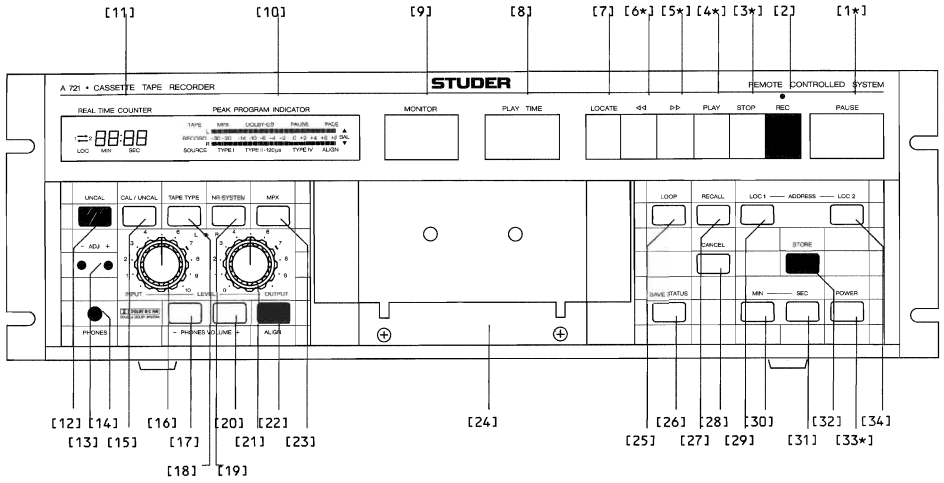
ENGLISH

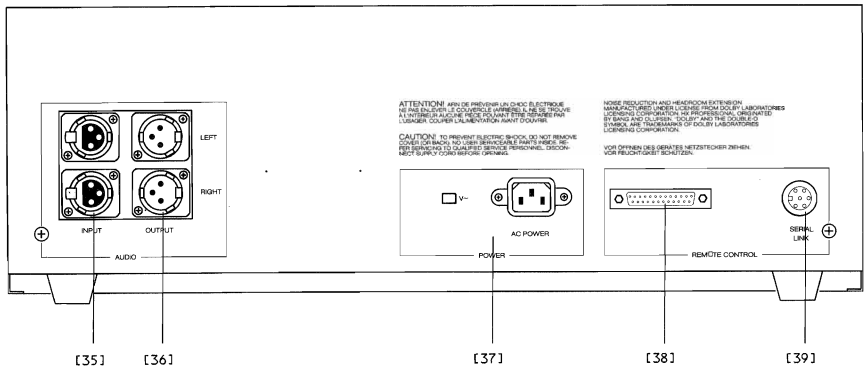
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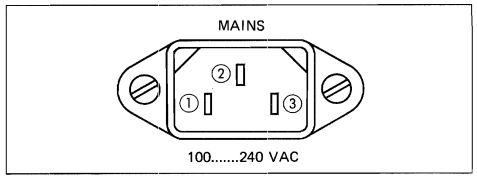




1. GENERAL

Check that the line voltage selector setting matches your local line voltage.
If this is not the case, adjust the voltage selector and check the rating of the primary fuse (Section 2.5.8).
Fuse ratings:
100 ... 140 V AC: TT 500 mA / 250 V (SUPER SLOW)
200 ... 240 V AC: TT 250 mA / 250 V (SUPER SLOW)

IMPORTANT:
STANDBY mode:
When the unit is switched off it is not disconnected from the mains. Certain components inside the unit are under line voltage!



1 Phase
2 Protector ground
3 Neutral

1.1 OPERATING CONTROLS

[1]* Pause key
[2] Record key with feedback LED
[3]* Stop key
[4]* Play key
[5]* Fast forward key
[6]* Rewind key
[7] Locate key, searches the last reproduce/record starting position
[8] Cassette play time; C46, C60, C90, C120
[9] Key for TAPE/SOURCE changeover
[10] Peak program and status indicator
[11] Display for real time, LOC 1, LOC 2, and LOOP
[12] Indicator for uncalibrated input and output level
[13] Adjustment of real-time indication
[14] Headphones socket
[15] Key for calibrated/uncalibrated input and output level
[16] Input level control (only enabled in UNCAL mode)
[17] Headphones volume (–)
[18] Tape type selector (manual); for cassettes coded according to IEC standards the tape type is automatically detected and set.
[19] Switch for noise reduction system: DOLBY B, DOLBY C or OFF
[20] Headphones volume (+)
[21] Output level control (only enabled in UNCAL mode)
[22] Calibration data memory select as well as calibration start.
[23] Key for multiplex filter (only active if DOLBY B or C is switched on)
[24] Cassette tape transport
[25] Key for LOOP mode / headblock lift
[26] Store operating state
[27] Retrieve memory content LOC 1 and LOC 2
[28] Erase key for LOC 1 and LOC 2
[29] Memory LOC 1
[30] Minutes input for memories LOC 1 and LOC 2
[31] Seconds input for memories LOC 1 and LOC 2
[32] Key for storing LOC 1 and LOC 2
[33]* On/Standby key
[34] Memory LOC 2

* The cassette tape recorder can be switched on directly by pressing one of these keys. The corresponding function is executed immediately.
For switching off, the POWER button [33] must be pressed for at least one second (protection against inadvertent off-switching.

1.2 Connector panel

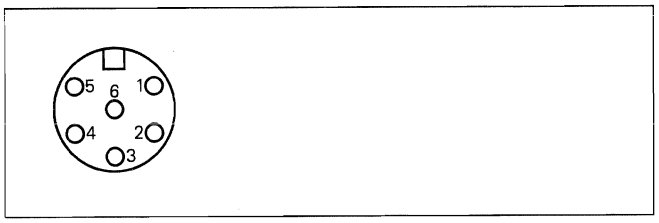
[35] Balanced input (XLR)
[36] Balanced output (XLR)
[37] Power inlet / line voltage selector
[38] D-type connector for optional parallel remote control
[39] SERIAL LINK socket (for operation with REVOX B203 • TIMER CONTROLLER)

1.2.1 Pin assignment

SERIAL LINK

(6-Pin DIN 45322)

1 GND
2 GND (floating)
3 Serial IN/OUT
4 +5 V (floating)
5 +5 V (max. 150 mA)
6 n.c.

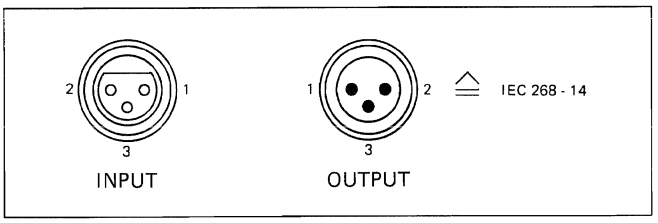


Line input/output

(XLR jack/socket, IEC 268-14)

1 Audio ground
2 A-line (hot)*
3 B-line (cold)

* The A-line is "hot" if the recorder is connected to an unbalanced source.

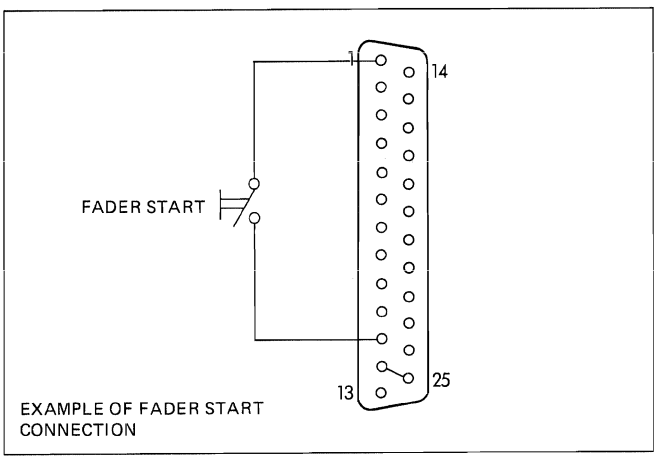


PARALLEL REMOTE

(25-Pin subminiature, D-type)

01	GND	
02	BR-REW	(feedback: rewind / o.c.)
03	BR-FORW	(feedback: fast forward / o.c.)
04	n.c.	
05	n.c.	
06	SR-FADRY	(switch: fader start ready)
07	BR-LOCST	(feedback: LOC START / o.c.)
08	BR-FADRY	(feedback: fader start ready / o.c.)
09	BR-REC	(feedback: record / o.c.)
10	n.c.	
11	FAD 1	(fader start connection)
12	FAD 2	(fader start connection)
13	n.c.	
14	GND	
15	BR-PLAY	(feedback: reproduce / o.c.)
16	BR-STOP	(feedback: stop / o.c.)
17	n.c.	
18	SR-LOCST	(switch: LOC START)
19	SR-REC	(switch: rewind)
20	SR-REW	(switch: rewind)
21	SR-FORW	(switch: fast forward)
22	SR-PLAY	(switch: reproduce)
23	SR-STOP	(switch: stop)
24	n.c.	
25	+22 V (V_S)	

o.c. = open collector
n.c. = not connected



EXAMPLE OF FADER START CONNECTION

1.3 START-UP PROCEDURE

First establish the audio connections and then connect the cassette recorder to the mains with the aid of the bypacked power cord. When the recorder is connected to the mains it is always in standby mode.
Press the POWER [33] key or one of the tape transport functions: The recorder switches on and the peak program indicator [10] and the real-time counter [11] are illuminated.

To switch off the recorder the POWER [33] key must be pressed for at least one second (protection against inadvertent off-switching). The recorder returns to standby mode.
The following parameters are stored in EEPROM and are consequently retained even in the absence of line voltage (no batteries):

	POWER STATUS	(on/off)
	POWER ON STATUS	(stop, play, play + rec)
	PLAY TIME	(C46, C60, C90, C120)
	TAPE TYPE	(memory locations A1, A2, A3)
	NR SYSTEM	(Dolby B, Dolby C, OFF)
	MPX FILTER	(on/off)
	PHONES VOLUME	(headphones volume)
*	LOC 1	(real time in LOC 1)
*	LOC 2	(real time in LOC 2)
*	COUNTER PARAMETERS	(real-time parameters)
*	TAPE PARAMETERS	(calibration data)

* These values are stored immediately after entry or calibration; the other values only after the recorder has been switched off with POWER [33] or if the SAVE STATUS [26] key is pressed. No parameters are stored in the event of a line voltage interruption.

1.4 REPRODUCE FUNCTIONS

The transport functions can be initiated in any sequence, i.e. it is not necessary to press the STOP [3] key before changing to a different function.
When the optical tape end sensor detects the transparent leader, the recorder switches automatically to stop. When the tape is rewound to the start the recorder automatically searches the beginning of the tape, switches automatically to stop, and resets the counter to zero.
If the tape is to be positioned at the start of the transparent leader, the key << [6] must be pressed in which case the beginning of the tape is not searched.

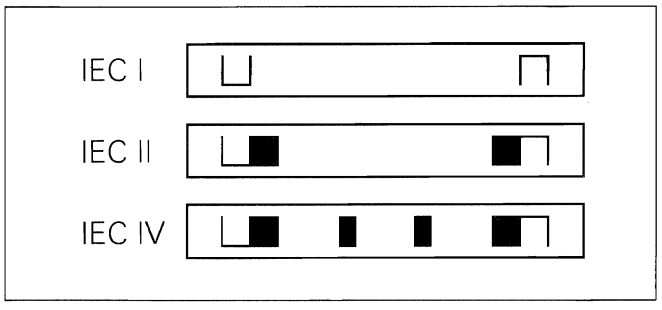
1.4.1 Inserting the cassette

Press the cassette into the cassette compartment [24] so that it engages in the positioning pins.
If the cassette is encoded according to IEC standards, the tape type is automatically recognized and indicated on the display.

1.4.2 TAPE TYPE [18]

For cassettes that are not IEC coded, the tape type must be entered manually.
Press TAPE TYPE [18] until the correct designation appears on the display:

IEC I	= Ferric oxide tape (Fe_2O_3)
IEC II	= Chromium dioxide tape with 70 µs equalization
IEC II 120 µs	= Chromium dioxide tape with 120 µs equalization
IEC IV	= Metal tape (Fe)



1.4.3 PLAY TIME [8]

The play time of the cassette is entered with the PLAY TIME [8] key. When this key is pressed once, the set play time is displayed for a few seconds. This value can be changed by repeatedly pressing the key during the display time (C46, C60, C90, C120).
The play time specification is used by the real-time counter for computing the time indication.

1.4.4 NR system [19]

When Dolbyized recordings are reproduced or such a recording is to be set up, press the NR SYSTEM [19] repeatedly until the desired noise reduction system (DOLBY B or DOLBY C) is indicated. The Dolby level corresponds to the 0 dB mark of the peak program indicator (200 nWb/m) for calibrated output level.

1.4.5 PLAY [4]

The play operation is initiated by pressing the PLAY [4] key. The monitor switch changes automatically to TAPE.
In uncalibrated mode (CAL/UNCAL [15] key) the output level can be adjusted with the output level control [21]. In this case the peak program indicator shows the line level.
The headphones output can be varied independently of the line outputs with the PHONES VOLUME -/+ [17/20] keys in 8 steps.
From play mode it is possible to switch directly to record by pressing REC [2] and PLAY [4]; by pressing PLAY [4] again, play mode is reactivated.

1.4.6 OUTPUT LEVEL [21]

In uncalibrated mode CAL/UNCAL [15] (UNCAL [12] is illuminated), the output level can be influenced with the OUTPUT LEVEL [21] control. It can be boosted by 10 dB relative to calibrated mode. Position 7 corresponds approximately to calibrated mode.
Level differences between the two channels can be corrected with the aid of the concentrically arranged knobs. Outer knob = right-hand channel, inner knob = left-hand channel.

1.4.7 STOP [3]

All operating modes are immediately interrupted whenever STOP [3] is pressed. The tape transport is stopped and a preselected record function is cancelled.

1.4.8 Fast forward >> [5]

Pressing the fast forward key >> [5] spools the tape at high speed in the direction of the tape end, i.e. the tape is spooled from the left-hand hub to the right-hand hub.
For fine-positioning keep the STOP [3] key pressed while you touch the >> [5] key: The tape advances in small increments in the direction of the tape end.

1.4.9 Rewind << [6]

Pressing the rewind key << [6] spools the tape at high speed in the direction of the tape start, i.e. the tape is spooled from the right-hand hub to the left-hand hub.
For fine-positioning keep the STOP [3] key pressed while you touch the << [6] key: The tape advances in small increments in the direction of the tape start.

