBB 0207	10K
R 33	RCA-5120	RESISTOR CARBON 12K 0.66W 5%	1	MBB 0207	12K
R 57	RCA-5150	RESISTOR CARBON 15K 0.66W 5%	1	MBB 0207	15K
R 70	RCA-5150	RESISTOR CARBON 15K 0.66W 5%	1	MBB 0207	15K
R 18	RCA-5180	RESISTOR CARBON 18K 0.66W 5%	1	MBB 0207	18K
R 22	RCA-5180	RESISTOR CARBON 18K 0.66W .5%	1	MBB 0207	18K
R 30	RCA-5180	RESISTOR CARBON 18K 0.66W 5%	1	MBB 0207	18K
R 43	RCA-5220	RESISTOR CARBON 22K 0.66W 5%	1	MBB 0207	22K
R 44	RCA-5220	RESISTOR CARBON 22K 0.66W 5%	1	MBB 0207	22K
R 74	RCA-5220	RESISTOR CARBON 22K 0.66W 5%	1	MBB 0207	22K
R 76	RCA-5220	RESISTOR CARBON 22K 0.66W 5%	1	MBB 0207	22K
R 77	RCA-5220	RESISTOR CARBON 22K 0.66W 5%	1	MBB 0207	22K
R 83	RCA-5220	RESISTOR CARBON 22K 0.66W 5%	1	MBB 0207	22K
R 20	RCA-5330	RESISTOR CARBON 33K 0.66W 5%	1	MBB 0207	33K
R 5	RCA-5390	RESISTOR CARBON 39K 0.66W 5%	1	MBB 0207	39K
R 25	RCA-5390	RESISTOR CARBON 39K 0.66W 5%	1	MBB 0207	39K
R 32	RCA-5470	RESISTOR CARBON 47K 0.66W 5%	1	MBB 0207	47K
R 56	RCA-5470	RESISTOR CARBON 47K 0.66W 5%	1	MBB 0207	47K
R 21	RCA-5560	RESISTOR CARBON 56K 0.66W 5%	1	MBB 0207	56K
R 41	RCA-5560	RESISTOR CARBON 56K 0.66W 5%	1	MBB 0207	56K
R 46	RCA-5560	RESISTOR CARBON 56K 0.66W 5%	1	MBB 0207	56K
R 66	RCA-5560	RESISTOR CARBON 56K 0.66W 5%	1	MBB 0207	56K
R 78	RCA-5560	RESISTOR CARBON 56K 0.66W 5%	1	MBB 0207	56K
R 19	RCA-5680	RESISTOR CARBON 68K 0.66W 5%	1	MBB 0207	68K
R 7	RCA-6100	RESISTOR CARBON 100K 0.66W 5	1	MBB 0207	100K
R 53	RCA-6100	RESISTOR CARBON 100K 0.66W 5	1	MBB 0207	100K
R 63	RCA-6100	RESISTOR CARBON 100K 0.66W 5	1	MBB 0207	100K
R 34	RCA-6390	RESISTOR CARBON 390K 0.66W 5	1	MBB 0207	390K
R 45	RCA-6470	RESISTOR CARBON 470K 0.66W 5	1	MBB 0207	470K



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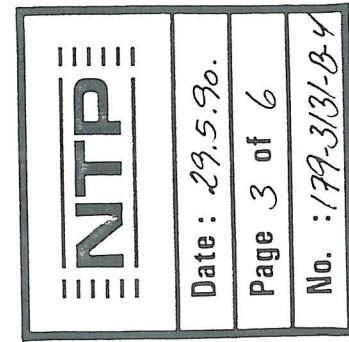
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No. : 179-310-B-4

