BRÜEL & KJÆR
Nærum - Denmark

08 711 2730

Service Instructions

7001

Tape Recorder

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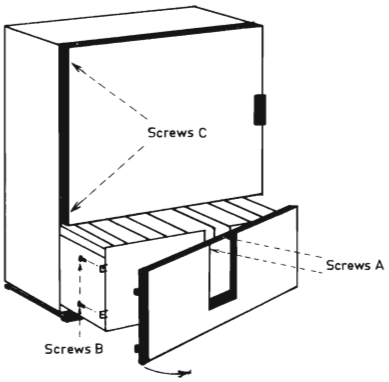

Removal of the Metal Case

After removal of the backplate four screws will appear and after loosening these the cabinet can be dismounted.

Removal of the Electronic Section

Disconnect the control box ZH 0005 and loosen the two allen screws "A" located behind it. Pull out the complete section. The meter circuits can be reached by removing the two screws "B" and swinging the meter panel away from the electronic section.

Opening of Tape Transport Base

The tape transport base can be opened after turning the two screws located at the left hand side of the base 45° left. When opening the transport base a full 90° the stop lever at the top hinge must be lifted and the supporting leg located along the left side of the transport should be released and allowed to drop. Remove the lid by loosening the screws "C" and lifting the lid free of the screws.

Trouble Shooting

If the reason for a fault is not an obvious one such as a missing power supply, broken down resistor, blown or disconnected fuse etc., then first test the voltages of the power supply and compare them with the voltages shown in the circuit diagram in order to localize the defect. Should this method of finding the fault prove unsuccessful, then check the instrument by adopting the method described in the adjustment procedure. When the trouble has been found and remedied, the voltages and adjustments which are influenced by the remedy must be rechecked.

continued

The tolerances stated in the instructions can only be used as a guide for adjustment and control, but any deviations must not be corrected without being sure that the tolerances of the instruments used for making the adjustment are so small as to have no influence on the measurements.

The instructions in this manual are given purely as a guide to the service of equipment with minor faults. Some faults, as f.inst. small deviations in tolerances require for their correction special control equipment and extensive experience, and in these cases it is necessary to send the instrument to the factory.

Spare Parts

Please state type and serial number of apparatus when spare parts are ordered.

Instruments Necessary for Service Repair

Multimeter (50 μA)
Electronic Voltmeter type 2409
Frequency Analyzer type 2107
Beat Frequency Oscillator type 1022
Frequency Counter
Oscilloscope

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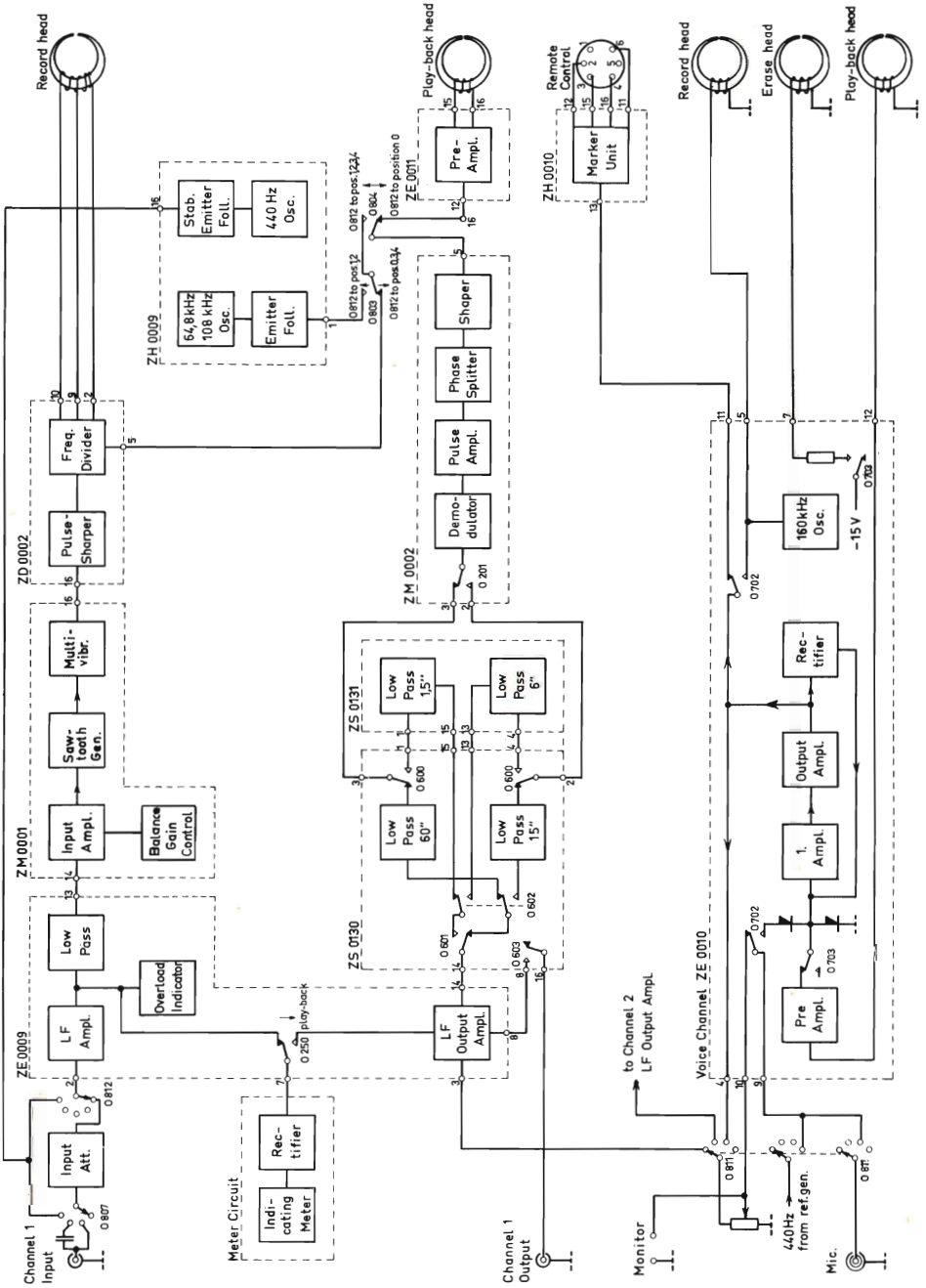
Block Diagram

valid from serial no. 212727

7001.1



Checking Procedure 7001.2

valid from serial no. 153180

This section is meant for a quick check of the complete tape recorder in order to carry out a main check after a repair or in order to localize a suspected fault to be in one certain circuit. A further examination of the respective circuit can be carried out according to the adjustment procedure of the single circuits.

As the two channels are electrically equal only channel 1 will be mentioned in the checking procedure.

Signal to Noise Ratio

RECORD SWITCH 2: "Off"
RECORD SWITCH 1: "Ref."
TAPE SPEED IPS: "15"
INPUT ATTENUATOR: "0 dB"
O 16: "10 1/2" Reel"

The recorder should be mounted with a recommended type of instrumentation tape in a good condition. 10 1/2" precision reels should be used.

Set the tape counter to 0 and erase the tape with a "Bulk Tape Eraser".

Record approx. 12 feet.

RECORD SWITCH 1 to "AC"

Record approx. 12 feet.

Connect a Frequency Analyzer type 2107 to Channel 1 Output.

Rewind and Play-back.

The output from the first 12 feet should be 1 V ± 0,2 dB.

The noise from the last 12 feet should be max. 4 mV (2107 on "Average").

Carry out the same checks on 1,5 - 6 and 60 ips.

On 1,5 ips the noise is allowed to increase to 6,3 mV (2107 on "Average").

If the noise is too high check: Tape, reels and tape tension. Clean tape heads and pinch rollers. Demagnetize the ferrit heads.

Sensitivity and Balance

RECORD SWITCH: "DC"
INPUT ATTENUATOR: "0 dB"

Apply a voltage of exactly +1,4 V to the input socket of type 7001 and record approx. 12 feet.

Connect a multimeter to the respective output socket.

Rewind and play back.

The output voltage should be +1,4 V ±0,1 V.

Same check with an input signal of -1,4 V DC.

Same check and tolerance on all tape speeds.

If type 7001 is outside the tolerance adjust balance and gain according to 7001.6 and 7001.7.

Frequency Response

RECORD SWITCH: "AC"
INPUT ATTENUATOR: "0 dB"
TAPE SPEED IPS: "60"

Connect a BFO type 1022 to the input socket of type 7001 and adjust the output from type 1022 to a 0 dB deflection on type 7001.

Connect an electronic voltmeter or a Frequency Analyzer type 2107 to the output socket of type 7001.

When recording check the frequency response on the output of type 7001.

Tolerance: 20-20000 Hz ± 0,5 dB.

TAPE SPEED IPS to "15"

Repeat the measurements. Tolerance: 20-5000 Hz ± 0,5 dB.

TAPE SPEED IPS to "6"

Repeat the measurements. Tolerance: 20-2000 Hz ±0,5 dB.

TAPE SPEED IPS to "1,5"

Repeat the measurements. Tolerance: 20-500 Hz ± 0,5 dB.

The frequency response can be checked without type 2107.

This can be done by rewinding and playing back the recorded signal and now read the output voltage on the build-in meter.

Distortion

RECORD SWITCH: "AC"
INPUT ATTENUATOR: "0 dB"
TAPE SPEED IPS: "60"

Connect a BFO type 1022 to the input of type 7001.

Input signal: 4000 Hz and the voltage adjusted to give a 0 dB deflection on type 7001.

Record a reasonable tape length.

Connect a Frequency Analyzer type 2107 to the output socket.

Rewind and play back.

2nd and 3rd harmonics should be less than 1% of the 1 V output signal.

Same checks and tolerances on 15-6 and 1.5 ips except for the frequency which should be 1000-400 and 100 Hz respectively.

Crosstalk

RECORD SWITCH: "AC"
INPUT ATTENUATOR: "0 dB"
RECORD SWITCH: "AC"
TAPE SPEED IPS: "15"

Erase the tape with a "Bulk Tape Eraser".

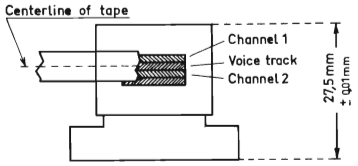
Apply a 1000 Hz signal to Channel input socket of type 7001 and adjust the voltage to give a 0 dB deflection on type 7001.

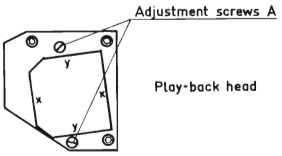
Record a reasonable length of tape.

Connect a Frequency Analyzer type 2107 to Channel 2 output socket.

Rewind and play back.

A 1000 Hz signal should be below 3.2 mV on Channel 2 output socket.





Adjustment of Play Back Head

The heads are adjusted from the factory and should not be touched unless it is absolutely necessary.

The gab azimuth (adj. screws A) can be adjusted electrically according to the following procedure:

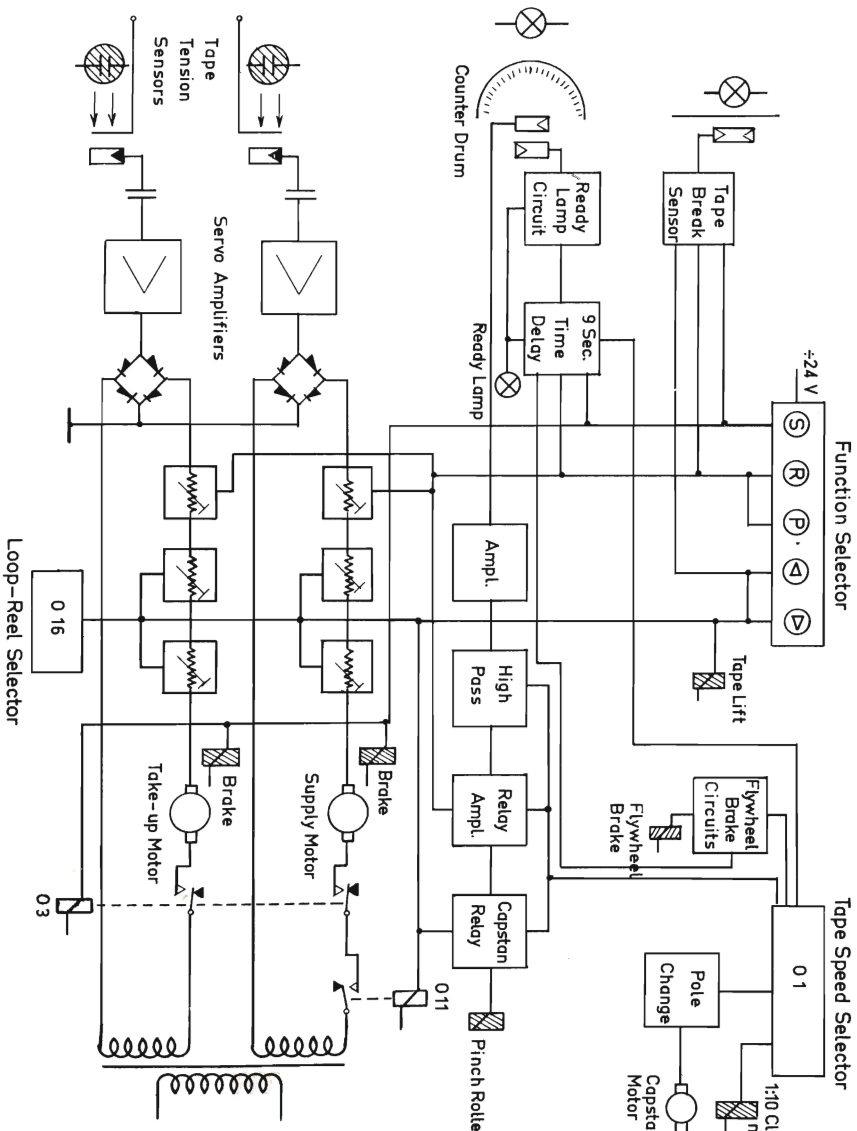
By recording the same input signal on both channels the phase shift between the output signals can be directly checked on a double beam oscilloscope connected to the two outputs and the adjustment can be made simply by loosening one and tightening the other of the screws A. A turn of 10-20° causes a fairly big change.

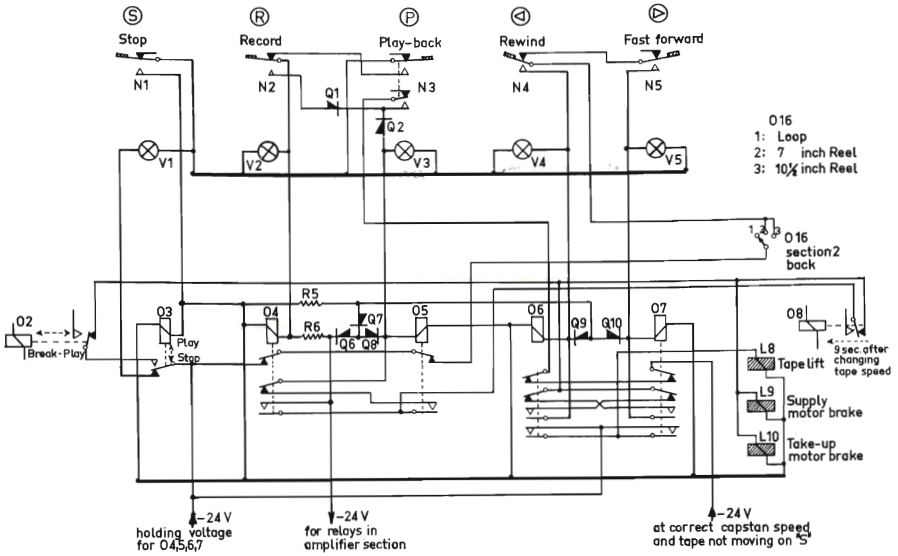
When the two beams on the scope coincide with each other the two channels are in phase.

If an extremely exact measuring set-up is available the height of the head can be adjusted according to the above shown drawings. The distance (27.5 mm) from the bottom of the base plate to the two points X on the top of the head can be adjusted by two allen screws at the bottom of the plate. The distance to the point y is adjustable by means of the screws A.

However, if a new head is ordered from stock the head is mounted and adjusted on the base.

Technical Description





FUNCTION SELECTOR

Stop:

No relays energized corresponds to situation "S".

Stoprelay O 3 disconnects the holding voltage for the relays O 4, O 5, O 6, and O 7, and for the brakemagnets L 9 and L 10. R 5 limits the current through Q 6-10, when O 3 is released by pushbutton "S".

Play-back:

O 5 is energized from 24 volts via O 7, O 6, N 3, and Q 2. At the moment where O 5 is energized V 3 will light, and through Q 8, Q 7, and R 5 a current will flow and activate O 3. If there is tape in the recorder (O 2 released) the holding voltage (-24 V) for O 5 is connected via O 3, O 2, O 8, O 5, and O 4.

Record:

"Record" relay O 4 can only be energized when both "R" and "P" are pressed down at the same time. Besides that the "R" situation is rather equal to "P". R 6 at O 4 prevents direct shortconnection of the 24 volts when changing from "R" to "P".

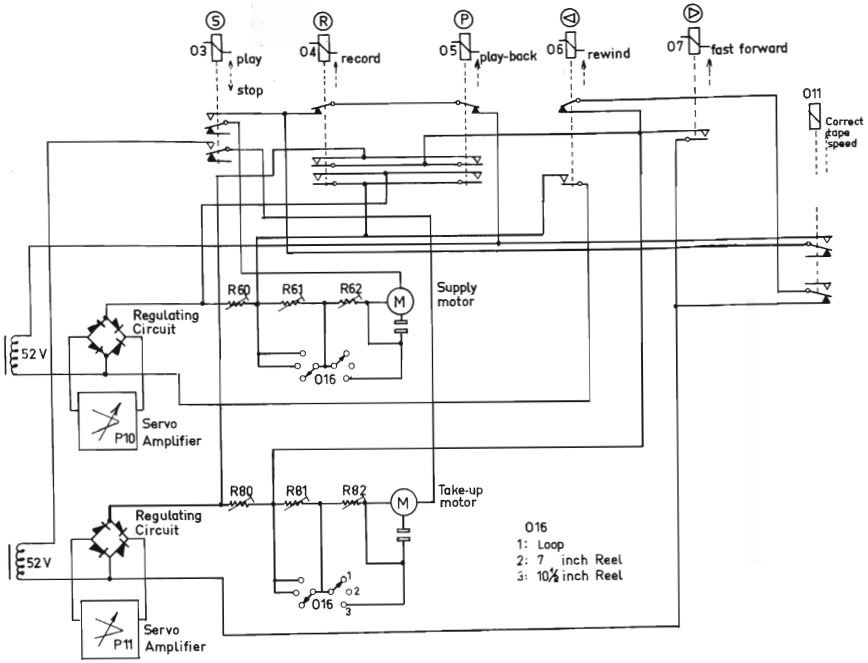
Fast-forward:

In position "Loop" (O 16) the voltage for both "▷" and "◁" (O 6 and O 7) is disconnected by O 16 section 2 back.

If type 7001 is in position "S" and "7 or 10½ inch Reel" the following will happen by pressing N 5 ("▷"): -24 volts will reach O 7 via breakcontacts in O 4 and O 5, switch O16, N 4, and N 5. When O7 is activated, lamp V 5 will light and O 3 is energized through Q 10 and R 5. If there is tape in the recorder the holdcircuit is closed via O 3, O 2, O 6, and O 7. In situation "◁" or "▷" L 8 is energized in order to lift the tape from the heads.

Rewind:

The energized and holding circuits of O 6 are equal to those of O 7, and by changing from "◁" to "▷" or opposite one relay will be activated before the other is released.



REEL MOTORS

Take-up Motor

O 16: "10 1/2 inch Reel"
Position "S"

The AC voltage is disconnected by contacts in O 3.

Position "R" or "P"

In order to obtain the correct tape speed as fast as possible at 15 and 60 ips, the regulating circuit is shortconnected by O 6 and O 11, and the take-up motor will have 52 V AC direct from the transformer. As soon as the tape has reached the correct speed O 11 will be energized (see pich roller control) and the motor will have servoregulated voltage via O 3, O 16, and O 4 or O 5 and the servoamplifier.

Rewind:

The take-up motor will get a reduced voltage via contacts in O 3 and O 16 through R 80 and the diodecircuit of the servoamplifier.

Fast forward:

The motor has full voltage (52 V AC) via O 3, O 16, and O 7.

Supply Motor

O 16: "10 1/2 inch Reel"
Position: "S"

Voltage disconnected by contacts in O 3.

Position: "R" or "P"

When the take-up motor is accelerating to correct tape speed at 15 or 60 ips the voltage to supply motor is disconnected by O 11.

At correct speed O 11 is energized and the motor will have servoregulated voltage via O 11, O 3, O 4, or O 5 and the servoamplifier.

Rewind:

The motor gets full voltage (52 V AC) via O 5, O 4, O 3, O 16, and O 6.

Fast Forward:

The motor gets reduced voltage through O 5, O 4, O 3, O 16, R 60, and the diodecircuit of the servoamplifier.

SWITCH O 16

"10 1/2 inch Reels":

O 16 is switched so that no resistors are connected in series with the motors except R 60 which reduces the voltage for the supply motor at "Fast forward" and R 80 reducing the voltage for the take-up motor at "Rewind".

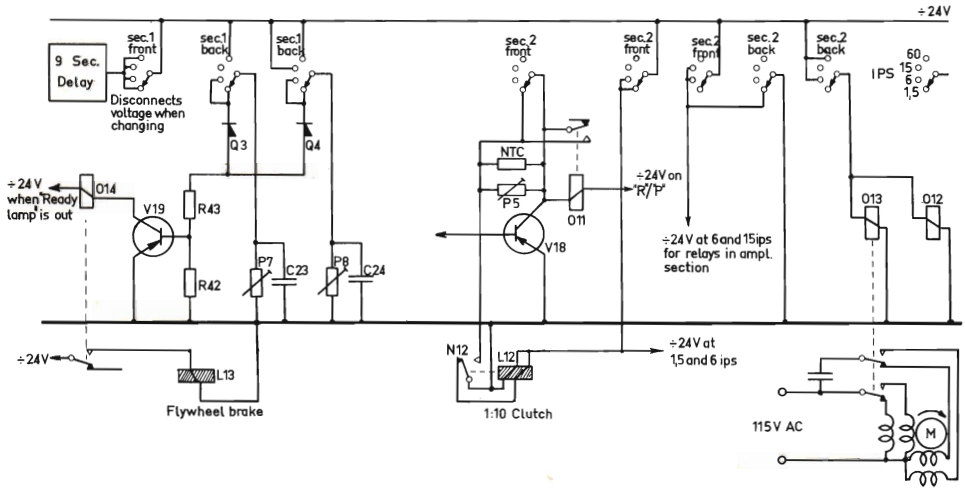
"7 inch Reels":

R 62 and R 82 are connected in series with the motors in order to change the regulation range of the servoamplifiers. This is necessary because of the differences in hub size of 10 1/2 and 7 inch reels.

"Loop":

R 62 and R 82 are still connected and the supply motor has furthermore R 61 connected because of the mechanical friction in all the wheels of the loop arrangement. R 81 is here connected in series with the take-up motor.

The Relay voltage to O 6 and O 7 is disconnected by O 16 as the loop arrangement does not allow "fast forward" or "rewind".



TAPE SPEED SELECTOR O 1

Section 2, back:

The relays O 12 and O 13 are activated in position 6 and 60 ips. O 12 changes the high-pass filter in "Pinch roller control". O 13 changes the motor from a 2-pole motor at 6 and 60 ips to an 8-pole motor at 1.5 and 15 ips.

Section 2, front:

Changing between the two lower speeds (1.5 and 6 ips) and the two higher speeds (15 and 60 ips) is carried out by a mechanical clutch making a gear ratio of 1:10. The change is made by a magnet (L 12) which is activated at 1.5 and 6 ips. This magnet has two coils: A drawcoil (4 Amps.) and a holdcoil (0.18 Amps.). The drawcoil is disconnected by a microswitch as soon as the changing is finished.

The relay O 11 activates the pinch rollers. In position 6 ips there is a fixed time delay made by a NTC resistor.

