

## D I R E C T I O N S

for

### LYREC Magnetic Tape Recorder, Type TRA 2

Lyrec Tape Recorder type TRA2 consists of a mechanical unit type TR2 and an amplifier type AR2 each mounted in a carrying case.

Machine and amplifier have been carefully tested and adjusted before shipment.

At the factory is kept a measuring sketch and a set of charts for each machine and amplifier. Please therefore state the series number of the machine or the amplifier in case of complaints or enquiries, if any. In connection with the shipment, however, accidents may take place despite careful packing, and it is therefore our hope that these directions, in connection with photographs and diagrams will render it easier to repair possible defects and moreover serve to the best possible working and operation of the apparatus.

#### MECHANICAL UNIT Type TR2.

The main components of the mechanical unit are: Synchronous motor with rubber intermediate wheels, flywheel and capstan together with supply motor and take-up motor, both with magnetic brakes. Around these motors changing switches and manoeuvring rods are built on a heavy aluminium front plate.

On the front of this plate steering idlers are mounted for the tape together with the three heads, erase head built together with the erase oscillator in one unit, recording head and playback head respectively.

On the front plate there are also 3 manoeuvring knobs. The uppermost has 3 positions: STOP in the centre, RECORDING to the left and PLAYBACK to the right. The knob can only be set on recording position when at the same time the little safety button to the left has been depressed.

Below the starting knob, the speed switch is positioned, by which it is possible to change the tape speed between  $7\frac{1}{2}$  and 15 inches per second. The changing of the tape speed should only be made when the machine has come to a standstill, otherwise the rubber wheels between motor and flywheel may be damaged.

The lowest knob is intended for rewinding or fast forward winding, as it will appear from the inscription beside the knob. In the central position the current for the reel motors has been switched off and at the same time the current for the synchronous motor has been switched on in this position. Care should therefore be taken that this changing switch is in the central position on recording or playback.

Out of regard to a suitably loose winding of the tape and to wear and tear on the sound heads, the tape will automatically be lifted from the heads when the starting knob is set on stop position. However, the tape bears against the playback head under a slight pressure so that it will be possible to monitor cues and the like on forward winding and rewinding.

The use of oblique reels should be avoided, as they may cause speed variations in the tape running.

The tape runs from the left reel across the left steering idler, in between the tape equalizing cylinder and the little lever with the cross pin, across the erase head, across the little steering idler, in between capstan and rubber thrust pulley, across the right steering idler to the right reel.

The insertion of the tape appears from photograph No. 1839.

When the starting knob is set on recording position, which may only take place when at the same time the safety button has been depressed, the following will take place:

- 1) The little lever with the cross pin is released and tip over, in which way the tape is tightened across the tape equalizing cylinder.
- 2) The lifting roller in the centre is lowered down between the erase head and the recording head so that the tape bears against the sound heads.
- 3) The rubber thrust pulley is pressed against the capstan that starts rotating, in which way the tape is carried ahead.

The parts on the back of the front plate appear from photo No. 1840a with reference numbers; R-numbers and C-numbers refer to attached wiring diagram No. 1802.

- 1) Phase correction resistance 3000 ohms (R 19) in series with phase condenser 2.1 MF (C 17) for the synchronous motor.
- 2) Phase condenser 2.1 MF (C 17) for synchronous motor. The two terminals are blank and only serves to hold the leads from the synchronous motor.
- 3) Synchronous motor 1500 r.p.m. The two yellow leads are the main coil and the two black leads are the auxiliary coil.
- 4) Phase condenser 1 MF (C 18) for take-up motor (right reel motor). One terminal is blank and only serves to hold the leads from the motor.
- 5) Take-up motor (right reel motor). The two yellow leads constitute the main coil and the two green leads the auxiliary coil.
- 6) Friction brakes on the shaft turning to the rear of the take-up motor, consisting of the following parts as from the motor and to the rear: disc fixed by a screw - felt disc - knurled loose disc - felt disc - thin brass disc - foam rubber disc - clamped disc.
- 7) Rubber roller, movably suspended in a lever and a chain.
- 8) Magnetic brake for take-up motor.
- 9) Keeper for magnetic brake.

The function of the braking arrangement 6-7-8-9 for the take-up motor is as follows: when the take-up motor (5) receives current, either on recording, playback or on winding to the right, the arrangement will not be braking, the knurled disc on the motor shaft only pushing the rubber roller (7) away. If on the other hand, the tape rotates the take-up motor (on rewinding), the knurled disc on the motor shaft will engage the rubber roller and press it up against the underlayer, in which the lever and the chain of the rubber roller are fastened. The knurled disc is therefore prevented from rotating together with the motor shaft, but being fixed between the two discs pressed against it by the foam rubber disc, a friction will arise between the knurled disc and the felt disc. The friction may be adjusted by clamping the sponge rubber disc more or less by loosening the

aftermost slitted clip pulley and displace it on the shaft.