1.4.10 LOCATE [7]

When you press this key the tape is positioned at the last record or reproduce start location. It can be used for fast and accurate searching of the record drop-in point.

1.4.11 MONITOR [9]

The MONITOR [9] key switches over between source and tape. The current setting of this key is indicated on the display with the word SOURCE or TAPE.
When the recorder is switched on for the first time, the switch is always in the SOURCE position. It changes automatically to TAPE when the PLAY key is pressed.
When a recording is prepared with REC and PAUSE, this switch first changes to SOURCE, and when the recording is actually started (by pressing the PAUSE key) it changes to TAPE.

1.5 RECORD FUNCTIONS

Caution:
A recording always erases both channels. For this reason and in order to maintain compatibility to mono recorders, mono sources should always be recorded simultaneously on both channels.

- Insert cassette
- Select the PLAY TIME with key [8].
- For uncoded cassettes enter the TAPE TYPE with key [18].
- Select the desired NR SYSTEM with key [19].

1.5.1 MPX filter [23]

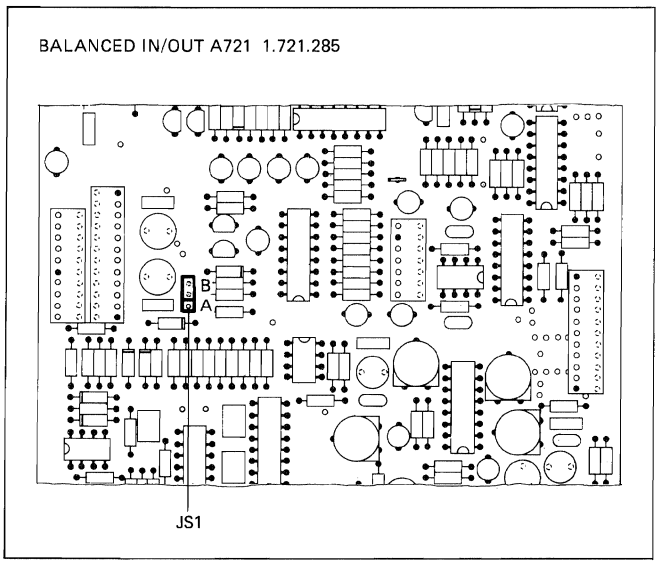
When FM programs are recorded from FM tuners with weak pilot tone attenuation, the multiplex filter is to be activated by pressing the MPX [23].
However, this is only possible in conjunction with one of the two Dolby noise reduction systems.

1.5.2 INPUT LEVEL [16]

In uncalibrated mode (CAL/UNCAL [15] is pressed, UNCAL [12] is illuminated), the sensitivity can be influenced with the INPUT LEVEL [16] control. It can be increased by 10 dB relative to calibrated mode. Position 7 corresponds approximately to calibrated mode.
Level differences between the two channels can be corrected with the aid of the concentrically arranged knobs. Outer knob = right-hand channel, inner knob = left-hand channel.

1.5.3 Peak program indicator [10]

In the SOURCE setting the peak program indicator shows calibrated line level, in the TAPE position the actual line level. When jumper JS1 on the BALANCED IN OUT PCB 1.721.285 is set to position A, the calibrated value is always indicated in record mode, regardless of the monitor switch setting.



The following peak levels should not be exceeded in a recording:

IEC I = +6 dB
IEC II = +4 dB
IEC IV = +6 dB

These values apply to high-quality tapes.
To prevent overdriving at high frequencies, the peak program indicator has a tape type dependent treble boost.

1.5.4 Record REC [22]

When REC [2] and PLAY [4] are pressed (hold REC pressed while also pressing PLAY), a recording is started immediately, the blinking message RECORD appears on the display, and the red LED above the REC key lights up.
The SOURCE/TAPE switch changes immediately to TAPE (reproduction of recorded signal).
From record mode it is possible to switch directly to play by pressing PLAY [4]; by pressing REC [2] and PLAY [4] again, record mode is reactivated.

1.5.5 PAUSE [1] Fade in/out

A recording can be prepared by pressing REC [2] and PAUSE [1] (press both keys simultaneously). The RECORD message flashes and PAUSE and FADE are displayed.
When the PAUSE [1] key is pressed, the recording starts and the audio signal is faded in over approx. 0.2 seconds.
When PAUSE [1] is pressed again, the audio signal is faded out over approx. 2 seconds. Afterwards the tape stops.
The fade-in/fade-out procedure can be repeated by pressing this key again.
During a recording the TAPE signal is connected to the output, during a pause (REC + PAUSE) the SOURCE signal is connected.

1.6 SPECIAL FUNCTIONS

1.6.1 CAL/UNCAL [15]

When you press this key the line inputs and outputs change from calibrated mode to uncalibrated mode. The status is indicated by the red LED UNCAL [12].
In calibrated mode the input and output levels can be influenced with the potentiometers LEVEL INPUT [16] and LEVEL OUTPUT [21].

1.6.2 PHONES [14]

Headphones with an impedance of 200Ω to 600Ω can be connected to the PHONES [14] socket. The output level can be adjusted with the keys PHONES VOLUME -/+ [17/20].

1.6.3 PHONES VOLUME -/+ [17/20]

The PHONES VOLUME - [17] key decreases the output level of the PHONES [14] socket in 8 steps, the PHONES VOLUME + [20] key increases it correspondingly.
This adjustment is independent of the line level.

1.6.4 LOOP [25]

When addresses are stored in LOC 1 and LOC 2, the recorder can be switched to loop mode by pressing the LOOP [25] key. This mode is indicated on the far left of the real-time counter window by the symbol 1⇄2.

While a loop is active the loop can be restarted by pressing the LOOP key again. The LOOP mode can be terminated by pressing one of the transport functions (STOP, PLAY, >>, <<, LOCATE). It is not possible to erase the content of an address memory while a LOOP is active.
The loop always starts with the lower of the two addresses, regardless in which memory it is stored.
In order to play a cassette in loop mode, enter the time (address) zero (00:00) into one address memory and enter a time that is greater than the cassette play time into the other memory.
The tape address of the last record or reproduce drop-in can, if the real time has already been computed, searched by pressing the LOCATE [7] key.

1.6.5 SAVE STATUS [26]

When the SAVE STATUS [26] key is pressed the following parameters are written into a nonvolatile memory (EEPROM):

POWER STATUS	(on/off)
POWER ON STATUS	(stop, play, play + rec.)
PLAY TIME	(C46, C60, C90, C120)
TAPE TYPE	(memory locations A1, A2, A3)
NR SYSTEM	(Dolby B, Dolby C, OFF)
MPX-FILTER	(on/off)
PHONES VOLUME	(headphones volume)
* LOC 1	(real time in LOC 1)
* LOC 2	(real time in LOC 2)
* COUNTER PARAMETERS	(real-time parameters)
* TAPE PARAMETERS	(calibration data)

* These values are stored immediately after they have been entered or after calibration.

1.6.6 RECALL [27]

The RECALL [27] key is used for retrieving the content of the address memories LOC 1 and LOC 2 without positioning the tape at that memory address.
Press RECALL [27] followed by LOC 1 or LOC 2.

1.6.7 CANCEL [28]

This key is used for erasing the content of address memories LOC 1 and LOC 2.
Press CANCEL [28] followed by one of the keys LOC 1 or LOC 2.
It is not necessary to erase the address memories before a new value is entered, they can be simply overwritten with the new values.

1.6.8 ADDRESS LOC 1 / LOC 2 [29/34]

If the real time has already been computed, a value can be entered into the address memories LOC 1 and LOC 2 in two different ways:

a) Storing the momentary tape address without influencing the current mode by pressing STORE [32] followed by LOC 1 [29] or LOC 2 [34].
b) Entering the address (time) with the keys MIN [30] and SEC [31]. The minutes and seconds can be entered by pressing the corresponding keys repeatedly. When the desired time is visible in the real-time counter [11], the value can be saved by pressing STORE [32] followed by LOC 1 [29] or LOC 2 [34].

The stored tape address can be searched at any time, regardless of the current tape deck mode (exception: record mode) by touching LOC 1 [29] or LOC 2 [34].
Assigned address memories are identified on the display [11] by the message LOC and the number 1 and /or 2.

1.6.9 MIN / SEC [30/31]

These keys can be used to display any time, regardless of the operating mode (exception: LOOP mode).
Each time the button is pressed the indicated value increments by 1, if the button is held continuously the value increments rapidly.

1.6.10 STORE [32]

When this key is pressed, storing of a real time into one of the address memories (LOC 1 or LOC 2) is prepared. Press STORE [32] followed by LOC 1 or LOC 2. The STORE command is cancelled if any key other than LOC 1 or LOC 2 is pressed.

1.6.11 POWER [33]

The POWER [33] key switches the recorder on and off.

Caution:
When the recorder is switched off it is in standby mode as long as it is still connected to the AC outlet which means that certain parts are always under line voltage!

To switch on the recorder simply touch the POWER key or one of the tape transport keys.
To switch off the recorder it is necessary to press POWER [33] longer than 1 second (protection against inadvertent off-switching).

1.7 REAL-TIME COUNTER [11]

The real-time counter always indicates the play time that has elapsed since the start of the tape. For cassettes that were not rewound before insertion, the tape counter computes the current tape address in record or reproduce mode within approximately 5 seconds, provided the total playing time (C46.....C120) has been entered correctly with PLAY TIME [8].
The counter content is erased whenever the cassette is changed. (Indication: --:--). When this value is displayed this means that the current address has not yet been computed. Start the cassette with PLAY [4] or REC [2] + PLAY [4] or rewind it to the beginning with << [6]. The counter is automatically set to zero (00:00) at the transition point from the leader to the tape.

Since in contrast to open-reel recorders no tacho roller can be used for cassette recorders, the play time is computed based on the speed differential between the two hubs. The accuracy is influenced by the hub diameter, the tape thickness, as well as the air cushion between the individual tape layers (the air cushion becomes greater in spooling mode).
If, for example, a cassette is inserted exactly in the middle of the play time, both hubs rotate at the same speed. During the time required for computing the tape address the ratio between the two speeds changes only by 0.2 %, i.e. in the magnitude of the wobble.

Better reproducibility is obtained if the cassette is rewound to the beginning of the tape where the counter is automatically reset to zero at the transition from the leader to the tape.

1.7.1 ADJ -/+ [13] Adjustment of real-time indication

With the ADJ -/- [13] key the real-time counter can be adjusted to the cassette types being used. Enter the cassette play time with PLAY TIME [8] and determine the actual playing time in reproduce mode (PLAY [4]) by means of a stopwatch.
The difference between the actual time and the displayed time is to be divided by the step width of the corresponding cassette play time. The result is the number of steps that are to be entered with a pointed tool (pencil) on the keys ADJ -/+ [13].

PLAY TIME	Step width
C-46	1.3 seconds / step
C-60	1.8 seconds / step
C-90	2.6 seconds / step
C-120	3.6 seconds / step

Example:
The actual play time in reproduce mode of a C-90 cassette is 48 minutes, 15 seconds. The real-time counter indicates 47 minutes, 20 seconds.

Play time: 48' 15" = 2895 seconds
Counter reading: 47' 20" = 2840 seconds

-> (2895 - 2840) : 2.6 = 55 : 2.6 = 21.15

This means that the push button ADJ + [13] would have to be pressed 21 times with a pointed tool.
This alignment has no influence on the computation accuracy of the real time for cassettes that were not rewound.

1.8 AUTOMATIC CALIBRATION

The Studer A 721 · Cassette Tape Recorder can automatically calibrate itself to the specific lot of cassette tapes. The data specific to the particular tape are automatically stored and can be retrieved, when required.

1.8.1 ALIGN [22]

With the ALIGN [22] button the memory is selected that contains the data with which the recording has been made or in which the calibration data are to be stored. The following memory locations are available for the various tape types:

IEC I: 2 memory locations A1, A2
IEC II: 3 memory locations A1, A2, A3
IEC IV: 1 memory location A1

When the ALIGN [22] key is pressed the first time, the currently used memory location is indicated. When this key is pressed again during the indication time, the memory location changes, but only within the selected tape type.

1.8.2 Calibration

The calibration should not be performed at the beginning of the tape because of slight mechanical damage at the transition from the leader to the tape.
During the calibration operation use the same noise reduction system (NR SYSTEM [19] key) that will subsequently be used for the recording (compensation of errors in the Dolby circuit).
For poor or even damaged cassettes the calibration should be performed without the noise reduction system.

The recording is prepared by pressing REC [2] and PAUSE [1].
Press the ALIGN [22] key: The calibration operation is started. After completion of the calibration the recorder rewinds automatically to the start position and the calibration data are written into the preselected memory.

1.8.3 Calibration error

If for any reason the calibration process cannot be performed correctly, the memory designation (A1 ... A3) will remain on the display [11] and the ALIGN message on the display [10] flashes.
The recorder is blocked until one of the tape transport keys (PAUSE, STOP, PLAY, >>, <<) is pressed. The data stored so far are retained in the memory.

Possible fault sources are:
- Cassette positioned on transparent leader.
- Wrong TAPE TYPE [18] selected.
- Contaminated soundheads.
- Defective tape material.

For poor or even damaged cassettes the calibration should be performed without any noise reduction system, because drop-outs have a stronger effect in conjunction with a noise reduction system and consequently produce less satisfactory calibration data.

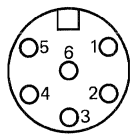
1.9 TECHNICAL APPENDIX

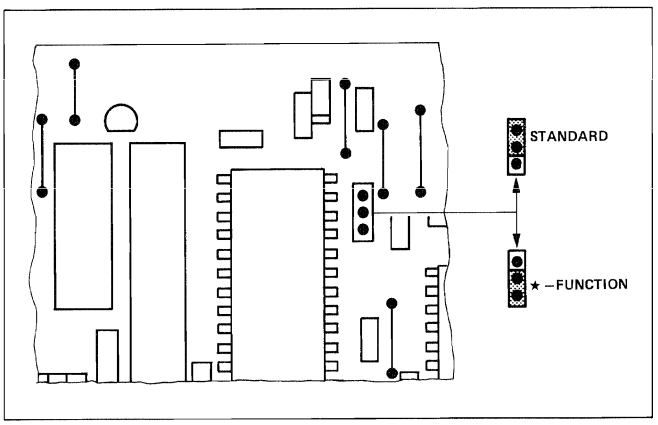
1.9.1 SERIAL LINK [39]

The SERIAL LINK [39] socket provides a connection to the REVOX B203 • Timer Controller. The A721 • Cassette Tape Recorder is then identified and treated as a B215 • Cassette Tape Deck (same device identifier).
If a IR-Transmitter REVOX B201CD or B205 is used together with a B203 • Timer Controller as receiver, two different addresses can be defined for the recorder. This is effected by corresponding positioning of the jumper JSP1 on the SYSTEM CONTROL A721 PCB 1.721.225 (device 1, or device 2 with * address).
Further possibilities of use of the SERIAL LINK socket are documented in the REVOX IR REMOTE CONTROL SYSTEMS Service Manual (Order No.: 10.30.0430).

