

Brüel & Kjær

4416

Response Test Unit

valid from serial no. 575443

037-261



Service

4416

Response Test Unit

valid from serial no. 575 443

037-261

Consisting of:	Page	Date
Service Instruction	0-1	4.76
Simplified Diagram	0-2	4.76
Adjustment Procedure	1-1	4.76
- -	1-2	4.76
- -	1-3	4.76
- -	1-4	4.76
ZS 0298 Remote Control	1	1.76
ZT 0294 Amplifier/Power Supply	1	1.76
- - - -	2	1.76
ZT 0295 Input Filter	1	1.76
Circuit Diagram with Parts List/ Cabinet Parts	2-1	1.76

Trouble Shooting

If any faults should occur please check the instrument according to the Adjustment Procedure.

When a fault has been traced and corrected, the voltages and adjustments influenced by the correction must be rechecked. The complete instrument should then be tested to make sure that all basic functions are operative.

The tolerances given in these notes are intended for use as guide for adjustments.

Before correcting any apparent deviation make sure that the measuring instrument has tolerances small enough not to affect the measurement.

Modifications

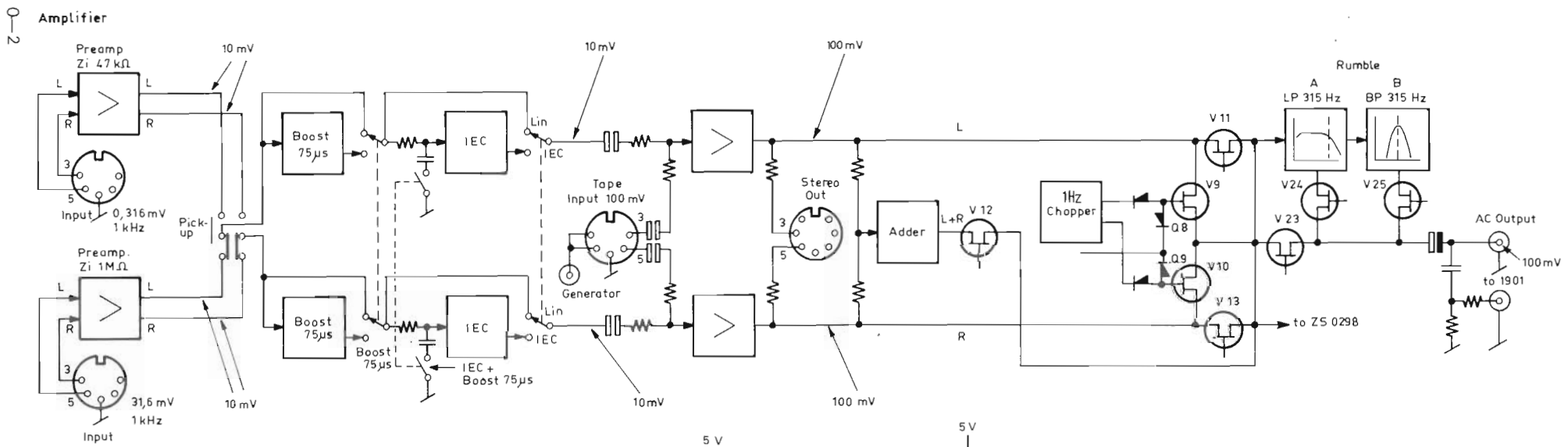
Due to the constant technical progress the instrument will be modified from time to time in order to provide continuously improved performance.

For this reason there may be small differences between the instrument and the Service Instruction.

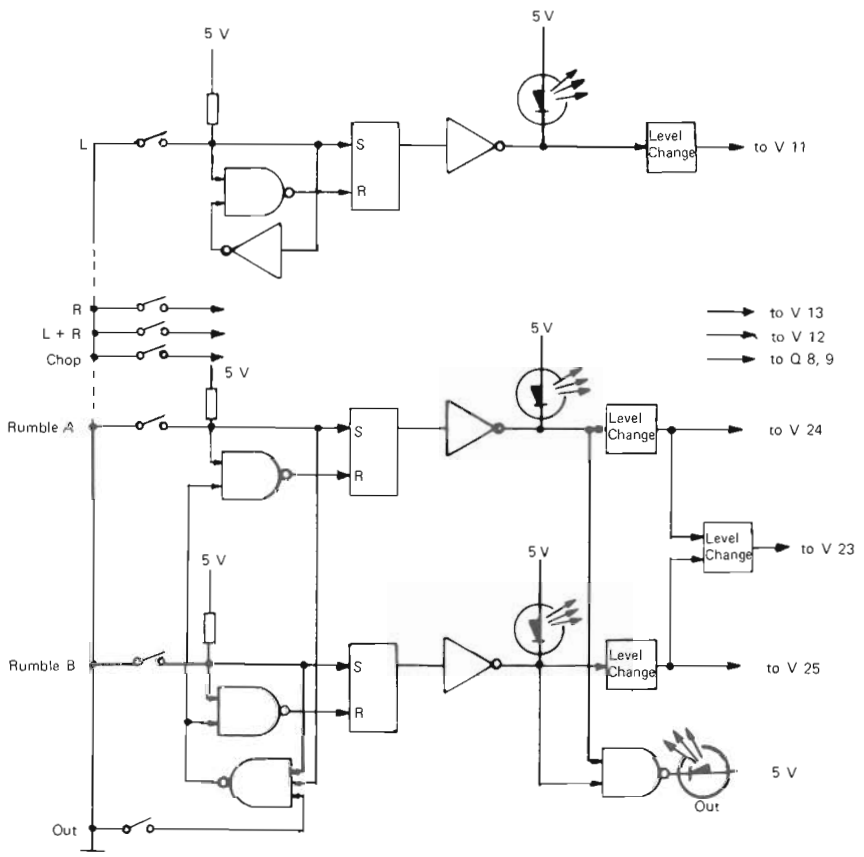
However, the local Representative Service is in possession of all information regarding the modifications that have been made.

Spare Parts

Please state type and serial number of the instrument when ordering spare parts.



0-2



1.1. Power

BOOST
EQUAL
RUMB
PICK-L

PICK-L

1.3. Chopper

1.4. Noise

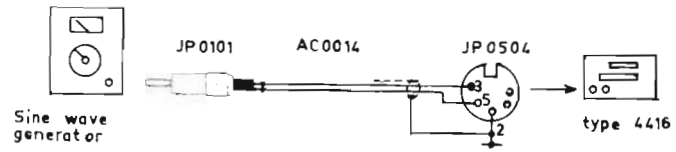
1.1. Power

4.76

4.76

1.1. Power Supply

Check the voltage across C71: 15 V ± 0,6 V
C72: -15 V ± 0,6 V
C73: 5 V ± 0,3 V



1.2. Gain

BOOST 75 μs: "Out"
EQUALIZATION: "Lin"
RUMBLE FILTER: "Out"
PICK-UP: "47 kΩ"

Input signal to "47 kΩ" input: 0,316 mV RMS at 1 kHz.

Check the output voltage at "AC Output" socket: 100 mV RMS ± 3,5 mV.

Check that the output voltage do not change more than 15 mV for all combinations of EQUALIZATION/BOOST.

Switch between L and R and check that the difference between the output voltage is not more than 2 mV

PICK-UP to "1 MΩ"

Input signal to "1 MΩ" input: 31,6 mV RMS at 1 kHz.

Check the output voltage at "AC Output" socket: 100 mV RMS ± 3,5 V.

Input signal to "Tape Recorder" input: 100 mV RMS at 1 kHz.

Check the output voltage at "AC Output" socket: 100 mV RMS ± 3,5 mV.