NTP 179-310B LIMITER AMPLIFIER

PARTS LIST

REF. NO	NTP-ID.	DESCRIPTION	QTY	MANUFACT/DRW.NO.	PART NO.
R 65	RCA-6470	RESISTOR CARBON 470K 0.66W 5%	1	MBB 0207	470K
R 68	RCA-7150	RESISTOR CARBON 1M5 0.66W 5%	1	MBB 0207	1M5
R 26	RMA-4221	RESISTOR METAL 2K21 0.4W 1%	1	PHILLIPS MR25	2322 151 52212
R 28	RMA-4274	RESISTOR METAL 2K74 0.4W 1%	1	PHILLIPS MR25	2322 151 52742
R 8	RMA-4332	RESISTOR METAL 3K32 0.4W 1%	1	PHILLIPS MR25	2322 151 53322
R 85	RMA-4392	RESISTOR METAL 3K92 0.4W 1%	1	PHILLIPS MR25	2322 151 53922
R 4	RMA-4562	RESISTOR METAL 5K62 0.4W 1%	1	PHILLIPS MR25	2322 151 55622
R 79	RMA-4562	RESISTOR METAL 5K62 0.4W 1%	1	PHILLIPS MR25	2322 151 55622
R 80	RMA-4825	RESISTOR METAL 8K25 0.4W 1%	1	PHILLIPS MR25	2322 151 58252
R 9	RMA-5392	RESISTOR METAL 39K2 0.4W 1%	1	PHILLIPS MR25	2322 151 53923
R 38	RMA-5475	RESISTOR METAL 47K5 0.4W 1%	1	PHILLIPS MR25	2322 151 54753
R 39	RMA-5475	RESISTOR METAL 47K5 0.4W 1%	1	PHILLIPS MR25	2322 151 54753
R 72	RTC-1940	RESISTOR PTC 9R4	1	PTC Q63100	P2390 C970
R 27	RWA-0000	STRAP 0.0 OHMS	1	RWA-0000	RWA-0000
R 71	RWC-1470	RESISTOR WIRE-WOUND 4R7 3W	1	RP145129	RP145129
R 73	RWC-2820	RESISTOR WIRE-WOUND 82R 3W	1	RP145152	RP145152
R 55	RYA-8100	RESISTOR HIGHVOLT 10M 0.25W	1	PHILLIPS VR25	2322 241 13106
P 4	RFA-6200	TRIMPOTENTIOMETER 200K	1	BOURNS 3006	3006P-1-204
P 1	RFC-3100	TRIMPOTENTIOMETER 100R	1	BOURNS 3386	3386P-1-101X
P 2	RFC-3500	TRIMPOTENTIOMETER 500R	1	BOURNS 3386	3386P-1-501
P 5	RFC-4100	TRIMPOTENTIOMETER 1K	1	BOURNS 3386	3386P-1-102
P 3	RFC-5100	TRIMPOTENTIOMETER 10K	1	BOURNS 3386	3386P-1-103
C 12	CCB-0147	CAP CERAMIC 4.7PF/100V	1	- PH 2222	632 2222 632 57478
C 20	CCB-0147	CAP CERAMIC 4.7PF/100V	1	PH 2222	632 2222 632 57478
C 3	CCB-0182	CAP CERAMIC 8.2PF/100V	1	PH 2222	632 2222 632 57828
C 4	CCB-0182	CAP CERAMIC 8.2PF/100V	1	PH 2222	632 2222 632 57828
C 16	CCB-0212	CAP CERAMIC 12PF/100V	1	PH 2222	632 2222 632 58129
C 9	CCB-0222	CAP CERAMIC 22PF/100V	1	PH 2222	632 2222 632 58229
C 17	CCB-0222	CAP CERAMIC 22PF/100V	1	PH 2222	632 2222 632 58229
C 21	CCB-0222	CAP CERAMIC 22PF/100V	1	PH 2222	632 2222 632 58229
C 10	CCB-0247	CAP CERAMIC 4.7PF/100V	1	PH 2222	632 2222 632 58479
C 15	CCB-0256	CAP CERAMIC 56PF/100V	1	PH 2222	632 2222 632 58569
C 5	CCB-0322	CAP CERAMIC 220PF/100V	1	PH 2222	632 2222 632 58221



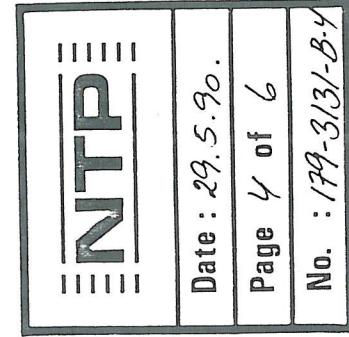
Date : 29.5.90.

