

MECHANICAL LABORATORY
B U D A P E S T

Type STM-500,
STM-510
STUDIO QUALITY SOUND RECORDING
APPARATUS
TECHNICAL DESCRIPTION,
OPERATION AND MAINTENANCE

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1. GENERAL DESCRIPTION OF THE APPARATUS

The apparatus STM-500/510 is a magnetic tape sound recorder for professional purposes. The tape recorder STM-500 operates on Channel 1, with mono heads, one playback and one recording amplifier. The tape recorder type STM-510 gets supplied with stereo heads, two playback and two recording amplifiers. The oscillator is identical with both apparatuses. The range of use of the equipment is very wide, e.g.

- Radio and TV studios
- Disk studios
- Music schools
- Theatres, etc.

Its high technical standard is characterised by the following services and qualities:

- Clockwork precision mechanics having a simple design.
- Electronic control of tape feed device for elimination of faulty connections and for programming the individual modes of operation.
- Electronic switching elements in the tape feed device /triacs, diodes, transistors/.
- Partly electronic motor braking.
- Full possibility for remote control.
- Tape feed independent from mains frequency.
- Crystal precision.
- Possibility of speed shift corresponding to $\pm 1/4$ and $1/2$ sound intervals.
- Tape speed check with control lamp and stroboscope. The stroboscopic lamp is fed by the crystal oscillator network.
- Tape length measuring /electronic/ clock - calibrated in time - and provided with digital display tubes

assures maximum accuracy. Display with four digits /minute, second/.

- Simple introducing of tape, without wrapping of roller,
- Tape tension control before and behind the sound axis.
- Rubber roller and swinging arms with electronic movement damping.

2. TECHNICAL DATA

Tape speed:	38,1 and 19,05 com/sec $\pm 0,1\%$
Stability:	$10^{-5}/C^{\circ}$ /crystal precision/
Slip:	max. $\pm 0,1\%$
Tape tension before sound axis:	80 gr \pm 15 gr
Tape speed checking:	a. by control lamp b. by stroboscope
Running-up time:	$\leq 0,5$ sec
Rapid winding time:	max. 2,5 minute /1000 m/
Whining:	38 cm/sec : $\leq 0,04\%$ weighted value
/According to DIN 45507/	19 cm/sec : $\leq 0,06\%$
Measuring of program time:	electronic clock /max. 99'59"/ digital display
Clock precision:	$\pm 0,1\%$ /absolute/
Line input:	symmetrical, input impedance ≥ 5 kohm /30 Hz - 16000 Hz/
Input level:	min. 0 dB; max. 12 dB
Line output:	symmetrical, output impedance = max. 50 ohm /30 Hz - 16000 Hz/

Line output voltage:	max. 12 dB at 200 ohm
Correction time constant:	38 cm/sec : 35 μ sec; 19 cm/sec : 70 μ sec
Frequency response	38 cm/sec : 31,5-18000 Hz \pm \pm 1,5 dB
/overall/	19 cm/sec : 40-16000 Hz \pm 1,5 dB
Recommended tape:	38 cm/sec : AGFA PER-555 19 cm/sec : BASF LR-56
Signal-to-noise ratio:	38 cm/sec : 62 dB /stereo/ 51,4 mM/mm 19 cm/sec : 61 dB /stereo/ 51,4 mM/mm
Signal-to-noise ratio:	38 cm/sec : 62 dB /mono/ 32 mM/mm 19 cm/sec : 61 dB /mono/ 32 mM/mm
Distortion from tape:	38 cm/sec : \leq 1,5% /51,4 mM/mm/ 19 cm/sec : \leq 2%
Cross-talk attenuation:	min. 32 dB /1 kHz/
Erase attenuation:	min. 85 dB /38 cm/s 1 kHz/
Magnetic biasing frequency:	240 kHz
Erasing frequency:	120 kHz
Dimensions:	705x635x910 /1270/ mm
Weight:	85 kg

3. PUTTING INTO OPERATION, DESCRIPTION OF FUNCTION

A T T E N T I O N !

The reference numbers /e.g. 5 etc./ are only valid for figures 1-13 of the operation manual.