1.3. Chopper

Connect a frequency counter or an oscilloscope to output of V7 and check the chopper frequency: 1 Hz ± 0,2 Hz.
If necessary adjust P1.

1.4. Noise

Short circuit JP 0101 and check the noise on "AC Output".
Check the noise for L, R and L + R. (Frequency range 20 Hz — 20 kHz)

Pick-up input check

BOOST 75 μs	EQUALIZATION	RUMBLE	PICK-UP to "47 kΩ"	PICK-UP to "1 MΩ"
			"47 kΩ" input shorted	"1 MΩ" input shorted
			Volt RMS	Volt RMS
Out	Lin	Out	*3,16 mV	*1,58 mV
Boost	Lin	Out	21 mV	15 mV
Boost	IEC	Out	6 mV	3,1 mV
Out	Lin	A	*0,95 mV	0,4 mV
Boost	Lin	A	0,7 mV	0,7 mV
Boost	IEC	A	2,5 mV	1,8 mV
Boost	IEC	B	0,26 mV	0,18 mV
Boost	Lin	B	0,36 mV	0,36 mV
Out	Lin	B	*0,3 mV	0,18 mV

Tape input check

			Tape input shorted
Out	Out	Out	* 1 mV

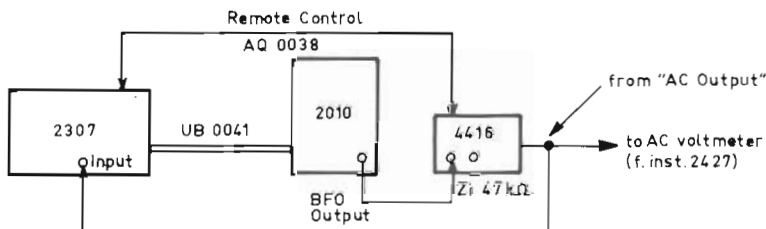
Figure marked with a * are specifications, the other should be used as a guide for trouble shooting.

1.5. Distortion

Check the distortion for L, R and L + R according to the scheme below.

The distortion should be measured with an output voltage of 1 V RMS.

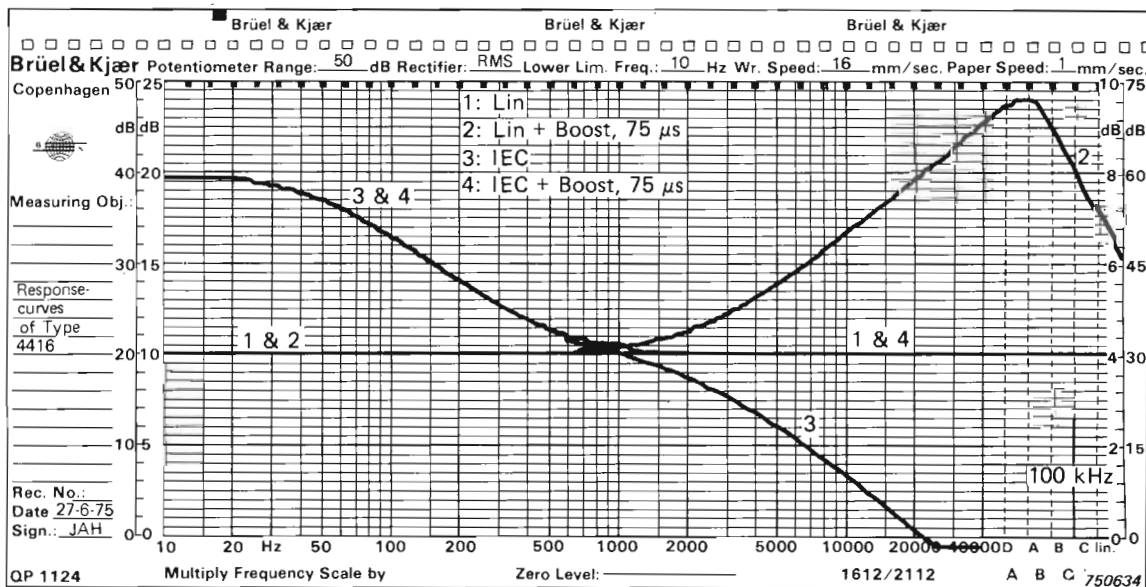
Tape input		20 Hz — 20 kHz	< 70 dB
Pick-up input	IEC/BOOST	5 Hz — 50 kHz	< 60 dB
	LIN/BOOST	5 Hz — 50 kHz	< 50 dB



To check item 1.6 and 1.7 a Level Recorder and a Sine Wave generator (frequency range 2 Hz — 200 kHz) is necessary.

The writing width of the Level Recorder is 100 mm.

1.6. Frequency Response



RUMBLE FILTER: "Out"

Knob setting for Type 2307

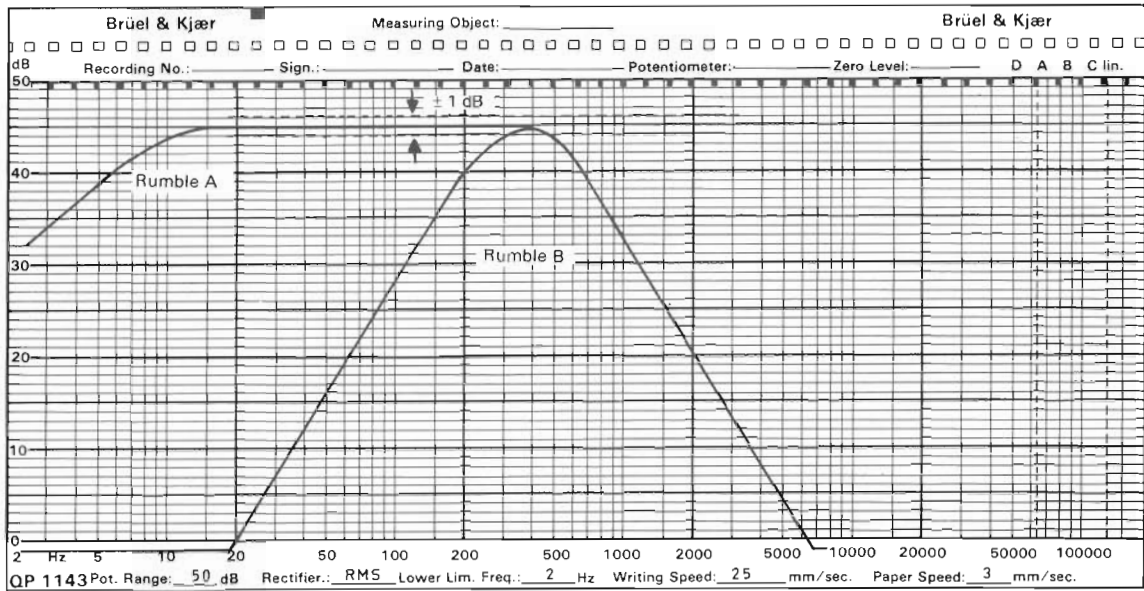
LOWER LIMIT FREQ.: "10 Hz"
 WRITING SPEED: "16 mm"
 PAPER SPEED: "1 mm"

Set the frequency to 10 Hz in 2 Hz — 2 kHz log frequency range.
 Input voltage to "47 kΩ" input: 0,316 mV RMS.

Start the Level Recorder and let it run until approximately 1 kHz. Stop the Level Recorder, change the frequency range of the generator to 200 Hz — 200 kHz and set the frequency pointer to the frequency where it was stopped.
 Start the Level Recorder and let it run out the rest of the chart.

This check should be done for L, R, L + R and for both 47 kΩ/1 MΩ inputs.