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No. : 179-310B-4

NTP 179-310B LIMITER AMPLIFIER

REF. NO	NTP-ID.	DESCRIPTION	QTY	PARTS LIST	MANUFACT / DRW. NO.	PART NO.
C 6	CCB-0322	CAP CERAMIC 220PF/100V	1	PH 2222	632	58221
C 18	CCB-0333	CAP CERAMIC 330PF/100V	1	PH 2222	632	70331
C 7	CCB-0347	CAP CERAMIC 470PF/100V	1	PH 2222	632	70471
C 22	CCB-0347	CAP CERAMIC 470PF/100V	1	PH 2222	632	70471
C 8	CFG-0847	CAP ELECTROLYTIC 4.7UF /4.0V	1	SIEMENS B41316	B41316	A7476 V
C 11	CFG-0847	CAP ELECTROLYTIC 4.7UF /4.0V	1	SIEMENS B41316	B41316	A7476 V
C 2	CFG-0922	CAP ELECTROLYTIC 220UF/4.0V	1	SIEMENS B41316	B41316	A7227 V
C 27	CFG-0922	CAP ELECTROLYTIC 220UF/4.0V	1	SIEMENS B41316	B41316	A7227 V
C 14	CFH-0710	CAP ELEKTROLYTIC 1UF /63V	1	SIEMENS B41316	B41316	A8105 V
C 19	CFH-0747	CAP ELECTROLYTIC 4.7UF /63V.	1	SIEMENS B41316	B41316	A8475 V
C 29a	CFH-0747	CAP ELECTROLYTIC 4.7UF /63V	1	SIEMENS B41316	B41316	A8475 V
C 28	CFH-0810	CAP ELECTROLYTIC 10UF /63V	1	SIEMENS B41316	B41316	A8106 V
C 29	CFH-0810	CAP ELECTROLYTIC 10UF /63V	1	SIEMENS B41316	B41316	A8106 V
C 31	CFH-0810	CAP ELECTROLYTIC 10UF /63V	1	SIEMENS B41316	B41316	A8106 V
C 24	CKC-0610	CAP POLYESTER 100NF/50V	1	WIMA MKS	MKS 2	100NF
C 25	CKC-0610	CAP POLYESTER 100NF/50V	1	WIMA MKS	MKS 2	100NF
C 30	CKC-0610	CAP POLYESTER 100NF/50V	1	WIMA MKS	MKS 2	100NF
C 13	CKI-0547	CAP POLYESTER 4.7NF/250V	1	SIEMENS B322560	B322560	D3473 J
C 13a	CKI-0547	CAP POLYESTER 4.7NF/250V	1	SIEMENS B322560	B322560	D3473 J
C 23	CKH-0622	CAP POLYESTER 220NF/100V	1	SIEMENS B322560	B322560	D1224 J
C 26	CKQ-0722	CAP POLYESTER 2.2UF/100V	1	SIEMENS B322562	B322562	D1225 J
C 1	CVB-0001	TRIMCAPACITOR 2-22PF	1	PH 2222	808	2222 808 11229
D 1	QDS-4002	DIODE, SILICIUM	1	F-126	1N 4002	
D 2	QDS-4002	DIODE, SILICIUM	1	F-126	1N 4002	
D 3	QDS-4002	DIODE, SILICIUM	1	F-126	1N 4002	
D 4	QDS-4002	DIODE, SILICIUM	1	F-126	1N 4002	
D 14	QDS-4002	DIODE, SILICIUM	1	F-126	1N 4002	
D 15	QDS-4002	DIODE, SILICIUM	1	F-126	1N 4002	
D 5	QDS-4148	DIODE, SILICIUM	1	QDS-4148	IN 4148	
D 6	QDS-4148	DIODE, SILICIUM	1	QDS-4148	IN 4148	
D 7	QDS-4148	DIODE, SILICIUM	1	QDS-4148	IN 4148	
D 8	QDS-4148	DIODE, SILICIUM	1	QDS-4148	IN 4148	
D 9	QDS-4148	DIODE, SILICIUM	1	QDS-4148	IN 4148	