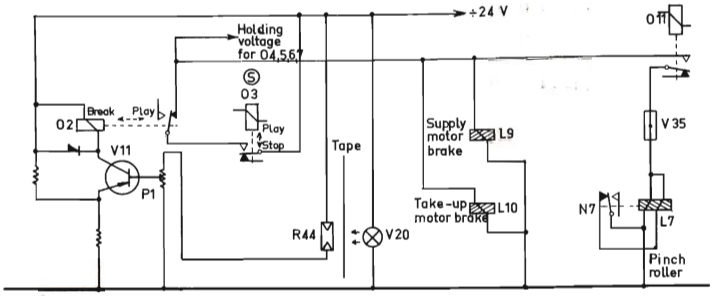
In positions 15 and 60 ips the pinch rollers are activated by the pinch roller control, because L 12 is released and therefore disconnects the groundconnection for O 11. In this case O 11 can only be energized when V 18 is on, which happens when the tape speed corresponds to the chosen speed.

Section 1, back:

This part of the selector controls the flywheel brake. When changing from 60 ips to 6 or 1.5 ips the voltage across C 23 and C 24 is connected through Q 3 and Q 4 to V 19 which energizes the flywheel brake relay O 14. When changing from 15 ips the voltage across C 24 is lead to V 19 through Q 4.

Section 1, front:

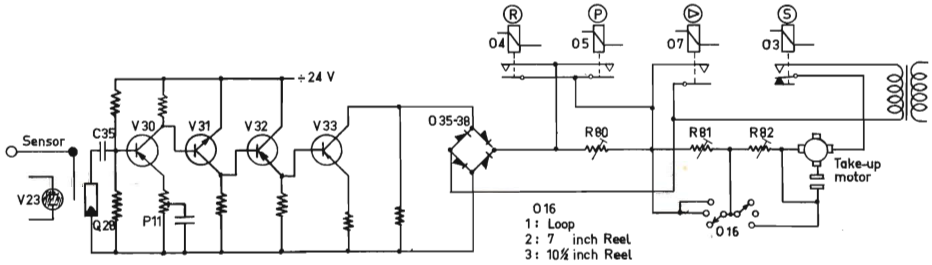
This part of the selector controls the time delay circuit , so that there is a delay time of 9 sec. after speed changes before further operation is possible.



TAPE BREAK CONTROL

The purpose of this circuit is to stop the recorder in the case of tape breaks, when the tape runs out or if a small piece of transparent tape is inserted in the tape.

As soon as R 44 gets light from V 20, relay O 2 is activated, the hold voltage for O 4, O 5, O 6, and O 7 is disconnected and type 7001 goes to position "S".



SERVOAMPLIFIERS

These circuits are made to keep the tape tension constant in positions "Record" and "Play-back" by empty as well as full reels.

The light from a neon lamp is measured by a photovoltaic cell Q 27 (Q 28). The amount of light is controlled by a tape tension sensor and the signal from Q 27 (Q 28) is fed to an amplifier with a succeeding power transistor connected to a bridge circuit in series with the motor.

By increasing tape tension Q 28 will have more light, the AC voltage to the amplifier is higher and the load of the bridge is decreasing which means a lower voltage to the motor. This causes decreasing tape tension and so a balance situation of 100 grams is obtainable.

The servoamplifier is able to regulate the motor voltage from 32-46 volts which is enough to keep a constant tape tension under all conditions.

ADJUSTMENTS

Delay Circuit

ON-OFF to "On"

When changing Tape Speed, relay O 8 should be energized and lamp "Ready" should be off for approx. 9 sec.

If necessary adjust P 2 (on printed circuit XC 0117).

Flywheel Brake

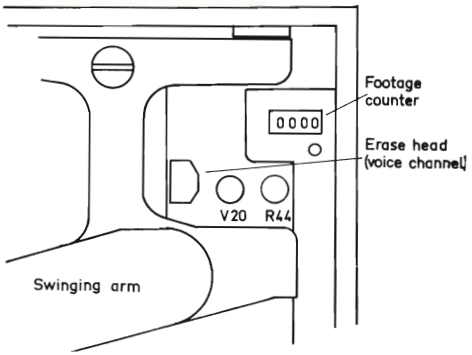
O 1: Change from "15-1.5 ips"

The brake time should be adjusted so that the correct captan speed (1.5 ips) is reached at the moment where the braking effect is finished. Can be watched on relay O.14.

Brake time approx. 3/4 sec. If necessary adjust P 8 (XC 0117).

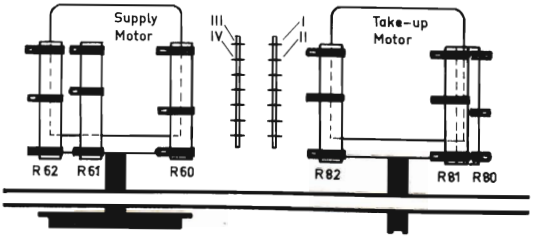
O 1: Change from "60-1.5 ips"

Brake time 3-5 sec. If necessary adjust P 7 (XC 0117).



Tape Break Sensor

Adjust sensitivity (P1 on XC0117) so that relay O 2 will not be released even if a white clear tape is inserted between V 20 and R 44.



Fast Forward-Rewind

LOOP-REEL: "10 1/2" Reel"

Mounted with 10 1/2" precision reels.

Supply reel full and take-up reel almost empty.

FAST FORWARD: "▷"

The take-up motor is stopped with a finger and the voltage for the supply motor should be high enough to keep a tape tension even if the take-up motor is turned slowly backwards.

If necessary adjust R 60.

continued

CIRCUIT DIAGRAM REF.	COMPONENT TYPE	STOCK REF.
	MECHANICAL PARTS:	
	Rubber Idler Wheels, 1:10 Reduction	DF 0012
	" Pressure Rollers in Loop Adaptor	DF 0209
	Guide Roller, 25Ø (1") with Bearings	UC 0017
	Turn Around Roller, 32Ø (1 5/16") "	UC 0014
	Pinch Roller with Bearings	DF 0200
	Clutch, Interm. Shaft of Motor Drive	DO 0006
	Clutch, Flywheel	UC 0003
	O-Ring for Clutch	YJ 0286
	Helical Spring for Tape Tension Sensor	DL 1000
	" " " Solenoid UM 1017	DL 1003
	" " " Reel Brakes	DL 1004
	Compr. Spring for Brake in Reel Arm and Slide on Loop Adaptor	DL 2025
	Compr. Spring for Clamp on Ext. Leg	DL 2028
	Spiral Spring for Pinch Roller Unit	DM 0002
	Cover for Record Head	FD 0007
	" " Reproduce Head	FD 0008
	" " Lamp on Tape Break Unit	DO 0023
	" " Plexiglas (Acryl)	FE 0001
	Extension Leg for Transport Base	YA 0147
	Clamp for Extension Leg	UC 0009
	MISCELLANEOUS:	
	Bezel for Overl. Indicators and Func. Sel. Buttons	SØ 0024
	Cable for 7001 - 2305 - 2112	AQ 0016
	Extension Board for Service	AR 0100
	Footage Counter	OB 0003
	Glass Cover for Ready Lamp	SG 0010
	Knob, Calibration Selector	SN 0014
	" , Power On-Off	SN 0015
	" , Loop-Reel Selector	SN 0016
	" , Tape Speed Selector 20 mm	SN 2007
	" , Record Switch and Monitor Controls 20 mm	SN 2022
	" , Input Attenuator 25 mm	SN 2522
	Screws for SN 2007 and SN 2022	YQ 2003
	Screws for SN 2522	YQ 2083
	Mounting Ring for SN 2522	DB 0674
	Lightbutton, red for Overload Indicator	SN 0100
	" , red Ⓢ	SN 0150
	" , white Ⓟ	SN 0151
	" , " Ⓡ	SN 0152
	" , " Ⓥ	SN 0153
	Microphone with Cable and Plug	MM 0006
	Moving Coil Meter (55 µA)	IM 0005
	Power Transformer	TN 0010
	Reel, 10 1/2" with Ampex Tape	QR 1001
	" , 10 1/2" empty (Magnesium)	LS 0024
	Tool for Lamp Replacing	QA 0034
	Unbraco Key 1.5 mm	QA 0042
	" 2 mm	QA 0046
	" 2 mm	QA 0048
	" 2.5 mm	QA 0049
	" 3 mm	QA 0038
	" 4 mm	QA 0021

TRANSISTORS:

CIRCUIT DIAGRAM REF.	COMPONENT TYPE			STOCK REF.
V 259,260	Germanium	PNP	2N2374	VB 0022
V 261,262	Silicon	NPN	BC 107	VB 0257
V 263,264	"	PNP	2N4289	VB 0049
V 300-314	"	PNP	2N3702	VB 0038
V 401	"	NPN	SA2738	VB 5301
V 402-404	"	NPN	BC 107	VB 0257
V 405	"	NPN	BF 173	VB 0065
V 406-408	Germanium	PNP	2N 502A	VB 0035
V 450	Silicon	NPN	2N1613	VB 0026
V 451-453	"	NPN	BC 107	VB 0032
V 454	"	NPN	2N1613	VB 0026
V 455-457	"	NPN	BC 107	VB 0032
V 458	"	NPN	2N1613	VB 0026
V 459-461	"	NPN	BC 107	VB 0032
V 500-503	"	NPN	BC 107	VB 0032
V 504	"	PNP	2N4289	VB 0049
V 550	Germanium	PNP	2N2374	VB 0022
V 650	Silicon	NPN	BC 107	VB 1032
V 651	"	NPN	BC 107	VB 0032
V 652	"	NPN	BC 107	VB 1032
V 653	"	NPN	BC 107	VB 0032
V 654,655	Germanium	PNP	2N1499A	VB 0042
V 700	Silicon	PNP	2N3702	VB 0038
V 701,702	"	NPN	BC 109	VB 0047
V 703	"	PNP	2N4289	VB 0049
V 704,705	"	NPN	BC 109	VB 0047
V 706	"	PNP	2N4289	VB 0049
V 707,708	"	NPN	BC 107	VB 0032
V 709,710	Germanium	PNP	2N2374	VB 0022
V 800-803	FET (matched pair)		2N4302	VB 1045

PRINTED CIRCUITS:

	with comp.	without comp.
Servoamplifier	ZE 0008	XC 0079
Freq. Divider	ZD 0002	XC 0092
Demodulator	ZM 0002	XC 0093
Marker Unit	ZH 0010	XC 0094
Voltage Stabilizer	ZG 0003	XC 0095
Low-Pass Filter	ZS 0130	XC 0096
"	ZS 0131	XC 0097
FM Modulator	ZM 0001	XC 0098
LF Amplifier	ZE 0009	XC 0099
Reference Generator	ZH 0009	XC 0100
Interc.circuit board	KC 0002	XC 0101
Meter Circuit Track 2	8010055	XC 0102
" " 1	8020030	XC 0103
Relay Circuit	ZH 0008	XC 0117
Power Supply	ZG 0002	XC 0196
Voice Channel	ZE 0010	XC 0266
Calibr.circuit Track 1		XC 0313
" Track 2		XC 0314
Preamplifier	ZE 0011	XC 0346
Adjustment Circuit	ZZ 0003	XC 0477

FUSES and LAMPS:

V 1-6	Lamp, func. selector	24 V/0.025A	VS	0007
V 20,21	Lamp, tape break-counter	"	VS	0007
V 22,23	Neon lamp, tape tension	110 V/0.3 mA	VS	8003
V 35	Fuse, pinch roller solenoid	1.6 A	VF	0013
V 43	Fuse, power line	2.5 A	VF	0011
V 45	Fuse, 1:10 clutch	1.6 A	VF	0013
V 462-464	Fuse, voltage stabilizer	1 A	VF	0008
V 805,805	Lamp, overload indicator	24 V/0.025A	VS	0007

PLUGS and SOCKETS:

Input-output plug		JP	0018
" socket		JJ	0115
Mic. socket		JJ	0204
Multiplug	10 pin	JP	1000
"	15 "	JP	1500
"	20 "	JP	2003
"	26 "	JP	2600
Multisocket	6 "	JJ	4704
"	7 "	JJ	0701
"	88 "	JJ	0800
"	10 "	JJ	1000
"	15 "	JJ	1500
"	16 "	JJ	1600
"	20 "	JJ	2003
"	26 "	JJ	2600
Relay socket		JJ	0012
"		JJ	2402

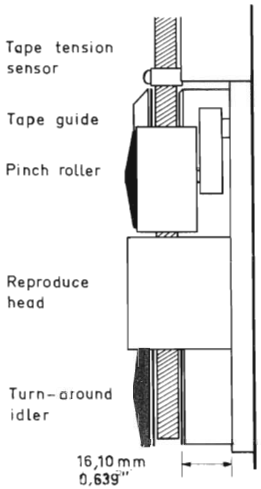
COILS:

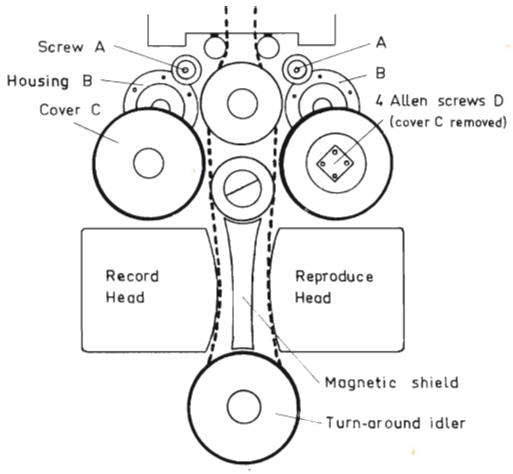
L 250	0.5 H	for ZE 0009	LB	0580
L 251	50 mH	" "	LB	0579
L 500	7 mH	" ZH0009	LB	0568
L 501	5 mH	" "	LB	0573
L 520	100 mH	" "	LB	0639
L 550	0.5 H	" ZH0010	LB	0601
L 600	19.5mH	" ZS 0130	LB	0569
L 601	21.4mH	" "	LB	0572
L 602	19.5mH	" "	LB	0569
L 603	78 mH	" "	LB	0571
L 604	85.6mH	" "	LB	0570
L 605	78 mH	" "	LB	0571
L 625	195 mH	" ZS 0131	LB	0574
L 626	214 mH	" "	LB	0575
L 627	195 mH	" "	LB	0574
L 628	780 mH	" "	LB	0577
L 629	856 mH	" "	LB	0576
L 630	780 mH	" "	LB	0577
L 700	Converter	" ZE 0010	LB	0563
L 701	Choke	" "	LB	0565

MECHANICAL PARTS:

	Motor Drive Unit	UM	0054
	Take-up Motor Unit	UM	0055
	Supply Motor Unit	UM	0056
	Tape Break Unit	ZB	0006
	Tape Tension Sensor Unit	ZB	0007
	Pinch Roller Unit, left	UD	0016
	" , right	UD	0017
	Loop Adaptor	UD	0011
	Dual Speed Synchronous Motor	UM	0034
	Reel Torque Motor	UM	0035
	Ferrit Record Head with Base Mounting	MR	0001
	" Reproduce " " " "	MR	0002
	Voice Erase Head	MR	0003
L 7	Solenoid for Pinch Rollers	UM	1017
L 8	" " Tape Lift Rollers	UM	0015
L 9,10	" " Reel Motor Brakes	UM	0015
L 12	" " 1:10 Clutch	UM	1017
L 13	" " Flywheel Brake	UM	0019
	Belt for Motor Drive and Reel Arm	DX	0024

continued





4.3. Guide Rollers and Pinch Rollers

The aluminium guide rollers and the rubber pinch rollers should be kept clean with a cloth damped with alcohol. Lubrication should under normal circumstances not be necessary. The bearings are either of the oilless type with a grease reservoir or precision ball bearings. The guide rollers with oilless bearings should have an end-play of 0.05 mm (0.002"). The Pinch rollers should have negligible amount of end-play.

Removal of Pinch Roller Assembly

If it is found necessary to remove the pinch roller assembly tHis can be done by removing the Allen screw and retaining washer "A". The assembly can now be pulled out from the base of the tape transport.

At reassembly make certain that the pin at the end of the shaft comes beneath the release mechanism which can be seen through the hole in the base.

Adjustment of Pressure

The correct pressure of the pinch roller against the capstan is between 900 and 1000 g (approx. 2 lbs. to 2 lbs. 4 oz.) this can be measured by placing a band around the roller and by use of a spring scale attached to the end of the band measure the force necessary to move the roller slightly from its position of rest. This measurement is very nearly the same as when the rollers are engaged against the capstan because of the flat characteristic of the spiral spring.

If adjustment is necessary insert a suitable tool in the holes provided in the bearing housing, loosen the screw of the retaining washer and turn the housing to increase or decrease the tension of the spiral spring.

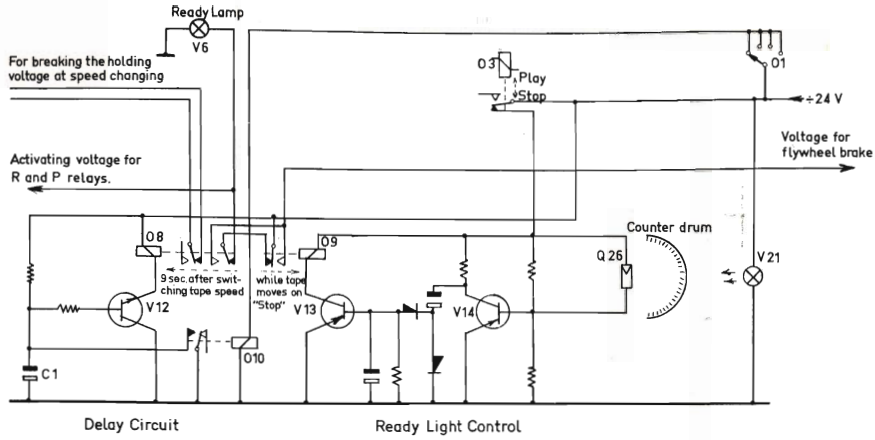
Alignment of Pinch Roller

If the pinch rollers should come out of alignment thus causing the tape to be forced against the sides of the guide rollers, a slight adjustment of the rollers may be necessary. First make certain that the tape tension is correct. The arms of the tension rollers should be on the marks of the sensors base mount. The cover "C" over the pinch rollers can be removed by inserting a narrow blade under the cover and prying the cover off. An adjustment of the roller is possible through an arrangement of the four Allen screws "D" pressed against four balls thus keeping the center bushing centered around the non rotating stud.

For adjustment proceed as follows:

1. Loosen all four screws approx. 1/8 of a turn (use a 1.5 mm hexagon wrench).
2. Turn the screw 1/2 turn out, at the pint where the roller should be tilted outwards.
3. Turn the screw opposite 1/2 turn in.
4. Tighten all screws 1/8 of a turn. Do not tighten too much, otherwise a distortion of the bushing will occur.

continued



READY LAMP CIRCUIT

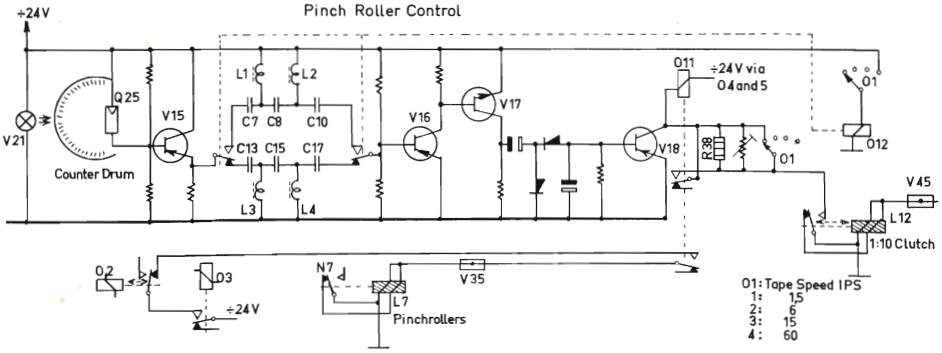
The purpose of this circuit is to switch off the function of the "R" and "P" buttons approx. 9 sec. after speed changes and in situation "Stop" while the tape is still moving.

SPEED CHANGING

When changing speed the voltage to O 10 is disconnected for a short moment. C 1 gets shortconnected and O 8 is energized. O 8 is released when C 1 has reached a voltage corresponding to the cut-off voltage of V 12.

TAPE MOVING ON "STOP"

Inside the counter drum is mounted a photodiode Q 26 getting light through the holes in the drum. If the tape is moving on "Stop" the AC Voltage from Q 26 is amplified, rectified and fed to V 13 which energizes relay O 9. Relay O 9 disconnects the voltage to O 4 and O 5 (R and P relays).



ACTIVATING OF PINCH ROLLERS

At 60 and 15 ips the pinch rollers are activated when the take-up motor has brought the tape to a speed corresponding to the chosen speed. The tape speed is measured by Q 25 in the counter drum. The diode gets light through 39 holes, which gives a certain frequency (525 Hz at 60 ips and 131 Hz at 15 ips). This AC voltage is applied to high pass filter, an amplifier and a DC amplifier stage succeeded by O 11 which activated the pinch rollers by means of L 7.

At 6 ips a fixed time delay is made by a NTC resistor R 38.

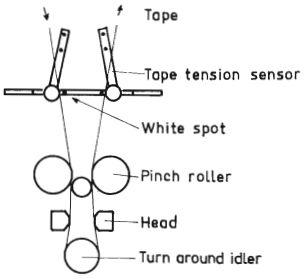
At 1.5 ips the pinch rollers are activated immediately.

REWIND: "◁"

Take-up reel full and supply reel almost empty.

Supply motor stopped and check as under "▷".

If necessary adjust R 80.



Servoamplifiers

SPEED SELECTOR: "1.5 ips"
PLAYBACK: "P"

Connect a multimeter (50 V AC) to the take-up motor (I and II).

Right tape tension sensor to inner position.
The voltage must be at least 46 V AC.

Sensor to outer position.
The voltage should be approx. 33 V AC.
If necessary adjust P 11 (XC 0079).

Connect the multimeter to supply motor (III and IV).

With sensor to inner and outer position check the motor voltage as before.

If necessary adjust P 10 (XC 0079).

Pinch Roller Control

SPEED SELECTOR: "1.5 ips"

When pressing down "P" the pinch roller should be clutched in at once.

SPEED SELECTOR: "6 ips"

The clutching in of the pinch rollers should take place approx. 0.5 sec. after pressing "P".

If necessary P 5 (on printed circuit XC 0117) should be adjusted until the clutching-in is as smooth as possible.

SPEED SELECTOR: "15 ips"

The clutching-in is controlled from the speed measured by the counter drum and can be adjusted by changing the values of C 13-17 (XC 0117).

SPEED SELECTOR: "60 ips"

The clutching-in can be adjusted at L 1 and L 2 or by changing-in the values of C 7-10 (XC 0117).

7" Plastic Reels

LOOP REEL: "7" Reel"
SPEED SELECTOR: "15 ips"

Supply reel full, take-up reel almost empty.

The right tape tension sensor is allowed to be a little outside the white spot on the sensor housing.

If necessary adjust R 82 (approx. 10 Ω).

Take-up reel full and supply reel almost empty.
The left sensor is allowed to be a little outside the white spot on the housing.
If necessary adjust R 62 (approx. 10 Ω).

After adjustments check "Pinch Roller Control" and "Fast Forward" - "Rewind" modes.

Loop

LOOP REEL: "Loop"
SPEED SELECTOR: "15 ips"

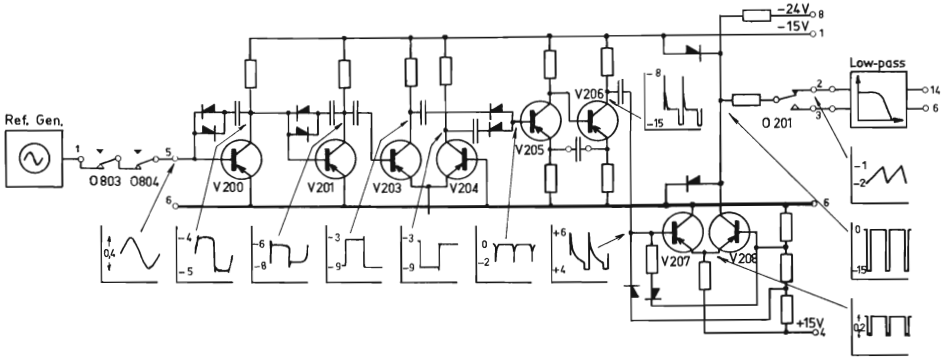
Mount a 25 feet endless tapeloop on type 7001.

The tape tension should be 100 grams (white spot on housing).

If not adjust R 61 (supply motor) and R 81 (take-up motor). Afterwards check activating of pinch rollers at 60 ips.