The tape recorder will be connected with its power cord to a mains supply of 220 V 50 Hz. Front cover plate of the apparatus shall be folded down and the red pushbutton /14/ on the switching keyboard pressed. /See figure 1/.

Thus the apparatus has been switched on.

The metal housing of the apparatus must be provided with separate protective earthing.

The protective earthing lead shall be fastened under the screw clamp placed on the rear upper connecting strip /see figure 3/. The in- and outgoing lines are received by the terminals of the rear lower connecting strip /see figure 2/:

for line input	XLR-3-11C
for line output	XLR-3-12C

Connection with Cannon plugs.

3.1 Speed setting

In the apparatus speed is changed electronically. Simultaneously /and automatically/ take place also correction change of the amplifiers and switching over of the time clock.

There is further a possibility for modifying the speed corresponding to $\pm 1/2$ and $\pm 1/4$ sound interval. The adjusted speed is indicated on the upper plate of the tape feed device /see figure 4/ by the corresponding signal light. / 38 19 /. The shifting of a half and a quarter of a sound is displayed

by the lamp bearing the inscription of "TONE". When changing the speed the light "FAULT" remains illuminated until the speed of the motor reaches the desired value.

3.2 Introducing of tape

On the basic apparatus a tape wound onto a metallic core according to DIN 45515 /max. diameter 290 mm/ may be placed. The tape can be slipped in a simple manner, it has not to be wrapped around rollers /see figure 4/. After having displaced the right side swinging arm from its home position the right side winding motor comes under power and slowly starts to rotate. Nevertheless this does not hinder the introduction of the tape because the voltage appears on the motor delayed /appr. 1 sec/. Simultaneously the rubber roller assumes a preparatory state and the rollers modifying the tape track go into their final position during playback and recording. In this way it could be obtained that at the time of starting the tape track has to be modified by the rubber roller by a small amount. That serves for two purposes:

- there is much place before the heads when introducing the tape
- starting may take quickly.

With the aid of adapters to be ordered separately to the apparatus also tapes wound on spools DIN 45514 /minimal interior core diameter 60 mm, ratio of outer core to interior one 3:1/ and on metal disks according to DIN 45517 Blatt 1 may be used.

The adapters can be bolted on the place of hold-down bracket 49, 51.

Care should be taken that when putting the tape spools on the switches 19 and 20 be switched in suitable positions. Switch 19 has two positions:

upper position:

for disks according to DIN 45515 and 45517 having minimum inside diameter 100 mm

lower position:

a. switch 20 in upper position:

for spools according to DIN 45514, having minimum inside diameter 60 mm

b. switch 20 in lower position:

for spools DIN 45514, inside diameter less than 60 mm /Attention: for that case the specification is not valid!/
/

3.3 Modes of operation

If a tape has been placed on the apparatus as described above the following modes of operation may be set by the selector switch:

- Playback
- Recording
- Winding to the left
- Winding to the right
- Variable winding
- Stop

The setting of the modes of operation is indicated by lighting pushbuttons.

3.3.1 P l a y b a c k


Indication of pushbutton:



This mode of operation may be switched directly or programmed. The latter means that when going over from rapid winding into

playback it is not necessary first press upon the stop button. The apparatus stops automatically and playback starts only after the tape having stopped,



3.3.2 R e c o r d i n g /latch/

Indication of pushbutton:  /red/

That state of operation only sets in by simultaneously pressing down the playback pushbutton.


That mode of operation may be programmed too.


3.3.3 W i n d i n g t o t h e l e f t /to the right/

Indication of pushbutton:  ()

It is possible to switch over to winding out of any mode of operation. The advancing speed of the tape cannot be controlled and is maximal.

3.3.4 V a r i a b l e w i n d i n g

Indication of pushbutton: 

That mode of operation facilitates seeking. As a matter of fact speed and direction of the advancing tape may be changed by knob 43 /see figure 4/. Besides as long as the pushbutton  is being pressed down the tape bears during its running against the playback head. There is thus a possibility for monitoring when winding.


3.3.5 S t a r t o f r e c o r d i n g f r o m p l a y b a c k

The design of the apparatus makes it possible to go over from

playback to recording without hearing a click. That permits subsequent repairs /mounting/.