Pin assignment of the SERIAL LINK [39]:

1 GND
2 GND (floating)
3 Serial IN/OUT
4 +5 V (floating)
5 +5 V (max. 150 mA)
6 not connected





1.9.2 Parallel remote control socket [38]

The 25-pin socket [38] (D-type) permits connection of a parallel remote control of the type also used with the tape recorders STUDER A807, A810, A812, and A820.

Desktop housing: Part No.: 1.128.095.00
- Remote control of PLAY, STOP, REC, <<, >>, and LOCATE
- Feedback indication of PLAY and REC

Studer standard module: Part No.: 1.328.555.00
Connection cable 15 m: Part No.: 1.328.295.00
- Remote control of PLAY, STOP, REC, <<, >>, LOCATE, FADER and BACKSPACE
- Feedback indication of PLAY, STOP, REC, <<, >>, LOCATE and FADER

Connector set Part No.: 20.020.303.16
Connector housing, 25-pin Part No.: 54.13.7022
Connector, 25-pin, coded Part No.: 10.217.001.06

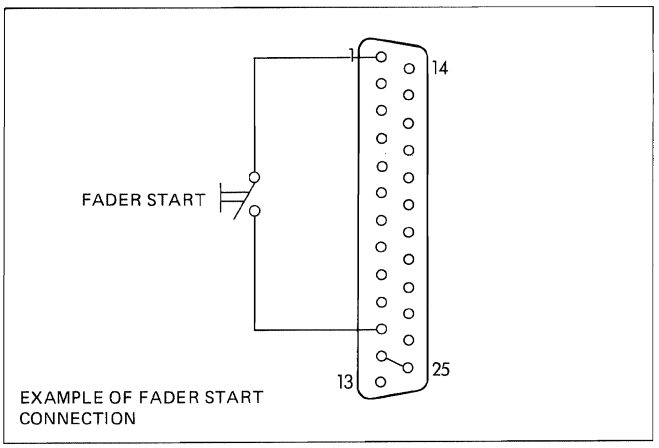
Pin assignment of the PARALLEL REMOTE CONTROL socket [38]

Pin	Signal name	Designation
01	+ 0.0	Ground
02	BR-REW *	Feedback lamp, REWIND
03	BR-FORW *	Feedback lamp, FORWARD
04	n.c.	
05	n.c.	
06	SR-FADRY +	Switch for FADER START READY command
07	BR-LOCST *	Feedback lamp, LOCATE
08	BR-FADRY *	Feedback lamp, FADER START READY
09	BR-REC *	Feedback lamp, RECORD
10	n.c.	
11	FAD1	Input, FADER START command, line A
12	FAD2	Input, FADER START command, line B (FADER START active, for DC voltage of any polarity from 5 to 24 V between pins 11 and 12.)
13	n.c.	
14	GND (0 V)	
15	BR-PLAY *	Feedback lamp, PLAY
16	BR-STOP *	Feedback lamp, STOP
17	n.c.	
18	SR-LOCST +	Switch for LOC START command
19	SR-REC +	Switch for RECORD command
20	SR-REW +	Switch for REWIND command
21	SR-FORW +	Switch for FORWARD command
22	SR-PLAY +	Switch for PLAY command
23	SR-STOP +	Switch for STOP command
24	n.c.	
25	+ 22 V	Supply + 22 V (max. 300 mA)

* Open collector output, active LOW. No internal pull-up resistor. Maximum HIGH level +30 V, maximum current 200 mA (built-in protective resistor 22 Ω).
+ Switch input. LOW level activates the command. Internal pull-up resistor.
n.c. = not connected.

Important:

If incandescent lamps are used as feedback lights, their inrush current should not exceed 0.3 A !

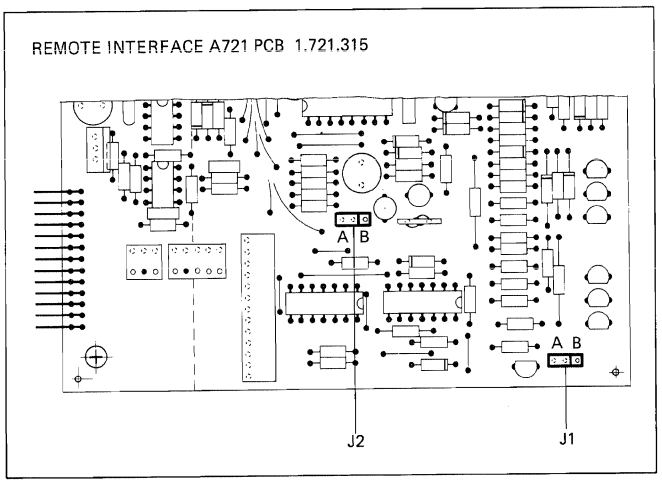


EXAMPLE OF FADER START CONNECTION

1.9.3 FADER START

The FADER START mode can be selected by setting the jumpers 1 and 2 on the REMOTE INTERFACE A721 PCB 1.721.315.

Jumper 1	Jumper 2	Fader start ready	Fader start input	Local control	Remote control	Comments
A	A	off on on	inactive active, off active, on	on on off	on on off	Standard setting
A	B	off on on	inactive active, off active, on	on on on	on on on	No restriction
B	A	off on on	inactive active, off active, on	on on off	on off off	Rem. control off when fader start ready on.
B	B					Not defined!



1.9.4 Timer operation

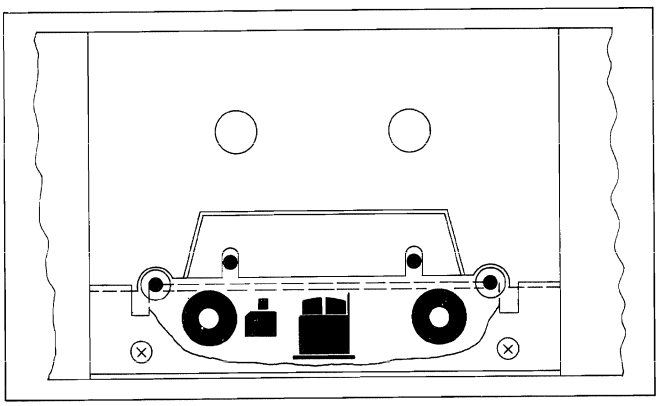
With the SAVE STATUS [26] key it is possible to implement a simple timer operation.
The desired mode is selected with REC [2] and PAUSE [1] for a recording and with PLAY [4] for reproduction, and is subsequently stored by pressing SAVE STATUS [26].
The recorder can now be disconnected from the AC outlet and connected to a commercially available timer.
For safety reasons record mode is activated only the first time the power is reapplied to the recorder. In reproduce mode, however, several on/off-switching cycles are possible.

1.9.5 Care and maintenance of the cassette tape deck

The only maintenance required on the cassette recorder is the occasional cleaning of the capstan shafts, pinch rollers, soundheads with tape guides, and demagnetization of metallic parts that come in contact with the tape.

For cleaning press the LOOP [25] key, the pivoting carrier, and the soundheads and pinch rollers are easily accessible.
For cleaning we recommend the Revox CLEANING KIT (Part No. 39000) as well as commercially available cleaning cassettes and demagnetizing chokes.

Important:
To prevent damage make sure that no cleaning fluid penetrates into the capstan motor bearings.



2. DISASSEMBLY INSTRUCTIONS

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2.1 GENERAL INFORMATION

CAUTION:
Before you remove any housing parts and electrical components, disconnect the unit from the AC power source!

Note:
- Whenever electronic components are removed or installed, it is important to follow the guidelines concerning the handling of MOS components located at the beginning of these maintenance instructions.

2.1.1 Required tools

1 Phillips screwdriver ..... size 1
1 Phillips screwdriver ..... size 2
1 Screwdriver ..... size 3
1 Screwdriver ..... size 4
1 Pair of flat-nose pliers
1 Pair of tweezers
1 Hexagon-socket-screw key ..... size 3
1 Box wrench ..... size 10
1 Open-end wrench ..... size 5
1 Open-end wrench ..... size 5.5
1 Tape deck holder .....Part No. 10.030.461.66

Recommendation: Line the workbench with a piece of cotton cloth in order to prevent marring of the equipment surfaces.

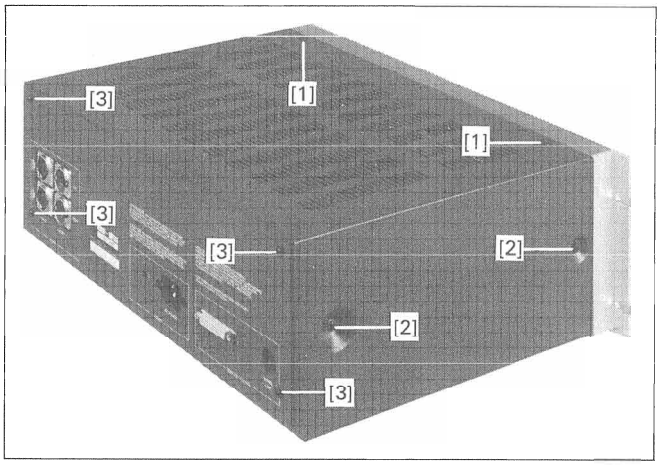
2.1.2 Reassembly

The unit is reassembled analogously in the reverse order of the subsequently described disassembly steps, and in accordance with the specific mounting instructions.

2.2 HOUSING

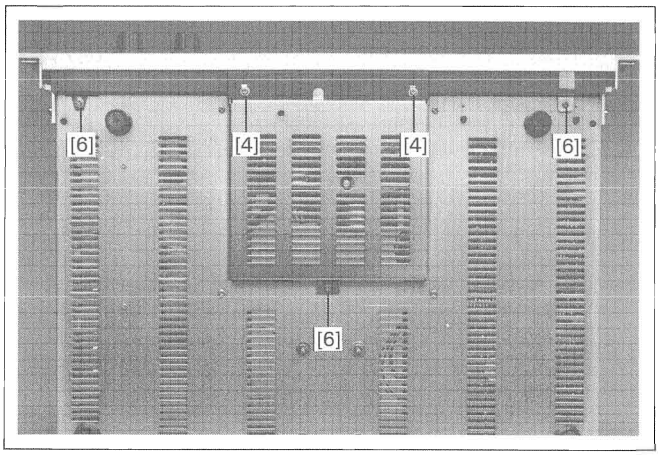
2.2.1 Top cover

- Unfasten the 2 screws [1] on the top of the unit.
- Unfasten 2 screws on each side [2].
- Unfasten 4 screws [3] on the rear of the unit, lightly lift the rear of the cover and pull if off toward the back.



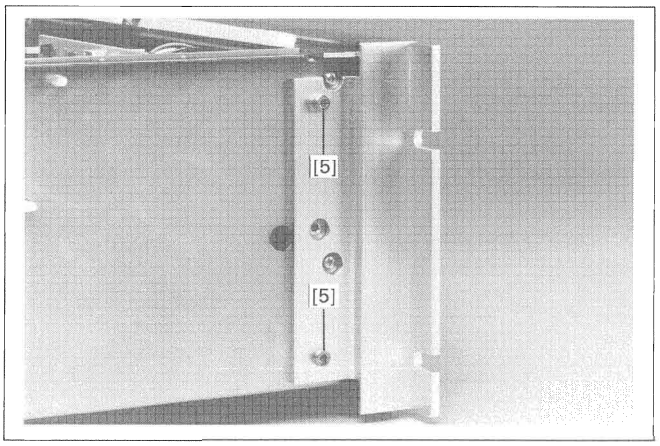
2.2.2 Bottom cover

- Unfasten 3 screws [4] on the underside of the unit and pull the cover off toward the back.



2.2.3 Rack bracket

- Remove the top cover (Section 2.2.1).
- Unfasten 2 screws [5] each.



2.2.4 Potentiometer knobs

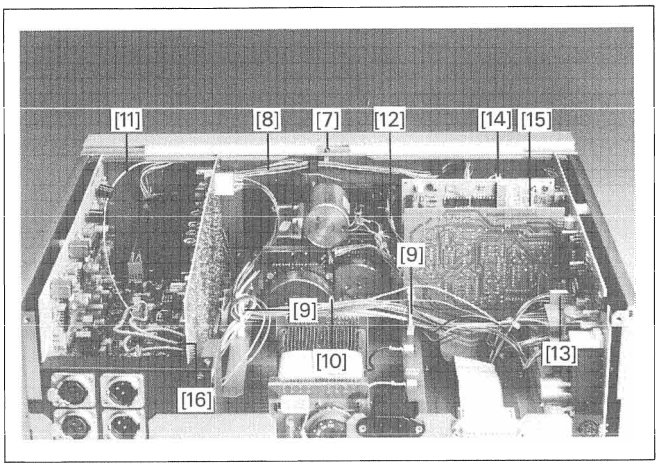
- Remove the front cover of the knobs.
- Unfasten the hexagon nut and remove the upper knobs.
- Unfasten the second hexagon nut and remove the lower knobs.