Demodulator ZM 0002
LF Amplifier ZE 0009

valid from serial no. 153180



Demodulator

CALIBRATION SEL. "1"	Measure the DC voltage between pin 6 and pin 14 on LF Amplifier ZE 0009 (XC 0099). Approx. 1.2 V.
CALIBRATION SEL. to "2"	The DC voltage should change to approx. 0.4 V. The fault tracing check the pulses shown above by means of an oscilloscope.

DC Balance

CALIBRATION SEL. "1"	Connect a Multimeter (50 mV) to output socket and ground. The voltage should be exactly 0 V. If not turn P 805 (DC Balance) to 0 V. If the range is too narrow turn P 805 to mid position and P 254 (XC 0099) to 0 V. Then adjust P 800 (XC 0103) to ∞ deflection to type 7001.
CALIBRATION SEL. to "0" INPUT ATT.: "0 dB" RECORD SWITCH to "AC"	Shortconnect the input socket to ground. Connect a Multimeter (50 mV) to pin 6 and 13 on ZE 0009 (XC 0099). The voltage should be 0 V. If not note the deviation from 0 V.
RECORD SWITCH to "AC"	The deflection should be exactly the same as for position "DC". If unbalance adjust P 255 to obtain the same deviation as for position "DC".
RECORD SWITCH to "DC"	Then adjust P 251 for 0 V deflection (multimeter in position 50 mV). Repeat the adjustment as the two potentiometers influence each other.

Sensitivity

RECORD SWITCH: "AC"	Apply exactly 1 V - 1000 Hz Sine to the input socket. Deflection on type 7001: 0 dB. If necessary adjust P 802 (XC 0103).
RECORD SWITCH to "Off" and "DC"	The deflection should be 0 dB ± 0.05 dB in both positions.

Output Voltage

CALIBRATION SEL.: "2"	The voltage on the output socket should be -1.4 V DC. If necessary adjust P 250 (on XC 0099).

continued

Care should be taken not to depart too far from the original adjustment of the roller. The roller assembly can be sent to the factory for realignment if a satisfactory adjustment cannot be made.

A further check of how the position of the tape on the guide rollers is affected by the alignment of the pinch rollers can be made by lifting the pinch roller free from contact with the capstan with the tape running of a speed of 15 ips. The position of the tape should not shift with either the roller engaged or disengaged.

The above check can also be made electrically since any change of tape position will cause a phase shift between recorded signals on the two channels. Proceed as described under section "Adjustment of Reproduce Head" while reproducing the signals conduct the same test as described above.

Turn-around Idler

There should normally never be a need for adjustment of this unit. The roller is aligned parallel to the base within $\pm$0.01 mm ($\pm$0.0004").

4.4. Record and Reproduce Heads

The ferrite heads should be kept strictly clean at all times. Remove the covers and the magnetic shield between them. With a lint free cloth damped in alcohol clean the surfaces of the heads.

Adjustment of Reproduce Head

Both heads are preadjusted to within 1 minute of arc at the factory and this adjustment should normally not be disturbed. If desired through, the Reproduce Head can be adjusted slightly in order to alter the phase relationship between the two tracks. By recording the same high frequency signal on both tracks of the tape and then reproducing the signals the phase relationship can be checked on a dual beam oscilloscope.

Using a 2 mm (5/64") hexagon wrench turn the adjustment screw located adjacent to the underside of the head slightly in or out while observing the two output signals on the oscilloscope. An adjustment of the screw should not exceed $\pm 20^{o}$. This procedure should be repeated at a lower frequency and also at different tape speeds.

4.5. Tape Tension Sensor

This unit together with the reel motor servo amplifier will keep the tape tension at 100 g $\pm$10% (3 1/2 oz. $\pm$ 10%) throughout a full reel of tape. Small rapid tape fluctuations will be taken up by the movement of the sensor rollers, These rapid fluctuations are kept from influencing the servo feed-back loop by heavy damping of the optical vane by silicone oil. The optical vane varies the light from a neon bulb in front of a silicon photo cell.

The silicone oil contained in each cylinder is 0.5 cm^3 of Dow Corning DC 200 100,000 cts.

For the correct functioning of the unit the spring tension at the left roller is 34 g (1.2 oz.) when the left side of the roller arm is held at the pin mark on the base of the unit. For the right roller the tension should be 32 g (1.1 oz.) measured at the roller.

With the roller arm held at the mark on the base the optical vane should cover half of the photocell area. Allow time for the vane to position itself. The unit must be vertical for this test. An adjustment of the position of the vane can be made at the point where the steel wire is fastened to the roller arm by slightly bending the wire.

For electrical adjustment see Tape Transport Section 7001.3.

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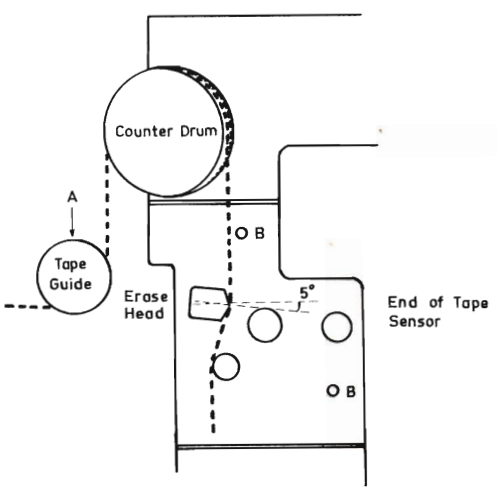

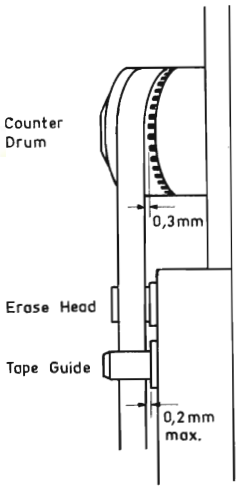

4.6. End of Tape Sensor

This unit also serves as base for the voice track Erase Head. Besides the lamp at the End of Tape photocell sensor there is also a lamp which operates in conjunction with photocells in the counter drum housing. The lamps can be replaced by pulling out the lamp housing, thus giving access to the lamps.

If the Erase Head should need adjustment or replacement, the complete unit should be removed from the base. With a 3mm hexagon wrench remove the two screws "B" and pull out the unit. The Erase Head must be mounted with a tilt of 5° as shown on drawing.

4.7. Position of Tape on Counter Drum

When driving the tape normally forward or fast forward the tape should be positioned on the counter drum within 0.3 mm (0.012") of the slots on the drum. Also the tape should be max. 0.2 mm (0.008") from the flange on the guide roller beneath the erase head.

If the tape is not positioned as stated above an adjustment of the guide roller to the left of the counter drum can correct this. Using a 1.5 mm hexagon wrench loosen the set screw holding the roller stud at point "A". Remove roller and stud. By loosening the two slotted screws the flanged holder can be moved to either side. To bring the tape closer to the slots on the counter drum move the holder to the right.

When fastening the stud with guide roller keep an endplay of approx. 0.05mm (0.002").

The position of the tape on the slotted counter drum during rewind of the tape will be affected by the position of the erase head. The position on the counter drum should not differ from the position the tape has when running forward. By changing back and forth between Rewind and Fast Forward any change in tape position can be readily seen. The difference should not exceed 0.3mm (0.012") If larger than this amount the Erase Head should be moved accordingly to left or right side. The entire unit can also be moved slightly left or right thus giving another means of adjusting the tape position.

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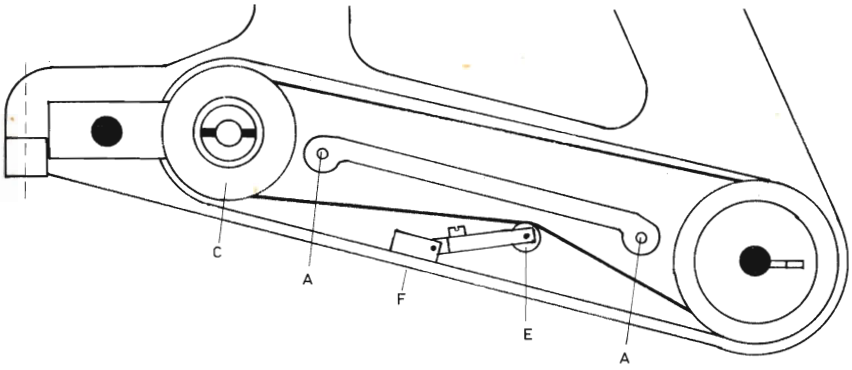

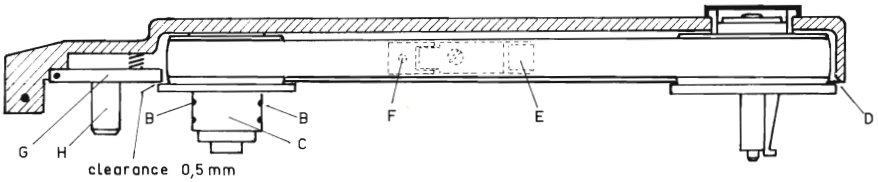

4.8. Reel Arm Drive Belt

Inspection

Unscrew the two screws "A" and remove the metal cover. Normally the belt should have a service life of several years. However, if the belt has not been running properly on the pulleys, the edges might have become rough and a replacement will be necessary.

Replacement of the Belt

Loosen the two screws "B" and pull out the pulley "C". The belt can now be removed through the opening "D". After replacement of the belt check that the belt is running free of the take-up arm when driven in both directions. The position of the tension roller "E" is critical for the correct performance of the belt and should not be changed unless it is strictly necessary. If the belt changes position on the pulleys more than 1 mm (0.040") when driven in either direction an adjustment of the position of tension roller "E" is necessary. Loosen screw "F" a small amount and turn roller slightly inward or outward while driving belt on pulleys. Fasten screw "F" in best possible position. Keep brake lever "G" in operation under this adjustment.

Reel Arm Brake

With the Reel Arm in its closed position, check the clearance between brake lever "G" and pulley "C". If it is not at least 0.5 mm (0.020") unscrew stud "H" and place a thin washer approx. 0.2 mm (0.008") thick between stud and lever.

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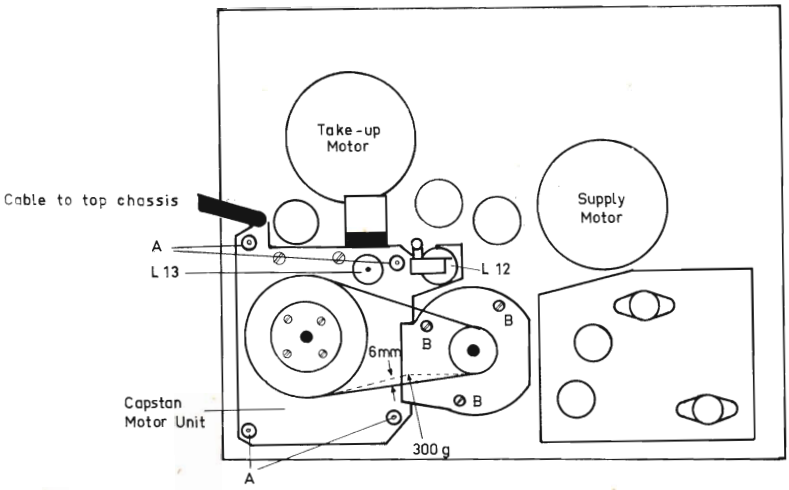

Motor Assembly , rear view

4.9. Capstan Motor Unit

Removal of Capstan Motor Unit

Remove the cable connector from the top chassis. Unscrew the four Allen screws "A" using an extended hexagon wrench 4 mm (5/32") width. Remove the motor unit, working the base free from the two guide pins.

Inspection and Maintenance of Unit

Check for any abnormal wear of parts. Clean rubber surface of the four idler rollers with a cloth damped with alcohol. Check rollers for free running and apply a drop of fine grad instrument oil to the steel pins. Make certain that the oil does not reach the rubber surface of the rollers. A drop of oil should also be given to the clutch where it slides on the drive shaft. If any adjustment of the unit should be found necessary follow the instruction given in this section.

Tension of Capstan Drive Belt

A force of approx. 300 g (10 1/2 oz.) applied midway between the drive wheels should displace the belt 6 mm (0.240"). If necessary to adjust the tension, loosen the screws "B" and change the motor position.

Adjustment of Flywheel Brake

To bring the speed of the flywheel down from 60 and 15 ips. to a lower speed a brake activated by the solenoid L 13 is engaged. The length of time of the braking action is controlled by preadjusted RC discharge circuits.

For electrical adjustment see Tape Transport Section 7001.3.

If the brake cannot bring the speed of the flywheel down within the time limit:

Approx. 1 sec. when changing from 15 to 1.5 ips.
" 4-7 " " " " 60 to 1.5 ips.

Clean the brake pad and the flywheel rim for any oil or dirt, and carefully smooth the brake pad by means of fine emery cloth.

The brake action can be altered by changing the position of the brake solenoid L 13. Loosen the screw "S" which locks the position of L 13 and screw the brake solenoid closer to the flywheel to obtain a shorter braking time. A quarter of a turn should be sufficient. After adjustment make certain that the solenoid, when activated, can push to the bottom of its stroke against the force of the brake springs. Can be checked by pushing against the end of the plunger with a finger while the solenoid is activated.

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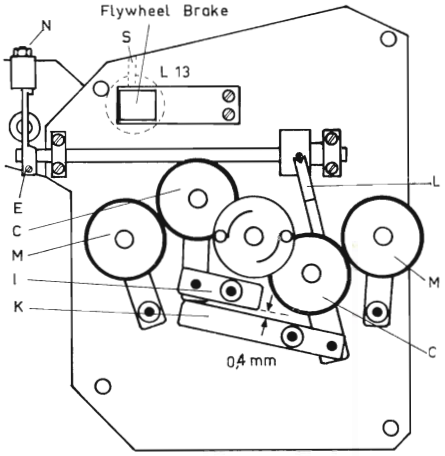
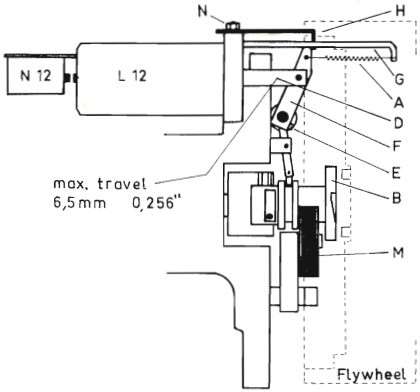
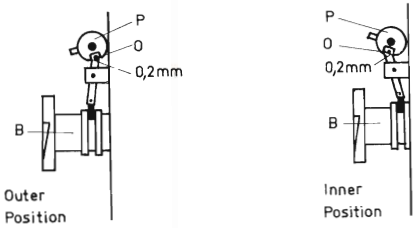




Capstan Motor Unit



Clutch Disc

Drive Clutch Travel and Speed Reduction

Remove the spring "A" from the rod "G" and press the plunger "D" in solenoid L12 against its stop. The clutch disc "B" should now be locked in its inner position by means of spring loaded steel balls. The clearance between the tap "O" and the slot of guide bushing "P" should be approx. 0.2 mm (0.008").

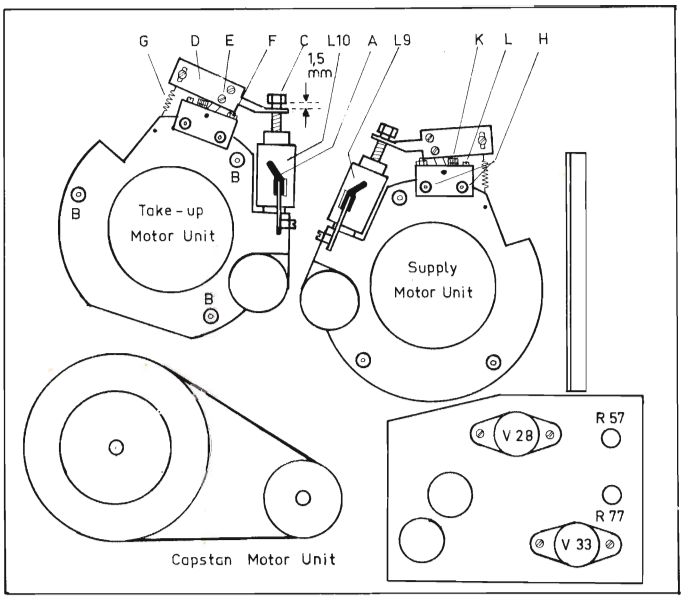
If necessary to adjust the clearance, loosen the screw "E" which clamps arm "F" to the clutch shaft and turn guide bushing to obtain the correct amount of clearance. Fasten screw "E". Fasten spring "A" to the rod "G". The clutch disc should now be in its outher position. Check again the clearance between the tap "O" and the slot of the guide bushing "P" approx. 0.2 mm (0.008").

If necessary to adjust the clearance, loosen the nut "N" and move the stop bracket "H" to obtain the correct amount of clearance. Fasten nut "N". Check that the length of travel of plunger "D" does not exceed 6.5 mm (0.256").

To ensure correct function of the clutch and speed reduction rollers the force from the spring "A" should be approx. 650 g (1 1/2 lbs.) which can be adjusted by the position of the rod "G". If an adjustment of the clutch travel has been made it will be necessary to check the distance between the two arms "I" and "K" approx. 0.4 mm (0.016"). The distance can be altered by adjusting or bending guide lever "L".

Check that micro switch N12 has switched off the main coil of L13 at a point 0.2 mm (0.008") from the inner position of plunger "D".

continued



Reel Motor Assembly. rear view

4.10. Supply and Take-up Motors

Removal of the Motor Unit

Remove the multicable connector "A". Unscrew the three Allen screws "B" using a 3 mm hexagon wrench and remove the motor unit.

Adjustment of Brake Lever

In order that the solenoid operated brakes of the reel motors function correctly a clearance of 1-1.5 mm (0.040-0.060") should be kept between the fork end of the brake lever "D" and the hexagon nut of the solenoid plunger "C". By loosening the two screws "E" the brake lever "D" can be repositioned for correct clearance. Check that the brake drum is running completely free of the brake lining when the solenoid plunger is pressed down. The clearance can, if necessary, be adjusted by the screw "F".

Checking the Reel Brakes

Wind a length of cord a few times around the outside rotor of the reel motor. Using a spring scale (0-1000 g, 0-2 lbs.) attached to the free end of the cord, unwind the cord slowly by a steady pull upwards. In the direction of lowest braking action the scale should read between 180-260 g (6 1/2-9 oz.). In the direction of highest braking action the scale should read between 360-520 g (13 oz. - 1 lb. 2 1/2 oz.).

Procedure for Adjusting Brakes

The two directions for braking are called:

I direction without self energizing action
II direction with self energizing action.

Adjustment if the checking of brakes has shown:

I and II too low: Tighten spring "G".

I and II too high: Loosen spring "G".

I correct and II low or I high and II correct. The selfenergizing effect must be increased. By loosening screws "H" and "K" the angle bracket can be moved outward by turning screw "L" one turn clockwise. Fasten screws "H" and "K". Readjust brake lever "D" as described above, and if necessary adjust screw "F". Check braking action again with spring scale.

continued

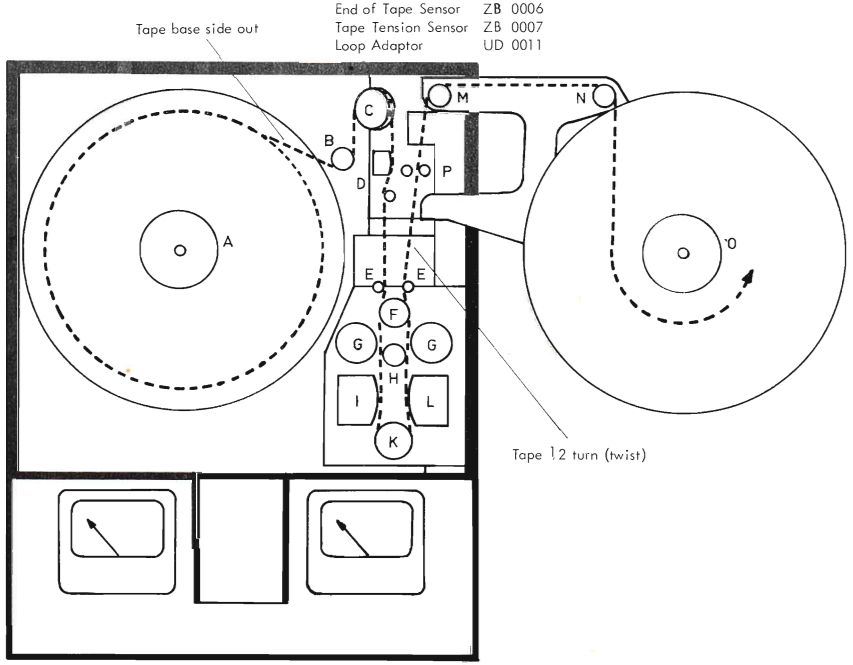
4.1. General Description

The entire tape transport has been built upon a sturdy sand-cast aluminium base which has been heat treated, aged, and machined to a high degree of accuracy. This high precision base together with the close tolerances of all the tape guiding members ensures a very stable tape motion with a minimum of skew and an extremely low amount of flutter.

In order to facilitate inspection or adjustment of the different subassemblies of which the tape transport is composed, the base can be swung out of its frame. Also most subassemblies can be removed without fear of causing misalignment. The electrical connections are made by connectors.

The Tape Transport type 7001 is comprised of the following main subassemblies.

Base Unit	UD 0001
Reel Arm.	UD 0002
Capstan Unit	UD 0006
Pinch Rollers	UD 0016-17
Motor Drive	UM 0054
Tape-up Motor	UM 0055
Supply Motor	UM 0056
End of Tape Sensor	ZB 0006
Tape Tension Sensor	ZB 0007
Loop Adaptor	UD 0011



4.2. Tape Loading

From supply reel "A" the tape is taken around the tape guide "B" over the counter drum "C", passing across erase head "D" to the right side of the tape tension roller "E", to the left of the tape guide "F" between the left pinch roller "G" and the capstan "H" across the record head "I" around the turn-around idler "K" across the reproduce head "L" between the capstan "H" and the pinch roller "G" and the tape guide "F" to the left side of the tape tension roller "E".

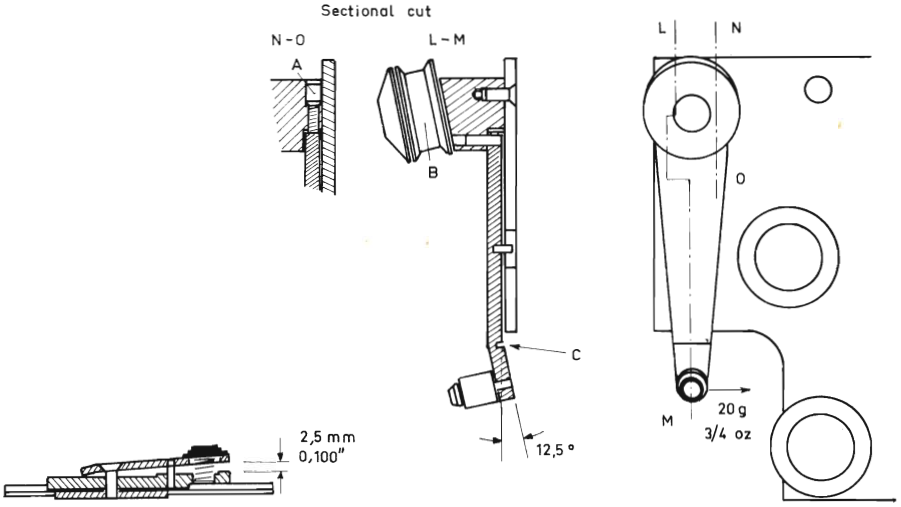
Twist the tape 180° counter clockwise (same direction as when opening the reel arm) and take the tape around the tape guide "M" and "N" and finally fasten the tape to the take-up reel "O".

Close and lock the reel arm and check that the tape is not twisted especially between the lamp housing and the photocell housing of the tape sensor "P".

continued

I low and II correct or I correct and II high. The selfenergizing effect of the brakes is too high and must be decreased. The angle bracket must be moved closer to the brake drum. Proceed as above but turn screw "L" counter clockwise one turn. Tighten screw "K" and then fasten screws "H". Reposition lever "D" and check screw "F". Check brakes with scale.

If the selfenergizing effect cannot be reduced to the correct amount, a cleaning of the brake lining can become necessary. Loosen the nut holding the solenoid and disengage it from the brake lever. By removing the retaining ring on the pivot pin the brake shoe assembly can be removed. Brush the felt pads and blow clean with compressed air. Reassemble the unit.