1.7. Rumble Filter



EQUALIZATION: "Lin."
 CHANNEL SELECTOR: "L + R"
 RUMBLE FILTER: "Out"

Adjust the input voltage to exactly 1 V RMS at 315 Hz on "AC Output".

RUMBLE FILTER to "A"

Output voltage: 1 V RMS \pm 20 mV.

RUMBLE FILTER to "B"

Output voltage: 1 V RMS \pm 20 mV.

Record the frequency response for RUMBLE A and RUMBLE B filters.

1.8. Max. Output Voltage

EQUALIZATION: "Lin."
 RUMBLE FILTER: "Out"

Connect an oscilloscope to "AC Output" socket and check that the output signal is not distorted for an input voltage of: 23 mV RMS to "47 k Ω " input
 2,3 V RMS to "1 M Ω " input

Check max. output voltage for L, R, L + R and for both 47 k Ω and 1 M Ω inputs.

1.9. Cross talk

EQUALIZING: "Lin."
 CHANNEL SELECTOR: "R"
 PICK-UP: "47 k Ω "

Connect the input signal to pin 3 and short circuit pin 5 to ground on 47 k Ω input
 Adjust the input signal to 3,16 V RMS at 1 kHz on "AC output"

Switch CHANNEL SELECTOR to "L" and check the cross talk according to the scheme below.

Input frequency	Pick-up		Tape
	47 k Ω	1 M Ω	
1 kHz	-65 dB	-65 dB	-65 dB
20 kHz	-45 dB	-40 dB	-45 dB
50 kHz	-35 dB	-30 dB	-35 dB

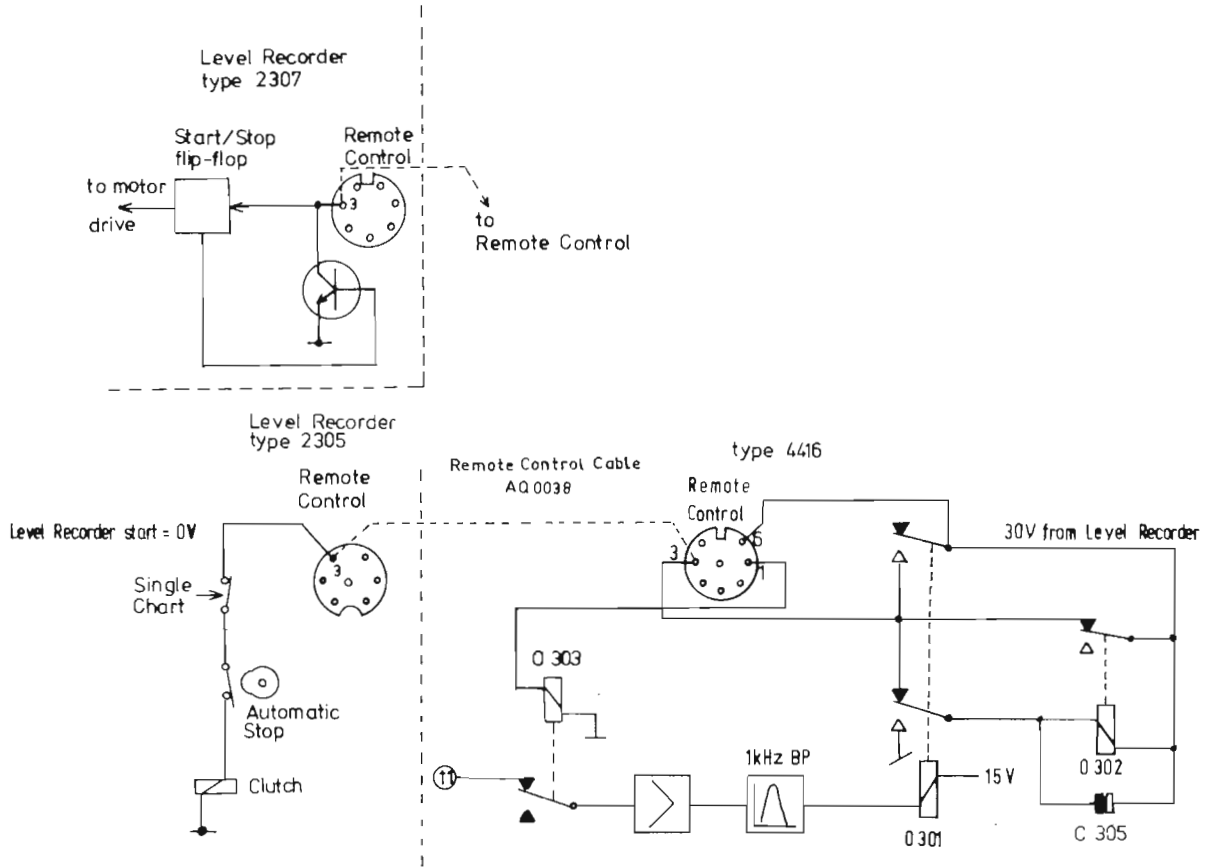
Change the input to channel "L" and check the cross talking.

PICK-UP to "1 M Ω "

Change the input signal to "1 M Ω " input and check the cross talk as described for "47 k Ω " input.

Change the input signal to "Tape" input and check the cross talk as described for "47 k Ω " input

1.10. Synchrostarter



EQUALIZING: "Lin."
 CHANNEL SELECTOR: "L + R"
 RUMBLE FILTER: "Out"
 PICK-UP: "47 kΩ"
 SYNCHROSTART: "Aut."

Connect "Remote Control" on Type 4416 to "Remote Control" on the Level Recorder

Adjust the input signal for 100 mV RMS at 950 Hz on "AC Output".

Switch PAPER DRIVE FUNCTION on Type 2307 to "Continue F".

Press "BFO Stop" on Type 2010 and check that the Level Recorder starts.

If the Level Recorder does not start adjust L301 (on ZS 0298) until the relay O301 will be energized and repeat the check.

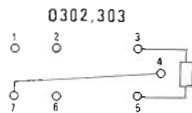
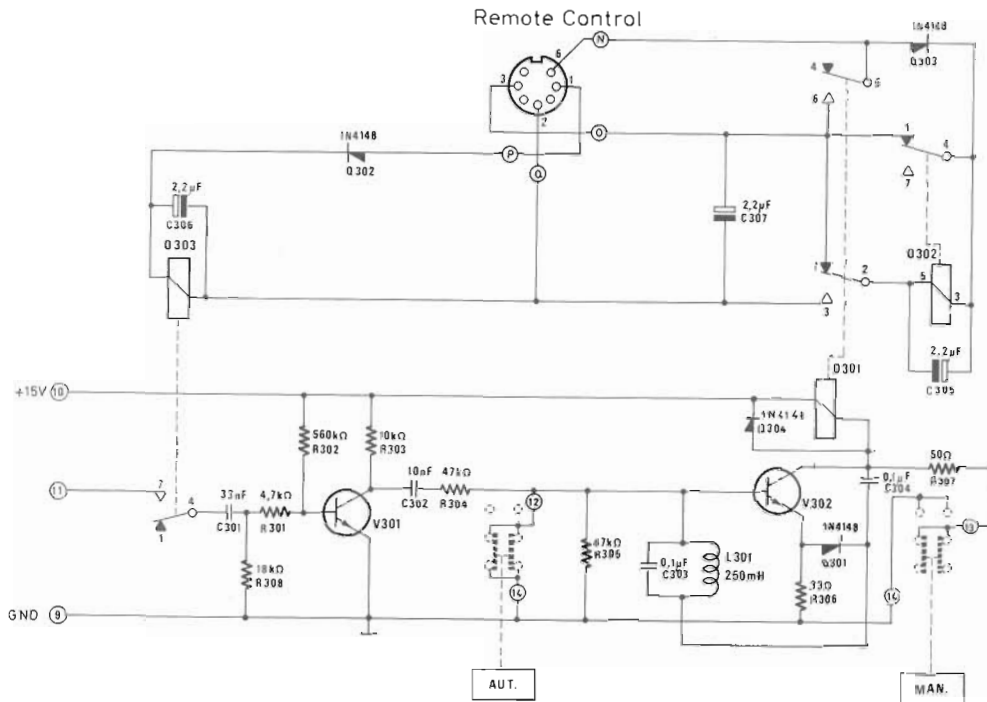
Change the input frequency to 1050 Hz and check again the start function.