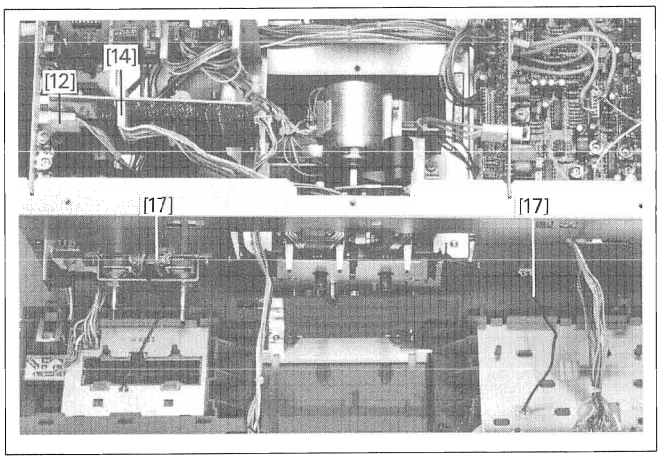
2.3 OPERATING PANEL

- Remove the top cover (Section 2.2.1).
- Remove the bottom cover (Section 2.2.2).
- Remove both rack brackets (Section 2.2.3).
- Remove both knobs 2.2.4
- From the bottom of the unit:
  Unfasten 2 screws [6] (one screw with ground contact spring).
- From the top of the unit:
  Unfasten 1 screw [7].
- Lift the cable harness [8] out of the plastic lugs
- Open the cable harness holder [9]
- Remove the three cable ties [10].
- Detach the following cable connections:
  - Yellow cable CAL/UNCAL [11] on BALANCED IN/OUT A721
  - KEYBOARD RIGHT A721 [12] -> REMOTE INTERFACE
  - KEYBOARD LEFT [13] -> SYSTEM CONTROL A721
  - DISPLAY BOARD [14/15] -> REMOTE INTERFACE
  - HEADPHONE JACK [16] -> BALANCED IN/OUT A721. For this purpose unplug the RECORD CONTROL A721 FROM THE BALANCED IN/OUT A721.
- Carefully lower the operating unit toward the front.
- Unfasten the black ground cables [17].

Reassembly instructions:

- Make sure that the cassette sensor lever and the SENSOR FLEX BOARD do not become damaged.
- It is important to reengage the cable harness [8] in the plastic lugs.



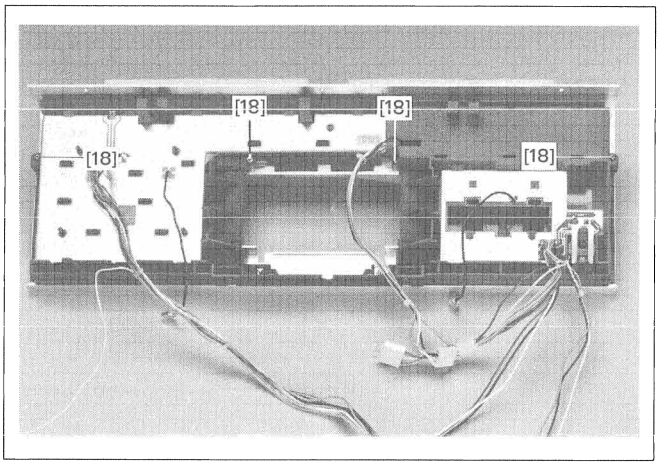


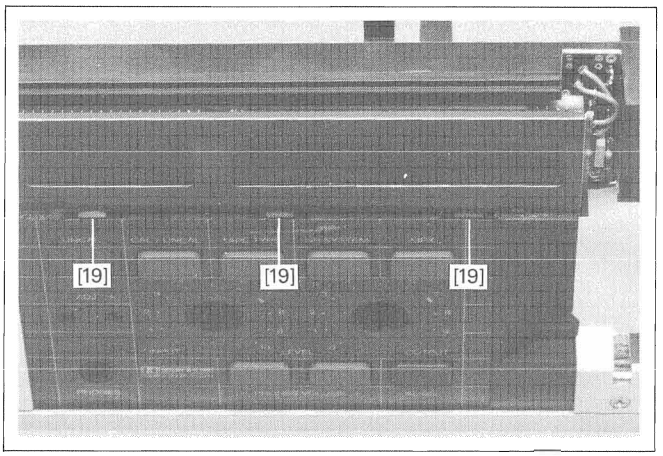
2.3.1 LC display

- Remove the operating panel (Section 2.3)
- Unfasten the 4 screws [18] and remove the top aluminum trim strip of the front panel.
- From the control panel side carefully release three snap fasteners [19] and simultaneously push out the DISPLAY BOARD through the opening on the underside by means of a screwdriver.

Note:
The 4 screws [18] of upper aluminum trim strip are also accessible from the inside of the unit so that it is not necessary to remove the control panel.
Removing the LC display without access from the back is somewhat more difficult.

Reassembly instructions:
- To prevent damage, do not press on the display surface of the LCD.

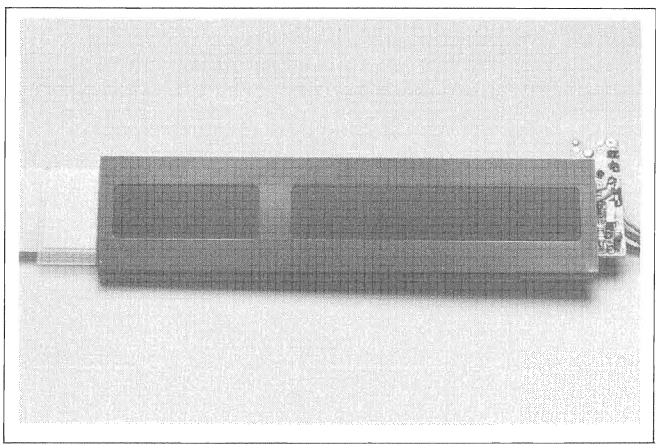




2.3.2 Replacing the display illumination

- Remove the control panel (Section 2.3).
- Remove the LC display (Section 2.3.1)
- Unsolder the two stranded wires of the luminescent lamp on the DISPLAY BOARD.
- Pull out the luminescent lamp together with the plastic key toward the left from below the display.

Reassembly instruction:
- Do not bend the luminescent lamp and do not pull it under the display by means of the connecting wires.



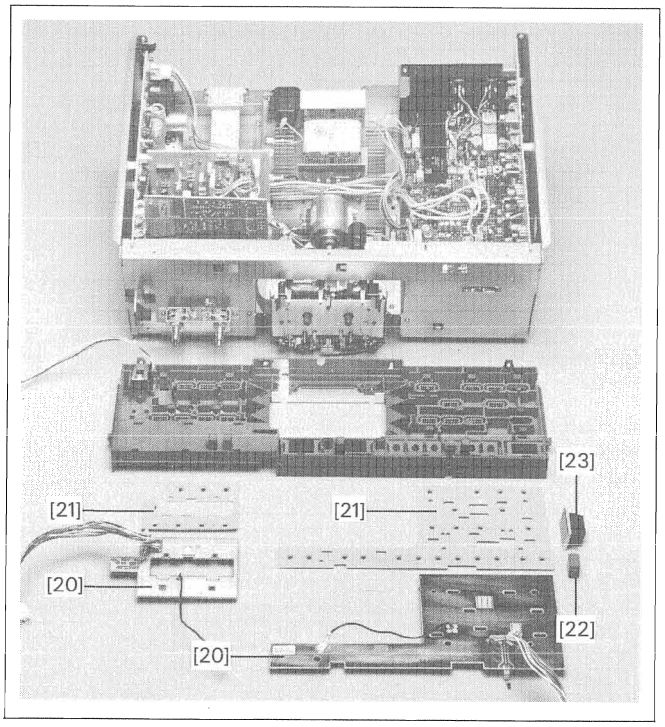
2.3.3 Keyboard PCB • Switching mats • Keys

- Remove the control panel (Section 2.3).
- Bend the snap fasteners one after the other, starting on one side, out of their locking position while carefully lifting the keyboard PCB [20].

Caution:
- Avoid any contact with the gold-plated switching contacts.
- Do not use the control panel while the keyboard PCBs are removed because the keys could drop out.

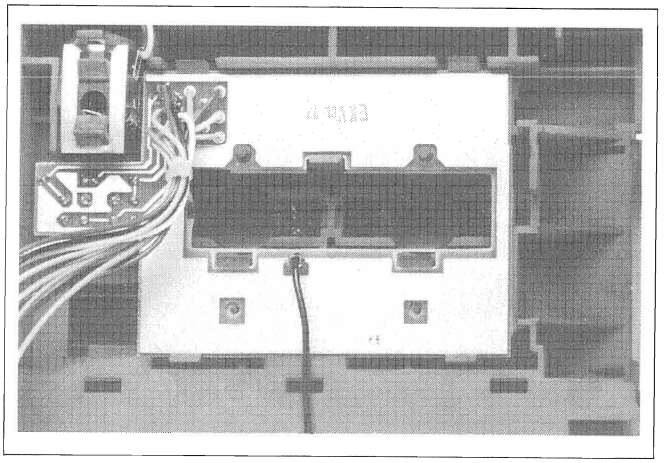
When the keyboard PCBs are removed, the switching mats [21] and the keys [22] can be removed toward the top. The keys [23] of the top row with aluminum caps can be pushed out of their holders by pressing them lightly toward the front.

Reassembly instruction:
- Prior to assembly, remove any dust on the contact surfaces of the keyboard PCBs and switching mats, the display, and the display window by means of a lint-free, clean piece of cloth.
- Prior to reinstallation of the keyboard PCBs, align the switching mats exactly in the centering pins and between the snap fasteners.
- Ensure that all snap fasteners have engaged above the circuit board.



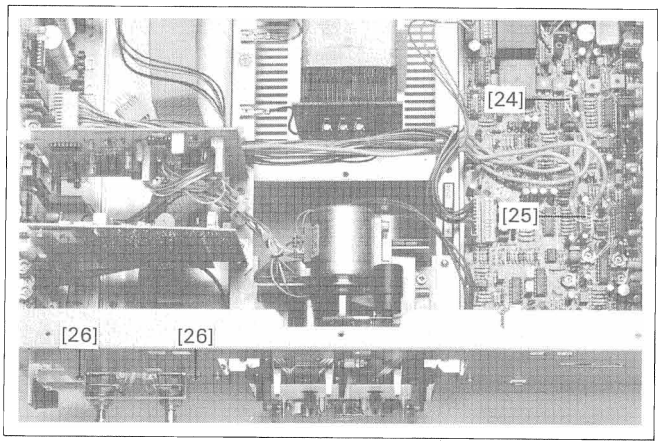
2.3.4 Headphones socket

- Remove the control panel (Section 2.3).
- Remove the bronze retaining spring.
- Press the snap fasteners out of their engaged position and pull the socket out of its holder.



2.3.5 Potentiometers

- Remove the control panel (Section 2.3).
- Detach the following cable connections:
  - INPUT LEVEL [24] -> BALANCED IN/OUT A721
  - OUTPUT LEVEL [25] -> BALANCED IN/OUT A721
- Unfasten the 2 screws [26] and remove the potentiometers from the chassis.



2.4 TAPE DECK

The tape deck is an electromechanical precision instrument and should therefore be handled with the necessary care:

- The tape deck should not be lifted by the capstan motor rotors, nor be set down on the latter. Improper handling of the rotors adversely affects the wow-and-flutter performance.
- The capstan motors require no maintenance and should not be disassembled.
- The removed tape deck can be set on the work bench in its normal operating position.
- For alignment work on the active tape deck outside the unit, a special holder (Part No. 1.710.118.04) is available. With this holder the tape deck can be operated in three positions (extension cables are necessary).

Important:

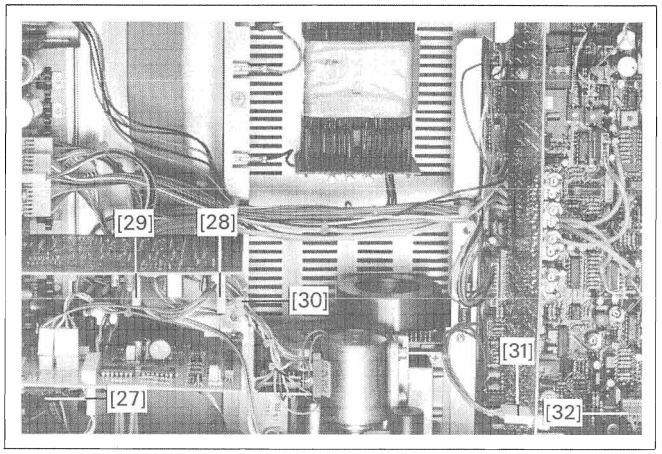
- Make sure that the SENSOR FLEX BOARD is not buckled and that the insulation does not become damaged.

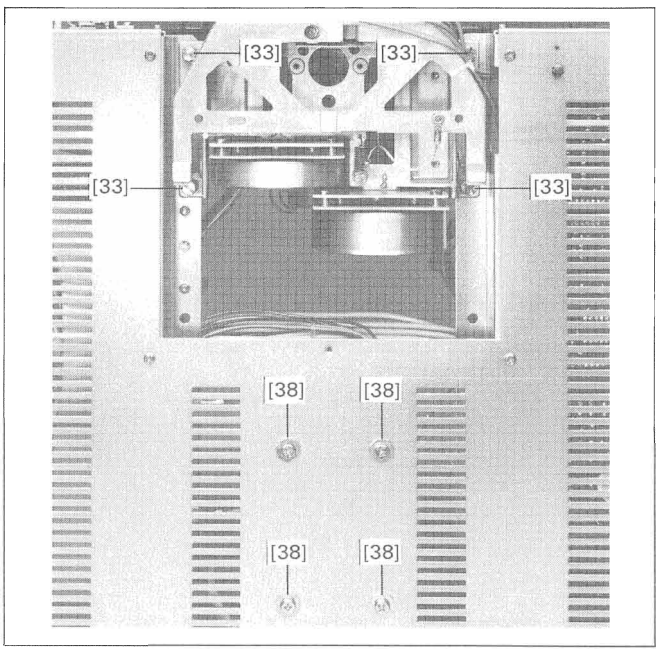
2.4.1 Replacing the tape deck

- Remove the top cover (Section 2.2.1).
- Remove the bottom cover (Section 2.2.2).
- Detach the following cable connections:
  - SENSOR FLEX BOARD [27] -> SYSTEM CONTROL A721
  - CAPSTAN MOTOR DRIVER LEFT [28] -> CAPSTAN MOTOR CONTROL
  - CAPSTAN MOTOR DRIVER RIGHT [29] -> CAPSTAN MOTOR CONTROL
  - TAPE DRIVE CHASSIS [30] -> SYSTEM CONTROL A721
  - RECORD / ERASE HEAD [31] -> RECORD CONTROL A721
  - REPRODUCE HEAD [32] -> BALANCED IN/OUT A721
- Place the unit upside down on the bench and remove the 4 collar screws [33] with the compression springs.
- Slide the transport mechanism slightly toward the back and carefully lift on the bottom and out of the unit.