4.11. Loop Adaptor

If the slider which carries the two tilted multitrack rollers should become sticky or have difficulty in keeping in an adjusted position it should be disassembled and the sliding surfaces cleaned. When assembled there should be 2.5 mm (0.100") between the release lever and the raised portion of the slider (see drawing).

The spring tensioned idler roller at the top of the adaptor should have a tension of 20 g ±20% (3/4 oz. ±20%). The tension can be adjusted at the Allen set screw "A".

If the tape running over guide roller "B" is being pressed too heavy against the sides of the roller an adjustment of the angle at point "C" will correct this. The angle is nominally 12 ½°.

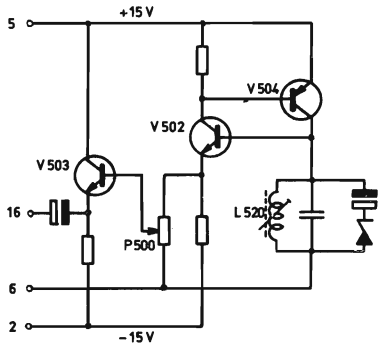
The tension of the two rubber pressure rollers should be 200 g ±25% (7 oz. ±25%). If it should be necessary to increase the tension, the V-shaped spring can be widened out.

4.12. Cleaning

Besides keeping the tape path clean it is of great importance that the entire tape transport together with the front cover are kept free from dust. The front cover which is made of Plexiglas (acryl) can best be kept clean with an antistatic cloth as used for records.

Reference Generator ZH 0009

valid from serial no. 229630



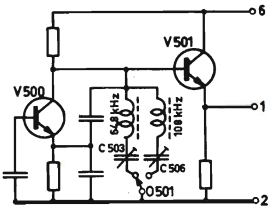
440 Hz Generator

Connect an Electronic Voltmeter and a Frequency Counter to pin 16 on ZH 0009 (printed circuit XC 0100).

The output voltage should be 1 V ±0.1 dB.
If necessary adjust P 500.

The output frequency should be 440 Hz ±2 Hz.
If necessary adjust L520

The distortion of the reference signal can be measured by means of a Frequency Analyzer type 2107: Max. 1%.



H.F. Oscillator

CALIBRATION SELECTOR: "1"

Connect an Electronic Voltmeter and a Frequency Counter to pin 1 on ZH 0009 (printed circuit XC 0100).

The output voltage should be 0.1 - 0.2 V.

The output frequency should be 108 kHz ± 50 Hz.
If necessary adjust C 506.

CALIBRATION SELECTOR to "2"

The output frequency should be 64.8 kHz ± 30 Hz.
If necessary adjust C 503.

Frequency Response

RECORD SWITCH: "AC"
CALIBRATION SELECTOR: "0"
INPUT ATTENUATOR: "0 dB"

Apply a 1 kHz signal to the input socket of type 7001 and adjust the voltage to give a deflection of 0 dB on type 7001.

Check the frequency response from 20-20000 Hz. Tolerance ±0.2 dB.

If necessary change in value of C 263 for correction at 20 kHz (XC 0099).

Low-Pass Filters

RECORD SWITCH: "AC"
CALIBRATION SELECTOR: "0"
INPUT ATTENUATOR: "0 dB"

Adjust an input signal of 440 Hz to give a 0 dB deflection on type 7001.

Measure the voltage on pin 7 and afterwards on pin 13 (on XC 0099). The difference should be 3 dB ±0.1 dB on all speeds.

Check the frequency characteristic on pin 13 according to the table below.

TAPE SPEED IPS: "60"	±0.25 dB until 20 kHz and dropped more than 20 dB at 130 kHz.
TAPE SPEED IPS: to "15"	±0.25 dB " 5 kHz " " 20 dB at 25 kHz.
TAPE SPEED IPS to "6"	±0.25 dB " 2 kHz " " 20 dB at 13 kHz.
TAPE SPEED IPS to "1.5"	±0.25 dB " 500 Hz " " 20 dB at 2.5 kHz.

If necessary the characteristics can be changed by changing in values of R 273, 275, 277 or 279 on 1.5, 6, 15 and 60 ips respectively.

Overload Indicator

CALIBRATION SELECTOR: "0"
RECORD SWITCH: "DC"
INPUT ATTENUATOR: "0 dB"

Apply exactly +1.5 V DC to the input socket of type 7001.

Adjust P 252 (on XC 0099) until the overload indicator lights up and then a little backwards so that the indicator does not light up after having reset it.

Apply -1.5 V DC to the input and adjust P 253 in the same way.

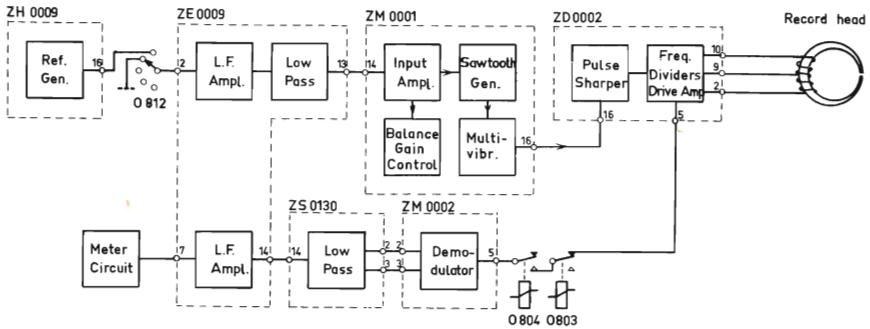
RECORD SWITCH to "AC"

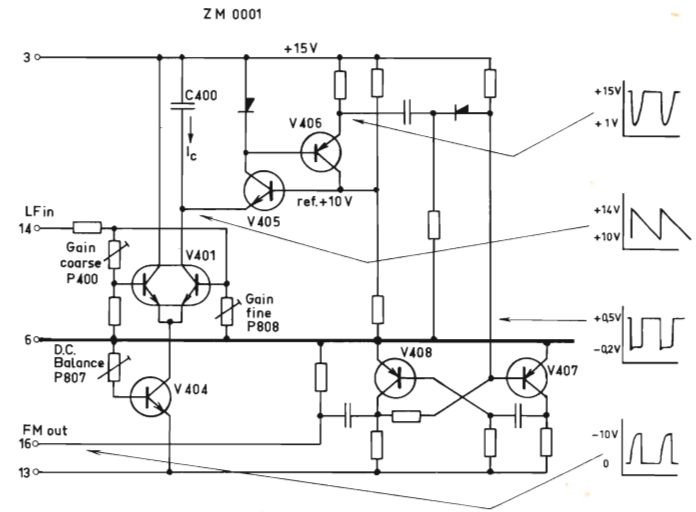
Apply 1 V - 1000 Hz sine to the input of type 7001.

The indicator should light up as soon as the input voltage is increased 0.8-1 dB.

FM Modulator ZM 0001

valid from serial no. 212727





Adjustment of Modulator

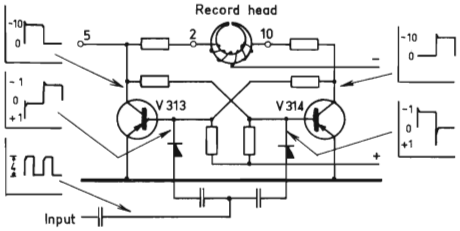
a. CALIBRATION SELECTOR: "3"

Connect a multimeter (50 mV) to the "Output" socket and adjust "3 Balance" to 0 V deflection.

b. CALIBRATION SELECTOR to "4"

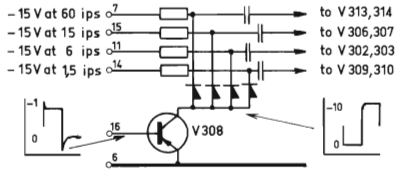
Adjust "4 Gain" to 0 dB on type 7001.

If the range of the "4 Gain" potentiometers is too narrow turn the potentiometers to mid position and adjust P 400 (on XC 0098) to 3 dB deflection on type 7001.



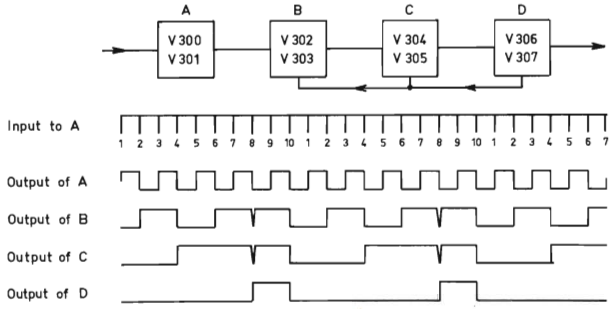
Drive Amplifier

The above drawing is a simplified diagram of the last divider, which is used as a drive amplifier for the record head as well. This divider is always in function, and it is the only divider on 60 ips.



Input Circuit

On the other tape speeds more dividers are connected, and this is done by using diode switches controlled from the tape speed selector to connect different collector resistors for V 308.



1:10 Divider

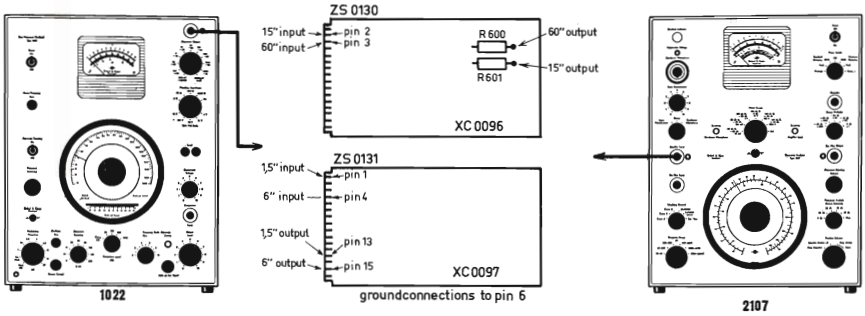
At 6 ips and 1.5 ips a 1:10 divider is used to divide the frequency from 108 kHz to 10.8 kHz, and this is arranged by feeding back the pulses from the last divider.

Fault Tracing

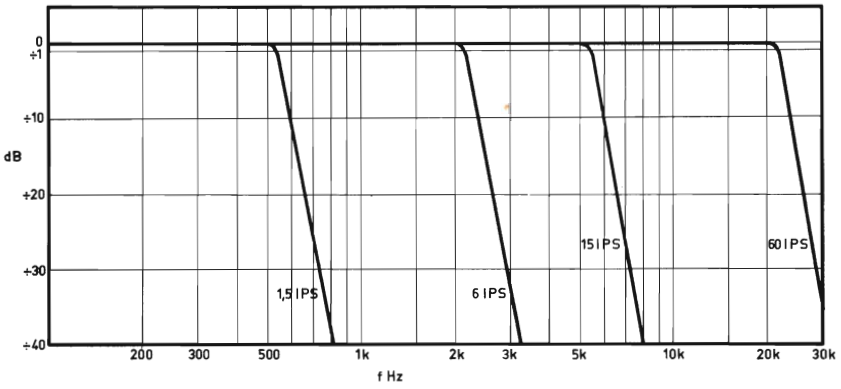
By changing tape speed it is possible to localize a defect to be in one certain divider, and this divider should be examined by means of an oscilloscope. Except for the frequency the pulse shapes are equal on all dividers.

Low-Pass Filters ZS 0130-0131

valid from serial no. 153180



0 dB corresponds to a filteroutput of 1 V.



Output from type 1022: 2 V – 200 Hz.

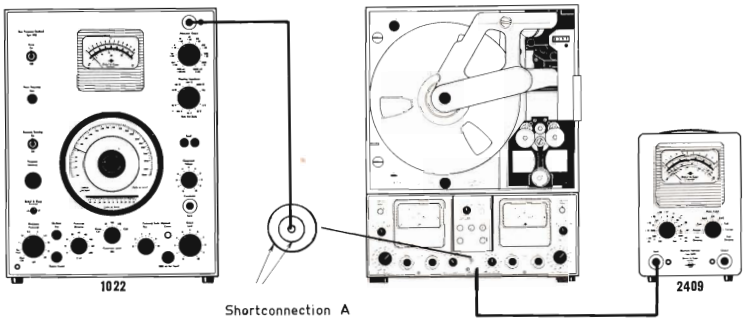
Deflection on type 2107: 1 V $\pm$1 dB.

Check the filter characteristics according to the curves above.

The linear part of the characteristic should be within $\pm$0.25 dB.

RECORD AMPLIFIER

Fig. 1



Sensitivity and AVC

MONITOR SELECTOR: "Voice"
MONITOR VOLUME: "Max."

Input signal from type 1022: 1 mV, 1000 Hz.
Output voltage on "Monitor" output: 1.6 V ± 2 dB.

Input signal: 10 dB above 1 mV, 1000 Hz (3.16 mV).
Output voltage: Same as before + max. 1 dB.

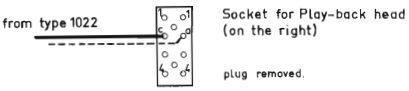
Decrease input voltage until the output voltage is 4 dB lower than above.
The input voltage from type 1022 should now be max. 500 µV.

Frequency Response

MONITOR SELECTOR: "Voice"
MONITOR VOLUME: "Max."

Shortconnect C 722 on printed circuit XC 0266 (ZE 0010).
Check the frequency response at an output voltage of 1 V.
Tolerance: 300-3000 Hz, +2, -1 dB. Ref. 1000 Hz, 0 dB.

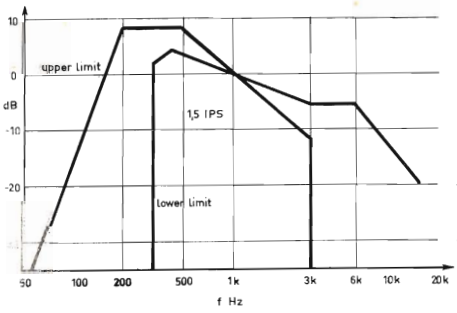
PLAY-BACK AMPLIFIER

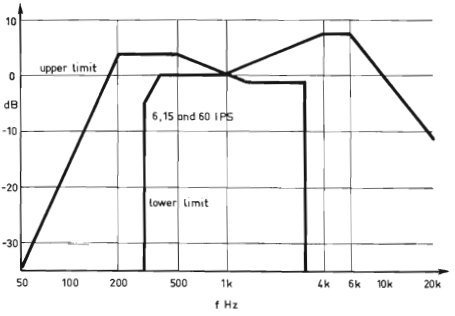


Sensitivity and Freq. Response

MONITOR SELECTOR: "Voice"
MONITOR VOLUME: "Max."
TAPE SPEED IPS: "6"

Remove shortconnection A. C 722 is still shortconnected.
Input signal: 60 µV, 1000 Hz.
Output voltage on "Monitor" output: 1.6 V ± 2 dB.
Adjust input to 1 V on "Monitor" output and check the frequency characteristic according to the curve below.





TAPE SPEED IPS to "1,5"

Input signal: 40 µV, 1000 Hz.
Output voltage on "Monitor" output: 1.6 V, ±2 dB.
Check the frequency response in the same way as before, but according to the other curve.
Remove shortconnection across C 722.

Bias Signal

FUNCTION SELECTOR: "P"

Type 7001 must be mounted with tape.
Shortconnection A (picture on the front side) to switch ZE 0010 to record position.

Measure the voltage across the erasing head with a multimeter: Approx. 1-1,5 V DC (can be measured from ground to pin 7 on XC 0226).

Measure the bias voltage to the record head with a type 2409: Approx. 4.5 - 5 V.

Record and Playback

FUNCTION SELECTOR: "P"

Connections as in fig. 1.
Input signal from type 1022: 3 mV, 1000 Hz.
Record the signal approx. ½ minute on all the tape speeds.
Remove all connections including shortconnection A (fig. 1).
Play-back the recordings at the respectively tape speeds.
(The record areas can be identified by the tape counter).
The signal on "Monitor" output should be 1.6 V +2, -4 dB at all speeds.

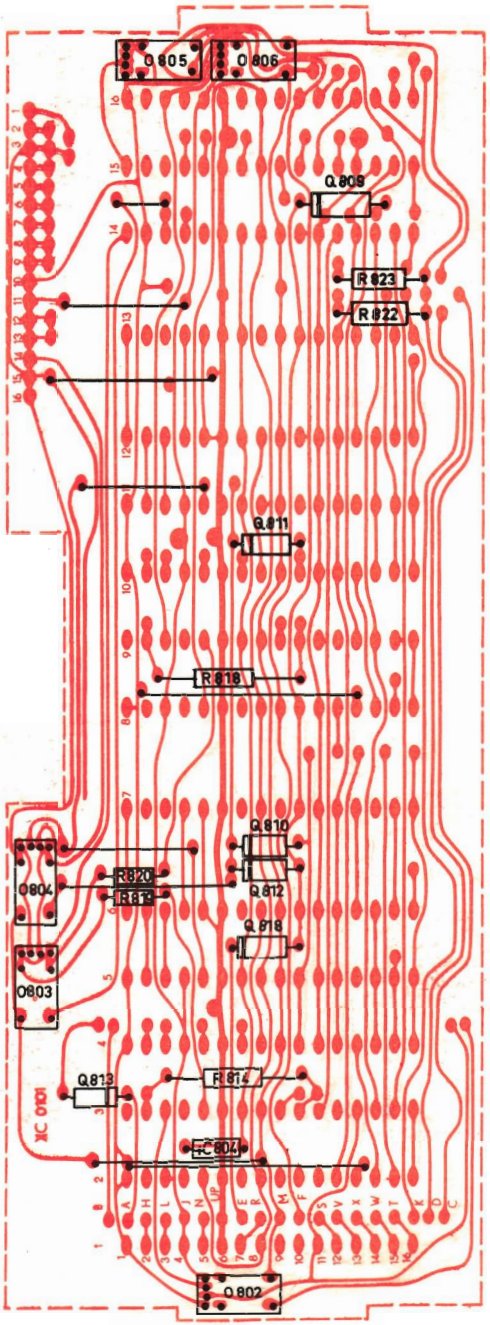
Erasing Effect

FUNCTION SELECTOR: "P"

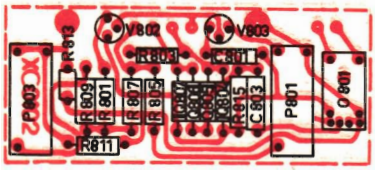
Shortconnection A, but no signal input to type 7001.
After rewinding erase the recorded areas on the respectively tape speeds.
Connect a set of headphones to "Monitor" output.
Remove shortconnection A and rewind.
The erasing effect should cause that no 1000 Hz signal at all can be heard on the phones.

Marker Unit ZH 0010

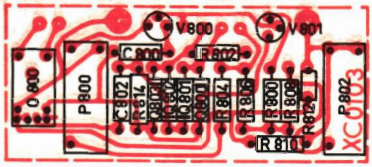
Input frequency to measuring point a (on printed circuit XC 0094): Exactly 440 Hz.
Relay O 550 (on XC 0094) should be activated at an input voltage of 0.6 V and released at 0.4 V.
If not measure the voltage in measuring point b (on XC 0094) by means of an electronic voltmeter and adjust L 550 for max. deflection.
The sensitivity of the "Marker Unit" can be adjusted by changing in the value of R 550 (on XC 0094).



Interconnection Circuit Board KC 0002
Printed Circuit XC 0101



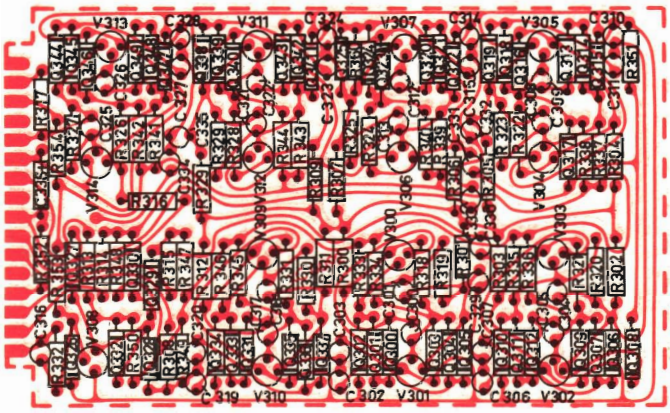
Printed Circuit XC 0102



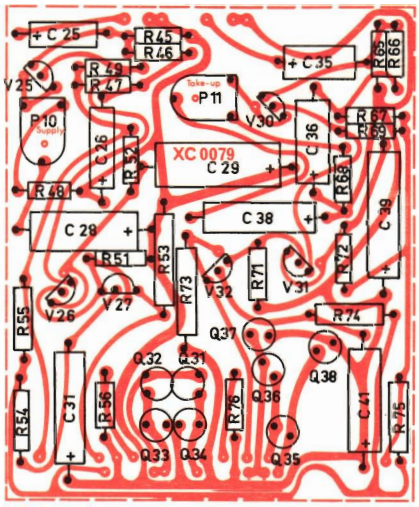
Printed Circuit XC 0103

Printed Circuit XC 0314

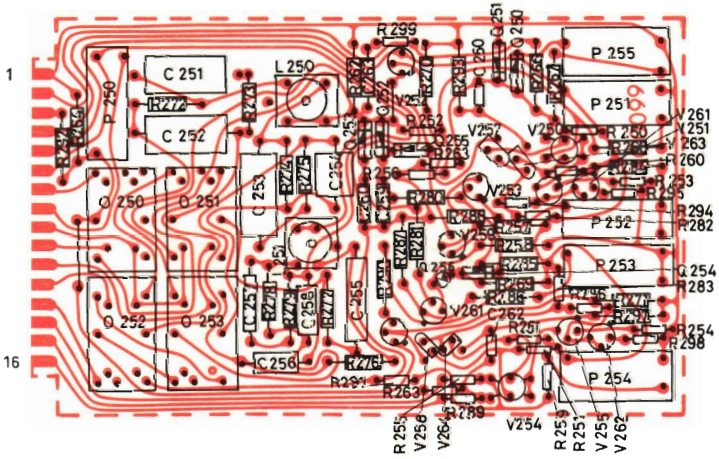
Printed Circuit XC 0313



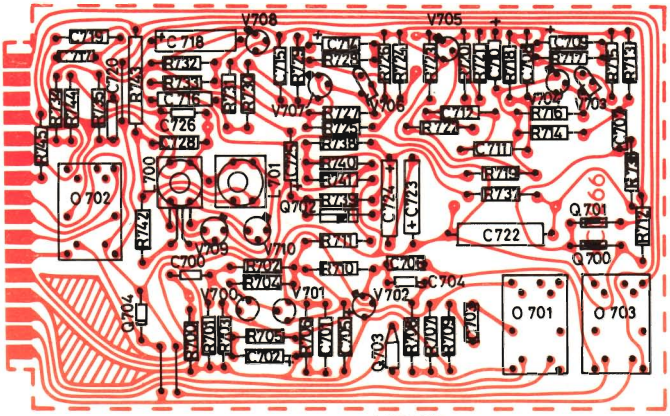
Frequency Divider ZD 000 2
Printed Circuit XC 0092



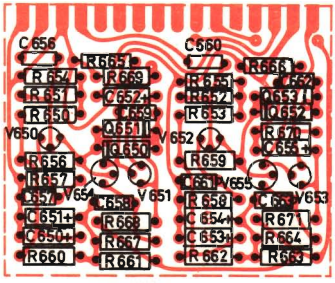
Servo Amplifier ZE 0008
Printed Circuit XC 0079



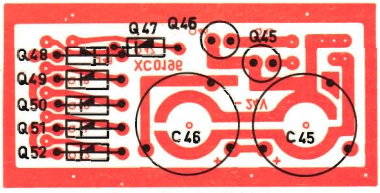
LF Amplifier ZE 0009
Printed Circuit XC 0099



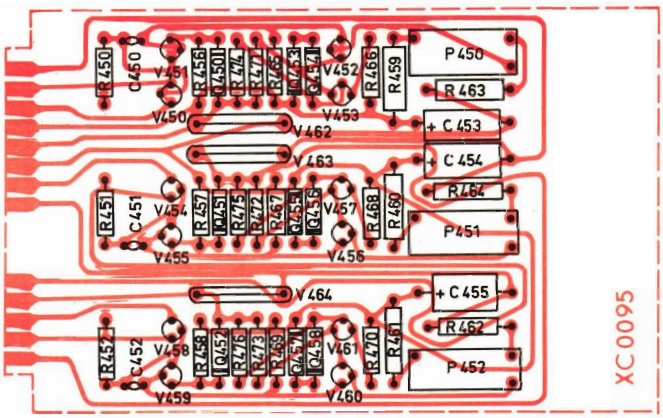
Voice Channel ZE0010
Printed Circuit XC0266