The braking effect may be suspended by feeding current to the magnetic brake. In this way the keeper of the magnet is attracted and the lowest part of the latter carrying an adjusting screw, will push the rubber roller away from the knurled disc, in which way the motor shaft can rotate freely.

The brake will be braking when the take-up reel is at a standstill, but when the winding potentiometer is set on REWINDING, current will at the same time be fed to the magnetic brake, so that the tape can run freely off the take-up reel. When subsequently the winding potentiometer is set on STOP, the magnetic brake will become currentless, after which the rubber roller is no more kept away, but engages the knurled disc, in which way the motor shaft and consequently the tape is braked.

- 10) Lever for flywheel brake.
- 11) Rocking lever, which is turned by means of the REC.-STOP-PLAYB. knob. In the STOP position, the lever 11 is pressed downwards and by means of the connecting rod 12 the lever 10 will brake the flywheel and the lever 13 will lift the rubber thrust pulley from the capstan. When the knob is set on RECORDING or PLAYBACK the flywheel brake will be disconnected and the rubber thrust pulley is pressed against the capstan.
- 12) Connecting rod.
- 13) Lever for rubber thrust pulley.
- 14) Spiral spring that determines the pressure of the rubber thrust pulley against the capstan.
- 15) Flywheel.

On the shaft of the synchronous motor is fixed a step cone pulley with two tracks, the diameters of which are like 1:2, and in between these and the little track of the flywheel are fixed two rubber intermediate wheels, but only one at a time is engaged. The engagement takes place by means of the speed changing switch  $7\frac{1}{2}$ "-15", which by means of two eccentric discs influence the levers upon which the two rubber intermediate wheels are suspended. Besides the mechanical function the speed changing switch has also an electrical function, as it will engage two relays in the amplifier at  $7\frac{1}{2}$ ", one in the recording amplifier the other in the playback amplifier. These two relays are intended for changing of correction joints, either corresponding to  $7\frac{1}{2}$ " or 15" tape speed.

Rubber intermediate wheels and speed changing switch are not indicated on the photo.

- 16) Resistance 300+130+90+80 ohms R 7) No. 34-1261
- 17) do 1000+700 ohms (R 6) No. 34-1260
- 18) do 3000 ohms (R 17)
- 19) do 6000 ohms (R 18)
- 20) do 1000+700 ohms (R 5) No. 34-1260
- 21) do 300+130+90+80 ohms (R 4) No. 34-1261
- 22) Playback head (impedance 80 mh, gap width 10 mu)
- 23) Recording head ( " 8 mh, " " 20 mu)

- 24) Potentiometer 300 ohms (R 3) for adjustment of the deflection of bias current on the VU-meter. This deflection should normally be 80 per cent.
- 25) Control lamp for synchronism, 6 V. 21 A connected in parallel over 50 ohms (R 20), in series with the auxiliary coil in the synchronous motor. On recording or playback the lamp should emit a steady light. If the light flashes, the synchronous motor has not fallen into synchronism. The reason for this may either be a too low temperature or a too low mains voltage.
- A slight variation in the voltage will not have a bad influence on the recording or playback, whereas an alteration of the number of cycles gives a variation of the tape speed, as the number of revolutions in the synchronous motor is dependent on the mains frequency.
- 26) Erase- and Bias Oscillator. This yields high frequency current with a frequency of 70kc/s for the erase head and bias for the recording head.
- There are 2 adjusting screws in the erase oscillator. With one marked BIAS the amperage of the high frequency current has been adjusted at such a value that it will reduce a 1kc/s signal by  $3\frac{1}{2}$  db, measured on a SCOTCH 111 A tape or a tape of similar kind. With the other adjusting screw marked SYM., the anode current in the two halves of the valve (ECC40) will be outbalanced so that no noise, originating from the pre-magnetizing, will arise. These adjusting screws should not be controlled later on, unless valves have to be replaced.
- 27) Equalizing mechanism for tape tension. This mechanism consists of a nylon cylinder across which the tape slides and a little spring-loaded lever, which can turn around the axis of the nylon cylinder and around which the tape is placed.
- 28) Lever, which by means of the rocking lever turns a bushing around the equalizing mechanism. This bushing will lift or lower the little lever with the cross pin on the front of the machine. When the machine is in STOP position, the little lever with the cross pin will be lifted so that the tape can easily be inserted (as it appears from the photo of the machine from the front) and so that it is possible to wind or rewind without damping the tape in the equalizing mechanism. When the operation switch is set on REC. or PLAYB. the little lever with the cross pin will be released, and the torsion spring incorporated in the mechanism gives the lever with the little cross pin a pressure of 20 grammes against the tape. The tape is therefore forced to run below the little cross pin and over the nylon cylinder, in which way a friction will arise, and when the tape has passed the equalizing mechanism, it will have obtained a suitable tension. If subsequently a variable friction will arise in the supply reel, the ensuing variable tape tension will be equalized in the equalizing mechanism.
- 29) Lever, which by means of a connecting rod is connected to the rocking lever (11) and is moved up and down with the latter when the operation switch on the front is changed from STOP to REC. or PLAYB. On the end of the lever (29) is fixed a pin that goes through an oblong hole in the front plate, and on the end of the pin is fixed a ball bearing on which the tape can run. When the operation switch is set on STOP, the lever with the ball bearing will be raised so that the tape is lifted from the sound heads, whilst on RECORDING or PLAYBACK it will be lowered down between the sound heads so that the tape can freely lie on the gaps of the sound heads.