Important:

- Make sure that the cassette sensor lever (for record inhibition and tape type detection) does not get bent.
- Make sure that the SENSOR FLEX BOARD is not buckled and that the insulation does not become damaged.

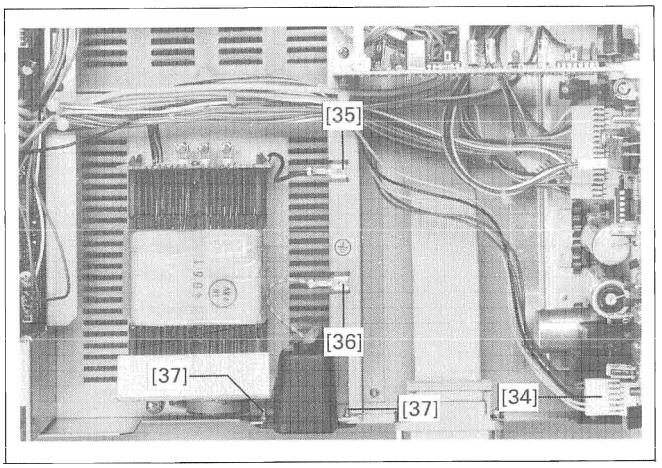




2.5 ELECTRICAL MODULES

2.5.1 Transformer 1.721.215

- Remove the top cover (Section 2.2.1)
- Remove the 2 cable ties [10].
- Detach the following cable connections:
  - MAINS TRANSFORMER A721 [34] -> SYSTEM CONTROL A721
  - Black ground conductor [35]
  - Ground connection [36]
- Unfasten the 2 screws [37] of the power connection.
- Unfasten 4 screws [38] on the underside of the unit.

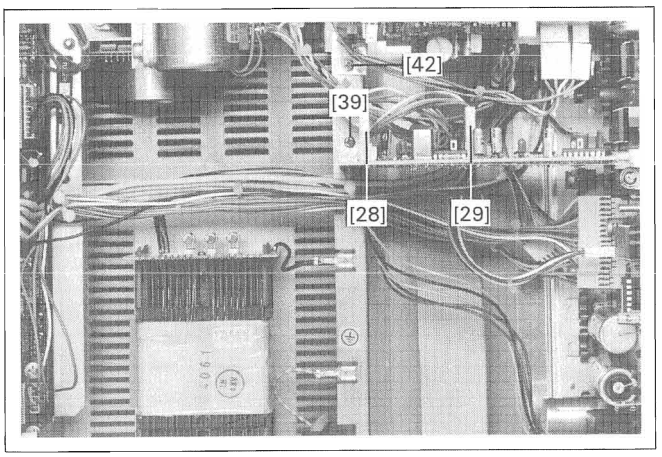


2.5.2 CAPSTAN MOTOR CONTROL 1.721.260

- Remove the top cover (Section 2.2.1).
- Separate the following cable connections:
  - CAPSTAN MOTOR DRIVER LEFT [28] -> CAPSTAN MOTOR CONTROL
  - CAPSTAN MOTOR DRIVER RIGHT [29] -> CAPSTAN MOTOR CONTROL
- Unfasten 1 screw [39] and pull the assembly off the SYSTEM CONTROL A721.

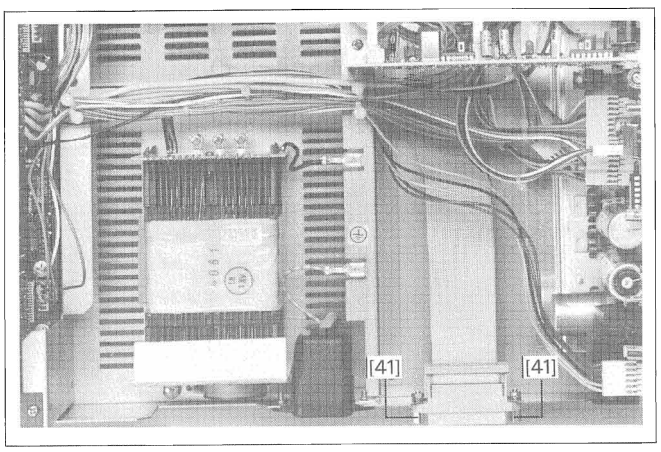
Reassembly instructions:

- Do not confuse the two connecting cables. The cable of the left-hand motor is to be connected to the left-hand socket.



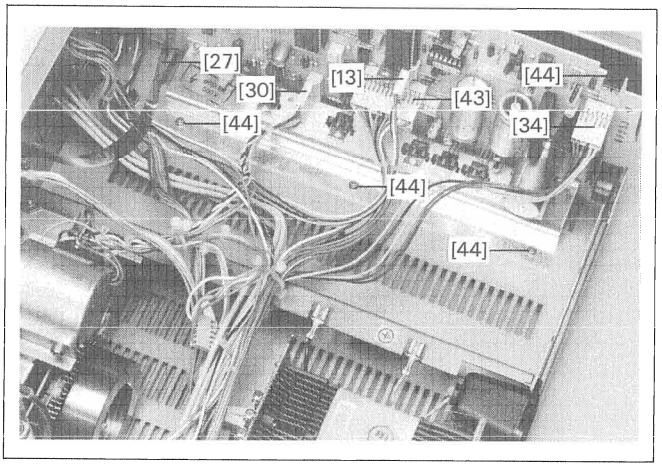
2.5.3 REMOTE INTERFACE 1.721.315

- Remove the top cover (Section 2.2.1).
- Detach the following cable connections:
  - KEYBOARD RIGHT A721 [12] -> REMOTE INTERFACE
  - DISPLAY BOARD [14/15] -> REMOTE INTERFACE
  - REMOTE INTERFACE [40] -> SYSTEM CONTROL A721
- Unfasten the 2 screws [41] of the parallel remote control connector.
- Unfasten 1 screw [42] and pull the assembly off the SYSTEM CONTROL A721.



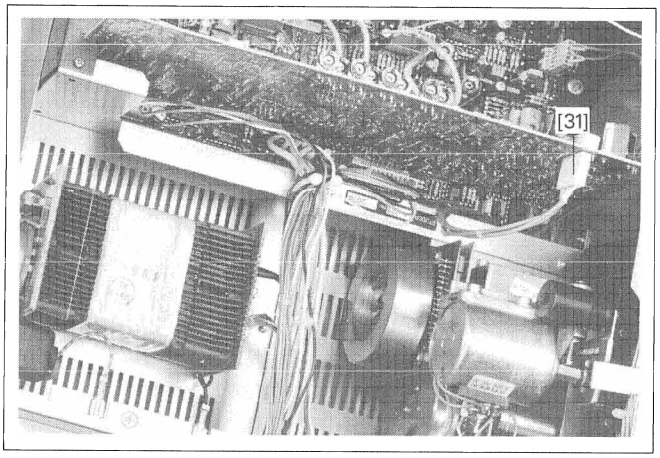
2.5.4 SYSTEM CONTROL A721 1.721.225

- Remove the top cover (Section 2.2.1).
- Remove the CAPSTAN MOTOR CONTROL (Section 2.5.2).
- Remove the REMOTE INTERFACE (Section 2.5.3).
- Detach the following cable connections:
  - KEYBOARD LEFT [13] -> SYSTEM CONTROL A721
  - SENSOR FLEX BOARD [27] -> SYSTEM CONTROL A721
  - TAPE DRIVE CHASSIS [30] -> SYSTEM CONTROL A721
  - MAINS TRANSFORMER A721 [34] -> SYSTEM CONTROL A721
  - SYSTEM CONTROL A721 [43] -> BALANCED IN/OUT A721
- Unfasten the 3 screws [43] and release the retaining clip [44]. Pull the assembly out of the unit toward the rear.



2.5.5 NR SYSTEM 1.721.290

- Remove the top cover (Section 2.2.1).
- Pull the assembly off the BALANCED IN/OUT board toward the top while pressing the distributor board down in the middle so that the latter will not bend.

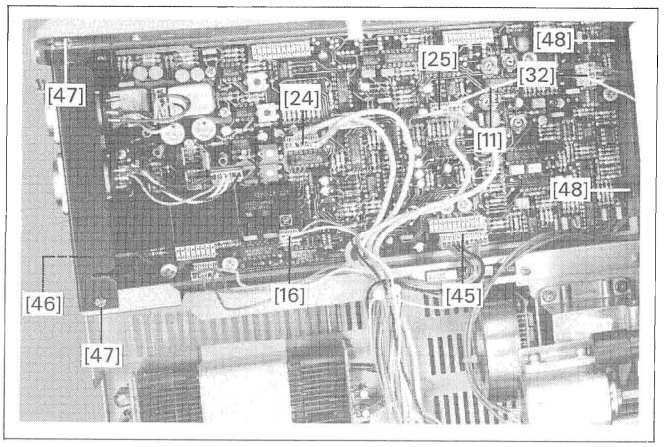


2.5.6 RECORD CONTROL A721 1.721.305

- Remove the top cover (Section 2.2.1).
- Detach the following cable connection:
  - RECORD / ERASE HEAD [31] -> RECORD CONTROL A721
- Pull the assembly off the BALANCED IN/OUT board toward the top while pressing the distributor board down in the middle so that the latter will not bend.

2.5.7 BALANCED IN/OUT A721 1.721.285

- Remove the top cover (Section 2.2.1).
- Remove the NR system (Section 2.5.5).
- Remove the RECORD CONTROL A721 (Section 2.5.6).
- Detach the following cable connections:
  - Yellow cable CAL/UNCAL [11] on BALANCED IN/OUT A721
  - HEADPHONE JACK [16] -> BALANCED IN/OUT A721
  - INPUT LEVEL [24] -> BALANCED IN/OUT A721
  - OUTPUT LEVEL [25] -> BALANCED IN/OUT A721
  - REPRODUCE HEAD [32] -> BALANCED IN/OUT A721
  - BALANCED IN/OUT [45] -> SYSTEM CONTROL A721
- Unfasten 1 screw [46] from the bottom.
- Unfasten 1 screw [47] from the top.
- Release the 2 retaining clips [48] and slide out the assembly toward the top.

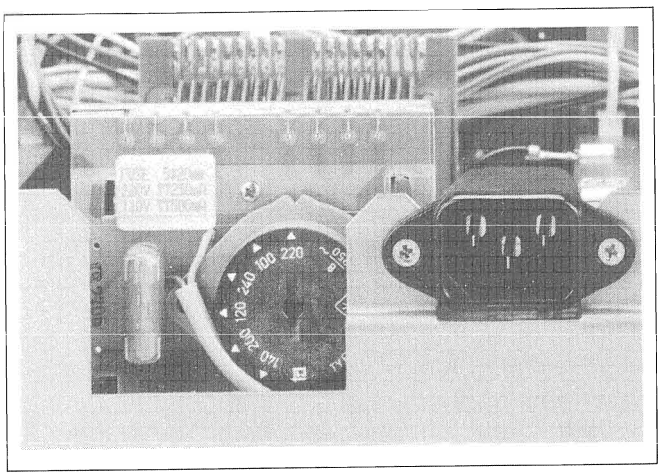


2.5.8 Primary fuse

- Detach the AC power cord!
- Remove the top cover (Section 2.2.1).
- The primary fuse is accessible from the back below the PVC shock protection.

  100 ... 140 VAC: TT 500 mA / 250 V (SUPER SLOW)
  200 ... 240 VAC: TT 250 mA / 250 V (SUPER SLOW)

- It is important to reinstall the PVC shock protection after the fuse has been replaced!



2.5.9 Secondary fuses

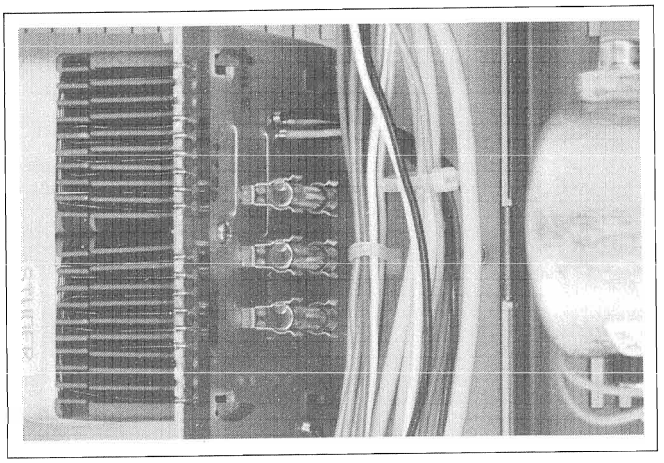
- Detach the AC power cord!

1st version:
- Remove the top cover (Section 2.2.1).
- The three secondary fuses are accessible on the secondary side of the transformer.

2nd version:
- Remove the bottom cover (Section 2.2.2).
- The tree secondary fuses are accessible on the secondary side of the transformer.

F1: 1.25 A / 250 V (SLOW)
F2: 1.25 A / 250 V (SLOW)
F3: 1 A / 250 V (SLOW)

- Replace defective fuses only with the type rated as specified above.