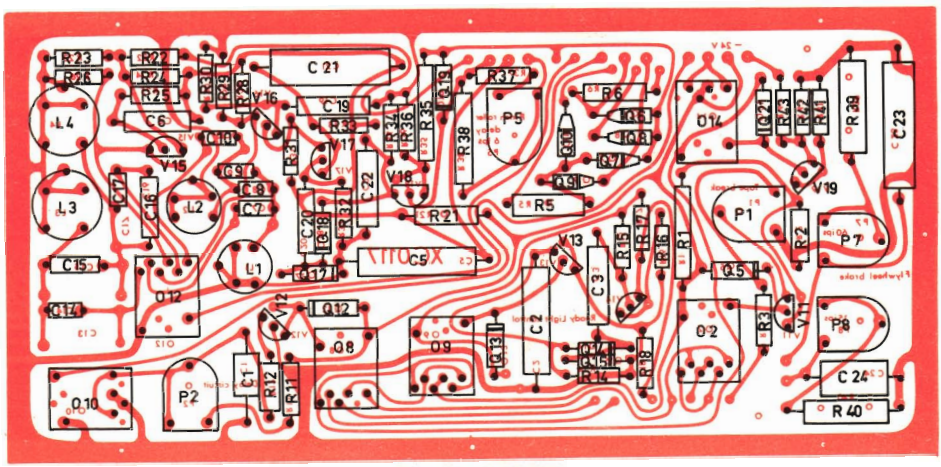
Preamplifier ZE 0011
Printed Circuit XC 0346



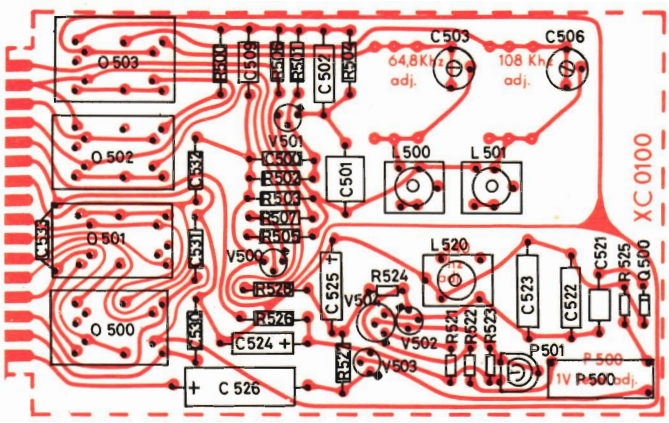
Power Supply ZG 0002
Printed Circuit XC 0196



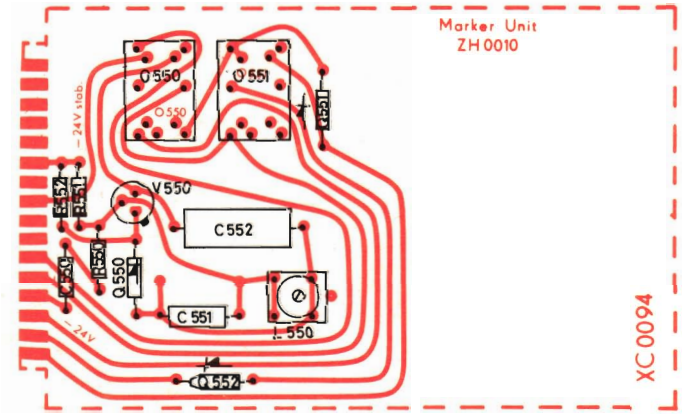
Voltage Stabilizer ZG 0003
Printed Circuit XC 0095



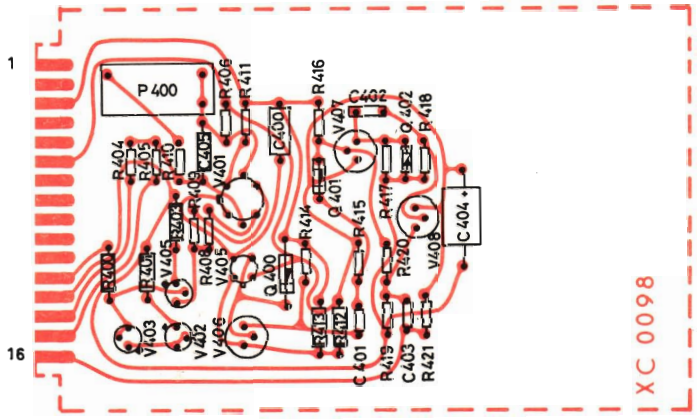
Relay Circuit ZH 0008
Printed Circuit XC 0117



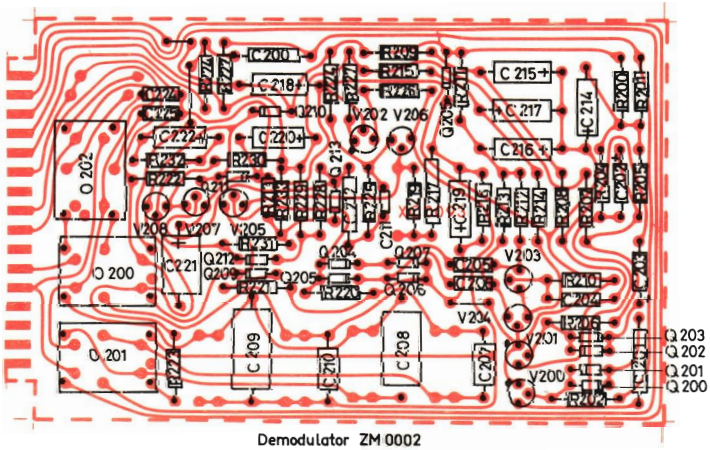
Reference Generator ZH 0009
Printed Circuit XC 0100



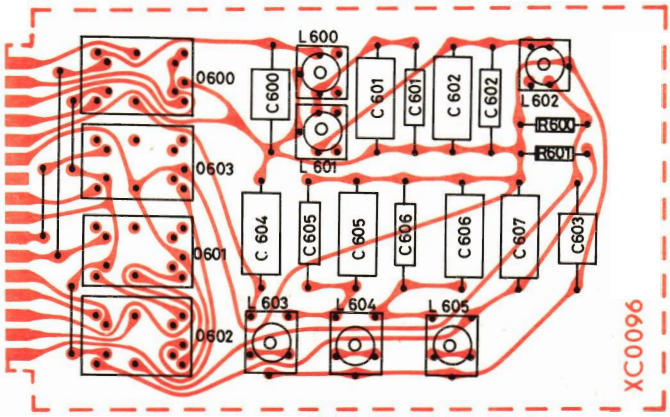
Marker Unit ZH 0010
Printed Circuit XC 0094



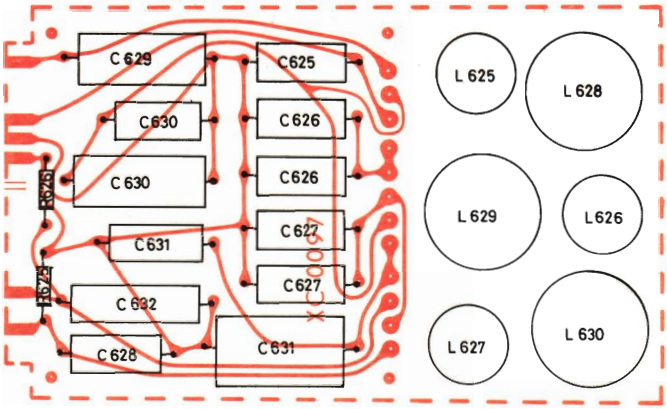
FM Modulator ZM 0001
Printed Circuit XC 0098



Demodulator ZM 0002
Printed Circuit XC 0093



Low-Pass filter ZS 0130
Printed Circuit XC 0096



Low-Pass filter ZS 0131
Printed Circuit XC 0097

CAPACITORS:

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
C 1	Electrolytic	50 µF/ 25 V	CE 8965
C 2	"	100 µF/ 25 V	CE 0415
C 3	"	50 µF/ 25 V	CE 8965
C 5	"	250 µF/ 25 V	CE 0413
C 6	"	20 µF/ 64 V	CE 8949
C 7	Polyester	68 nF/250 V	CS 0406
C 8	"	10 nF/250 V	CS 0403
C 9	"	47 nF/250 V	CS 0401
C 10	"	68 nF/250 V	CS 0406
C 13	"	0.18 µF/250 V	CS 0016
C 14	"	0.1 µF/250 V	CS 0402
C 15	"	0.22 µF/250 V	CS 0405
C 16	"	0.18 µF/250 V	CS 0016
C 17	"	0.1 µF/250 V	CS 0402
C 19	Electrolytic	100 µF/6.4 V	CE 0207
C 20	"	20 µF/ 64 V	CE 8949
C 21	"	250 µF/ 25 V	CE 0413
C 22	"	20 µF/ 64 V	CE 8949
C 23	"	250 µF/ 25 V	CE 0413
C 24	"	50 µF/ 40 V	CE 0418
C 25	"	20 µF/ 64 V	CE 8949
C 26	"	50 µF/ 25 V	CE 8965
C 27	"	800 µF/ 64 V	CE 0516
C 28	"	100 µF/ 25 V	CE 0415
C 29	"	250 µF/ 25 V	CE 0413
C 31	"	100 µF/ 25 V	CE 0415
C 32	"	47 µF/ 42 V	CE 0421
C 35	"	20 µF/ 64 V	CE 8949
C 36	"	50 µF/ 25 V	CE 8965
C 37	"	800 µF/ 64 V	CE 0516
C 38	"	100 µF/ 25 V	CE 0415
C 39	"	250 µF/ 25 V	CE 0413
C 41	"	100 µF/ 24 V	CE 0415
C 42	"	47 µF/ 42 V	CE 0421
C 45-49	"	800 µF/ 64 V	CE 0516
C 52	Paper	5 µF/220 V	CP 0659
C 200	Polyester	0.22 µF/250 V	CS 0017
C 201	"	0.15 µF/250 V	CS 0015
C 202	Electrolytic	2 µF/ 64 V	CE 0401
C 203	"	10 µF/ 15 V	CE 0001
C 204	"	2 µF/ 64 V	CE 0401
C 205,206	Polystyrol	100 pF/500 V	CT 0103
C 207	"	6 nF/250 V	CT 3365
C 208	"	60 nF/ 63 V	CT 1505
C 209	"	20 nF/500 V	CT 3230
C 210	"	2 nF/500 V	CT 3222
C 211	Ceramic	39 pF/400 V	CK 1390
C 212	Metal	0.25 µF/ 60 V	CP 0018
C 213	Polyester	0.1 µF/ 30 V	CS 0402
C 214-222	Electrolytic	32 µF/ 64 V	CE 0509
C 224	Polyester	22 nF/250 V	CS 0400
C 225	Polystyrene	4 nF/500 V	CT 1536
C 250	Ceramic	10 pF/400 V	CK 1100
C 251,252	Polystyrene	50 nF/125 V	CT 3430
C 253	"	8 nF/500 V	CT 3227
C 254	"	x10 nF/250 V	CT 1204
C 255	"	6.3 nF/500 V	CT 3234
C 256	"	5 nF/250 V	CT 1202
C 257	"	1.5 nF/500 V	CT 0120
C 258	"	800 nF/500 V	CT 3216
C 259,260	"	1 nF/125 V	CT 1018
C 262	Ceramic	10 pF/400 V	CK 1100
C 263	Polystyrol	160 pF/125 V	CT 1130
C 300-328	Ceramic	47 pF/400 V	CK 1471
C 329,330	"	500 pF/500 V	CK 0083
C 331	"	120 pF/400 V	CK 2121
C 332-335	"	500 pF/500 V	CK 0083
C 336	Electrolytic	10 µF/ 15 V	CE 0001
C 400	Glas	430 pF/500 V	CG 0010
C 401	Ceramic	4.7 nF/500 V	CK 3470
C 402	"	100 pF/400 V	CK 2100
C 403	"	4.7 nF/500 V	CK 3470
C 404	Electrolytic	32 µF/ 64 V	CE 0509
C 405	Polystyrol	510 pF/125 V	CT 1131
C 450-452	Ceramic	47 pF/400 V	CK 1471
C 453-455	Electrolytic	32 µF/ 64 V	CE 0509
C 500	Polyester	22 nF/400 V	CS 0105
C 501	Polystyrol	5 nF/500 V	CT 3226
C 502	Polyester	0.22 µF/250 V	CS 0017
C 503	Trimmer	10-40 pF/250 V	CV 0019
C 504	Polystyrol	600 pF/500 V	CT 0114
C 505	"	300 pF/500 V	CT 0109
C 506	Trimmer	10-40 pF/250 V	CV 0019
C 509	Polyester	0.1 µF/250 V	CS 0013
C 521	Electrolytic	5 µF/ 64 V	CE 0406
C 522	Polyester	0.22 µF/250 V	CS 0017
C 523	"	1 µF/100 V	CS 0336
C 524,525	Electrolytic	125 µF/ 16 V	CE 0312
C 526	"	100 µF/ 25 V	CE 0415
C 530-533	Polyester	0.1 µF/100 V	CS 0334
C 550	"	22 nF/400 V	CS 0105
C 551	"	0.22 µF/250 V	CS 0017
C 552	"	1 µF/250 V	CS 0025
C 600	Polystyrene	5 nF/500 V	CT 3226
C 601,602	"	1 nF/500 V	CT 3218
C 601,602	"	8 nF/500 V	CT 3227
C 603	Polystyrene	5 nF/500 V	CT 3226
C 604	"	20 nF/500 V	CT 3230
C 605,606	Polyester	4 nF/250 V	CT 3225
C 605,606	"	31.5 nF/250 V	CT 3238
C 607	"	20 nF/500 V	CT 3230
C 625	Polystyrol	50 nF/125 V	CT 3430
C 626,627	"	10 nF/500 V	CT 3228
C 626,627	"	80 nF/125 V	CT 3432
C 628	"	50 nF/125 V	CT 3430
C 629	"	0.2 µF/100 V	CT 3434
C 630,631	"	40 nF/250 V	CT 3239
C 630,631	"	0.316 µF/100 V	CT 3135
C 632	"	0.2 µF/100 V	CT 3434
C 650-655	Electrolytic	10 µF/ 16 V	CE 0001
C 656-663	Polyester	0.1 µF/250 V	CS 0402
C 665,666	Ceramic	4.7 pF/400 V	CK 0470
C 700	Polyester	0.1 µF/250 V	CS 0402
C 701	Ceramic	1 nF/400 V	CK 3100
C 702	Electrolytic	2.5 µF/ 64 V	CE 0401
C 703	Polyester	0.1 µF/250 V	CS 0402
C 704	"	10 nF/250 V	CS 0403
C 705	Electrolytic	2.5 µF/ 64 V	CE 0401
C 706,707	Polyester	0.1 µF/250 V	CS 0402
C 708	Ceramic	200 pF/400 V	CK 0078
C 709,710	Electrolytic	2.5 µF/ 64 V	CE 0401
C 711,712	Polyester	33 nF/250 V	CS 0007
C 713	"	0.1 µF/250 V	CS 0402
C 714	Electrolytic	10 µF/ 16 V	CE 0001
C 715	Ceramic	200 pF/400 V	CK 0078
C 716	Polyester	47 nF/250 V	CS 0009
C 717	"	22 nF/250 V	CS 0400
C 718	Electrolytic	20 µF/ 64 V	CE 8949
C 719	"	12.5 µF/ 25 V	CE 0416
C 720	Polyester	47 nF/250 V	CS 0401
C 722	"	0.33 µF/160 V	CS 0019
C 723,724	Electrolytic	100 µF/ 64 V	CE 0207
C 725	"	2.5 µF/ 64 V	CE 0401
C 726	Polystyrol	1.8 nF/ 64 V	CT 1127
C 728	Electrolytic	2.5 µF/ 64 V	CE 0401
C 800,801	"	1 nF/125 V	CT 1018
C 802,803	Polyester	22 nF/400 V	CS 0105
C 804	Electrolytic	2 µF/ 64 V	CE 0401
C 805,806	Metal	2.2 µF/100 V	CP 0014

continued

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
RESISTORS:					
R 1	Carbon	1/2 W	10%	1 kΩ	
R 2	"	1/3 W	"	50 Ω	
R 3	"	"	"	1 kΩ	
R 5	Wire	5.5 W	"	56 Ω	RX 0319
R 6	"	"	"	56 Ω	RX 0319
R 11,12	Carbon	1/3 W	"	100 kΩ	
R 14	"	"	"	10 kΩ	
R 15	"	"	"	1 kΩ	
R 16	"	"	"	50 Ω	
R 17	"	"	5%	90 kΩ	
R 18	"	"	10%	10 kΩ	
R 21	Wire	5.5 W	"	220 Ω	RX 0312
R 22	Carbon	1/3 W	"	50 kΩ	
R 23	"	"	2%	5.6 kΩ	
R 24	"	"	10%	100 kΩ	
R 25	"	"	2%	5.6 kΩ	
R 26	"	"	10%	1 kΩ	
R 28	"	"	"	40 kΩ	
R 29	"	"	"	2 kΩ	
R 30	"	"	"	50 Ω	
R 31	"	"	"	2 kΩ	
R 32	"	"	"	1 kΩ	
R 33	"	"	"	90 Ω	
R 34	"	"	"	5 kΩ	
R 35	"	1/2 W	"	2 kΩ	
R 36	"	1/3 W	"	10 Ω	
R 37	"	"	"	200 Ω	
R 38	NTC		"	5 kΩ	RN 0004
R 39,40	Carbon	1 W	"	1 kΩ	
R 41	"	1/3 W	"	10 Ω	
R 42	"	"	"	20 kΩ	
R 43	"	"	5%	3.15 kΩ	
R 44	PhotoresistorORP 61				RN 0100
R 45,46	Carbon	1/3 W	10%	25 kΩ	
R 47,48	"	"	"	10 kΩ	
R 49	"	"	"	4 kΩ	
R 51	"	"	"	1 kΩ	
R 52	"	"	"	500 Ω	
R 53	"	1/2 W	5%	315 Ω	
R 54	Wire	5.5 W	10%	390 Ω	RX 0301
R 55	"	"	"	220 Ω	RX 0312
R 56	"	1 W	"	2 Ω	RR 0002
R 57	"	10 W	"	100 Ω	RX 0108
R 60,61	"	"	"	220 Ω	RX 0204
R 62	"	"	"	47 Ω	RX 0203
R 65,66	Carbon	1/3 W	"	25 kΩ	
R 67,68	"	"	"	10 kΩ	
R 69	"	"	"	4 kΩ	
R 71	"	"	"	1 kΩ	
R 72	"	"	"	500 Ω	
R 73	"	1/2 W	5%	315 Ω	
R 74	Wire	5.5 W	10%	390 Ω	RX 0301
R 75	"	"	"	220 Ω	RX 0312
R 76	"	1 W	"	2 Ω	RR 0002
R 77	"	10 W	"	100 Ω	RX 0108
R 80	"	"	"	470 Ω	RX 0205
R 81,82	"	"	"	47 Ω	RX 0203
R 200	Carbon	1/3 W	"	1 kΩ	
R 201	"	"	"	63 kΩ	
R 202	"	"	"	1 kΩ	
R 203	"	"	"	100 kΩ	
R 204	"	"	"	2 kΩ	
R 205	"	"	"	40 kΩ	
R 206	"	"	"	1 kΩ	
R 207	"	"	"	63 kΩ	
R 208	"	"	"	1 kΩ	
R 209	"	"	"	250 Ω	
R 210	"	"	"	2 kΩ	
R 211	"	"	"	100 Ω	

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.
R 212,213	Carbon	1/3 W	10%	250 Ω	
R 214	"	"	"	400 Ω	
R 215	"	"	"	25 Ω	
R 216	"	"	"	1 kΩ	
R 217	Wire	1/2 W	"	510 Ω	RO 1201
R 219	Carbon	1/3 W	"	125 Ω	
R 220	"	"	"	1 kΩ	
R 221	"	"	"	100 Ω	
R 222	"	"	"	1 kΩ	
R 224	"	"	10%	200 Ω	
R 225	"	"	"	2 kΩ	
R 226	"	"	"	100 Ω	
R 227,228	"	"	"	1.6 kΩ	
R 229	"	"	"	2.5 kΩ	
R 230	"	"	"	400 Ω	
R 231	"	"	"	40 Ω	
R 232	"	"	"	160 Ω	
R 233	"	"	"	400 Ω	
R 234	"	"	"	1 kΩ	
R 250,251	Metal	1/4 W	1%	8.25 kΩ	RF 3825
R 252	"	"	"	100 kΩ	RF 5100
R 253,254	"	"	"	8.25 kΩ	RF 3825
R 255	"	"	"	12.1 kΩ	RF 4121
R 256	"	"	"	69.8 kΩ	RF 4698
R 257,258	Carbon	1/3 W	2%	10 kΩ	
R 259	Metal	1/4 W	1%	150 kΩ	RF 5150
R 260,261	"	"	"	8.25 kΩ	RF 3825
R 262	Carbon	1/3 W	10%	1.6 kΩ	
R 263	Metal	1/4 W	1%	1.62 kΩ	RF 0258
R 264	Carbon	1/3 W	10%	600 Ω	
R 265	Metal	1/4 W	1%	39.2 kΩ	RF 4392
R 266	Carbon	1/3 W	10%	3.16 kΩ	
R 267,268	Metal	1/2 W	1%	1 MΩ	RF 0111
R 269	Carbon	1/3 W	10%	100 kΩ	
R 270,271	"	"	"	16.6 kΩ	
R 272	"	"	1/2%	8 kΩ	
R 273	"	"	"	1.8 kΩ	
R 274	"	"	"	8.6 kΩ	
R 275	"	"	"	2.4 kΩ	
R 276	"	"	"	8.8 kΩ	
R 277	"	"	"	1.9 kΩ	
R 278	"	"	"	8.8 kΩ	
R 279	"	"	"	4.8 kΩ	
R 280,281	"	"	10%	2.6 kΩ	
R 282,283	Metal	1/4 W	1%	1.21 kΩ	RF 3121
R 284	Carbon	1/3 W	10%	500 Ω	
R 285-287	"	"	"	200 Ω	
R 288	"	"	"	500 Ω	
R 289	Metal	1/4 W	1%	20 kΩ	RF 0257
R 290	Carbon	1/3 W	10%	100 Ω	
R 291	Metal	1/4 W	1%	4.02 kΩ	RF 3402
R 292	Carbon	1/3 W	10%	10 Ω	
R 293	"	"	"	20 kΩ	
R 294	Metal	1/4 W	1%	49.9 kΩ	RF 4499
R 295	"	"	"	17.8 kΩ	RF 4178
R 296	"	"	"	49.9 kΩ	RF 4499
R 297	Carbon	1/3 W	10%	20 kΩ	
R 298	Metal	1/4 W	1%	17.8 kΩ	RF 4178
R 299	Carbon	1/3 W	5%	8.2 kΩ	RB 3820
R 300-315	"	"	10%	1 kΩ	
R 316,317	"	"	"	400 Ω	
R 318-325	"	"	"	16 kΩ	
R 326,327	"	"	2%	15.3 kΩ	
R 328-332	"	"	10%	16 kΩ	
R 333-346	"	"	"	160 kΩ	
R 347-350	"	"	"	31.6 kΩ	
R 351	"	"	"	12.5 kΩ	
R 352	"	"	"	31.6 Ω	
R 353	"	"	"	100 kΩ	
R 354	"	"	"	125 Ω	
R 360	"	"	"	31.6 kΩ	