- 30) Pilot Lamp. Gives a red light when the machine is set on RECORDING.
- 31) Magnetic brake for supply motor.
- 32) Keeper for magnetic brake.
- 33) Friction brake disc on supply motor.  
As to the function of 30), 31) and 32) : see description under pos. 6), 7), 8) and 9).
- 34) Supply motor (left reel motor). The two yellow leads constitute the main coil and the two green leads the auxiliary coil.
- 35) Phase condenser 1 MF (C 16) for supply motor. One terminal is blank and only serves to hold the leads from the reel motor.
- 36) Terminal box that contains a terminal board for attachment of the pilot cables from the amplifier and a filter resistance 500 ohms (R 2).
- 37) Rectifier for rectification of 110 volts a.c. for use in manoeuvring of magnetic brakes 8 and 31, and the two relays S13 and S14 in the amplifier.
- 38) Noise condenser .1 MF (C7-C9-C10-C12-C13-C14). The other two noise condensers (C 8 and C 11) are clamped to the motor plate behind the synchronous motor by means of stays; are not indicated on the photo.
- 39) Resistances 51 ohms (R8-R10-R11-R13-R14-R15) which, in connection with the condenser (38), serve to eliminate spark noise from the contacts on the winding switch (40).
- 40) Winding Switch. On turning to the left, the left reel motor is started, in which way the tape is rewound, and turning to the right the tape is wound ahead. The speed of the winding to be adjusted by turning the handle more or less. In the central position, which is distinctly marked, the current for both motors has been switched off.

All calibrations are set at the factory and normally these should not be controlled later on. Only in case of replacement of components it may be necessary to make a check.

Motors and other rotating parts are furnished with self-lubricating bearings and ball bearings, filled with greasing substance, and lubrication should therefore not be necessary the first couple of years. If lubrication be necessary all the same, care should be taken that the rubber wheels are not contaminated by grease or oil, as this will cause sliding with speed variations in the tape. If, through such lubrication, the rubber wheels (the two intermediate wheels between synchronous motor and flywheel, the two brake wheels and the rubber pulley pressing against the capstan) be contaminated by grease or oil, they must be cleaned with ether.

At the factory the recording- and playback heads have been adjusted so that the gaps are situated exactly at the contact point of the tape and exactly at right angles to the longitudinal direction of the tape.

If the heads in some way or other, be displaced, these should be adjusted. For this purpose is used a test tape on which is recorded 1 kc/s and 12 kc/s for adjustment of the playback head and frequencies from 20 to 17 kilocycles for recording of a frequency curve. For adjustment of the recording head a tone oscillator should also be employed.

## AMPLIFIER type AR 2.

- - - - -

The amplifier type AR 2 is designed for connection of one, in the alternative, two mechanical units type TR 2.

The amplifier is to be connected to 220 volts 50 cycles alternating current. A possible over- or under voltage may be compensated, the mains transformer in the amplifier being provided with tapping for 200-210-220-230-240 volts respectively.

The consumption of the mechanical unit type TR 2 is 115 watts and of the amplifier 95 watts, total 210 watts.

On erection of the plant the four cables from machine to amplifiers are to be connected to the various receptacles on the back of the amplifier, moreover microphones or line is connected. Wrong connections should be out of the question, the various connections on the back of the amplifier being distinctly marked.

The mains switch, which is fixed in the uppermost corner to the right on the front plate of the amplifier, works as a switch for the entire plant, and the light in pilot lamp on the VU-meter is a guarantee that the plant is provided with current.

The pilot lamp being lit is no guarantee that the amplifier will work, as the fuse on the back of the amplifier is inserted in the anode current circuit.