If the Level Recorder does not start adjust L301 until the relay O301 will be energized and repeat the start function.

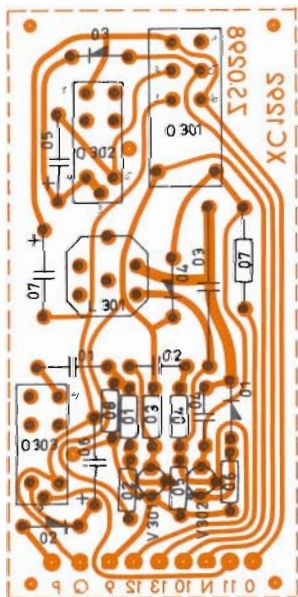
Change the input frequency to 700 Hz and let the Level Recorder run until automatic stop.

Increase the input frequency slowly and check that the relay will be energized between 800 Hz and 950 Hz and the Level Recorder will be started between 1050 Hz and 1250 Hz.

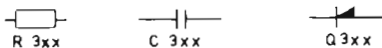
Repeat the adjustment of L301 until this is fulfilled.

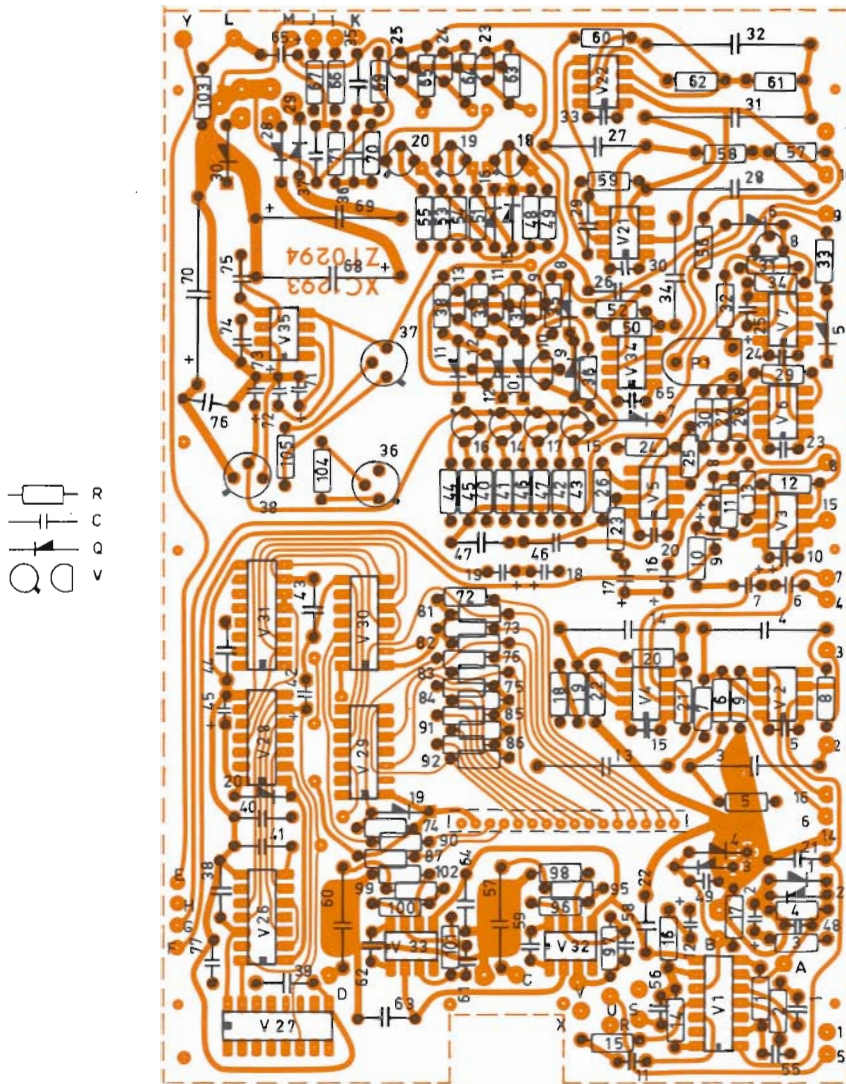


V301,302 - BC107B



CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
C 301	Polyester	33 nF/400 V	CS 0058
C 302	-	10 nF/250 V	CS 0403
C 303	Polystyrene	0.1 μF/ 63 V	CT 1543
C 304	Polyester	0.1 μF/250 V	CS 0402
C 305-307	Electrolytic	2.2 μF/ 63 V	CE 0401
L 301	Resonance Coil	250 mH	LB 0196
O 301	Relay A 2415-12 V Plastic Cover for above relay		OC 0042 SC 0014
O 302,303	Relay RH-24 V		OC 0037
Q 301-304	Silicon 1N4148	75 V/75 mA	QV 0216
R 301	Carbon 1/4 W	5% 4.7 kΩ	RB 3470
R 302	-	- 560 kΩ	RB 5560
R 303	-	- 10 kΩ	RB 4100
R 304,305	-	- 47 kΩ	RB 4470
R 306	-	- 33 Ω	RB 1330
R 307	-	1/3 W 10% 50 Ω	
R 308	-	1/4 W 5% 18 kΩ	RB 4180
V 301,302	Silicon NPN BC107		VB 0032