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.	
RESISTORS:						
R 400	Metal	1/4 W	1%	4.75 kΩ	RF	0261
R 401,403	"	"	"	10 kΩ	RF	0262
R 404,405	Carbon	1/3 W	5%	12 kΩ	RB	4120
R 406	"	"	"	15 kΩ	RB	4150
R 408,409	Metal	1/4 W	1%	649 Ω	RF	2649
R 410	Carbon	1/3 W	5%	4.7 kΩ	RB	3470
R 411	"	"	"	6.8 kΩ	RB	3680
R 412	Metal	1/4 W	1%	1 kΩ	RF	0260
R 413	"	"	"	500 Ω	RF	0259
R 414	Carbon	1/3 W	5%	100 Ω	RB	2100
R 415	"	"	"	1 kΩ	RB	3100
R 416	"	"	"	47 kΩ	RB	4470
R 417	"	"	"	560 Ω	RB	2560
R 418	"	"	"	27 kΩ	RB	4270
R 419	"	"	"	1.5 kΩ	RB	3150
R 420	"	"	"	18 kΩ	RB	4180
R 421	"	"	"	10 kΩ	RB	4100
R 450-452	"	"	10%	2.5 kΩ		
R 453-455	"	"	"	630 Ω		
R 456-458	"	"	"	1.6 kΩ		
R 459-462	Wire	1/2 W	"	510 Ω	RO	1201
R 463,464	"	"	"	150 Ω	RO	1200
R 465-470	Carbon	1/3 W	"	6.3 kΩ		
R 471-473	"	"	"	2 kΩ		
R 474-476	"	"	"	800 Ω		
R 500	"	"	"	100 Ω		
R 501	"	"	"	16 kΩ		
R 502	"	"	"	31.5 kΩ		
R 503,504	"	"	"	2.5 kΩ		
R 505	"	"	"	4 kΩ		
R 506	"	"	"	500 Ω		
R 507	"	"	5%	8 kΩ		
R 521	Metal	1/4 W	0.5%	1 kΩ	RF	3100
R 522	"	"	"	36.5 kΩ	RF	4365
R 523	"	"	"	4 kΩ	RF	3402
R 524	"	"	"	15 kΩ	RF	4150
R 525	"	"	"	20 kΩ	RF	4200
R 526	Carbon	1/3 W	10%	100 Ω		
R 527	"	"	5%	5 kΩ		
R 528	"	"	10%	100 Ω		
R 550	"	"	"	20 kΩ		
R 551	"	"	"	10 kΩ		
R 552	"	"	"	100 Ω		
R 600,601	Metal	1/2 W	2%	2 kΩ	RF	0104
R 625,626	"	"	"	2 kΩ	RF	0104
R 650-653	"	1/4 W	5%	1 MΩ	RB	6100
R 654,655	"	"	"	820 kΩ	RB	5820
R 656	"	"	"	100 kΩ	RB	5100
R 657,658	"	"	"	82 kΩ	RB	4820
R 659	"	"	"	100 kΩ	RB	5100
R 660-663	"	"	"	12 kΩ	RB	4120
R 664	"	"	"	220 kΩ	RB	5220
R 665,666	"	"	"	150 kΩ	RB	5150
R 667	"	"	"	220 kΩ	RB	5220
R 668	"	"	"	1.8 kΩ	RB	3180
R 669,670	"	"	"	2.2 kΩ	RB	3220
R 671	"	"	"	1.8 kΩ	RB	3180
R 700	"	1/3 W	10%	250 Ω		
R 701	"	"	"	300 kΩ		
R 702	"	"	"	500 kΩ		
R 703	"	"	"	30 kΩ		
R 704	"	"	"	6 kΩ		
R 705	"	"	5%	1.5 kΩ		
R 706	"	"	10%	50 kΩ		
R 707	"	"	5%	10 kΩ		
R 708	Carbon	"	5%	2.5 kΩ		
R 709	"	"	"	100 Ω		
R 710	"	"	10%	10 kΩ		

CIRCUIT DIAGRAM REF.	COMPONENT TYPE				STOCK REF.	
RESISTORS:						
R 211	Carbon	1/3 W	10%	5 kΩ		
R 712	"	"	"	1 kΩ		
R 713	"	"	"	300 kΩ		
R 714	"	"	"	500 kΩ		
R 715	"	"	"	30 kΩ		
R 716	"	"	"	6 kΩ		
R 717	"	"	5%	800 Ω		
R 718	"	"	10%	50 kΩ		
R 719	"	"	"	5 kΩ		
R 720	"	"	2%	3 kΩ		
R 721,722	"	"	"	150 kΩ		
R 723	"	"	10%	10 kΩ		
R 724	"	"	"	22 kΩ		
R 725	"	"	"	50 kΩ		
R 726	"	"	"	3.15 kΩ		
R 727	"	"	"	1 kΩ		
R 728	"	"	5%	85 Ω		
R 729	"	"	"	5 kΩ		
R 730	"	"	2%	2 kΩ		
R 731	"	"	"	10 kΩ		
R 732	"	"	5%	750 Ω		
R 733	"	"	10%	200 Ω		
R 734	"	"	5%	600 Ω		
R 735	"	"	10%	200 Ω		
R 736	"	"	"	50 kΩ		
R 737	"	"	"	16 kΩ		
R 738	"	"	"	100 kΩ		
R 739	"	"	"	15 kΩ		
R 740	"	"	5%	3.6 kΩ		
R 741	"	"	"	300 kΩ		
R 742	"	"	10%	10 kΩ		
R 743	"	1/2 W	"	400 Ω		
R 744	"	"	"	400 Ω		
R 745	"	1/3 W	"	500 Ω		
R 800,801	"	"	"	5 kΩ		
R 802,803	"	"	"	20 kΩ		
R 804,805	"	"	2%	40 kΩ		
R 806,807	"	"	"	45 kΩ		
R 808,809	"	"	5%	40 kΩ		
R 810,811	"	"	10%	60 kΩ		
R 812,813	NTC		"	150 kΩ	RN	0005
R 814,815	Carbon	1/4 W	20%	100MΩ	RH	0004
R 816	"	1/3 W	10%	10 Ω		
R 817,818	"	"	5%	630 Ω		
R 819,821	"	"	10%	10 kΩ		
R 822,823	Wire	5.5 W	"	30 Ω	RX	0309

ATTENUATOR RESISTORS:

R 824-851	Carbon	1/3 W	0.5%	9.288 kΩ		
R 852,853	"	"	"	35.9 kΩ		
R 854-879	"	"	"	174.40 kΩ		
R 880-881	"	"	"	348.88 kΩ		

Please, state serial number of apparatus when ordering attenuator resistors, or order one set of resistors.

POTENTIOMETERS:

P 1	Tape Break	carbon lin.	50 kΩ	PG	3501
P 2	Delay Circuit	"	220 kΩ	PG	4201
P 5	Pinch Roller 6 ips	"	200 Ω	PG	2100
P 7,8	Flyvhell brake	"	10 kΩ	PG	3102
P 10,11	Servoamplifier	"	1 kΩ	PG	2100
P 250	Output Voltage	wire lin.	500 Ω	PG	1501
P 251	LF-Amplifier	"	25 kΩ	PG	3251
P 252,253	"	"	1 kΩ	PG	2102
P 254,255	"	"	25 kΩ	PG	3251
P 400	Modulator	"	5 kΩ	PG	2504

continued.

CIRCUIT DIAGRAM REF.	COMPONENT TYPE		STOCK REF.
POTENTIOMETERS:			
P 450-452	Voltage Stabilizer	wire lin. 100 Ω	PG 1101
P 500	Ref. Gen. Voltage	" 5 kΩ	PG 2504
P 501	" Freq. Adj.	" 150 kΩ	PG 4151
P 800,801	Meter Circuit	" 10 kΩ	PG 3104
P 802,803	"	" 25 kΩ	PG 3251
P 804	Monitor Volume	carbon log. 10 kΩ	PP 3109
P 805-813	Calibration	wire log. 5 kΩ	PB 2500
SWITCHES-RELAYS:			
N 1-5	Function Selectors		NT 0016
N 7	Microswitch		NT 0017
N 9	Capstan Motor Selector		NN 0564
N 10	Power On-Off		NN 0011
N 12	Microswitch		NT 0017
N 800,801	Reset Switch		NT 0016
O 1	Tape Speed Selector		OP 7001
O 2	Tape Break Sensor Relay		OC 0011
O 3	Stop-Play Relay		OC 0018
O 4	Record Relay		OC 0017
O 5	Play Back Relay		OC 0017
O 6	Rewind Relay		OC 0017
O 7	Fast Forward Relay		OC 0017
O 8	9 sec. after Switching Tape Speed		OC 0011
O 9	Moving Tape on Stop		OC 0011
O 10	Speed Changing		OC 0011
O 11	Pinch Roller Relay		OC 0018
O 12	High Pass - Pinch Roller Control		OC 0011
O 13	" "		OC 0018
O 14	Flywheel Brake		OC 0011
O 15	Capstan Motor Unit		OC 0014
O 200-202	Demodulator Relays		OC 0021
O 250-253	LF-Amplifier Relays		OC 0021
O 500-503	Reference Generator Relays		OC 0021
O 550,551	Marker Unit Relays		OC 0021
O 600-604	Low Pass Filter Relays		OC 0021
O 701-703	Voice Channel Relays		OC 0021
O 800,806	Amplifier Panel Wiring Relays		OC 0016
O 807,808	Record Switch		OS 7001
O 809,810	Input Attenuator		OT 7001
O 811	Monitor Switch		OU 7001
O 812	Calibration Selector		OR 7001
DIODES:			
Q 1-4	Silicon	50 V/0.5 A	QV 0501
Q 5	Germanium	115 V/150 mA	QV 0085
Q 6-10	Silicon	50 V/0.6 A	QV 0501
Q 12,13	Germanium	115 V/150 mA	QV 0085
Q 14-18	Silicon	150 V/ 30 mA	QV 0202
Q 19-21	Germanium	115 V/150 mA	QV 0085
Q 25,26	Photodiode	30 V/ 1 mA	QV 0026
Q 27,28	Silicon Photo Element		QB 1000
Q 31-38	Silicon	100 V/ 3 A	QV 0212
Q 40-42	"	50 V/0.6 A	QV 0501
Q 45,46	"	100 V/ 3 A	QV 0212
Q 47-52	"	200 V/0.6 A	QV 0502
Q 55,56	"	50 V/0.6 A	QV 0501
Q 200-203	"	200 V/ 40 mA	QV 0022
Q 204-207	Germanium	90 V/ 50 mA	QV 0097
Q 208	Zener	5.6 V/ 40 mA	QV 1105
Q 209-212	Germanium	25 V/110 mA	QV 0094
Q 213	Silicon	150 V/ 30 mA	QV 0202
Q 250,251	"	200 V/ 40 mA	QV 0022
Q 252-255	Germanium	90 V/ 50 mA	QV 0097
Q 256	Zener	15 V/0.4 W	QV 1325
Q 300	Germanium	20 V/ 8 mA	QV 0098
Q 301	"	25 V/110 mA	QV 0094
Q 302,303	"	20 V/ 8 mA	QV 0098
Q 304	"	25 V/110 mA	QV 0094
Q 305,306	Germanium	20 V/ 8 mA	QV 0098
Q 307	"	25 V/110 mA	QV 0094
Q 308,310	"	20 V/ 8 mA	QV 0098
Q 311	"	25 V/110 mA	QV 0094
Q 312,313	"	20 V/ 8 mA	QV 0098
Q 314	"	25 V/110 mA	QV 0094
Q 315-317	"	20 V/ 8 mA	QV 0098
Q 318	"	25 V/110 mA	QV 0094
Q 319,320	"	20 V/ 8 mA	QV 0098
Q 321	"	25 V/110 mA	QV 0094
Q 322,323	"	20 V/ 8 mA	QV 0098
Q 324	"	25 V/110 mA	QV 0094
Q 325-332	"	20 V/ 8 mA	QV 0098
Q 333	"	25 V/110 mA	QV 0094
Q 334,335	"	20 V/ 8 mA	QV 0098
Q 336	"	25 V/110 mA	QV 0094
Q 337,338	"	20 V/ 8 mA	QV 0098
Q 339	"	25 V/110 mA	QV 0094
Q 340,341	"	20 V/ 8 mA	QV 0098
Q 342	"	25 V/110 mA	QV 0094
Q 343,344	"	20 V/ 8 mA	QV 0098
Q 345	"	25 V/110 mA	QV 0094
Q 346,347	"	20 V/ 8 mA	QV 0098
Q 345	"	25 V/110 mA	QV 0094
Q 349	"	20 V/ 8 mA	QV 0098
Q 400	"	45 V/100 mA	QV 0078
Q 401	"	25 V/110 mA	QV 0094
Q 402	Zener	6.2 V/0.25 W	QV 1322
Q 500	"	7 V/0.25 W	QV 1007
Q 650-653	Silicon	200 V/ 40 mA	QV 0022
Q 700,701	Germanium	25 V/110 mA	QV 0094
Q 702	"	115 V/150 mA	QV 0085
Q 703	Silicon	200 V/0.6 A	QV 0502
Q 704	"	330 V/150 mA	QV 0025
Q 800-807	"	150 V/ 30 mA	QV 0202
Q 808-815	"	50 V/0.6 A	QV 0501
TRANSISTORS:			
V 11	Silicon	PNP 2N4289	VB 0049
V 12	"	NPN 2N3704	VB 0028
V 13-16	"	PNP 2N4289	VB 0049
V 17	"	NPN 2N3704	VB 0028
V 18	"	PNP 2N3702	VB 0038
V 19	"	PNP 2N4289	VB 0049
V 25	"	PNP 2N4289	VB 0049
V 26	"	NPN 2N3704	VB 0028
V 27	"	PNP 2N4289	VB 0049
V 28	Germanium	PNP ASZ 16	VB 0029
V 30	Silicon	PNP 2N4289	VB 0049
V 31	"	NPN 2N3704	VB 0028
V 32	"	PNP 2N4289	VB 0049
V 33	Germanium	PNP ASZ 16	VB 0029
V 40-42	Silicon	NPN 40310	VB 0256
V 200-202	Germanium	PNP 2N2374	VB 0022
V 203-208	"	PNP 2N2048	VB 0041
V 250	Silicon	NPN TD 101	VB 5300
V 251-253	"	NPN BC 107	VB 0257
V 254	"	NPN TD 101	VB 5300
V 255	"	NPN BC 107	VB 0257
V 256	"	NPN 2N3053	VB 0251
V 257,258	"	PNP 2N4289	VB 0049

continued

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Nærum - Denmark

Circuit Diagram

valid from serial no. 153180

7001.13

sheet 1

Consisting of:

Tape Transport Section	sheet 2
Amplifier Panal Wiring	sheet 3
Reference Generator ZH 0009	sheet 4
Demodulator ZM 0002	sheet 5
LF Amplifier ZE 0009	sheet 6
Low Pass Filter ZS 0130	sheet 7
Low Pass Filter ZS 0131	sheet 8
Preamplifier ZE 0011	sheet 9
FM Modulator ZM 0001	sheet 10
Frequency Divider ZD 0002	sheet 11
Voice Channel ZE 0010	sheet 12
Marker Unit ZH 0011	sheet 13
Voltage Stabilizer ZG 0003	sheet 14

BRÜEL & KJÆR
Nærum - Denmark

Circuit Diagram
valid from serial **no.** 212727

7001.13
sheet 2

Tape Transport Section

Control Box
ZH0005

Relay Section
ZH0008

Transport Base

ZB0006
Tape break sensor

UD0009
Counter drum, Ready light and pinch roller control

ZB0007
Tape tension sensor

01 : Tape Speed IPS

1: 1,5 inches per second
2: 6 " " "
3: 15 " " "
4: 60 " " "

016 : Loop -7"- 10½" Reel

1: Loop
2: 7 inch Reel
3: 10½ inch Reel

ASZ16
RCA 40310

2N3702
2N3704

Play back head
Track 1 (upper track)
Voice track (center track)
Track 2 (lower track)
MR 0002
To Preamp. ZE 0011
XC 0326
Record Head
MR 0001
XC 0101
Connections to Tape Transport selection
H
N
R
L
J
M
U-P
S
V
X
W
T
K
B
E
F
D
A
C
- 24 V on 1.5 and 6 IPS
- 24 V when pinch rollers are activated
- 24 V on Ploy Back
- 24 V on 6 and 15 IPS
- 24 V on Record
Remote Stop
ER1 Q 808
ER1 Q 809
ER1 Q813
- 15 V
+ 15 V
- 24 V
Voltage Stabilizer
Modulator
Frequency Divider
LF Amplifier
Demodulator
Low Pass I
Low Pass II
Modulator
Freq. Div.
LF Ampl.
Dem.
Low Pass I
Low Pass II
Ref. Gen.
Voice Channel
Marker Unit
Q 803
Q 804
Q 805
Q 802
10 k.Ω. R 819
630 Ω. R 817
10 kΩ. R 820
630 Ω. R 818
Track 1
Track 2
2 µF C 804
Marker Output Viewed externally
V 804
Overload Indicator
Reset
30 Ω. R 822
V 806
V 807
Meter Lamps
ER1 Q 810
ER1 Q 811
ER1 Q 812
V 805
Overload Indicator
Reset
30 Ω. R823
V 808
V 809
Meter Lamps
V 806
Q 800
22nF C 802
1nF C 800
100 MΩ. R 814
20 kΩ. R 802
4 × OA 202 Q 800 – 803
2N 4302 V 800
2N 4302 V 801
I 1
Zero adj. 10 kΩ. P 800
25 kΩ. P 802 Gain adj.
50 kΩ. R 808
150 kΩ. R 812
60 kΩ. R 810
40 kΩ. R 804
5 kΩ. R 800
45 kΩ. R 806
XC 0103
DC Bal. 5 kΩ. P 805
Gain 5 kΩ. P 806
DC Bal. 5 kΩ. P 807
Gain 5 kΩ. P 808
XC 0313
DC Bal. 5 kΩ. P 809
Gain 5 kΩ. P 810
DC Bal. 5 kΩ. P 811
Gain 5 kΩ. P 812
XC 0314
Q 801
22nF C 803
1nF C 801
100 MΩ. R 815
20 kΩ. R 803
4 × OA 202 Q 804–807
2N 4302 V 802
2N 4302 V 803
I 2
Zero adj. 10 kΩ. P 801
25 kΩ. P 803 Gain adj.
50 kΩ. R 809
150 kΩ. R 813
60 kΩ. R 811
40 kΩ. R 805
5 kΩ. R 801
45 kΩ. R 807
XC 0102
Q 807
Record Switch I
Q 812
Calibration Selector
Q 808
Record Switch II
ER1 Q 814
ER1 Q 815
2 µF C 805
2 µF C 806
348,88 kΩ. R 880
35,9 kΩ. R 852
R 824
R 854
R 825
R 855
R 826
R 856
R 827
R 857
R 828
R 858
R 829
R 830
R 831
R 851
R 837
R 836
R 865
R 835
R 864
R 834
R 863
R 833
R 862
R 832
R 859
R 860
Attenuator Input Q 809
R 824–837 = 9,29 kΩ.
R 854–866 = 174,4 kΩ.
10 kΩ. R 821
10 Ω. R 816
Input I
Output I
Microphone
10 kΩ. P804 Monitor Volumen
Monitor Selector Q 811
Monitor
Input II
Output II
348,88 kΩ. R 881
35,9 kΩ. R 853
R 838
R 867
R 839
R 868
R 840
R 869
R 841
R 870
R 842
R 871
R 843
R 844
R 845
R 874
R 872
R 873
R 851
R 879
R 850
R 878
R 849
R 877
R 848
R 876
R 847
R 875
R 846
Attenuator Input Q 810
R 838–851 = 9,29 kΩ.
R 867–879 = 174,4 kΩ.

Q 807, 808 : Record Switch
1: Off
2: DC
3: AC
4: Ref.

Q 809, 810: Input Attenuator

1:	28 dB	9:	12 dB
2:	26 "	10:	10 "
3:	24 "	11:	8 "
4:	22 "	12:	6 "
5:	20 "	13:	4 "
6:	18 "	14:	2 "
7:	16 "	15:	0 "
8:	14 "		

Q 811: Monitor Selector
1: Track 1
2: Track 2
3: Voice
4: Marker

Q 812: Calibration Selector
1 Calibration Off
2 DC Bal. Play Back
3 Gain " "
4 DC Bal. Record
5 Gain "

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153.180
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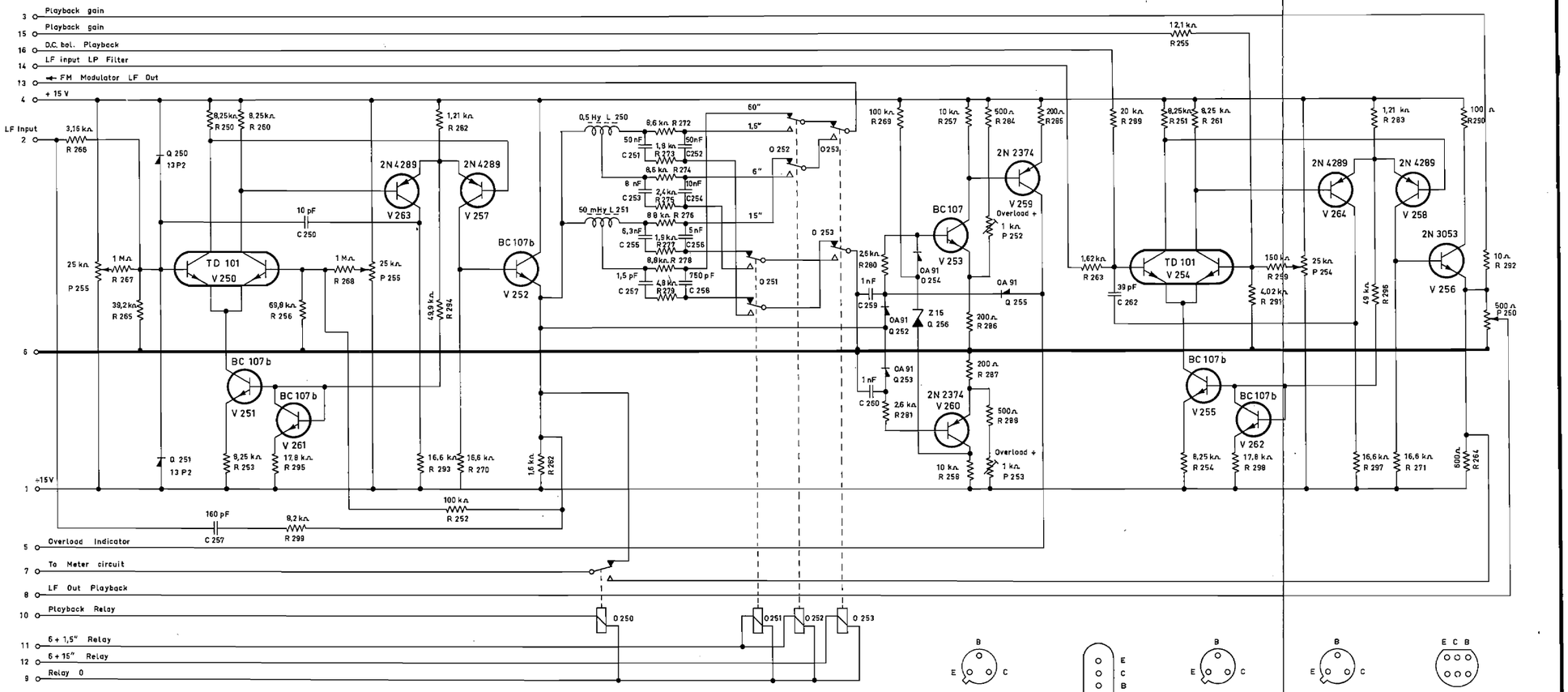
Amplifier Panel Wiring

Play back head
Track 1 (upper track)
Voice track (center track)
Track 2 (lower track)
MR 0002
To Preamp. ZE 0011
XC 0326
Record Head
Track 1 (upper track)
Voice track (center track)
Track 2 (lower track)
MR 0001
Voice Track Erase Head
ZB 0006
O 803
O 804
10 k.n. R 819
630.n. R 817
10 kn. R820
630.n. R818
- 15 V
+ 15 V
Voltage Stabilizer
Modulator
Frequency Divider
LF Amplifier
Demodulator
Low Pass I
Low Pass II
Modulator
Freq. Div.
LF Ampl.
Dem.
Low Pass I
Low Pass II
Ref. Gen.
Voice Channel
Marker Unit
O 805
Track 1
Track 2
2 µF C 804
- 24 V
O 802
Marker Output Viewed externally
V 804
Overload Indicator
Reset
V 805
V807
Meter Lamps
30 .n. R 822
ER1 Q 810
ER1 Q 811
ER1 Q 812
V 805
Overload Indicator
Reset
30.n. R823
V808
V 809
Meter Lamps
V 806
O 800
1nF C800
100 M.n. R 814
20 k.n. R 802
4 x OA 202 Q 800 - 803
DC Bal. 5 k.n. P805
Gain 5 k.n. P806
DC Bal. 5k.n. P807
Gain 5 k.n. P808
XC 0313
DC Bal. 5 k.n. P809
Gain 5 k.n. P810
DC Bal. 5 k.n. P811
Gain 5 k.n. P812
XC 0314
2N 4302 V 800
2N 4302 V 801
Zero adj. 10 k.n. P 800
I 1
25 k.n. P 802 Gain adj.
50 k.n. R 806
5 k.n. R 800
40 k.n. R 804
150 k.n. R 812
60 k.n. R 810
45 k.n. R 805
XC 0103
O 801
22nF C 803
1nF C 801
100 M.n. R 815
20 k.n. R 803
4 x OA 202 Q 804 - 807
2N 4302 V 802
2N 4302 V 803
Zero adj. 10 k.n. P 801
I 2
25 k.n. P 803 Gain adj.
50 k.n. R 809
5 k.n. R 801
40 k.n. R 805
150 k.n. R 813
60 k.n. R 811
45 k.n. R 807
XC 0102
O 807
Record Switch I
O 812
Calibration Selector
O 808
Record Switch II
ER1 Q 814
ER1 Q 815
2 µF C805
O 807
O 812
2 µF C806
O 808
348,88 k.n. R 880
35,9 k.n. R 852
R 824
R 854
R 825
R 855
R 826
R 856
R 827
R 857
R 828
R 858
R 829
R 830
R 831
R 861
R 837
R 866
R 836
R 865
R 835
R 864
R 834
R 863
R 833
R 862
R 832
R 859
R 860
Attenuator Input O 809
R 824-837 = 9,29 k.n.
R 854-866 = 174,4 k.n.
10 k.n. R 821
10 .n. R 816
Input I
Output I
Microphone
Monitor Selector O 811
Monitor
10 k.n. P804 Monitor Volumen
Input II
Output II
348,88 k.n. R 881
35,9 k.n. R 853
R 851
R 879
R 838
R 850
R 867
R 878
R 839
R 849
R 868
R 877
R 840
R 848
R 869
R 876
R 841
R 847
R 870
R 875
R 842
R 846
R 871
R 843
R 844
R 845
R 874
R 872
R 873
Attenuator Input O 810
R 838 - 851 = 9,29 k.n.
R 867 - 879 = 174,4 k.n.