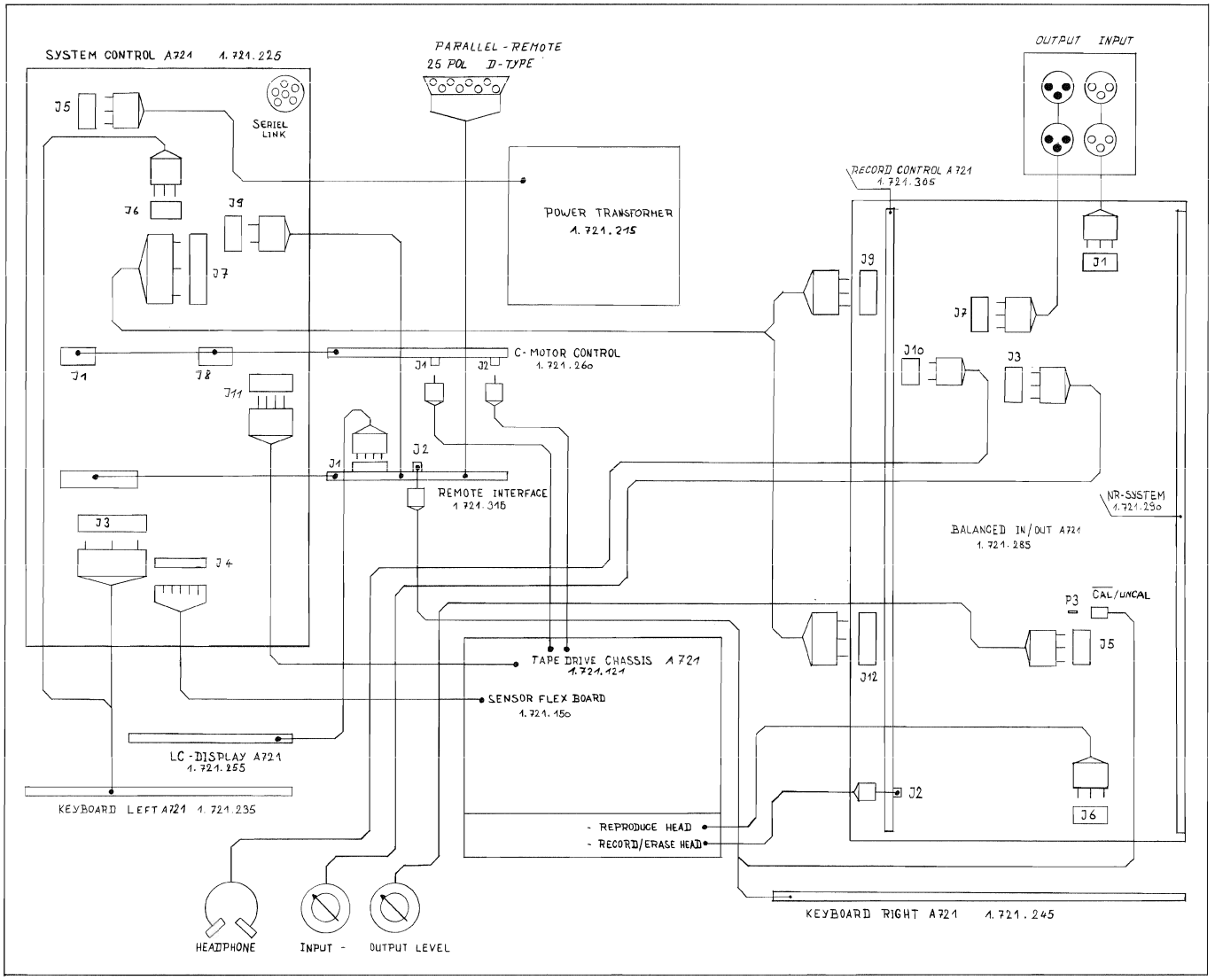


3. FUNCTIONAL DESCRIPTION

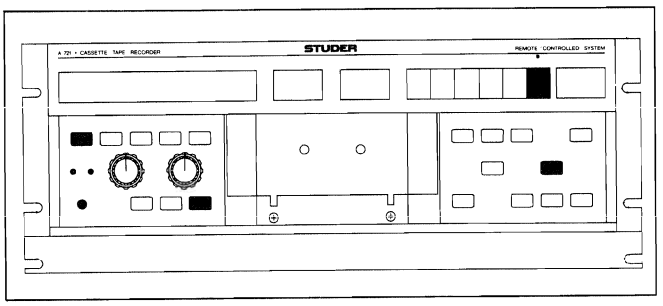
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WIRING DIAGRAM



3.1 OPERATING PANEL

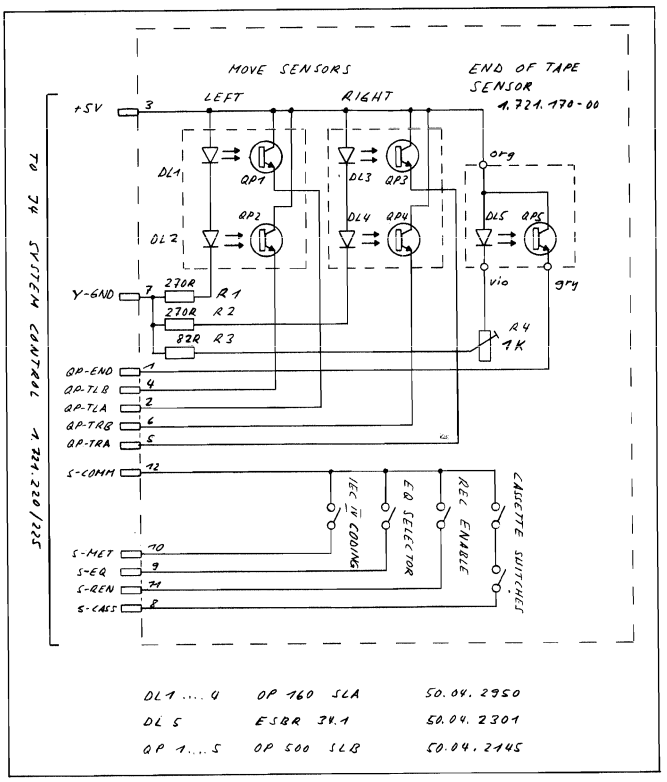


The front section of the unit is made of a plastic chassis to which aluminum sections are fastened and the following assemblies are engaged with retaining clips:

- KEYBOARD LEFT A721 1.721.235
- KEYBOARD RIGHT A721 1.721.245
- DISPLAY BOARD 1.721.255

All push buttons, except the two for adjusting the real-time counter, are wired in a matrix that is continually scanned by the microprocessor (IC9 on SYSTEM CONTROL 1.721.225). The keys establish contacts by means of conductive rubber and gold-plated, comb-type printed conductors.
Each of the two LC displays is controlled by a decoder (IC1 and IC2) in multiplex mode via the I^2C-bus of the microprocessor.
The display is backlit by a fluorescence foil (luminescent lamp) behind the LC display.

3.2 TAPE DECK 1.721.121

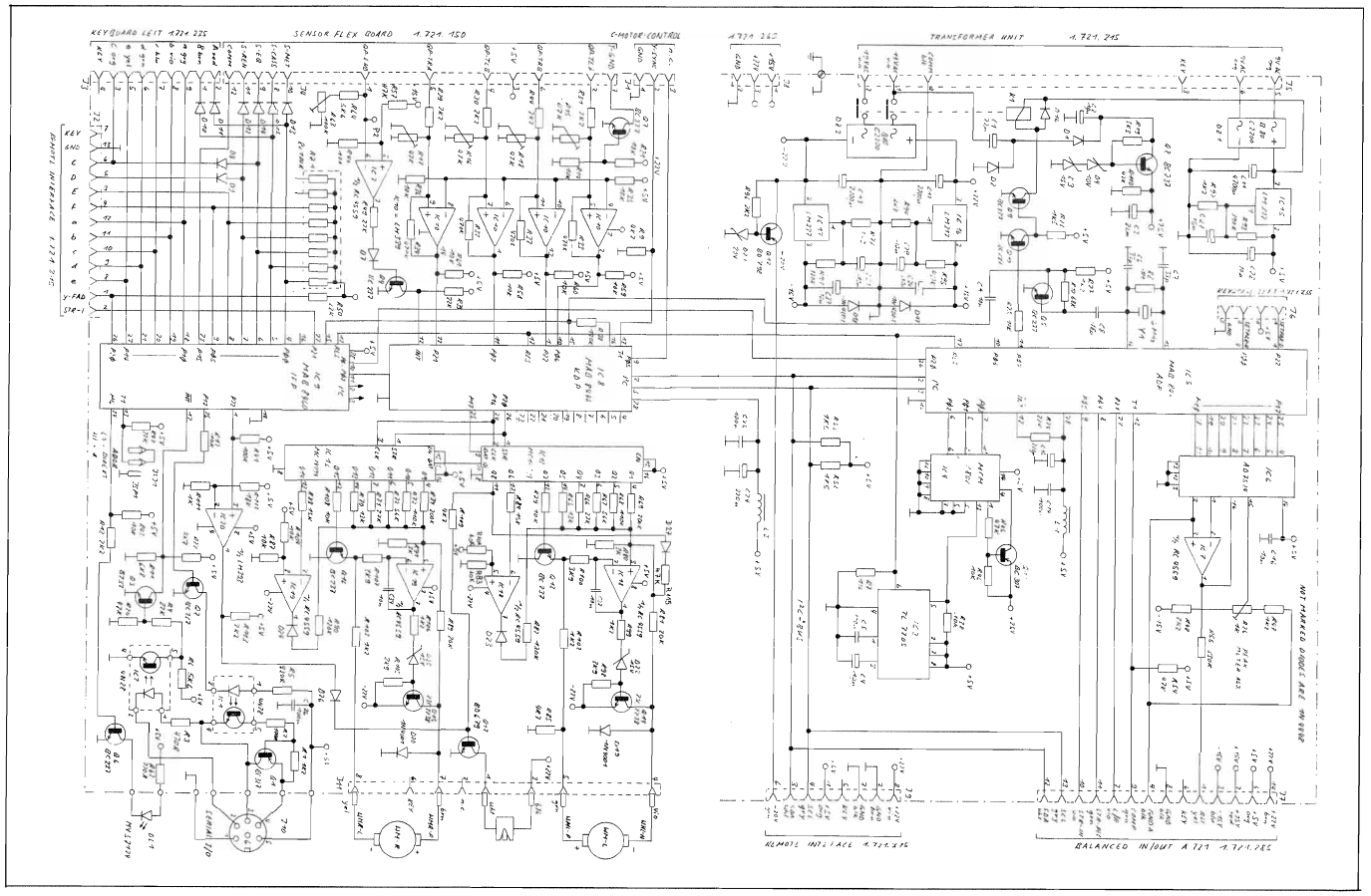


The transport mechanism, mounted on a rigid die-cast aluminum-alloy chassis is equipped with four motors.
The operating principle of the two capstan motors is described in Section 3.4 CAPSTAN MOTOR CONTROL A721.
A ring gear is mounted on each of the two hubs which in turn controls two tacho sensors each. For each hub, these sensors generate square-wave signals, phase-shifted by 90x, which are used for the real-time computation.
The tacho signals, the information of the tape end switch, the states of the scanning switches for record inhibition and tape type detection, as well as the feed-back for mounted cassette, are conducted via the SENSOR FLEX BOARD 1.721.150 to the SYSTEM CONTROL A721.
The two spooling motors and the pinch roller solenoid are also controlled by the SYSTEM CONTROL A721 via a separate cable harness.
The pinch rollers, the record, reproduce and erase head are mounted on the pivoting carrier which mechanically locks the cassette compartment in record and play mode so that the cassette cannot be unintentionally removed in these operating modes.

3.3 SYSTEM CONTROL A721 1.721.225

The following circuits are implemented on this module:

- Supply voltage control
- Microprocessor system
- Spooling motor control
- Serial link
- Audio function control
- Output meter



3.3.1 Supply voltage regulation

The power transformer supplies the two voltages 9 VAC and ±19 VAC from which the following voltages are derived:

+5 V regulated	for the control logic
+10 V unregulated	for the standby relay
+25 V stabilized	for the EEPROM programming
±22 V unregulated	for spooling motors, capstan motor control, pinch roller solenoid and relays.
±15 V regulated	for the audio electronics
-20 V regulated	for illuminating the display

In standby mode, the microprocessor interrupts the unnecessary supply voltages ±22 V, ±15 V, -20) with the aid of Q10, Q9, and the relay K1.
The write voltage of +25 V for programming the EEPROMs is generated from the 19 V AC via a voltage doubler circuit (C1, C2, D1, D2) with subsequent series stabilization (Q8, D3, D4).

3.3.2 Microprocessor system

The microprocessor system comprises three microprocessors that communicate with each other via the serial I^2C-bus.
The lock frequency (6 MHz) is the same for all microprocessors. It is generated by IC5 (Y1), buffered (Q5), and supplied to the other microprocessors (IC8, IC9).
The IF processor (IC9) with 6 K-byte ROM reads and processes the matrix of both keyboards as well as the data traffic from and to the SERIAL LINK.
The four tacho signals of the spooling motors are processed by the KD processor (IC8) with 4 K-byte ROM. Based on the cassette play time, the processor computes the played time and supplies the control signals for the spooling motors in serial form to the decoders (IC12, IC13). It also controls the pinch roller solenoid and supplies the data for the COUNTER display to the I^2C-bus.
The AD processor (IC5) with 4 K-byte ROM controls all audio functions on the BALANCED IN/OUT module and on the RECORD CONTROL module via the I^2C-bus and generates the data for the output meter.
It is also responsible for reading and storing the parameters in EEPROM (IC4):

	POWER STATUS	(on/off)
	POWER ON STATUS	(stop, play, play+rec)
	PLAY TIME	(C46, C60, C90, C120)
	TAPE TYPE	(memory locations A1, A2, A3)
	NR-SYSTEM	(Dolby B, Dolby C, switch off)
	MPX FILTER	(on/off)
	PHONES VOLUME	(headphones volume)
*	LOC 1	(memory address in LOC 1)
*	LOC 2	(memory address in LOC 2)
*	COUNTER PARAMETERS	(real-time parameters)
*	TAPE PARAMETERS	(Calibration data)

* These values are stored directly after they have been entered or following calibration; the other values only when the unit is switched off with the POWER [33] key or when the SAVE STATUS [26] key is actuated. The stored parameters are not overwritten in the event of a power failure.

3.3.3 Spooling motor control

Two digital/analog converters are implemented with the shift registers (IC12, IC13) used as decoders together with their amplifiers on their outputs and the opamps (IC18, IC19). Their output currents in turn control the regulating transistors (Q14, Q15) of the spooling motor control.

3.3.4 Serial link

The receive data are conducted from the SERIAL LINK socket via the opto coupler (IC2) and the transistor (Q3) to the IF processor (IC9).
The transmit data are conducted from the IF processor (IC9) via the transistor (Q2) to the opto coupler (IC1) and finally to the SERIAL LINK socket.