For this mode of operation the designers have built a useful network into the apparatus which functions as follows:

E.g. During his report the lecturer makes a mistake and the recording is being stopped. The operator rewinds the tape before the faulty part, then starts playing back.

Then he presses the recording button  and holds it down, on the two connecting points of the remote control device /B6-C6/ a short circuit appears switching indirectly the checking loudspeaker in the lecturer's cabinet. The lecturer hears the last sentence before the faulty part and prepares himself for continuing the text. When the last faultless sentence is finished the operator presses down the playback button too. Thus the recording starts but at the same time also the previously active short circuit comes to an end /the checking loudspeaker falls silent and the lecturer continues reading/.

3.4 Counter

/digital tape length measuring clock/

When switching on the apparatus the digital displays of the clock show 00 minute 00 second. During the slipping in of the tape - because of the rotation of the right roller - it will show some seconds. The clock may be reset to zero with the aid of pushbutton 45 /see figure 4/. The display shows at tape speeds of 38,1 and 19,05 \pm 0 cm/sec always the right time.

A T T E N T I O N !

At the tape speed corresponding to sound intervals $\pm 1/2$ and $\pm 1/4$ as a matter of fact the clock shows the time not in absolute values but related to the tape as timecoordinate. This means that while the speed selector button "38" and "19" commutates also the clock, switching of the sound shift does not affect the clock.

3.5 Remote control

Except the adjustable winding in every mode of operation the apparatus may be controlled from the remote control desk. The remote control connecting plug is situated on the rear lower connecting strip /see figure 3/. As a remote control desk also the own mode switching unit of the apparatus may be used that can simply be lifted out of the apparatus. In the same manner the digital clock may be used for remote display too. Of course both can be ordered from the manufacturer separately too, as options. If the digital clock should be placed in some distance from the apparatus the following have to be born in mind:

- The lead of the 5 V supply voltage /A9-A10/ should be prepared of a wire having large cross section because the clock only functions faultlessly when the supply voltage is on $5\text{ V} \pm 0,25\text{ V}$. The relatively high current flowing in the lead /appr. 0,5 A/ may cause strong voltage drop. Therefore in certain conditions /longer distance/ it is recommended to produce for the clock the supply voltage of $5\text{ V} \pm 0,25\text{ V}$ on the site.
- The lead of the clock control pulses /B9-B10/, should be in order to protect it against external disturbances, of screened cable. Its capacity should possibly not exceed 10-15 nF per cable.

3.6 Start of playback from mixing table

The design of the apparatus permits starting and stopping of playback from the manual controller of the mixing table /A6-C1/.

4. CONSTRUCTION OF THE APPARATUS

The apparatus consists of three main parts:

- tape feed device
- amplifiers
- supply unit

4.1 Tape feed device

This part of the apparatus is built on an extremely strong aluminium casting. The main parts form independent mechanical blocks which are connected with the apparatus mechanically by means of bolts and electrically by connectors.

The block units - generally after loosening four screwed connections that are releasable from above - may be lifted out upwards. Dismounting the whole running gear takes not more than 5-6 minutes - also for unskilled persons. That has its advantages in the maintenance and in troubleshooting.

Mechanical blocks that may be lifted out of the running gear /figure 13/:

- head unit
- main motor unit
- right side winding unit
- left side winding unit
- mode of operation switch
- right side swinging arm and regulating unit
- left side swinging arm and regulating unit
- digital clock /electric unit!/
- output code and monitoring unit /electric unit!/

In addition there are in the running gear the control circuits of the tape feed electronics and of the main motor. These are the following /see figure 1/:

In order to be easily accessible they take place in the console rising over the running gear / see figure 5/:

4.3 Amplifiers

already been discussed in a corresponding place. On the pair of jacks the output of playback amplifier I and playback amplifier II may be listened. The signal lights have of the key is pushed forward. the playback amplifiers; they are only connected when the arm connectors / see figure 2 / are not connected to the output of In the home position of the allotter key the line output

- line allotter key
- one pair of jacks each for monitoring the output of playback amplifier I and of playback amplifier II
- signal lights

Here are placed the following:

4.2 Output code and monitoring unit 39 / see figure 4/

Further a work hour counter / see figure 1 / has been built into the running gear starting when the apparatus is switched on. Maximum capacity is 9999 hours. It cannot be reset to zero / from outside/.