60" No Voltage on 11 and 12

15" Voltage on 12

6" " " 11 and 12

1,5" " " 11

2N 2374 | 2N 4289 | BC 107 | 2N 3053 | TD 101

Print no. XC 0099

12-9-1968	212727		

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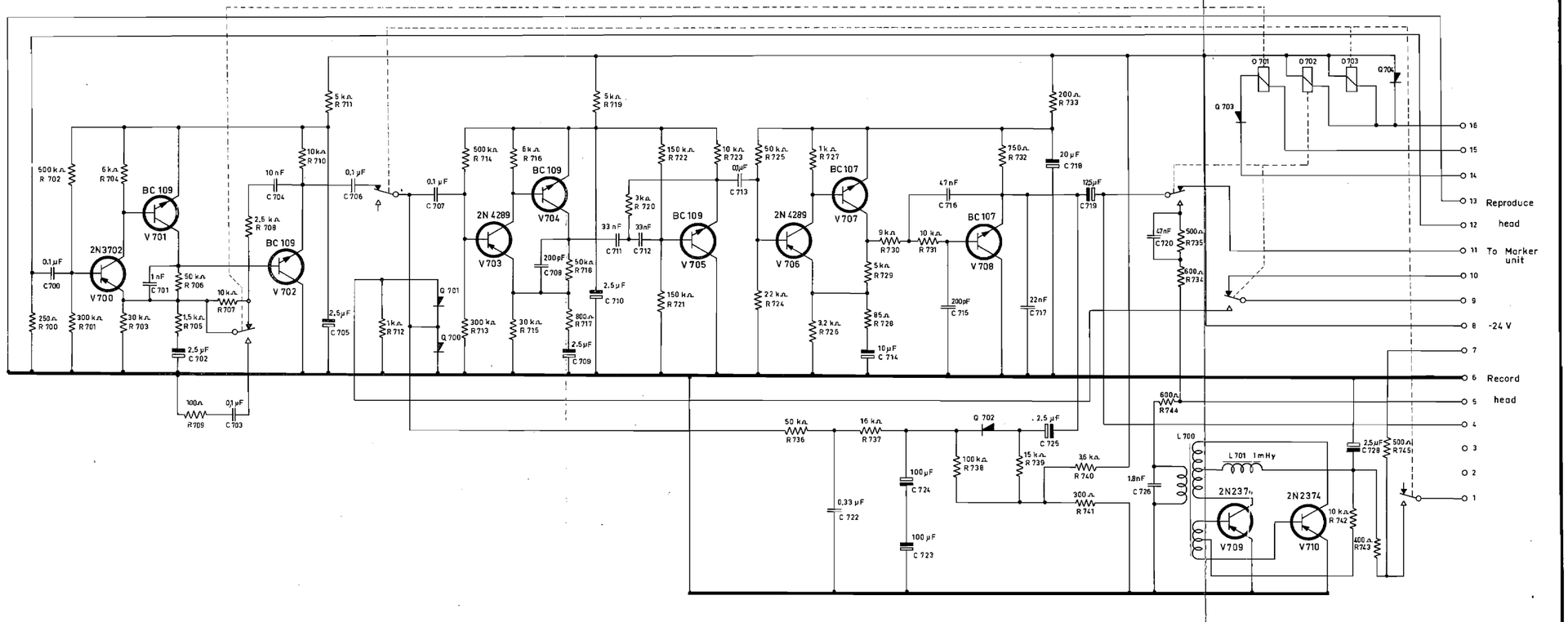
LF Amplifier
ZE 0009

BD 0031 –



Print no. XC 0266

21·6·66	153180			
2·7·68	153180			

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Voice Channel
ZE 0010

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Circuit Diagram
valid from serial no. 153180

Amplifier Panal Wiring

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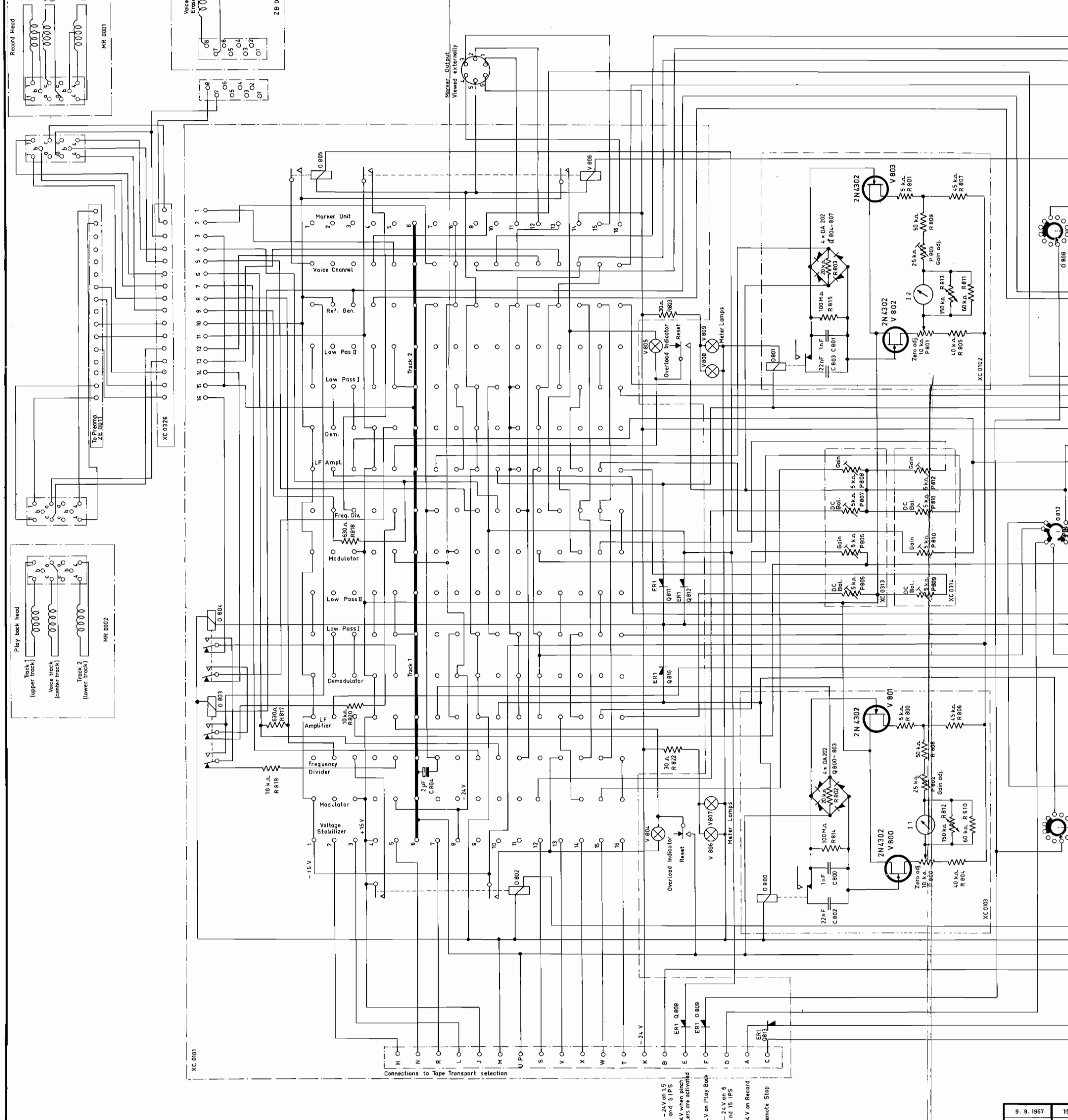
sheet 3



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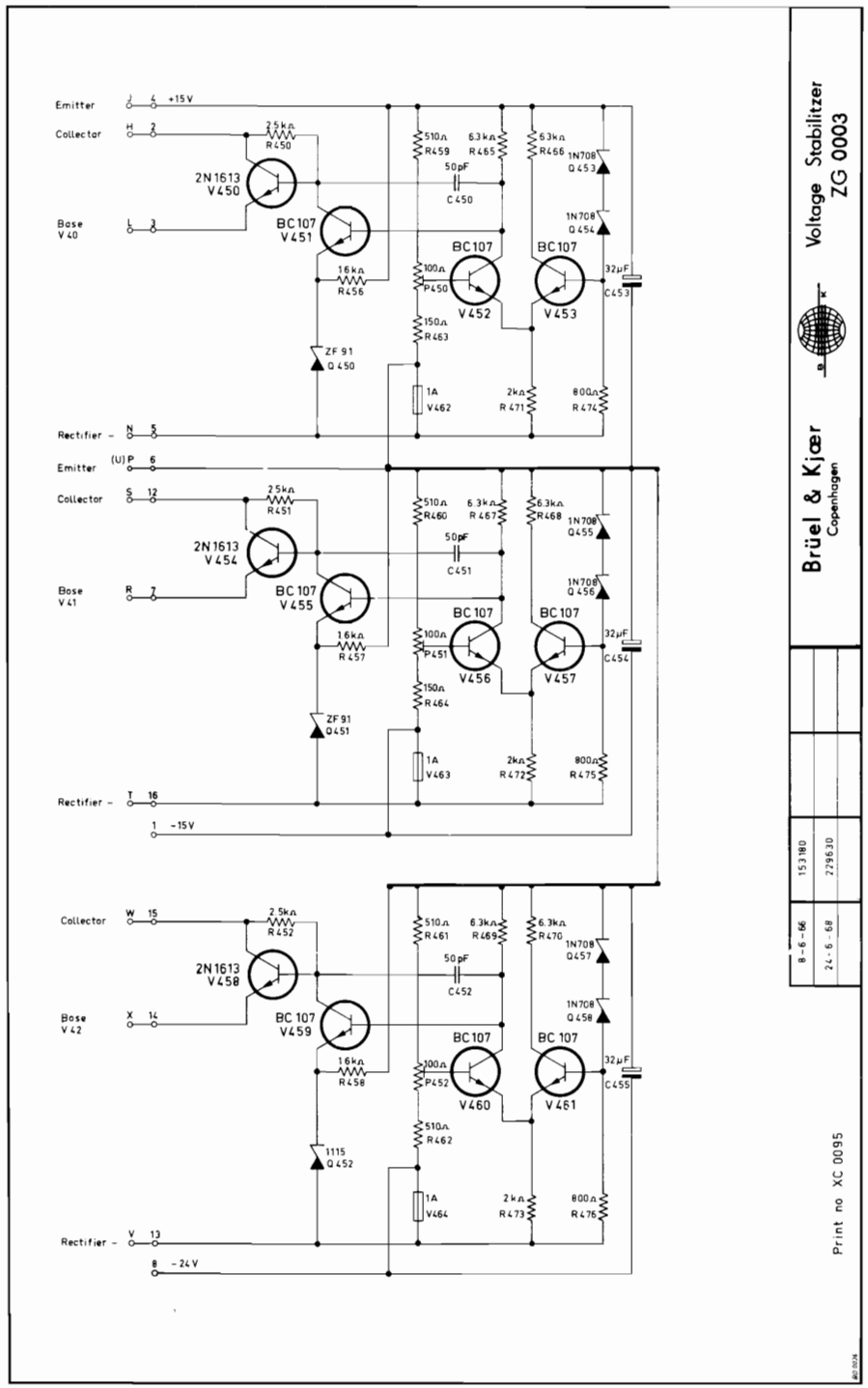
Circuit Diagram

valid from serial no. 229630

7001.13

sheet 14

Voltage Stabilizer ZG 0003



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Voltage Stabilizer
ZG 0003

8-6-66	153180	
24-6-68	279630	

Print no XC 0095

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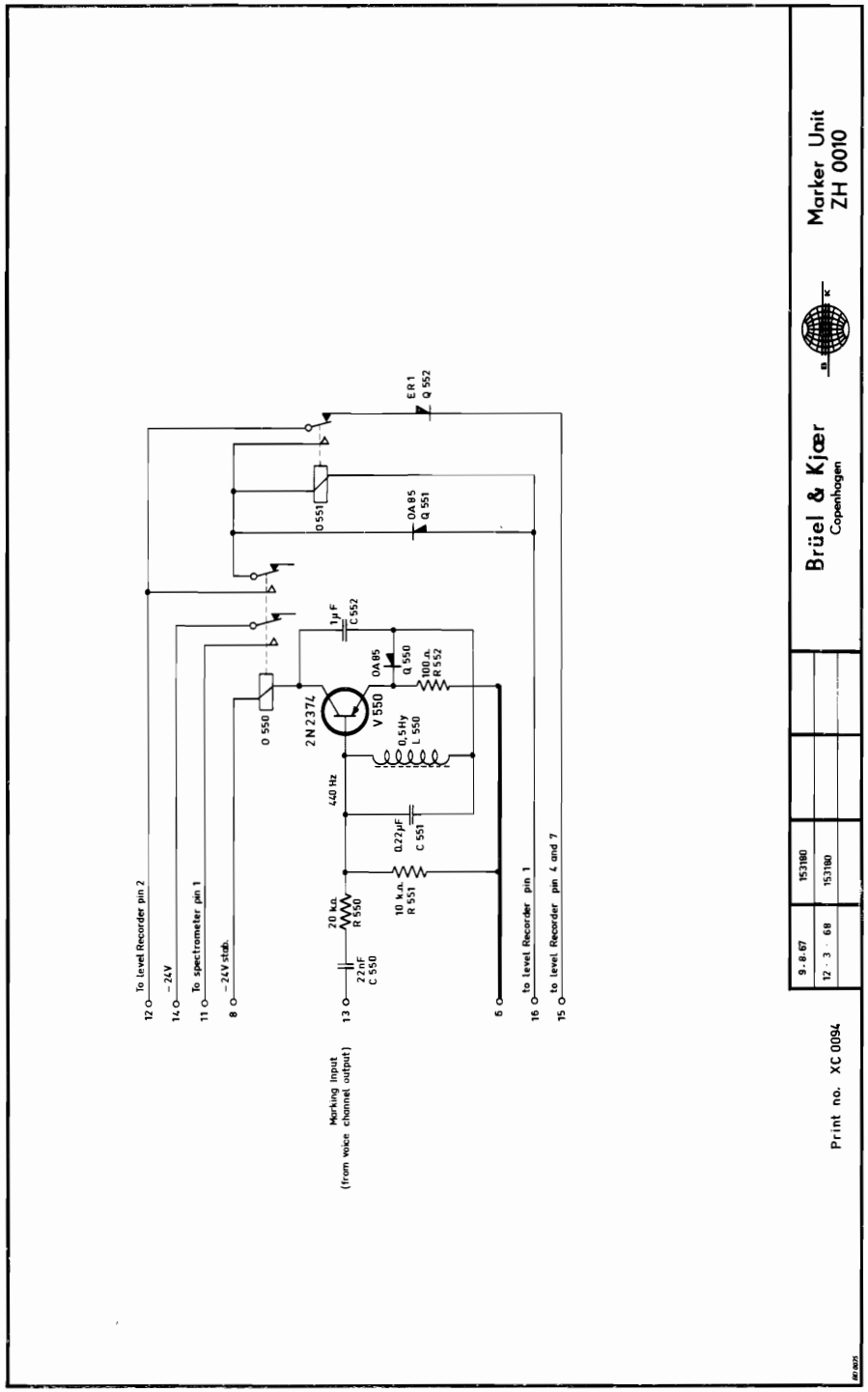
Circuit Diagram

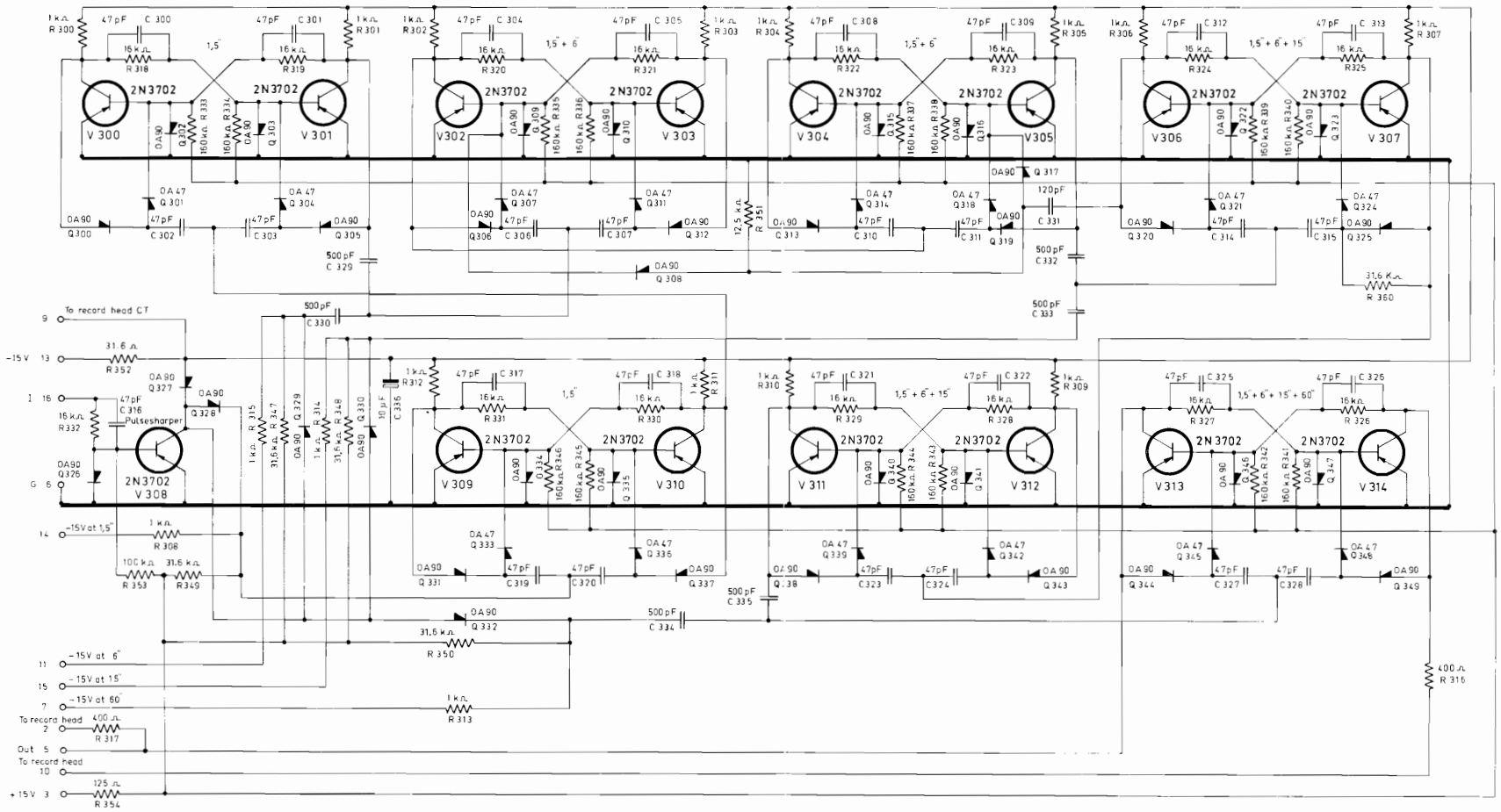
valid from serial no. 153180

7001.13

sheet 13

Marker Unit ZH 0010




2N3702
V 300
V 301
V302
V 303
V 304
V305
V306
V 307
V 308
V 309
V 310
V 311
V 312
V 313
V 314
To record head CT
To record head
Out
To record head
Pulsesharper
-15V at 1,5"
-15V at 6"
-15V at 15"
-15V at 60"
+15V
Print no. XC 0092
7.6.1966
153180
24-6-68
220630
Brüel & Kjær
Copenhagen
Frequency Divider
ZD 0002