3.3.5 Control of the audio functions

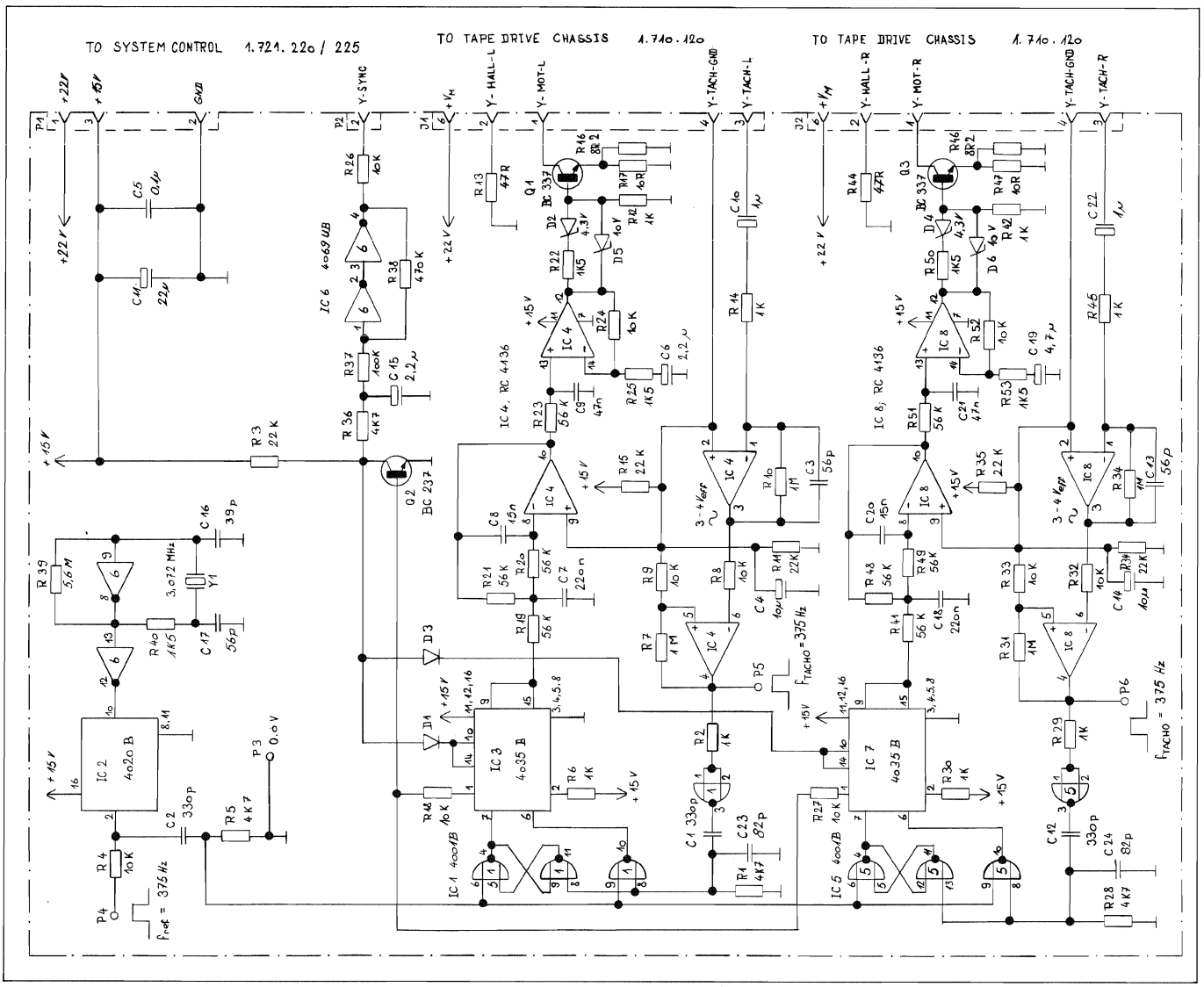
The control commands for the audio functions are written by the AD processor to the I^2C-bus. On the BALANCED IN/OUT and RECORD CONTROL modules, the data are subsequently combined in several serial/parallel converters to 8-bit bus data or converted into individual control signals for the audio switches.

3.3.6 Output meter

The AD processor (IC5) together with the D/A converter (IC6) and the opamp (IC7) produces a reference signal (REF) for comparison with the rectified momentary audio signal on the BALANCED IN/OUT module. With the L/R signal it alternatingly connects the left-hand and the right-hand channel to the comparator (IC26 on the BALANCED IN/OUT 1.721.285) and thus receives the COMP signal for processing the data for the output meter.
The reference signal and consequently the indication for the desired 0 dB level can be influenced with the trimmer potentiometer (R26).

3.4 CAPSTAN MOTOR CONTROL 1.721.260

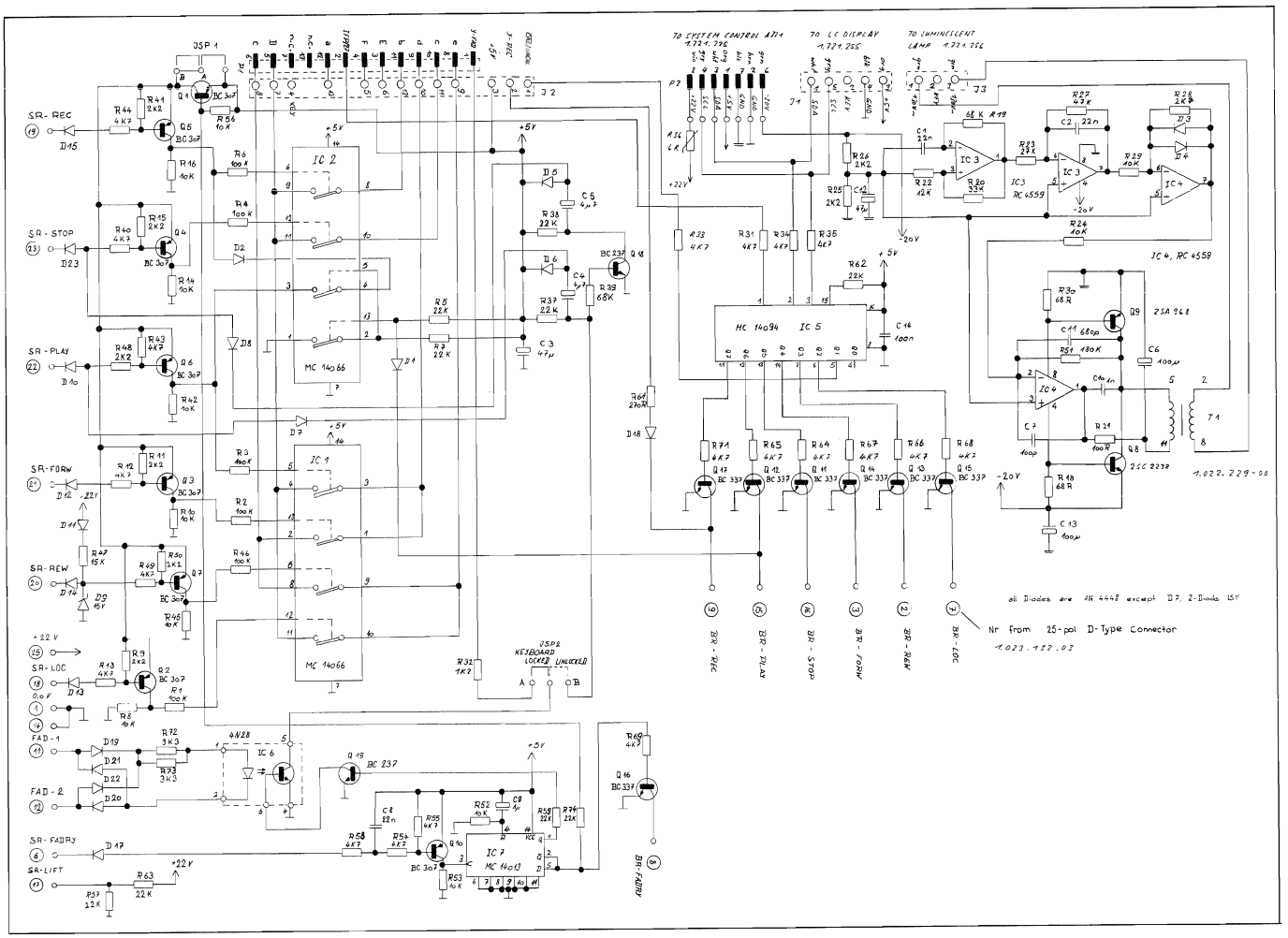
Separate control circuits are used for the two capstan motors designed according to the MDD principle. The common reference frequency of 375 Hz is supplied to the control circuits by a quartz oscillator (IC6, Y1) with subsequent binary divider (IC2).
The amplifier/limiter circuits for the corresponding tacho signals (Y-TACH) are implemented with one half each of IC4 and IC8.
The phase comparators (IC3 and IC7) compare the phase relation of the tacho signals with the one of the reference signal. Their output signals (pin9/15) control the two transistors Q1 and Q3 via carrier filters with compensation networks (IC4, IC8). These transistors supply the control currents for the commutation transistors (Q1 to Q4 on the CAPSTAN MOTOR DRIVER 1.021.516).



3.5 REMOTE INTERFACE A721 1.721.315

The following circuits are implemented on this module:

- Parallel remote control
- Luminescence driver



3.5.1 Parallel remote control

The received control commands are taken directly via CMOS switches (IC1, IC2) to the keyboard matrix of the right-hand keyboard. The feedbacks are picked up from the I^2C-bus by an 8-bit shift register/latch (IC5) and used for controlling the open collector transistors (Q11 to Q15, Q17).

The SR-FADRY signals control a flip flop (IC7) for the fader start ready function. The fader start signal (FAD-1, FAD-2) conducted via a two-way rectifier (D19 to D22), can be connected with any polarity and is electrically isolated from the remaining circuit by the optocoupler (IC6).

3.5.2 Luminescence driver

A 600 Hz oscillator with nearly sine-shaped voltage characteristic is implemented with IC3, IC4. This voltage is amplified in a small power stage (IC4, Q8, Q9) and stepped up by transformer (T1) to the required 130 V.

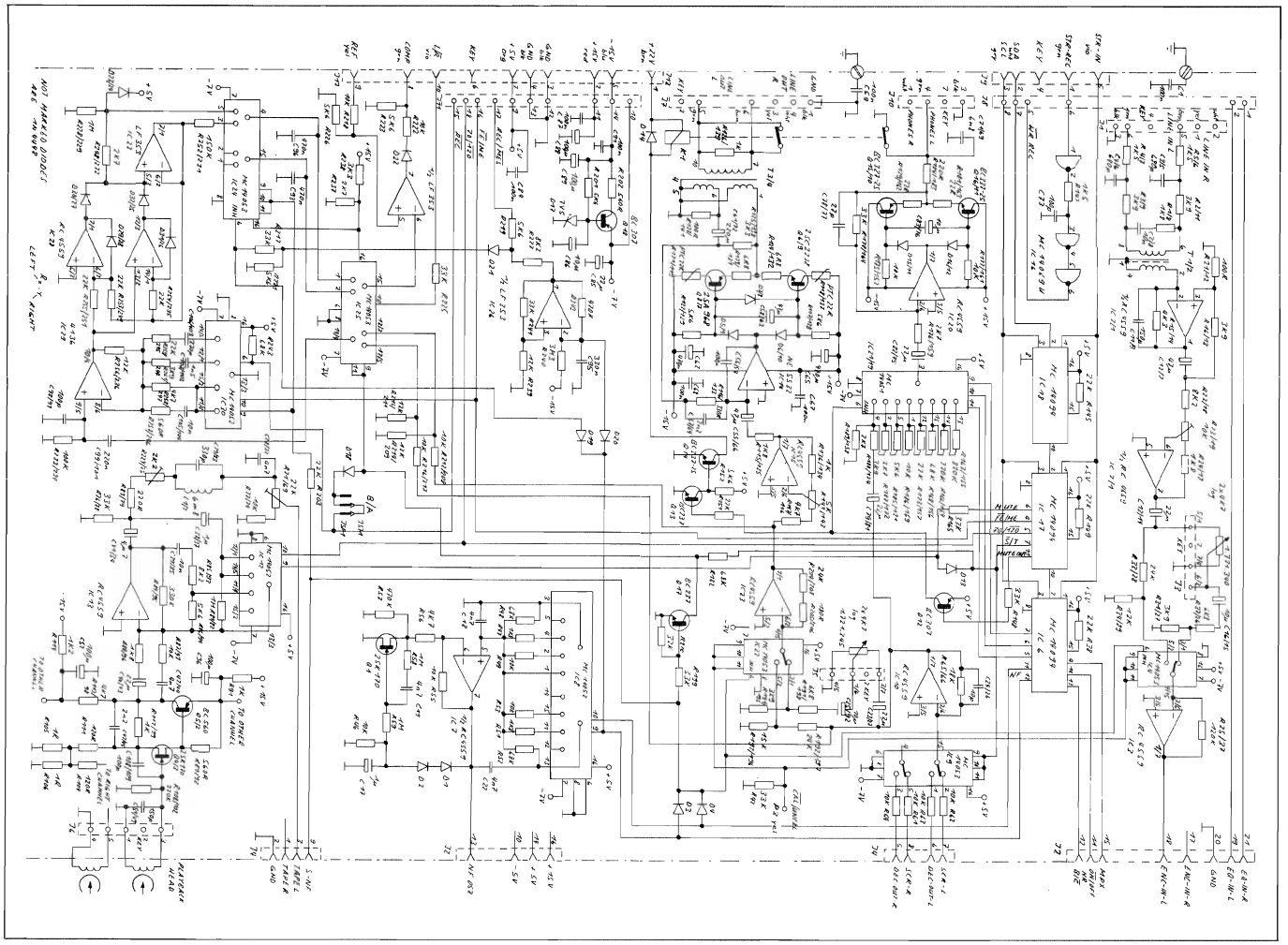
3.6 BALANCE IN/OUT A721 1.721.285

The following circuits are implemented on this module:

- Level control, headphones amplifier
- peak/medium value rectification
- Automatic calibration
- Reproduce amplifier

Note:

As a rule only the left-hand analog channel is shown in the diagram. At the element designation (e.g.: R22/18) the number before the slash (R22) identifies the element of the left-hand channel, the number behind the slash (R18) the element of the right-hand channel.



3.6.1 Level adjustment, headphones amplifier

The audio signal is conducted, from the balanced line input via an isolation transformer (T1/T2). In or to minimize distortions in the transformer, the latter is operated in short circuit mode and with compensation of the winding resistance.
The desired input line level can be adjusted with the trimmer potentiometer R23/19.
With IC4 and the CAL/UNCAL signal, the microprocessor switches between calibrated and uncalibrated mode. The audio signal is subsequently taken to the NR SYSTEM. With three shift registers (IC18, IC17, IC6) the control functions of the I^2C-bus are converted from serial to parallel and buffered. Among others also the data for the headphones gain which connect the input of the multiplexer (IC21/19) to the short-circuit-proof push-pull output stage (IC20, Q16/11, Q15/10) and permit the volume to be adjusted in eight steps.
With the analog switch (IC9) either the SOURCE or the TAPE signal is connected to the LINE and headphones output as well as to the rectifier for the PEAK meter.