- control circuit I
- control circuit II
- regulating circuit
- switching circuit
- high frequency stabilizer
- main motor regulating circuit
- main motor driving circuit

These are replaceable cards mounted on printed circuit boards. Stabilizer I supplies the running gear with d. c. voltage and stabilizer II the amplifiers.

- stabilizer I,
- stabilizer II.

The stabilizers and the mains transformers are mounted into a common frame / see figure 7/. The supply unit is connected to the tape recorder by means of a connector, and after having loosened two screws may be pulled out backwards. In front the supply unit is provided with a flap door. Behind it are placed the two stabilizing networks:

4.4 Supply unit

Every amplifier may be pulled out from the chassis after having opened a locking device.



- playback amplifier Channel 1,
- playback amplifier Channel 2,
- recording amplifier Channel 1,
- recording amplifier Channel 2,
- erasing and magnetic biasing oscillator
- dynamic modulation meter / and checking instrument/.

5. MAINTENANCE INSTRUCTIONS

5.1 Mechanical maintenance

5.1.1 Checking of the direction of the sensitive mechanical brakes

Placing a torque meter / optional attachment / on the place of the tape spools braking torque will be measured in clockwise and anticlockwise directions.

	grams/cm 	grams/cm 
right side	1000-1200	300-400
left side	300-400	1000-1200

5.1.2 Pressure check and read -
 adjustment for rubber roller

Displace the swinging arms on both sides from their end position. Screw off the cover plate of the rubber roller. Switch on playback. Hang the arm of spring force 2000 grams on the shaft of the rubber roller, while applying a very little braking with the fingers on the rubber roller pull latter from the shaft by means of the spring force measuring device. Then read the tensile force where the roller stopped.

Rated value: 1200 grams

There is a possibility for readjustment through the bore of the cover plate of the main motor unit. / Inscrption 1200 gr. / The desired value should be adjusted by approaching from below / from the lower values /.

Remove the shielding cups of the heads, /Hold-down spring will be pressed perpendicularly to the circumference, see figure 6/. A special-purpose device should be used for demagnetization.

5.17 Demagnetization

In order of preserving the rubber material it also should be cleaned only with cloth dipped into soapy water.

5.16 Cleaning of the rollers

The heads and guiding elements should be cleaned at least daily with a brush dipped into alcohol. /Rubber surface of the right side guide roller may only be cleaned with cloth or brush immersed into soapy water! /

5.15 Cleaning of the heads

The bearings used in the tape recorder do not need any lubrication.

5.14 Lubrication

Instructions of the manufacturer, element/, Readjustment should be made according to service

Tape tension regulation is fully electronic /also the sensing tension should remain on the value of $80 \text{ gr} \pm 15$, the tape spool diameter reduces from 290 mm to 115 mm, tape station in playback and in recording modes of operation, while device /optional attachment/, measure the value of tape tension in playback and in recording modes of operation, while On the place of the head unit put a tape tension measuring

5.13 Checking of tape tension

After several thousand hours of use the heads should be re- placed. The necessity of replacement should be decided in each case by electric measurement. Replacement and adjustment of the heads as well as measuring of the amplifiers should be accomplished in the way specified in the "Measuring Instruc- tions" of the manufacturer. For adjusting and setting the heads figure 9 gives assistance.

5.20 Adjustment of the heads

The lamps of the operational mode selector switch may be rep- laced after having removed the covers of the individual push- buttons. For lifting out use tool or suitably dimensioned bipolan tube. Replacement of the lamps in the allotting key and monitoring unit is analogous with the difference that the row of lights has a common cover lid.