It is advisable to start the plant a few minutes before use and to let the motors run without tape, so that the machine as well as the amplifiers will obtain a suitable working temperature.

The amplifier may be employed for the following purposes:

1. Recording with one machine (I) or (II)
2. Continuous recording with two machines type AR2 (I and II)
3. Playback, mixing, recording of gramophone records etc.
4. Re-recording from machine I to machine II or vice versa.
5. Universal amplifier (without simultaneous use of tape).

### 1. Recording with one machine.

- - - - -

After the motor having run a few minutes without tape, the latter should be inserted in the machine and the switch for tape speed set on the speed required,  $7\frac{1}{2}$ , 15 or 30 inches per second. For the sake of safety the bias voltage should be checked before recording. Turn the starter switch of the machine to RECORDING (out of regard to precautionary reasons this can only take place when the push button by the starter switch is fully depressed).

The red lamp on the machine indicates that the erase oscillator is provided with current, and if the selector switch on the amplifier is in the correct position, the red pilot lamp in the uppermost left corner of the amplifier will also emit light.

The selector switch has four positions, two to the left with the generic term RECORDING MACHINE I and sub-terms PLAYBACK MACHINE II and PLAYBACK MACHINE I and the two positions to the right with the generic term RECORDING MACHINE II and sub-terms PLAYBACK MACHINE II and PLAYBACK MACHINE I.

The mode of proceeding is now as follows: The cables from the machine is for example connected to the set of plug sockets on the back of the amplifier marked No. 1. The selector switch is now set on position REC.MACH.I - PLAYB.MACHINE I. If both the red pilot lamps on the machine and the amplifier emit light, then turn the switch below the VU-meter to position BIAS and if the VU-meter shows a deflection of 80, then turn the same changing switch right to the left to REC. and the plant will now be ready for recording.

The level required is adjusted by means of two potentiometers marked MIC I and MIC II-LINE.

Channel nr. 2 has two inputs and can be used either as an input for microphone or a 600 ohms line. Above the input potentiometers are fixed two changing switches marked BASS ATTN, with a cut-off of 0, -3, -6 and -9 db at 100 c/s of which the changing switch that belongs to channel 2 has an extra position marked LINE IN, and in this position LINE IN will be connected and the bass attenuation filter disconnected.

The tone frequency voltage necessary for the maximum signal of the tape can be read on the VU-meter. The medium level should preferably have such a value that the peaks will not reach higher than 0 db.

The changing switch marked MONITOR that has 3 positions, is intended for changing over of the monitor amplifier between INPUT (from microphone or line in) , LINE OUT or OUTPUT.

The incorporated loudspeaker is only small and cannot bear great effect. Therefore it should not be used for a quality check, this should only be made with a loudspeaker arrangement suitable for this purpose, and this loudspeaker arrangement should either be connected on the back of the amplifiers to the plug socket marked LOUDSP. 5 ohms or to the jack fixed on the front plate beside the loudspeaker. In the last instance the incorporated loudspeaker will automatically be set out of commission. The volume to be adjusted by means of the potentiometer marked MONITOR VOL.

## 2. Continuous Recording with two Machines, Type AR 2.

- - - - -

As a whole the mode of proceeding is the same as mentioned under point 1, however, care should be taken that the 3 cables from machine I are connected to the receptacles marked nr. 1 on the back of the amplifier and the 3 cables from machine II to the receptacles marked nr. 2.

It would be appropriate to start the machine, upon which it is the intention to continue the recording, a little while before the other machine has run empty of tape and then make a quick change-over with the selector switch when a suitable place appears in the recording, for example a brief interval in a dialogue or a piece of music.

### 3. Playback, Mixing, Recording of Gramophone Records etc.

-----

Playback with the monitor amplifier in connection with an extra loudspeaker is mentioned under point 1. The starter switch is turned to the PLAYBACK position and the volume is adjusted by means of the potentiometer marked MONITOR VOL.

In so far as the effect of the monitor amplifier be not sufficient, a power amplifier unit with a 600 ohms input may be connected to the receptacle on the back of the amplifier marked LINE OUT. The necessary input voltage to the power amplifier unit will in this case be adjusted by means of the potentiometer marked LINE OUT BY TAPE. The changing switch for the VU-meter is set on PLAYB. and now the input voltage for the power amplifier unit can be read on the VU-meter.

It is advisable to adapt the sensitivity of the power amplifier unit so that it will reach maximum signal at about 1,5 volts. 0 VU corresponds to 1.23 volts.

When using a power amplifier unit, connected to LINE-OUT, the incorporated monitor amplifier will not be employed, but of course it may be used as a check, as mentioned under point 1.