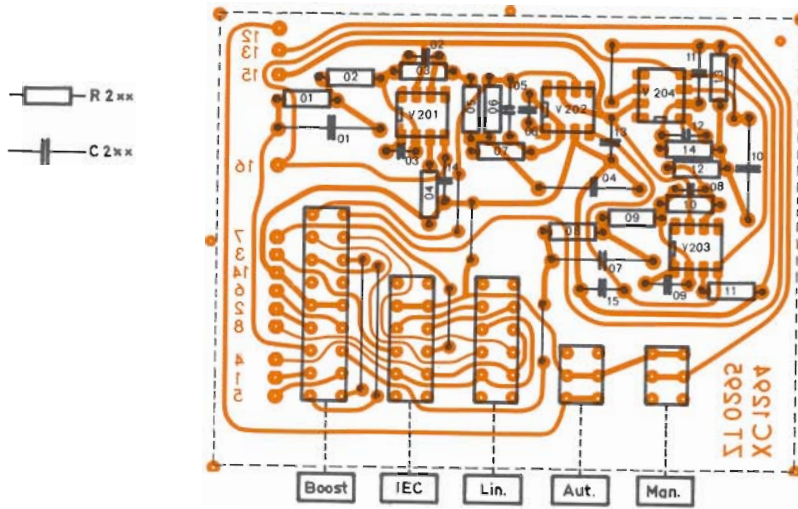
viewed from the bottom side

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
C 1	Ceramic	1 nF/400 V	CK 3101	C 27	Polystyrene	20 nF/ 63 V	CT 1125
C 2	Tantalum	150 μ F/ 6,3 V	CF 0048	C 28	-	75 nF/ 63 V	CT 1523
C 3	Polystyrene	30 nF/ 63 V	CT 1519	C 29	Polyester	0,1 μ F/250 V	CS 0402
C 4	-	27 nF/ 63 V	CT 1518	C 30	Ceramic	30 pF/400 V	CK 0105
C 5	Ceramic	8,2 pF/400 V	CK 0820	C 31,32	Polystyrene	100 nF/ 63 V	CT 1543
C 6,7	Tantalum	150 μ F/ 6,3 V	CF 0048	C 33	Ceramic	30 pF/400 V	CK 0105
C 8,9	-	15 μ F/ 20 V	CF 0010	C 34	Polycarbonate	0,22 μ F/ 63 V	CS 0801
C 10	Ceramic	3,9 pF/400 V	CK 0390	C 35	Polyester	47 nF/250 V	CS 0401
C 11	-	1 nF/400 V	CK 3101	C 36	-	10 nF/250 V	CS 0403
C 12	Tantalum	150 μ F/ 6,3 V	CF 0048	C 37	Polystyrene	3 nF/ 63 V	CT 1157
C 13	Polystyrene	30 nF/ 63 V	CT 1519	C 38-41	Polyester	0,1 μ F/250 V	CS 0402
C 14	-	27 nF/ 63 V	CT 1518	C 42	Tantalum	47 μ F/ 6,3 V	CF 0023
C 15	Ceramic	8,2 pF/400 V	CK 0820	C 43,44	Polyester	0,1 μ F/250 V	CS 0402
C 16,17	Tantalum	150 μ F/ 6,3 V	CF 0048	C 45	Tantalum	47 μ F/ 6,3 V	CF 0023
C 18,19	-	15 μ F/ 20 V	CF 0010	C 46,47	Polyester	0,1 μ F/250 V	CS 0402
C 20	Ceramic	3,9 pF/400 V	CK 0390	C 48,49	Ceramic	3,3 pF/400 V	CK 0330
C 21,22	Polyester	0,1 μ F/250 V	CS 0402	C 55,56	-	8,2 pF/400 V	CK 0820
C 23	Ceramic	8,2 pF/400 V	CK 0820	C 57	Polyester	0,22 μ F/100 V	CS 0339
C 24	-	30 pF/400 V	CK 0105	C 58	Ceramic	1 pF/400 V	CK 0100
C 25	Tantalum	2,2 μ F/ 35 V	CF 0022	C 59	-	10 pF/400 V	CK 1100
C 26	Polycarbonate	0,1 μ F/100 V	CS 0381	C 60	Polyester	0,22 μ F/100 V	CS 0339