Lamps

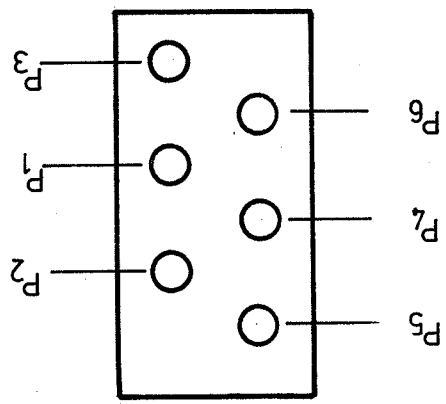
5.19 Replacement of signal

- Remove the cover plate bolts
- Screw off cover plate of rubber roller and pull down said roller from the shaft
- Remove cover plates
- /Take care of the swinging arms!/
- Remove faulty mechanical block units
- /After having loosened the bolts it can be pulled out upward/
- Reassembly in reverse order.

units

5.18 Replacement of block

- P₂ = Level control /38/
- P₅ = Level control /19/
- P₁ = treble correction 16 kHz /38/
- P₄ = treble correction 16 kHz /19/
- P₃ = treble correction 10 kHz /38/
- P₆ = treble correction 10 kHz /19/

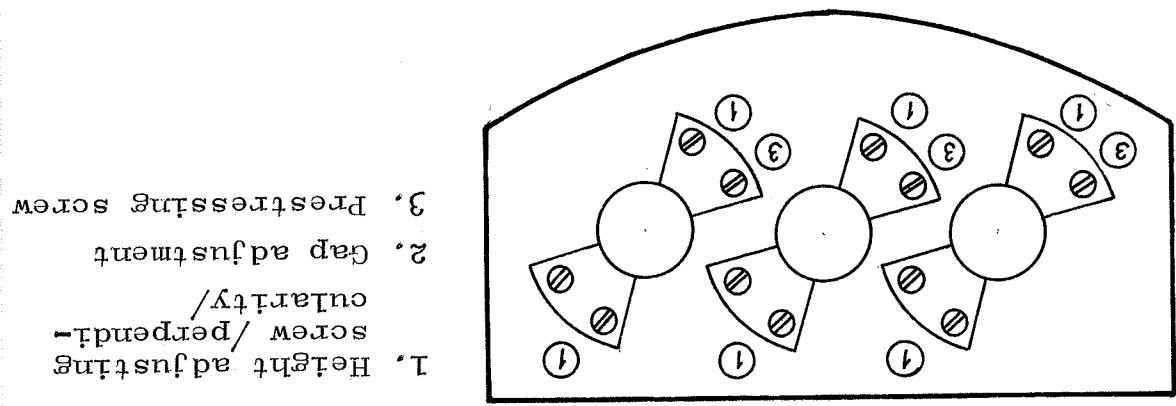


Playback amplifier

The electric maintenance includes the periodical checking of the main technical parameters of the apparatus and some re-adjustment of the setting elements being led out. The following drawings may be helpful to said operations:

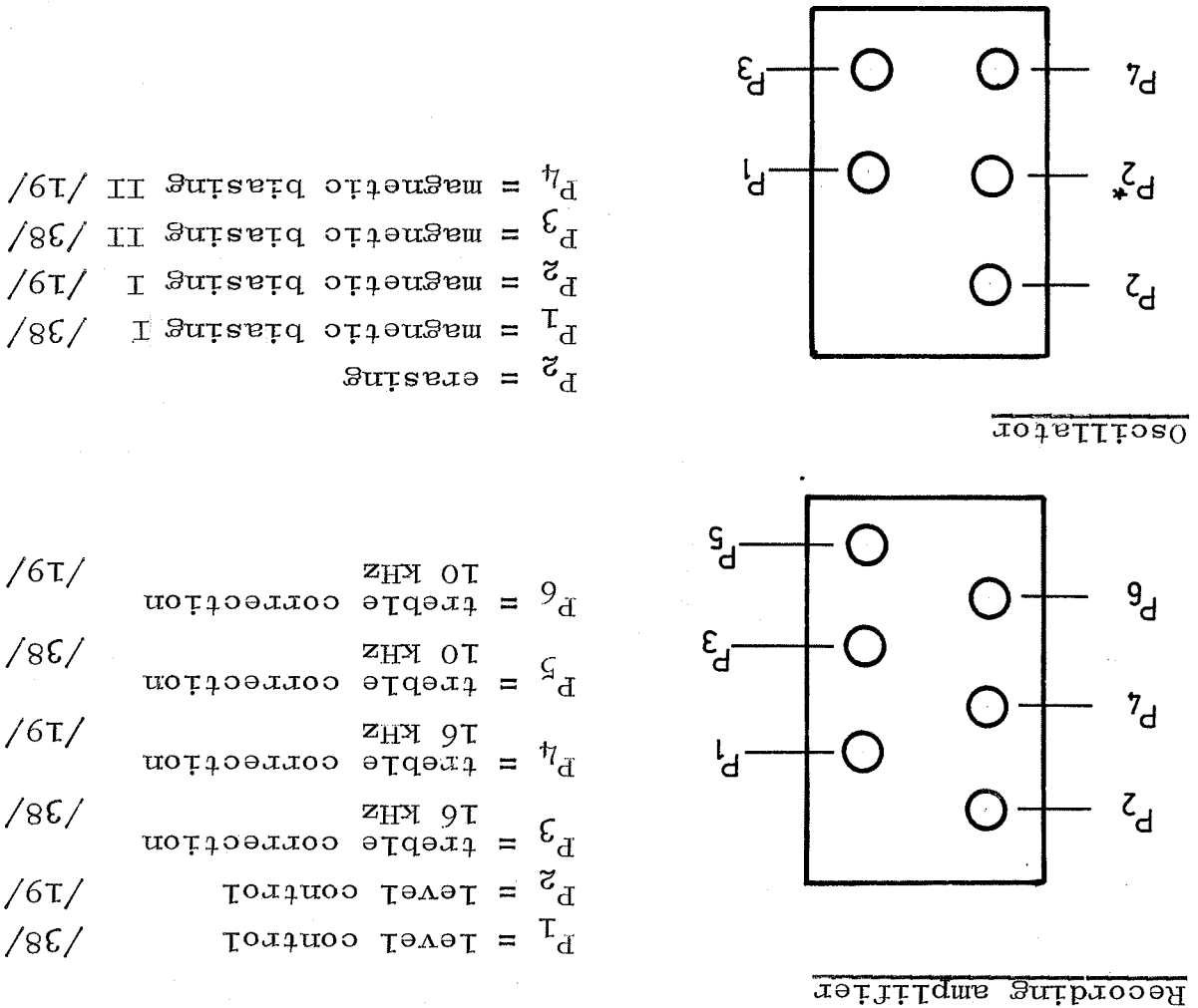
5.2 Electric maintenance

Figure 9.



As the revolution number of the main motor is compared to a crystal oscillator by the control electronics readjustment of speed is unnecessary, respectively impossible. Measuring is limited only to check tape speed. For the measurement a tape having 52 microns ± 2 microns thickness is used. / It is checked by mechanical measurement. / At the beginning $\phi = 290$ mm / and at the end $\phi = 100$ mm / of the tape reel number of stroboscopic signs will be measured. Difference allowed between the beginning and the end of tape is max. 6 signals per minute. Then quantity of signals is measured at the middle of tape reel. Allowed maximum here is ± 6 signals/minute.