For mixing, LINE-OUT is connected to a 600 ohms input on a mixer table and it is advised not to use greater input voltage than necessary. The normal input voltage required for a mixertable is 100 - 150 m.V. The maximum signal can be read in the VU-meter on the mixer table.

LYREC recording turntable can be connected direct to the monitor amplifier and the sensitivity adjusted, so that 0 db corresponds to maximum signal of the cutting machine.

### 4. Re-recording from Machine I to Machine II or vice versa:

-----

The machines to be connected with the amplifier as mentioned under point 2. Moreover LINE-IN is to be connected with LINE-OUT on the back of the amplifier.

The tape, that is to be re-recorded, is inserted in machine I and a new tape is inserted in machine II. The selector switch is set on REC-MACH.II - PLAYB. MACH. I. Turn switch for VU-meter to REC. position and the level is adjusted by means of the potentiometers LINE-OUT BY TAPE and LINE-IN.

During re-recording the loudspeaker switch marked MONITOR must not, under any circumstances, be set on any other position than INPUT, as otherwise the amplifier will oscillate back. Consequently it will be impossible to make any simultaneous check of the re-recorded tape. During the monitoring check, machine I should be stopped and the monitoring is carried out on machine II in the normal way.

### 5. Universal Amplifier (without simultaneous use of Tape):

-----

Furthermore the amplifier can be used without machine or tape

as a microphone - and line amplifier, or if the effect of the monitor of 8 watts will suffice, the unit will be very suitable for all-round use. If a greater effect be required, a power amplifier unit should be connected as mentioned under point 3, and the input voltage is adjusted by means of the potentiometer marked LINE-CUT-DIRECT. A monitoring check can be carried out by means of the built-in monitor amplifier and loudspeaker.

The amplifier unit type AR2 consists of three different amplifiers:

1. Recording Amplifier
2. Playback Amplifier,
3. Monitor Amplifier.

#### RECORDING AMPLIFIER:

-----

This amplifier is equipped with 2 independent input channels, of which channel 1 is a microphone channel exclusively, while channel 2 can be changed over between microphone or 600 ohm's line respectively. The 2 microphone transformers marked T4 and T5 have a primary impedance of 50 ohms and the secondary windings are connected to an input valve each, marked V1 and V2. The primary windings of the two microphone transformers are wound with 2 x 50 ohms impedance, which as a rule are connected in parallel, in which way is obtained an input impedance of 50 ohms. But if it is desired to use microphones with an impedance of 200 ohms, the leads for the transformers can be changed over, so that the windings be situated in series, in which way a 200 ohms input impedance is obtained.

In between each of the anodes of the input valves and the potentiometers R55 and R56 is inserted a variable dialogue filter in three stages with a cut-off of 0, -3, -6 and -9 db at 100 c/s. The two switches belonging to the dialogue filter are marked S12 and S11. The changing switch marked 11 in channel 2 is provided with an extra position, marked LINE IN. In this position the microphone and dialogue filter are disconnected, while the potentiometer R56 is connected direct on the secondary side of the line transformer, marked T6. The primary impedance of this transformer is greater than 5000 ohm.

After the potentiometers R55 and R56 follows the combined mixing - and phase inverting valve V3. From the anode of this valve the input voltage for the recording valve V 5 are taken. In the cathodes of V5 operating with a heavy current feed back, are situated the high note corrections for  $7\frac{1}{2}$  as well as for 15 inches tape speed. Resistance R70 and condenser C40, which are connected in parallel with a variable condenser so that the total capacity will be about 4,5 nF as stated on the diagram, serve to corrections for 15 inches tape speed. Relay, marked S14, receives its operative voltage from the changing switch for tape speed in the mechanical part, type TR 2 and TR4, and the condenser, marked C38, will in this way also be automatically connected, when the changing switch for tape speed is set on position  $7\frac{1}{2}$  inches.

The output transformer T7 is connected to the receptacles marked REC. I and REC. II over the changing switch S4, which again is connected with the measuring switch for bias voltage S3.

The amplifier valve  $\frac{1}{2}$  V4, the grid of which is led to one of the anodes on V3 over C33, acts as a pre-amplifier, partly for the metre-valve  $\frac{1}{2}$  V4 and partly as a pre-amplifier for LINE-OUT (over potentiometer R13 and valve V8), and partly as a pre-amplifier for the monitor amplifier (over changing switch S9 and potentiometer R24).

In the grid of the metre valve is fixed a voltage divider R64 and R65 so adjusted that 0 VU- corresponds to the greatest permissible maximum signal of the tape. (At sinusoidal measuring voltages, however, there will be 6 db in reserve). The valve, which is cathode-coupled to the components, choke DO-1000, electrolytic condenser C35 and resistance R66 are led to the changing switch for VU meter.