ZT 0294

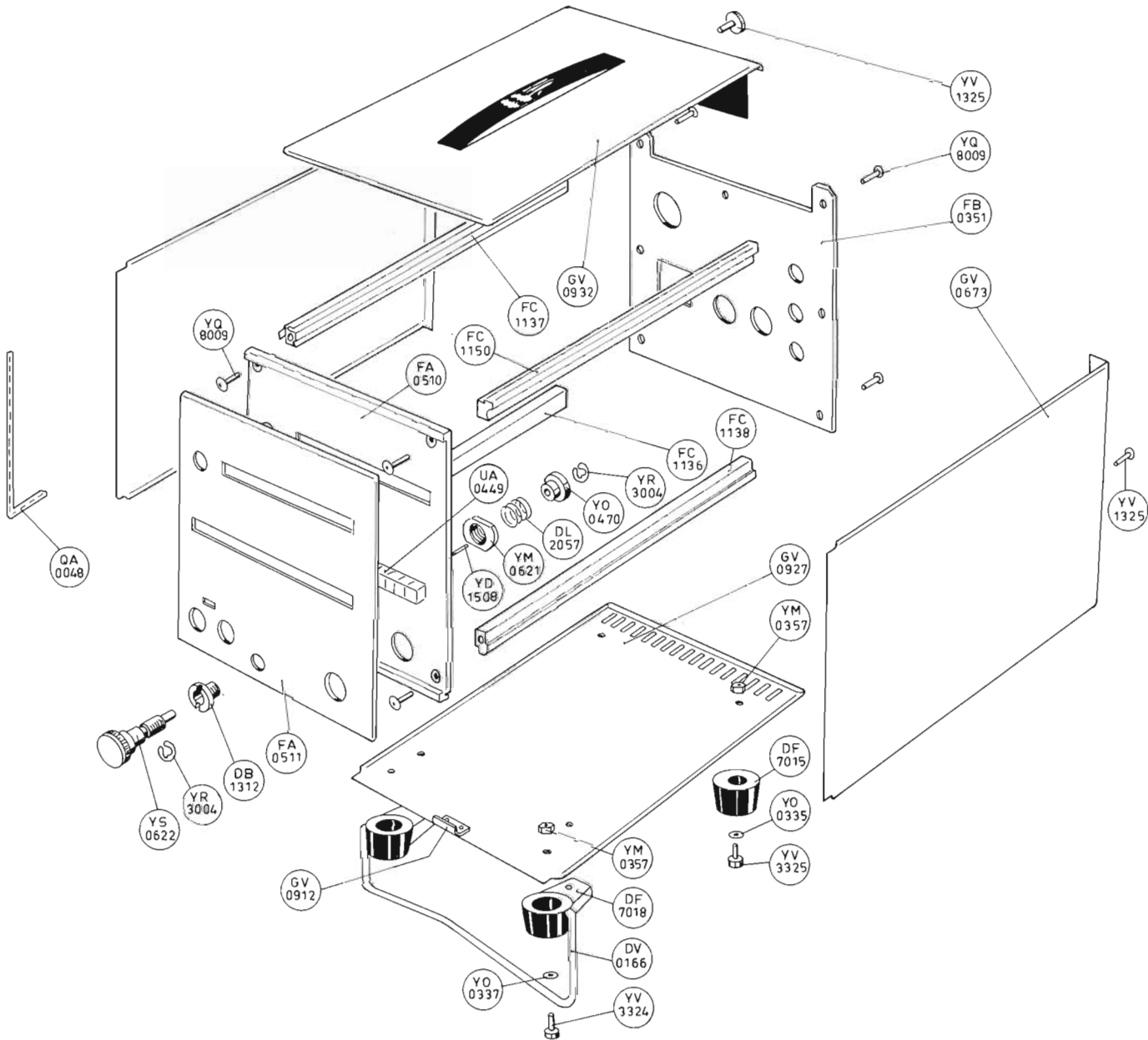
ZT 0294 Layout Diagram with Parts List

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.		
C 61	Ceramic		1 pF/400 V	CK 0100	R 50	Metal	1/4 W	1%	82,5 kΩ	RF 4825	
C 62	-		10 pF/400 V	CK 1100	R 51	Carbon	-	5%	15 kΩ	RB 4150	
C 63,64	Polyester		0,1 μF/250 V	CS 0402	R 52	Metal	-	1%	82,5 kΩ	RF 4825	
C 65	Ceramic		30 pF/400 V	CK 0105	R 53	Carbon	-	5%	15 kΩ	RB 4150	
C 68,69	Electrolytic		100 μF/ 40 V	CE 0443	R 54,55	-	-	-	39 kΩ	RB 4390	
C 70	-		470 μF/ 40 V	CE 0417	R 56	Metal	-	1%	45,3 kΩ	RF 4453	
C 71-73	Tantalum		15 μF/ 20 V	CF 0010	R 57	-	-	-	17,4 kΩ	RF 4174	
C 74-77	Ceramic		47 nF/ 30 V	CK 4470	R 58	-	-	-	5,62 kΩ	RF 3562	
C 78	Electrolytic		22 μF/ 40 V	CE 0428	R 59	Carbon	-	5%	27 kΩ	RB 4270	
					R 60	Metal	-	1%	11 kΩ	RF 4110	
P 1	Cermet		22 kΩ	PG 3221	R 61	-	-	-	3,83 kΩ	RF 3383	
					R 62	Carbon	-	5%	12 kΩ	RB 4120	
Q 1-20	Silicon	1N4148	75 V/75 mA	QV 0216	R 63-65	-	-	-	100 kΩ	RB 5100	
Q 28-30	-	1N4004	400 V/1 A	QV 0237	R 66,67	-	-	-	4,7 kΩ	RB 3470	
					R 69	-	-	-	68 kΩ	RB 4680	
R 1	Metal	1/4 W	1%	61,9 kΩ	RF 4619	R 70	-	-	47 kΩ	RB 4470	
R 2	Carbon	-	5%	100 Ω	RB 2100	R 71	-	-	10 kΩ	RB 4100	
R 3	Metal	-	1%	2 kΩ	RF 3200	R 72-75	-	-	1 kΩ	RB 3100	
R 4	Carbon	-	5%	47 kΩ	RB 4470	R 76	-	-	100 Ω	RB 2100	
R 5	Metal	-	1%	3,32 kΩ	RF 3332	R 81-87	-	-	1 kΩ	RB 3100	
R 6	-	-	-	9,76 kΩ	RF 3976	R 90	-	-	390 Ω	RB 2390	
R 7	-	-	-	115 kΩ	RF 5115	R 91,92	-	-	1 kΩ	RB 3100	
R 8	-	-	-	12,7 kΩ	RF 4127	R 95,96	Metal	-	1%	499 kΩ	RF 5499
R 9	Carbon		5%	10 kΩ	RB 4100	R 97	-	-	316 kΩ	RF 5316	
R 10	Metal		1%	4,75 kΩ	RF 3475	R 98	Carbon	-	5%	330 kΩ	RB 5330
R 11,12	-		-	47,5 kΩ	RF 4475	R 99,100	Metal	-	1%	499 kΩ	RF 5499
R 13	Carbon		5%	47 kΩ	RB 4470	R 101	-	-	316 kΩ	RF 5316	
R 14	Metal		1%	61,9 kΩ	RF 4619	R 102	Carbon	-	5%	330 kΩ	RB 5330
R 15	Carbon		5%	100 Ω	RB 2100	R 103	-	-	220 kΩ	RB 5220	
R 16	Metal		1%	2 kΩ	RF 3200	R 104,05	-	-	150 Ω	RB 2150	
R 17	Carbon		5%	47 kΩ	RB 4470						
R 18	Metal		1%	3,32 kΩ	RF 3332	V 1	2 × Op. Amp.		739	VE 0079	
R 19	-		-	9,76 kΩ	RF 3976	V 2-7	Op. Amp.		301	VE 0044	
R 20	-		-	115 kΩ	RF 5115	V 8	Silicon	PNP	BC177	VB 0071	
R 21	-		-	12,7 kΩ	RF 4127	V 9-13	FET	N	NF510	VB 1021	
R 22	Carbon		5%	10 kΩ	RB 4100	V 14-20	Silicon	PNP	BC177	VB 0071	
R 23	Metal		1%	4,75 kΩ	RF 3475	V 21,22	Op. Amp.		301	VE 0044	
R 24,25	-		-	47,5 kΩ	RF 4475	V 23-25	FET	N	NF510	VB 1021	
R 26	Carbon		5%	47 kΩ	RB 4470	V 26	4 × 2 Input NAND		7400	VD 0002	
R 27,28	Metal		1%	49,9 kΩ	RF 4499	V 27	S-R Flip-Flop		74279	VD 0073	
R 29	-		1%	24,9 kΩ	RF 4249	V 28	2 × 4 Input NAND		7420	VD 0007	
R 30	Carbon		5%	22 kΩ	RB 4220	V 29	6 × INV		7416	VD 0051	
R 31	-		-	330 kΩ	RB 5330	V 30	4 × 2 Input NAND		7400	VD 0002	
R 32	-		-	10 kΩ	RB 4100	V 31	S-R Flip-Flop		74279	VD 0073	
R 33	-		-	100 kΩ	RB 5100	V 32-34	Op. Amp.		301	VE 0044	
R 34	-		-	15 kΩ	RB 4150	V 35	± 15 V Regulator		4195	VE 0068	
R 35-39	-		-	100 kΩ	RB 5100	V 36	Silicon	PNP	40406	VB 0053	
R 40	-		-	39 kΩ	RB 4390	V 37	-	NPN	40407	VB 0054	
R 41	-		-	15 kΩ	RB 4150	V 38	5 V Regulator		78M05	VE 0069	
R 42	-		-	39 kΩ	RB 4390		Printed Circuit Board			XC 1293	
R 43	-		-	15 kΩ	RB 4150		Heatsink			DT 0036	
R 44	-		-	39 kΩ	RB 4390		8 pin-Socket for dual-in-line			JJ 0804	
R 45	-		-	15 kΩ	RB 4150		14 pin-Socket for dual-in-line			JJ 1408	
R 46	-		-	39 kΩ	RB 4390		16 pin Socket for circuit board			JJ 1624	
R 47	-		-	15 kΩ	RB 4150						
R 48	-		-	22 kΩ	RB 4220						
R 49	-		-	15 kΩ	RB 4150						



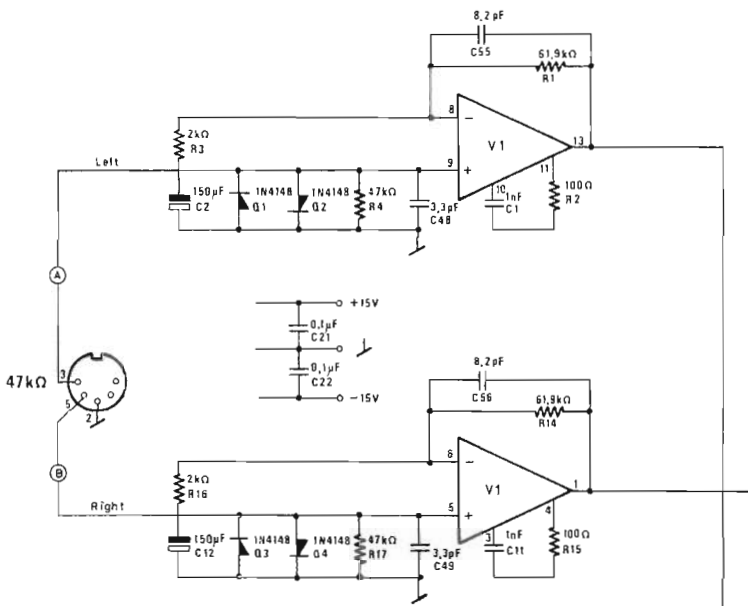
Viewed from the top side

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.	CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
C 201	Polystyrene	1,6 nF/500 V	CT 1103	R 201	Metal	1/4 W 1%	47,5 kΩ RF 4475
C 202	Ceramic	33 pF/400 V	CK 1330	R 202	-	-	2,21 kΩ RF 3221
C 203	-	150 pF/400 V	CK 2151	R 203	-	-	4,99 kΩ RF 3499
C 204	Polystyrene	11 nF/ 63 V	CT 1551	R 204	Carbon	- 5%	4,7 kΩ RB 3470
C 205	-	130 pF/100 V	CT 1138	R 205	Metal	- 1%	953 Ω RF 2953
C 206	Ceramic	150 pF/400 V	CK 2152	R 206	-	-	9,53 kΩ RF 3953
C 207	Polystyrene	1,6 nF/500 V	CT 1103	R 207	-	-	475 Ω RF 2475
C 208	Ceramic	33 pF/400 V	CK 1330	R 208	-	-	47,5 kΩ RF 4475
C 209	-	150 pF/400 V	CK 2151	R 209	-	-	2,21 kΩ RF 3221
C 210	Polystyrene	11 nF/ 63 V	CT 1551	R 210	-	-	4,99 kΩ RF 3499
C 211	-	130 pF/100 V	CT 1138	R 211	Carbon	- 5%	4,7 kΩ RB 3470
C 212	Ceramic	150 pF/400 V	CK 2151	R 212	Metal	- 1%	953 Ω RF 2953
C 213-215	-	47 nF/ 30 V	CK 4470	R 213	-	-	9,53 kΩ RF 3953
				R 214	-	-	475 Ω RF 2475
	Push Button Selector		OJ 0056	V 201-204	Op. Amp.		301 VE 0044
					Printed Circuit Board		XC 1294