5.2.1 Tape speed checking

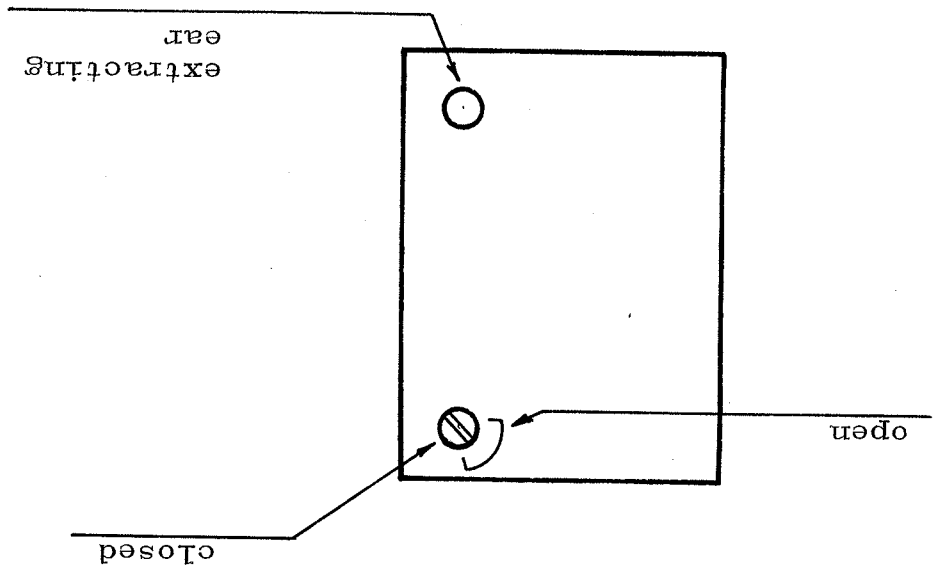


- output level of playback amplifiers / on 0 dB and 20 dB level/

The unit takes place in the amplifier block and may give a good help for maintenance purposes / see figure 5/. The following may be measured with it:

5.2.3 Instrument for measuring and checking dynamic modulation / VU - meter /

Figure 8.



The units of the running gear may be pulled out after having removed the cover plates. The individual cards should be pulled out or introduced only in the disconnected state of the apparatus. After having opened the locks of the amplifiers they must be lifted out of the console mounted above the running gear by means of an extracting wrench / See figure 8/.

5.2.2 Replacement of electrical units

It shall be noted that into the VU-meter two light emitting diodes /LED/ have been built in /see on figure 5 positions 61, 64/ that are flashing at the values of the output level above +6 dB /1,55 V / /peak indicator/.

MODULATION!

MAGNETIC BIASING ALWAYS SHOULD BE MEASURED WITHOUT

The required measurement takes place always by pressing the corresponding pushbutton. The upper part of the scale is graduated in decibels /0 dB = 1,55 V/, the lower part is calibrated for the values of the magnetic biasing and erasing currents.

- current of the recording heads /magnetic biasing/
- current of the eraser head

STM - 510 STUDIO TAPE RECORDER

847-0000-00/18

Position	Denomination	Drawing number, standard	Quantity	Replacing material	Placement	Note
1.	2.	3.	4.	5.	6. box	9.
	I. Basic apparatus consists of: /STM-510 tape recorder set/					
1.	STM-510 tape recorder	875-0000-00	1		7. drawer	
	II. Attachment materials:					
2.	Mains connecting cable	843-15100-00	1			
3.	Eight-pole connecting cable /plug type DS/	847-41300-00	1			
4.	Twelve-pole PCB connecting cable	945-0400/12A	2			
5.	13-pole needle contact connecting cable	847-41100-00	1			
6.	20-pole PCB connecting cable	945-0400/20A	1			
7.	20-pole connecting cable /plug type DS/	847-41400-00	1			

Packed according to TU-159

1.	2.	3.	4.	5.	6.	7.	8.	9.
8.	31-pole needle-contact connecting cable	847-41200-00	1					
9.	Hold-down part, assembled	817-06010-00	2					
10.	Spool guide, assembled	817-06020-00	2					
11.	Tape wheel	817-06900-00	2					
12.	Connector	XLR-3-11c	2					
13.	Connector	XLR-3-12c	2					
	Tools							
14.	Fork wrench	840-Sz-00-01	2					
15.	Extractor wrench	847-40000-01	1					
16.	Claw-type wrench	847-40000-02	1					
17.	Claw-type wrench	847-40001-00	1					
18.	Pipe wrench LT 5,5	847-40002-00	1					
19.	Screwdriver $\phi 3$	847-40003-00	1					
20.	Screwdriver $\phi 4$	847-40004-00	1					
21.	Screwdriver $\phi 5$	847-40005-00	1					
22.	Special screwdriver	847-40006-00	1					
23.	Gauge	847-40010-00	1					
	III. Replacement parts							
24.	Connecting plug for remote control	847-41500-00	1					

Packed according to TU-159

1.	2.	3.	4.	5.	6.	7.	8.	9.
25.	Connecting plug	T-3080-002	4					
26.	Fuse, tubular type B20/5,2N 1A	MSz 8863/4	10					
27.	Soffit light 24 V 3W with head S7	7536	1					
28.	Signal lamp 12V 1,2W	IMP-F3	2					
	IV. Documentation							
29.	STM-510 instruction manual		1					
30.	Register		1					

Packed according to
TU-159