#### PLAYBACK AMPLIFIER:

- - - - -

The input transformer T1 of the amplifier can be changed over by means of the switches S1 and S2 that work together with the switches S3 - S4. These changing switches have previously in this direction been called selector switch, and it makes it possible to change over between PLAYB. I and PLAYB. II together with REC. I and REC. II when employing 2 recorders. Below the diagram of the playback amplifier are indicated the four various positions.

The secondary winding of the transformer is carried on to the grid of the valve V6, where the frequency correction necessary for the playback takes place, both for low and high frequencies. The correction for low frequencies takes place in the circuit, consisting of the resistances R1-R2-R4 and condenser C1, and this correction should not normally be altered. The high note correction at 15 inches tape speed is obtained through the circuit, consisting of the resistances R4 and R3 together with a trimmer capacitor of 40 pF C2 connected in parallel with a capacity of 25 pF. At a tape speed of  $7\frac{1}{2}$  inches a greater pitch for high notes is required and this is obtained by means of condenser C4, which is automatically connected with relay S13 that is connected in series with relay S14. The high note corrections for  $7\frac{1}{2}$  inches as well as for 15 inches should normally not be altered either. When, however, the machine has been used for a long time, it may be necessary to make a check, as heavy wear and tear of the heads may cause that high frequency will fall.

The corrected tone frequency is then led to the amplifier valve V7 and from there over the potentiometer R14 to the line output valve V8, which is also suitable as a combined mixing- and phase inverting valve for the signals from playback head and from the microphone inputs and further on to the line output transformer T2 with an output impedance of 500 ohms, which is connected with a receptacle marked LINE OUT.

#### MONITOR AMPLIFIER:

- - - - -

This amplifier consists of the combined amplifier- and phase inverting

valve V9 together with the output valves V10 and V11 and the output transformer T3 that has an output impedance of 5 ohms and has been carried direct to the receptacle marked LOUDSP. 5 ohms and to the built-in monitor loudspeaker marked Ph. 9742. In the circuit of the monitor loudspeaker a jack has been inserted, to which either a head-phone or an extra loudspeaker is connected and in that case the built-in loudspeaker will be set out of function.

In the input of the amplifier there is a change-over switch marked S9 with 3 positions, marked INPUT, LINE-OUT and OUTPUT together with a volume control marked R24.

#### DIRECTIONS:

- - - - -

By means of the wiring diagram nr.1427A and the arrangement plans nos. 1450 - 1451 - 1452 - 1453 it can be seen where the various components are positioned.

On the diagram d.c. voltages as well as tone frequency voltages are indicated. The d.c. voltages (designated=) are measured by means of a voltmeter with 20.000 ohms per volt, while the tone-frequency voltages (designated  $\sim$ ) for the playback amplifiers refer to voltages at 1000 c/s, measured with LYREC's test tape on the machine. (Notice: This tape is recorded at - 20 db). The tone frequency voltages in the recording amplifier are also measured at a frequency of 1000 c/s and the necessary measuring voltage can be obtained from a tone oscillator, which are connected to the various inputs. If the tone oscillator is not equipped with different output impedances corresponding to the input transformers in the recording amplifier, a readjustment of the impedances must be made by means of an ordinary L-link in order to agree with the values indicated on the diagram.

On measuring the recording amplifier the changing switch for the VU-meter is set on REC. position, and the tone oscillator is set on 1000 c/s. The input potentiometer in the channel that is to be measured, should be fully opened, and the potentiometer marked LINE-OUT DIRECT (R.13) should also be fully opened. The output voltage of the tone oscillator is then adjusted until the deflection of the VU-meter is 0. Normally this voltage must be about 130 mV on connection to LINE-IN and about 30 micro volts on connection to MICROPHONE I or II. Then if the amplifier is in order, the values of the various places in the recording amplifier, indicated on the diagram, should be measured.