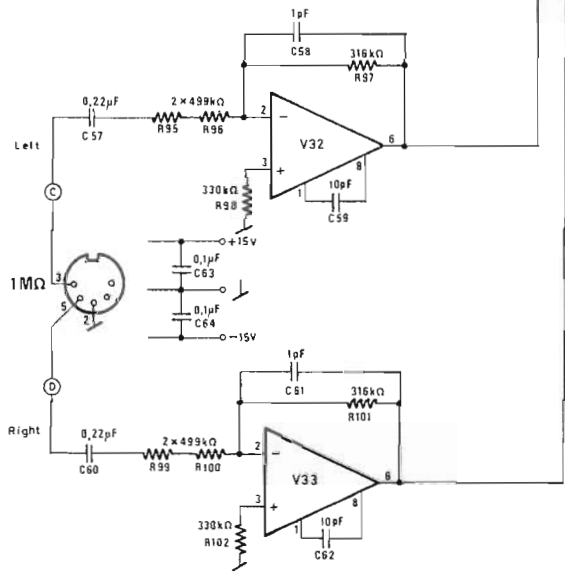


Q 21-27	LED	RL209			QV 4001	Mains Switch	NN 0014
						Cover for above switch	DD 0088
R 77-80	Carbon	1/4 W	5%	390 Ω	RB 2390	"Pick up" Selector	NN 0040
R 88,89				390 Ω	RB 2390	5-pin DIN Socket	JJ 0501
	Printed Circuit Board				XC 1295	Circuit Board with components	
	Printed Circuit Board with components				OZ 0011	Remote Control	ZS 0098
	16-pole Flexible Interconnector				AR 1010	Amplifier/Power Supply	ZT 0294
	BNC Socket				JJ 0121	Input Filter	ZT 0295
	7-pin DIN Socket				JJ 0709		
	Banana Socket				JT 6204		
	Mains Socket				OA 0037		
	Stand-Off				XL 0163		
	Mains Voltage Selector				JS 0001		
	Fuse, slow 220 V				VF 0012		
	Fuse, slow 110 V				VF 0026		
	Mains Transformer				TN 0103		

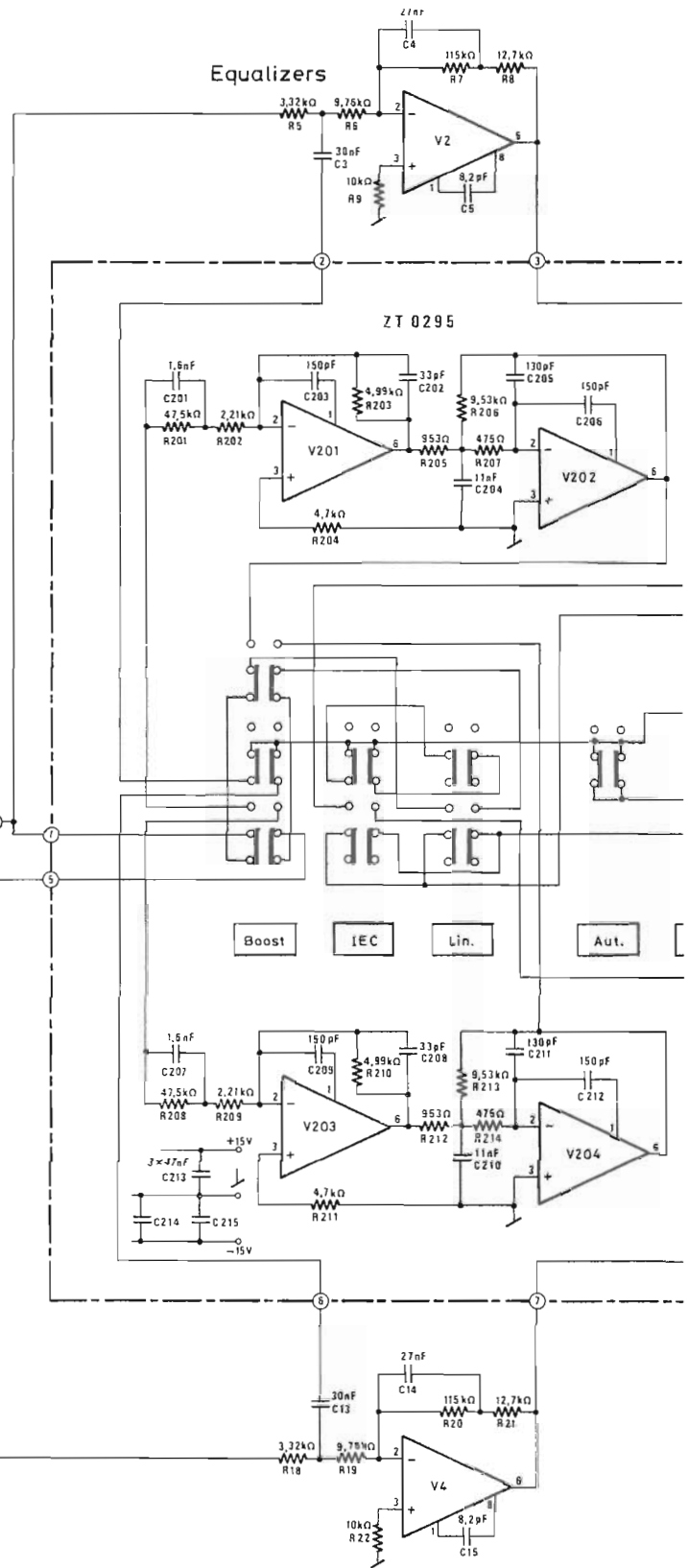
Preamplifiers



Pick-up



Equalizers



V26-30 SN 7400
V29-SN 7416
V28-SN 7420

V1-JA739

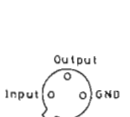
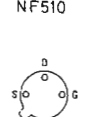
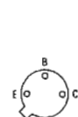
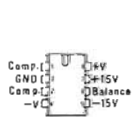
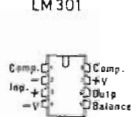
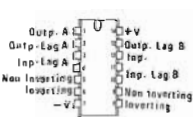
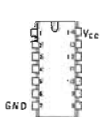
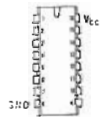
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V37-NPN 40407