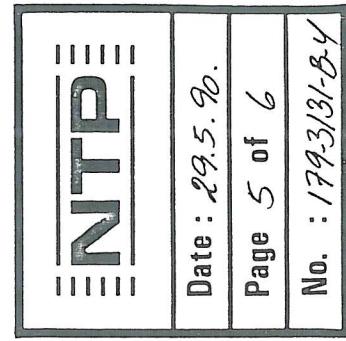


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No. : 179-3131-B-4

REF. NO	NTP-ID.	DESCRIPTION	QTY	PARTS LIST	PAGE
D 10	QDS-4148	DIODE, SILICIUM	1	QDS-4148	5
D 11	QDS-4148	DIODE, SILICIUM	1	QDS-4148	
D 12	QDS-4148	DIODE, SILICIUM	1	QDS-4148	
Q 6	QBN-0237	TRANSISTOR, NPN	1	TO-92	
Q 8	QBN-0237	TRANSISTOR, NPN	1	TO-92	
Q 10	QBN-0237	TRANSISTOR, NPN	1	TO-92	
Q 11	QBN-0237	TRANSISTOR, NPN	1	TO-92	
Q 12	QBN-0237	TRANSISTOR, NPN	1	TO-92	
Q 4	QBN-0241	TRANSISTOR, NPN	1	TO-92	
Q 1	QBP-0307	TRANSISTOR, PNP	1	TO-92	
Q 2	QBP-0307	TRANSISTOR, PNP	1	TO-92	
Q 7	QBP-0307	TRANSISTOR, PNP	1	TO-92	
Q 9	QBP-0307	TRANSISTOR, PNP	1	TO-92	
Q 5	QBP-0450	TRANSISTOR PNP	1	TO-92	
Q 13	QFN-4302	FET	1	QFN-4302	
Q 3	QFN-5486	FET TRANSISTOR	1	QFN-5486	
A 7	IIA-082	OP-AMP	1	TEX. TL082P	
A 1	IIA-356	OP-AMP	1	NAT. LF356N	
A 2	IIA-1034	OP-AMP	1	NE 5534	
A 3	IIA-1034	OP-AMP	1	NE 5534	
A 4	IIA-1034	OP-AMP	1	NE 5534	
A 5	IIA-1034	OP-AMP	1	NE 5534	
A 6	IIA-5532	OP-AMP	1	TEX. NE5532P	
A 8	QZR-0024	REFERENCEDIODE	2,45V	TO-18	
TR 1	LTB-0003	TRANSFORMER PLUGIN	1:3	BEYER 310	
TR 2	LTL-0001	OUTPUTTRANSFORMER	1.2	LUNDAHL 5001	
SW 1	STB-0122	TOGGLE SWITCH DPDT	1	ALCO TT	
SW 2	STB-0122	TOGGLE SWITCH DPDT	1	ALCO TT	
TP 1	MHT-0002	TESTPOINT	1	ASSMANN ALP 65	
TP 1	KFM-3101	CONN 31P MAL ANGLE	1	SIEMENS C42334	
2	ME0-0951	CARD HANDLE CLEAR	1	ELMA 1091-51	
3	179-3140	P.C. BOARD	1	179-3140-B-3	
4	179-3152	SCREENPLATE	1	179-3152-B-4	



Date : 29.5.90.