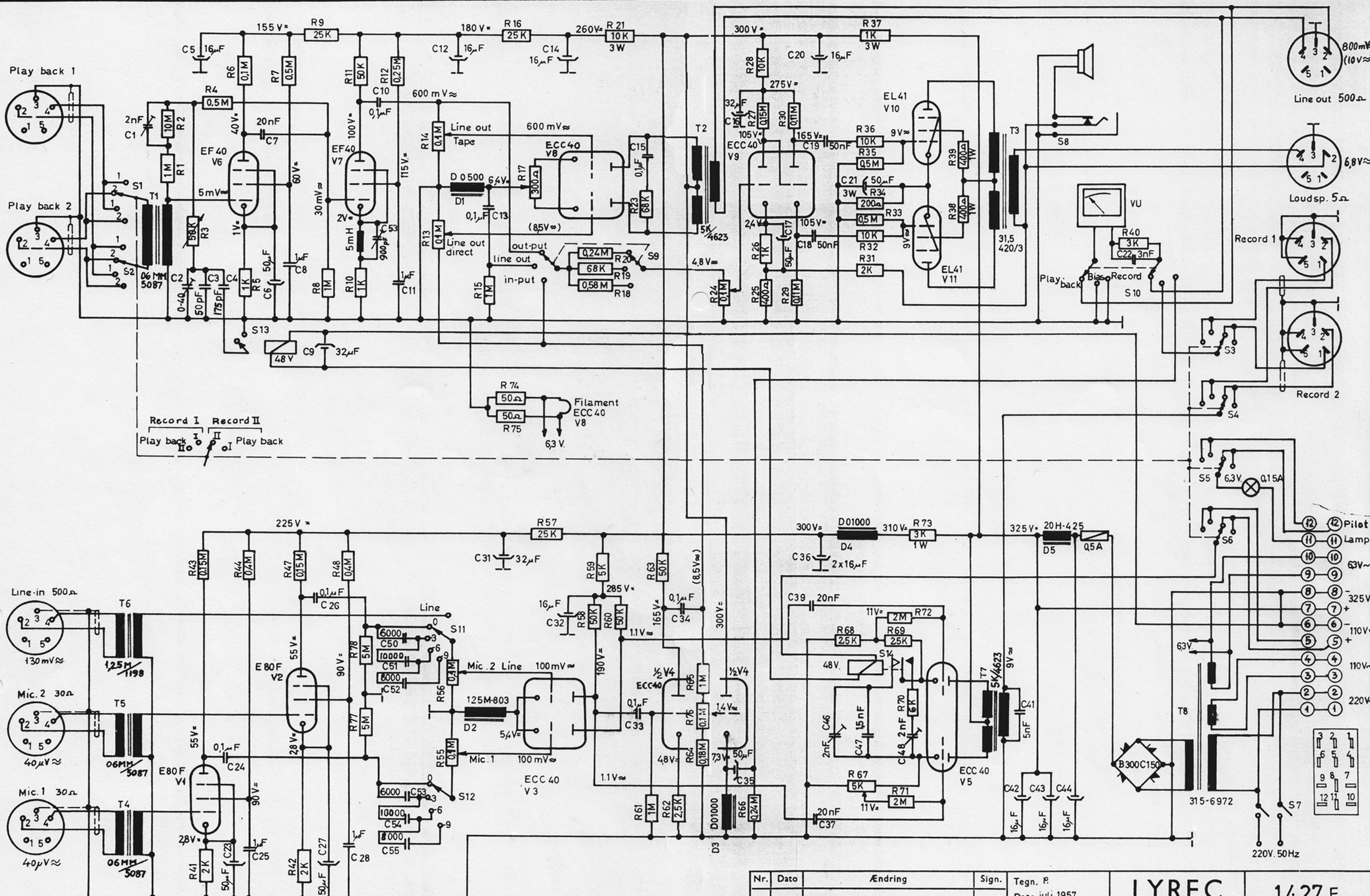
As also the line output can be changed over to the recording amplifier (via potentiometer R13 LINE-OUT DIRECT), the voltages, which are indicated in brackets on the diagram over the playback amplifier, correspond to the measuring values in the recording amplifier.

That the values in brackets are 20 db greater than those indicated for the playback amplifier, is due to the fact that the measurements in the recording amplifier are made at maximum signal (0 VU), while the measurements in the playback amplifier are made from the test tape, which - as mentioned elsewhere - are recorded with a level that is 20 db

below 0 VU.

The percentage of defects in the amplifier, type AR 2, has been so low that it has not been possible to make any statistical treatment of defects. Hitherto the most common defects have been valve defects, like microphony, noise and hum and on the part of the double valves that both systems are growing older in a disuniform way. It is therefore important that there is an interbalance between the two systems in the valve V5 and the two systems in the valve V8, and it is advisable to check this now and then.