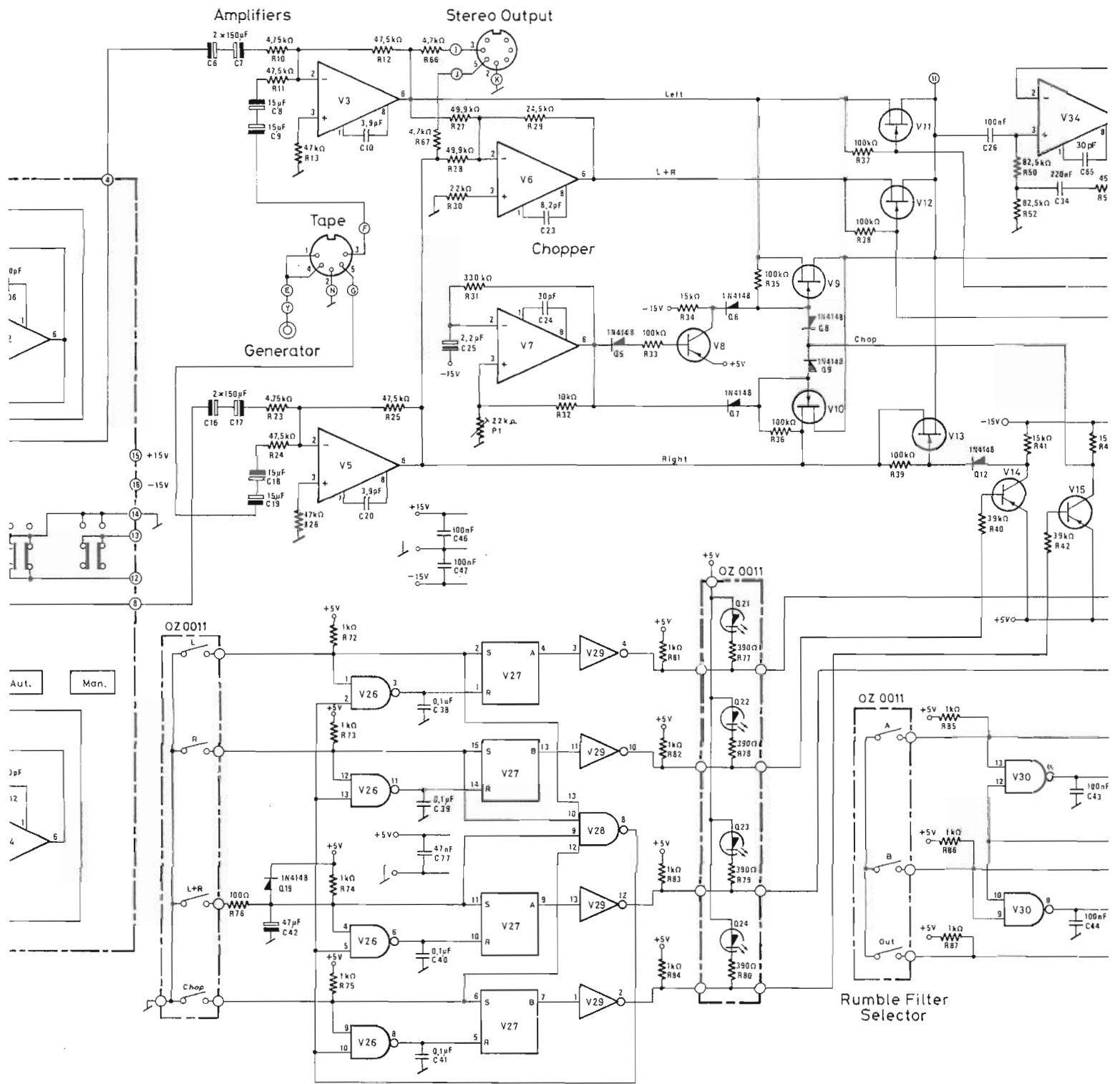
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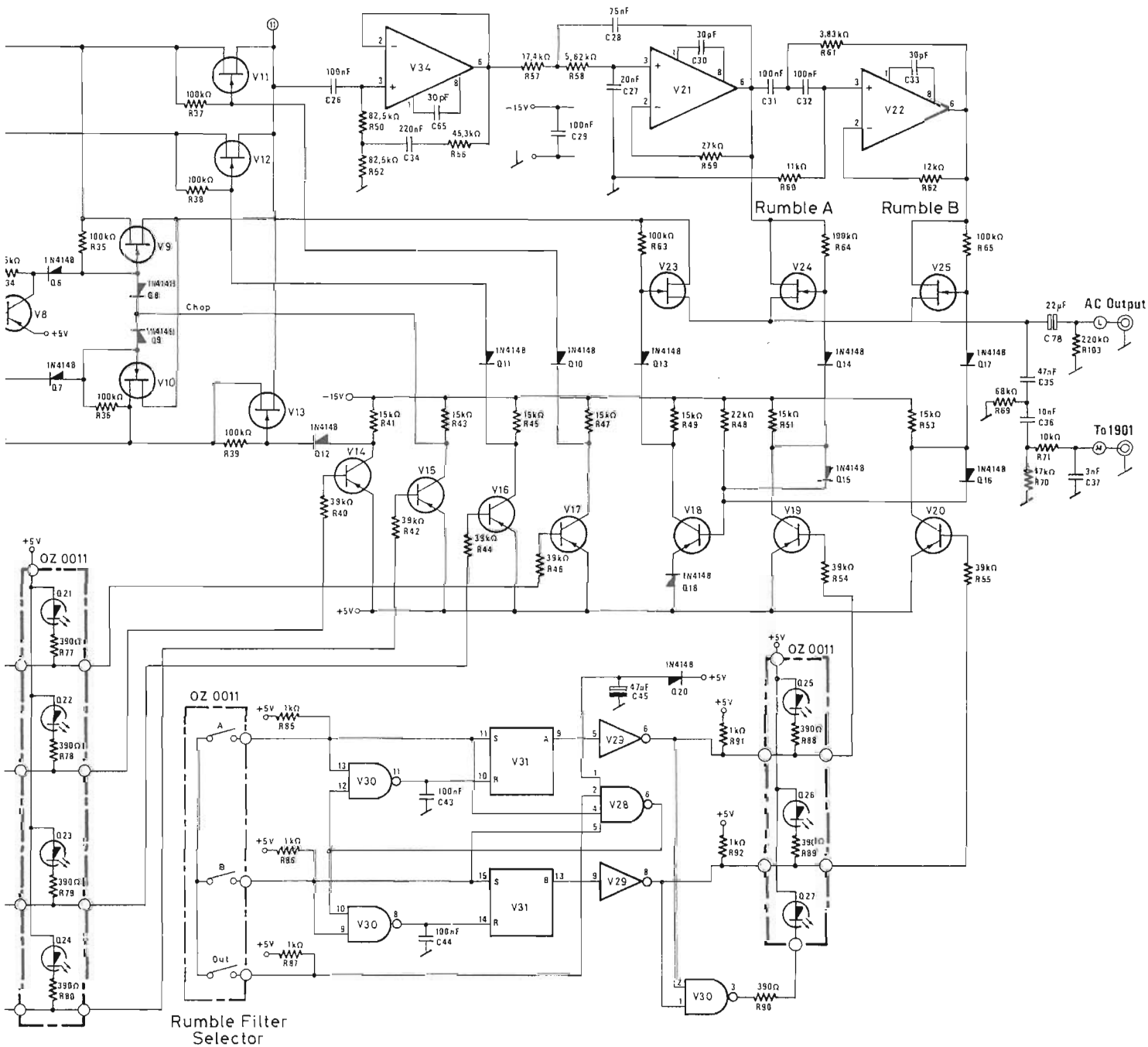


Top view

Bottom view



Rumble Filters



Rumble Filter Selector