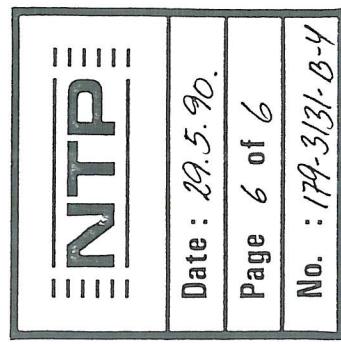
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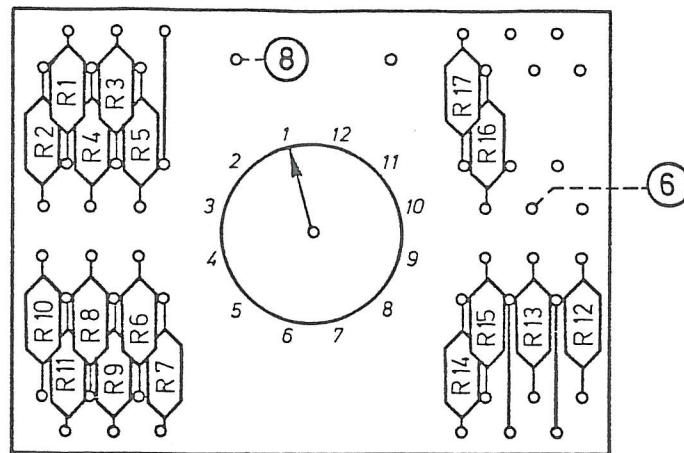
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Multi 29.05.90 9:18 PARTS LIST 179-310B PAGE 6

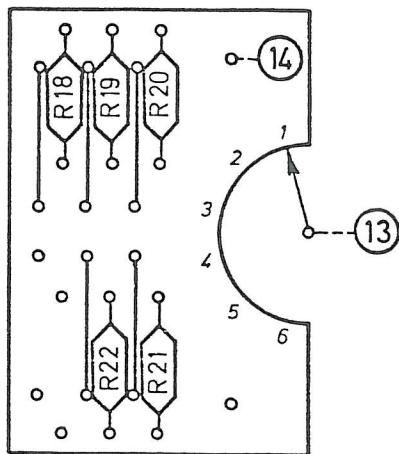
NTP 179-310B LIMITER AMPLIFIER PARTS LIST

REF. NO	NTP-ID.	DESCRIPTION	QTY	MANUFACT/DRW.NO.	PART NO.
5	351-1054	THREADED BUSHING	4	351-1054-A-4	351-1054
6	QBA-0016	TRANSISTOR OVEN	1	QBA-0016	5 ST 1-2

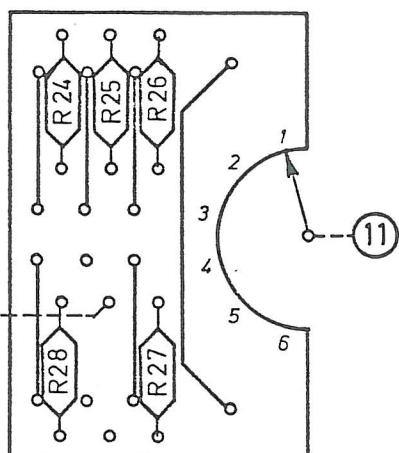




RS 1.



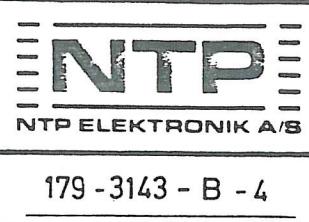
RS 2.



RS 3.

Målestok :	2 : 1
Konstruktør:	H.E.N.
Tegnet :	10.8.79 JS
Godkendt :	KH.
Revideret :	1

Switch Units
Limiter Amplifier 179-310B
Components Lay-out.



179-3143 - B - 4