In case defects might occur, and these cannot be traced back to valve defects like distortion, faint reproduction etc. the d.c.-and tone frequency voltages indicated on the diagram, will be a help on locating the defect. It should be observed that the monitor amplifier and the loudspeaker are used in locating defects in valves as well as defects of components. If, for example, there is acoustic feedback, the defect can be traced in the following way: Switch S9 be turned to position INPUT, turn down the potentiometers R55 and R56, if the defect is still present, it must either be in valve V3 or V4, otherwise it is easily located by means of the two input potentiometers.



| Nr.       | Dato | Ændring  | Sign.    | Tegn. P.       |
|-----------|------|----------|----------|----------------|
|           |      |          |          | Dato juli 1957 |
|           |      |          |          | Kontr. M       |
|           |      |          |          | Dato           |
| Materiale |      | Br. Vægt | Maalest. |                |
|           |      | g        |          |                |

**LYREC**  
COPENHAGEN

**1427 E**

Diagram  
 Amplifier, Type AR2

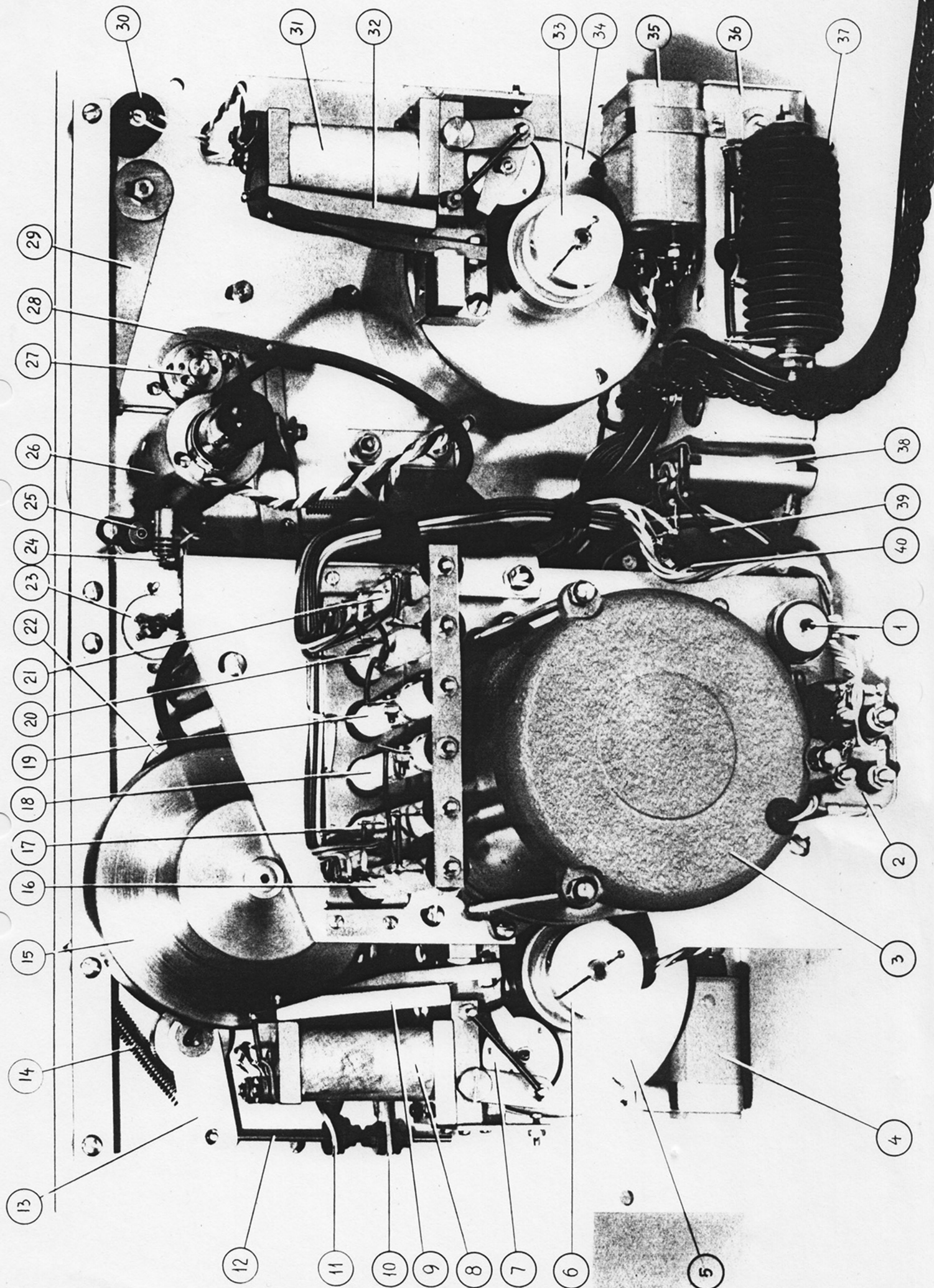


LYREC  
KØBENHAVN  
TYPE TR 2  
NR. 5149

STOP  
AFSP.  
INDSP.

7 1/2"  
15"

FREM  
TILBAGE



LYREC  
COPENHAGEN

1840<sub>A</sub>