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Circuit Diagram

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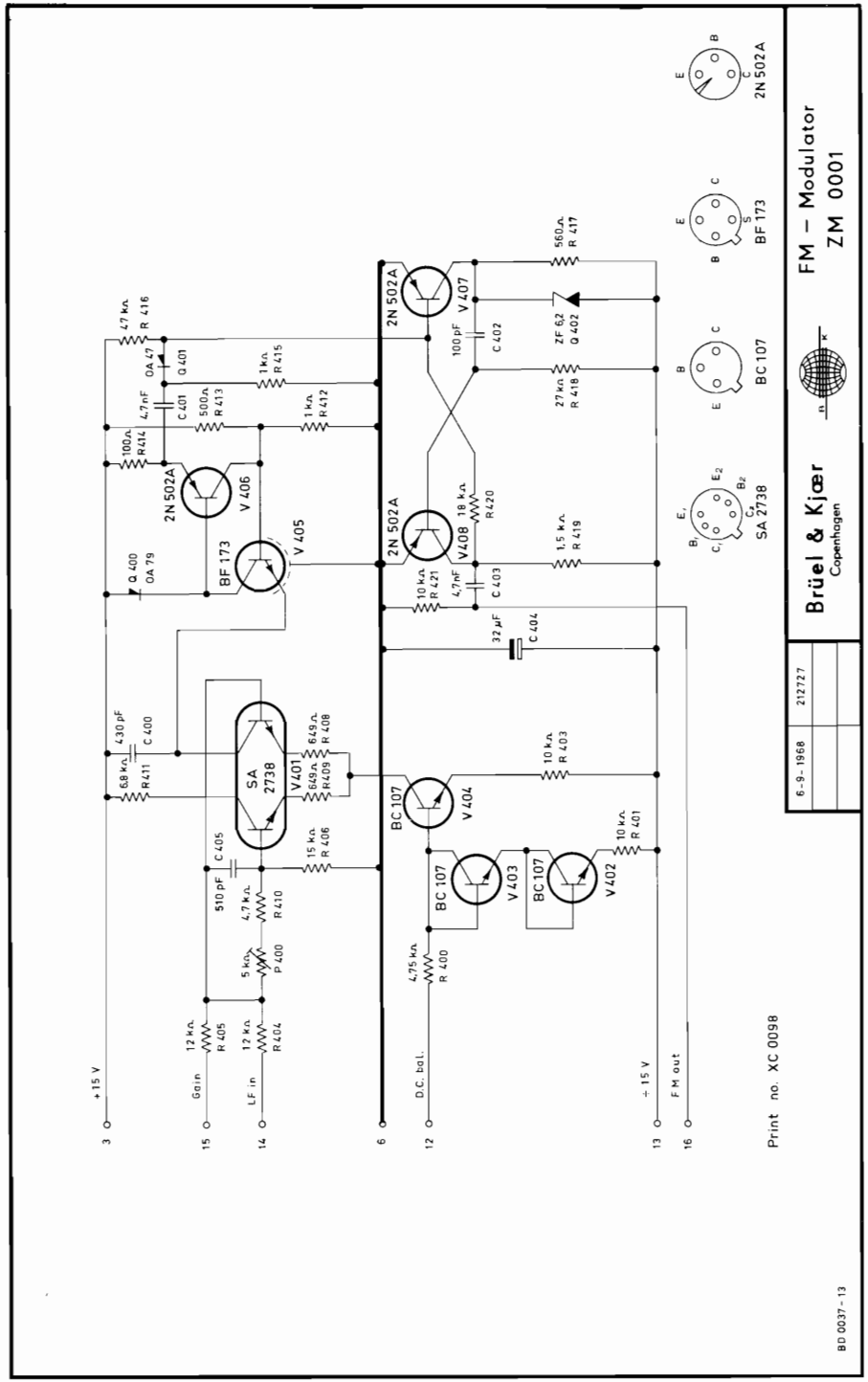
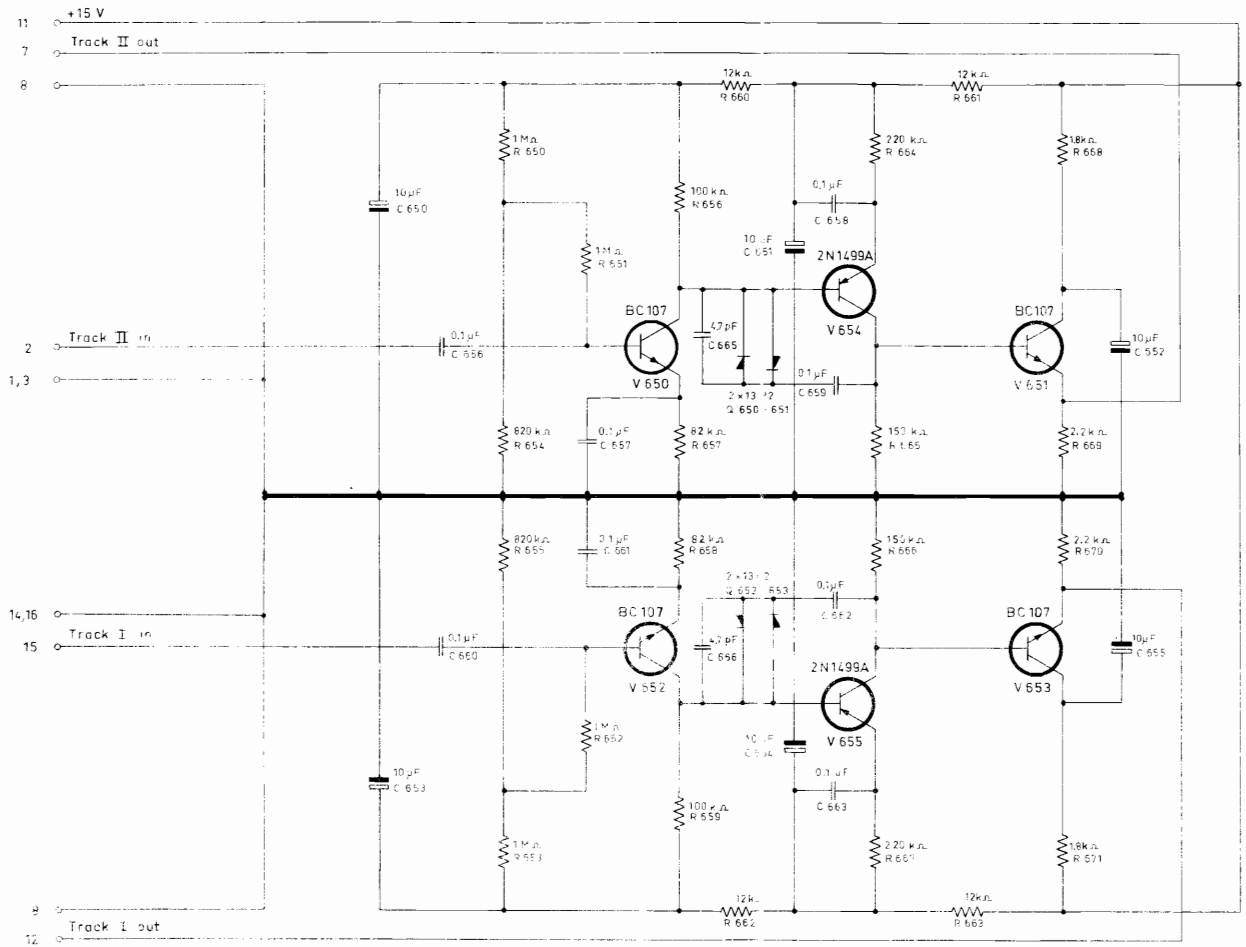
7001.13

sheet 10

F.M. Modulator ZM 0001





Print no. XC 0346

16-6-66	153180		
26-6-68	153180		

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Preamplifier
ZE 0011

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Circuit Diagram

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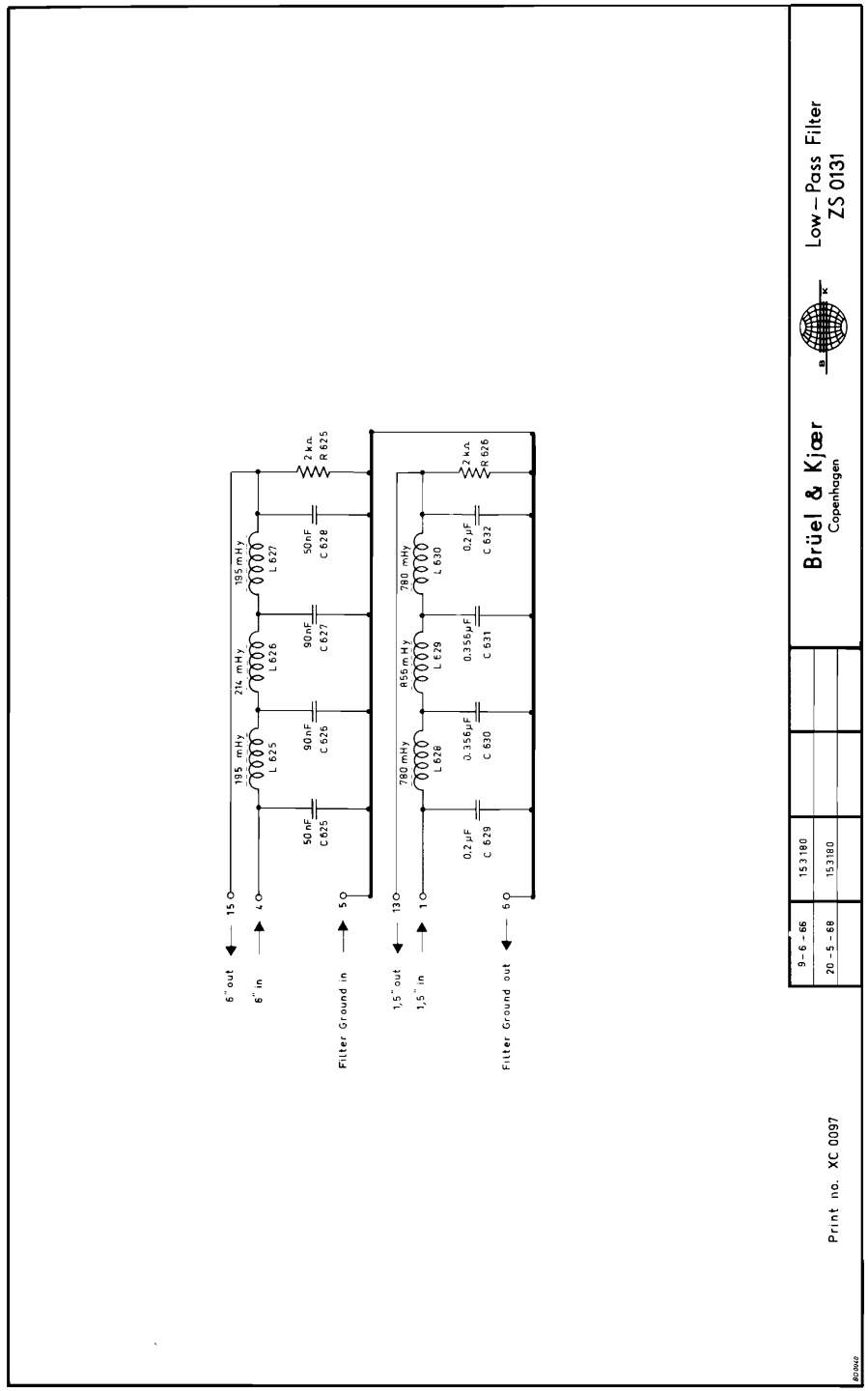
7001.13

sheet 8

Low Pass Filter ZS 0131



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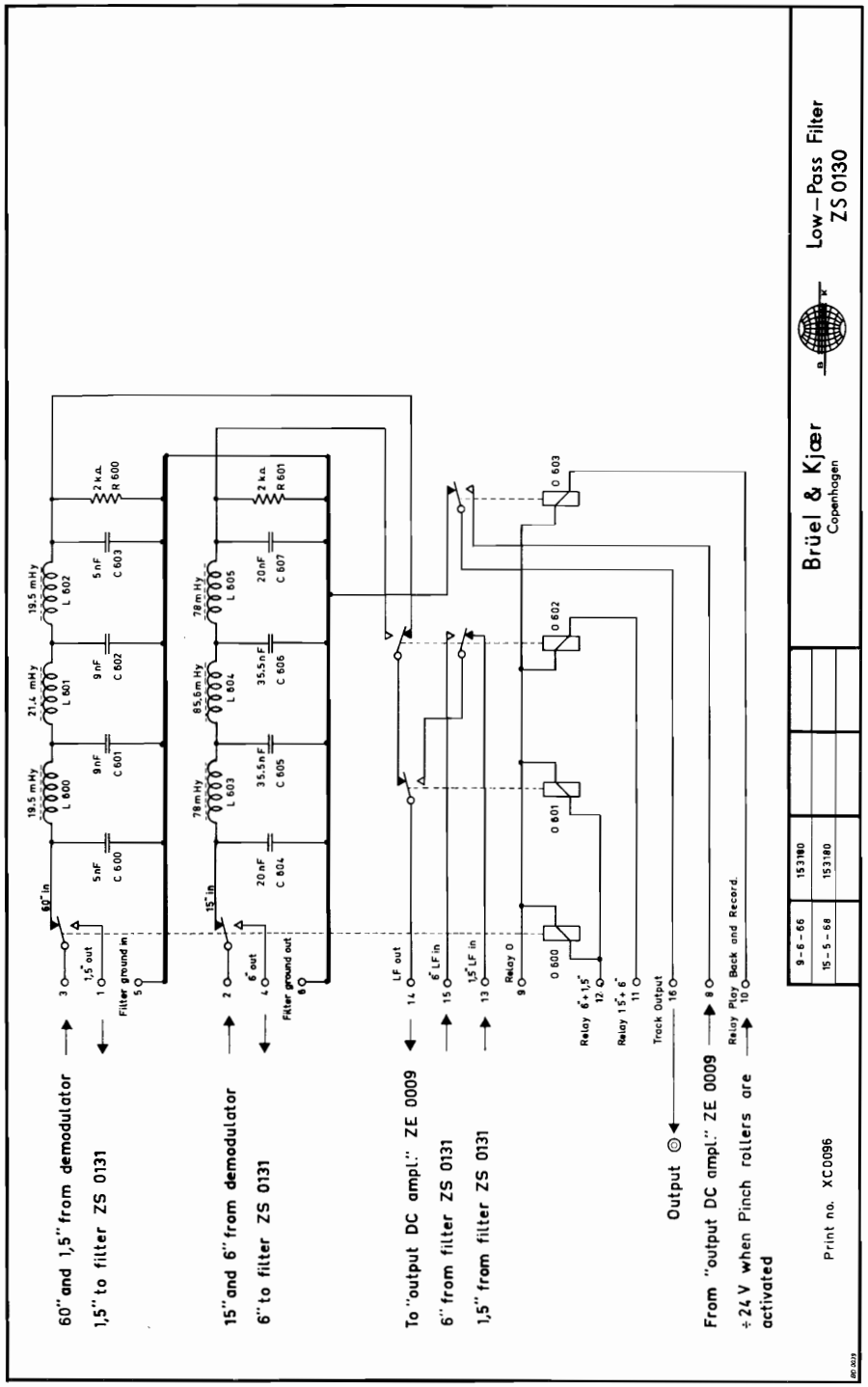
Circuit Diagram

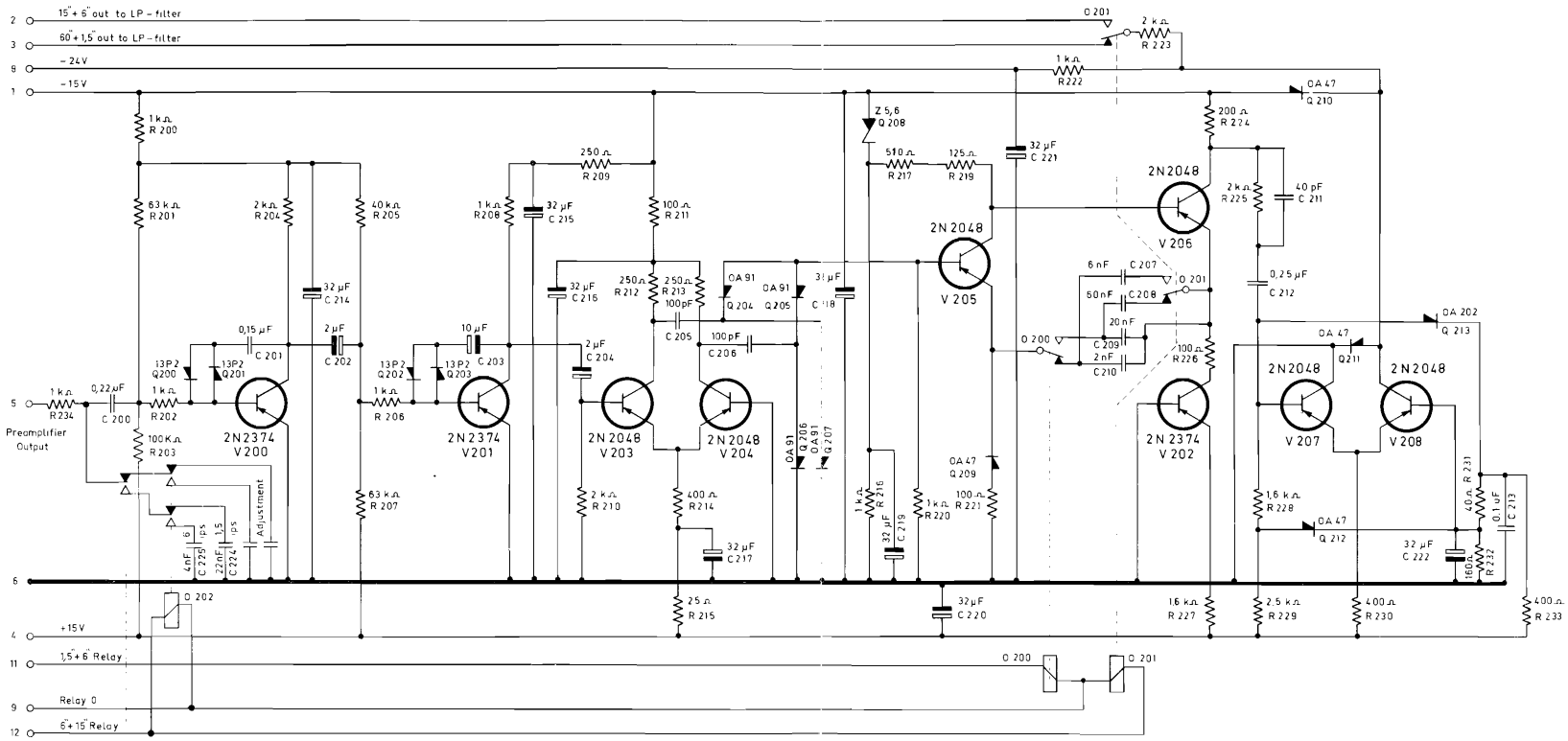
valid from serial no. 153180

7001.13

sheet 7

Low Pass Filter ZS 0130



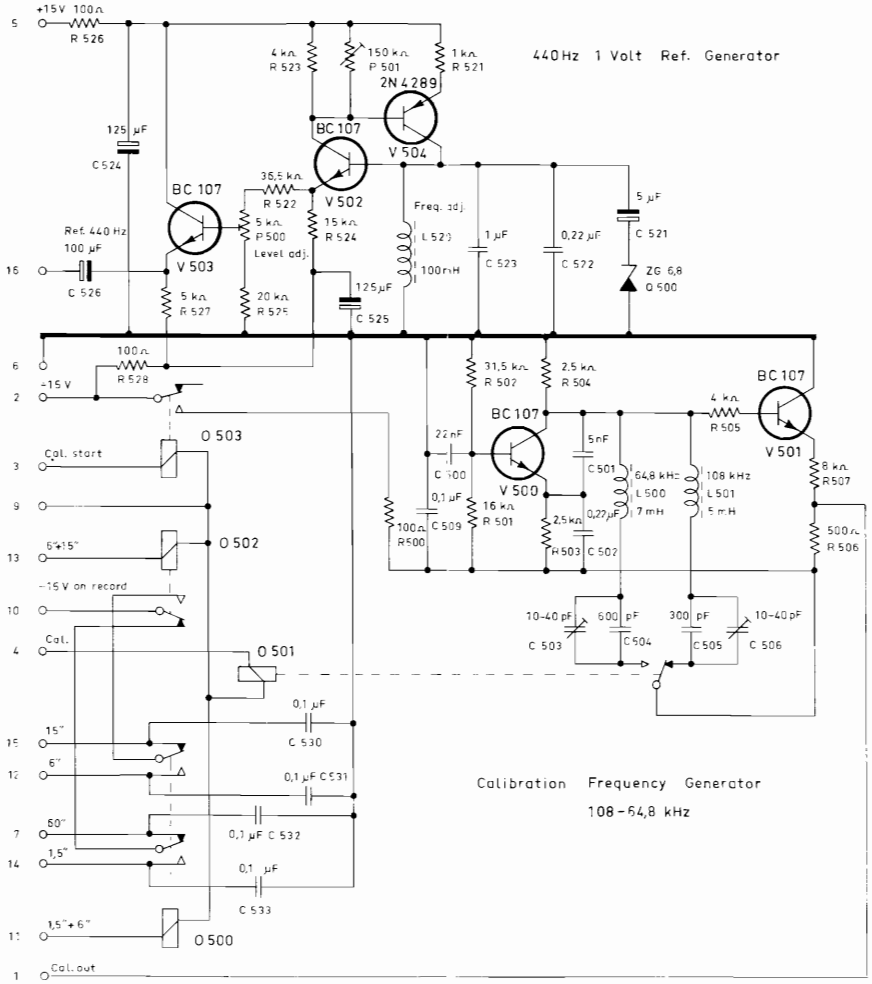


14-12-65	153180			
8-10-68	229630			

Print no. XC 0093

Brüel & Kjær
Copenhagen

Demodulator
ZM 0002



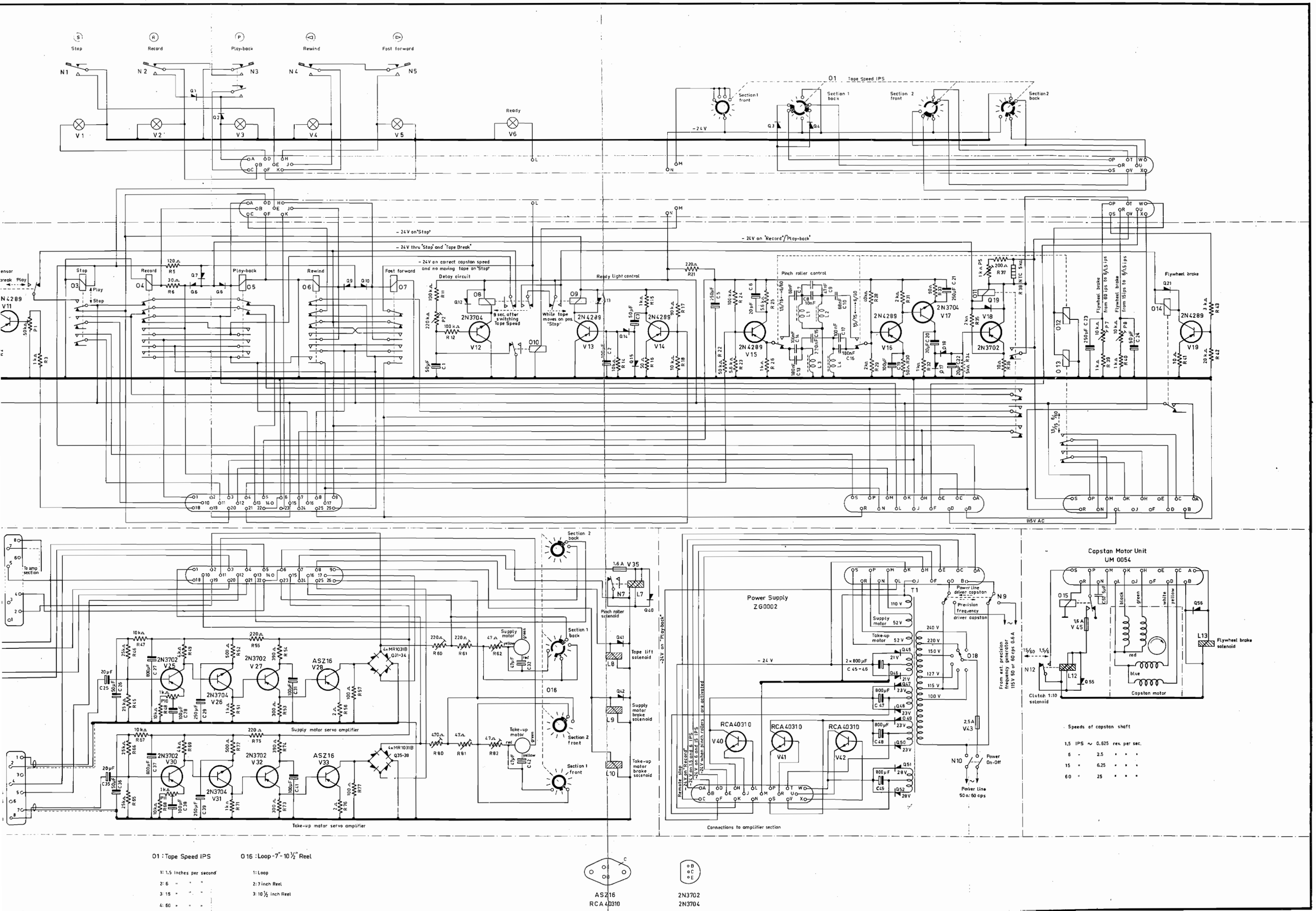
229630	21-10-1968		

Brüel & Kjær
Copenhagen

Reference Generator
ZH 0009

Print no. XC 0100

BP 2034


Stop
Record
Play-back
Rewind
Fast forward
Ready
Tape Speed IPS
Section 1 front
Section 1 back
Section 2 front
Section 2 back
– 24 V
– 24 V on "Stop"
– 24 V thru "Stop" and "Tape Break"
– 24 V on correct capstan speed and no moving tape on "Stop"
– 24 V on "Record"/"Play-back"
Delay circuit
Ready light control
Pinch roller control
9 sec. after switching Tape Speed
While tape moves on pos. "Stop"
Flywheel brake
Supply motor servo amplifier
Take-up motor servo amplifier
Power Supply ZG0002
Capstan Motor Unit UM 0054
Capstan motor
Clutch 1:10 solenoid
Flywheel brake solenoid
Pinch roller solenoid
Tape lift solenoid
Supply motor brake solenoid
Take-up motor brake solenoid
Power On-Off
Power Line 50 or 60 cps
115 V AC
Connections to amplifier section
To amp section
From ext. precision frequency generator 115 V 50 or 60 cps 0.6 A
Remote stop
Speeds of capstan shaft
1,5 IPS ~ 0.625 rev. per sec.
6 " 2.5 " " "
15 " 6.25 " " "
60 " 25 " " "
01 : Tape Speed IPS
1: 1,5 inches per second
2: 6 " " "
3: 15 " " "
4: 60 " " "
016 : Loop - 7" - 10½" Reel
1: Loop
2: 7 inch Reel
3: 10½ inch Reel
ASZ16
RCA 40310
2N3702
2N3704