3.6.2 Peak / mean value rectification

Two selectors of the analog switch (IC25) supply either calibrated or uncalibrated line level to the rectifier (IC27, IC28, IC29). The multiplexer (IC30) causes a tape-type-dependent treble boost.
With the selector (IC24), the output meter is changed over for automatic calibration from PEAK to VU characteristic.
The L/R signal of the microprocessor alternatingly connects the rectified left and the right level signal (C96, C93) to the comparator IC26 where it is compared with a reference signal produced by the microprocessor.

3.6.3 Automatic calibration

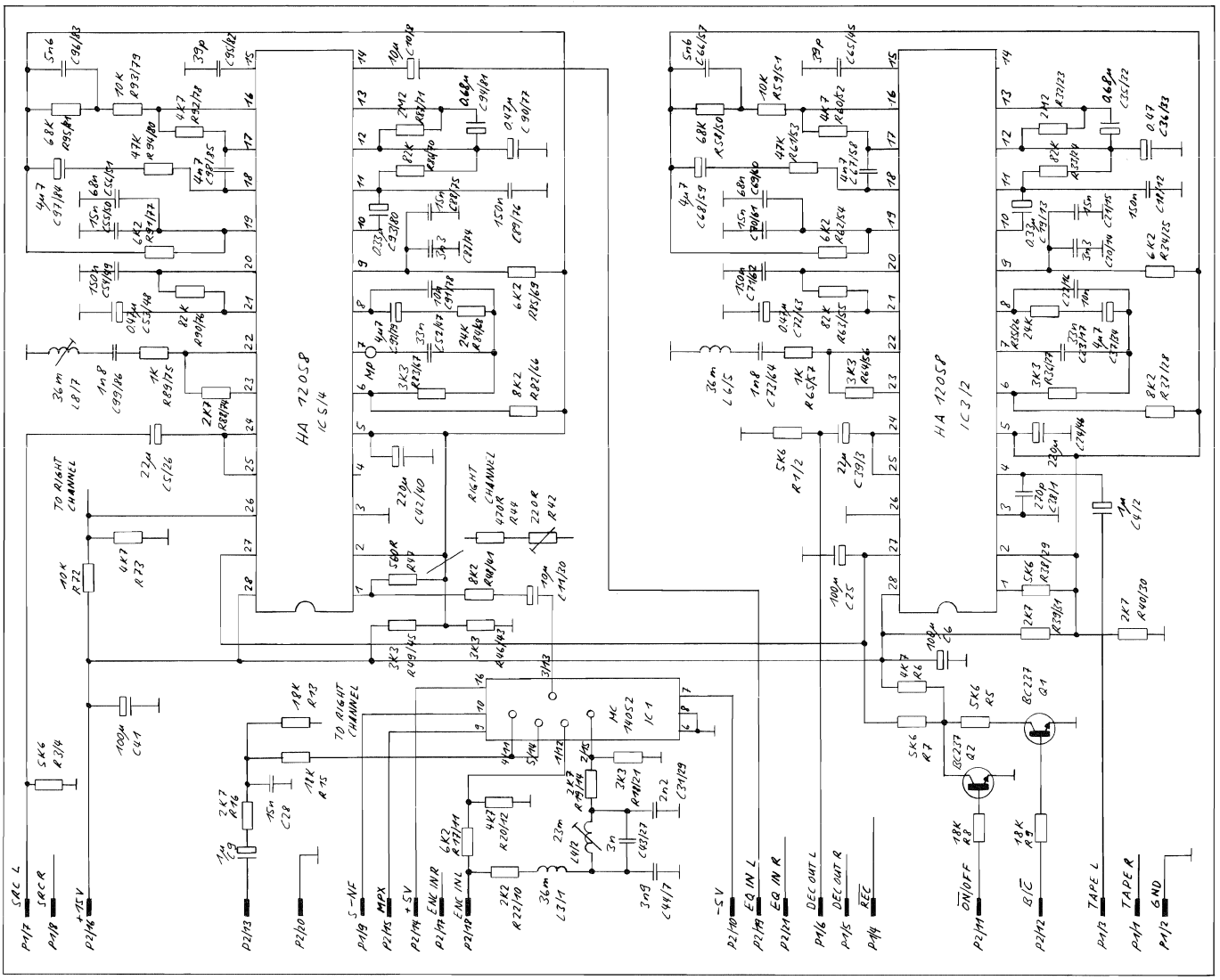
The multiplexer (IC8) and the opamp (IC7) together constitute the test oscillator for automatic calibration which can be selected at three different frequencies (500 Hz, 4 kHz, 17 kHz).
The signal of the test oscillator is connected via the NR SYSTEM 1.721.290, so that the Dolby control circuit can also be involved in the calibration.
In order to prevent crosstalk from the record to the reproduce head at high frequencies, the measuring frequency is recorded in bursts of 120 ms under control of the square-wave generator (IC26, pin1). The same signals causes the analog switches (IC24) to be opened via the inhibit input (the values are preserved) and the record signal on the RECORD CONTROL 1.721.305 module is muted (IC14). This ensures that only the signal across tape is measured and evaluated. The test oscillator and the square-wave burst generator are switched on or off via the inputs of the shift register (IC6, pin11 and pin 12).

3.6.4 Reproduce amplifier

A linear amplifier stage is implemented with the discrete components Q4/3, Q5/2. The opamp (IC13) with the external components performs the required equalization. The first equalization time constant is 3180 µs, the second time constant is switched over by IC12 as a function of the tape type and is either 70 µs or 120 µs.
The reproduce level can be aligned with the trimmer potentiometers R71/R69, and the high end frequency response gain can be influenced with the trimmer potentiometers R224/75.
After the Dolby circuit on the NR SYSTEM, the audio signal is conducted to the CAL/UNCAL selector (IC22) and from there to the output level potentiometer (IC15). The desired output level can be adjusted with the trimmer potentiometers R144 (R143).
The balanced line driver (IC14, Q6/9, Q8/7) supplies the isolation transformer (T3/4). The signal is fed back to the line driver via the winding 5/6.

3.7 NR SYSTEM 1.721.290

Only the left-hand analog channel is shown in the diagram. At the element designations (e.g.: R28/29) the number before the slash (R28) identifies the element of the left-hand channel, the number behind the slash (R29) the element of the right-hand channel.
The noise reduction system type DOLBY B/C is based on the IC HA12058. This IC permits a changeover between Dolby B, Dolby C, and bypass by three different voltage levels on a single control line (pin27).
With the electronic selector (IC1) before the encoder inputs (IC5/4) it is possible to change over between the direct audio signal, the signal across the MPX filter, and the test oscillator for automatic calibration.
The output signal (SRC) of the encoders (IC5/4, pin24) is taken linearly to the monitor switch on the BALANCED IN/OUT module. The EQ-IN signal after the Dolby encoder (IC5/4, pin14) is taken to the record equalizer on the RECORD CONTROL module.
Analogously to the encoder, the signal (TAPE L/R) originating from the tape is decoded and also taken as the DEC-OUT L/R signal (IC3/2, pin24) to the monitor switch.
The trimmer potentiometer R42 should be left in the center position. Differences in the overall gain of the two audio channels can be compensated at a different point.



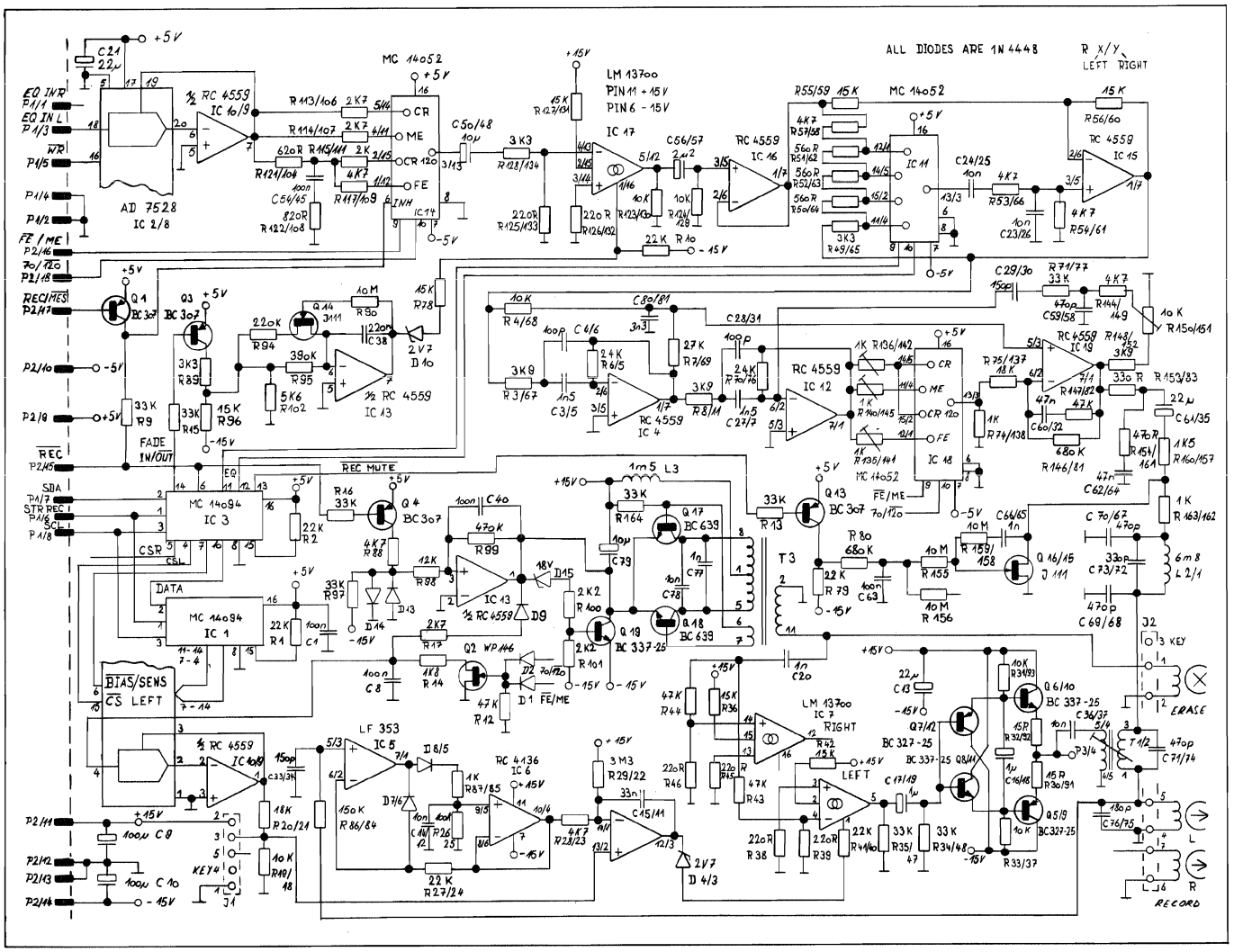
3.8 RECORD CONTROL A721 1.721.305

The following circuits are located on this module:

- Automatic fade in/out, equalization changeover
- Treble boost
- HF oscillator, bias control

Note:

As a rule, only the left-hand analog channel is shown in the diagram. At the element designations (e.g.: R22/18) the number before the slash (R22) identifies the element of the left-hand channel, the number behind the slash (R18) the element of the right-hand channel.



3.8.1 Automatic fade-in/out, equalization changeover

The signal from the NR system (EQ IN L/R) is attenuated by the digital/analog converter (IC2/8) in accordance with the head and tape related data. The switch (IC14) is used for changing over the equalization time constant between 70 µs and 120 µs in the record path.
The control signal (FADE IN/OUT) is read from the I^2C-bus by the serial/parallel converter (IC3) and converted in IC13 into a control current for the current-controlled opamp (OTA-IC17). The FET (Q14) approximates the control current to a logarithmic characteristic.
The selector switch (IC11) together with the opamp (IC15) constitutes a 4-stage equalizer that influences the frequencies at around 4 kHz. The exact value for the position of the selector switch is determined during the automatic calibration.

3.8.2 Treble boost

The treble of the analog audio signal available at the opamp (IC15, pin 1/7) is boosted by two series-connected band passes (IC4, IC12). The selector switch (IC18) connects the treble trimmer potentiometers (R136/142, R140/145, R135/141) into the signal path as a function of the tape type. The treble boost of each channel can be influenced with the trimmer potentiometers (R150/151). The lower frequencies are connected directly via R4/68 and R7/69 to the amplifier (IC19).
With the REC MUTE signal (IC3, pin13), the microprocessor is able to switch the record signal on or off via the transistor (Q13) and the FET (Q16/15) without any switching clicks.
The record signal is then fed via the bias trap (L2/1, C73/72) and the RF coupling transformer (T1/2) to the record head.

3.8.3 RF oscillator, bias control

The 105 kHz RF oscillator (T3, Q17, Q18, C77, C78) is switched on and off softly by slow modification of its supply voltage with the REC signal via the transistor (Q4) and the integrator (IC13, Q19). At the same time the record signal is enabled by the same control signal via the selector switch (IC14).

The set point value for the HX-PRO control circuit is taken via the digital/analog converter (IC2/8, IC10/9), serving as an attenuator, to the integrator (IC6, pin 13/2). The FET switch (Q2) allows the D/A converters (IC2/8) to be operated also with IEC-I tapes with relatively low bias current within a large resolution range.

The actual value for the HX-PRO control circuit is picked up at the record head, rectified (IC5), filtered, and amplified (IC6).
The result of the comparison of the set point with the actual value (IC6, pin 12/3) controls the RF current via the current-controlled amplifier (OTA-IC7), the power stage, and the coupling transformer (T1/(2). The amplifier (IC7) receives the RF signal via the capacitor C20 from the RF oscillator. To ensure that the correct treble equalization can be set at the optimum operating point, the set point of the control circuit and consequently the working point can be modified manually by means of an external wiring (bias adjustment unit) via the multipoint connector J1.

4. ALIGNMENT INSTRUCTIONS

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4.1 General information

CAUTION: Electric shock hazard
when the unit is opened. Certain components are energized with line voltage!

4.1.1 Required special tools

- Double-end screw driver Part No. 10.030.461.61
- Spring dynamometer 0 - 500 g Part No. 10.249.001.01
- Soundhead alignment gauge Part No. 1.710.118.01
- Special open-end wrench 8 mm Part No. 10.030.462.10
- Mirror cassette Part No. 10.241.010.00
- Service holder for tape deck Part No. 10.030.461.66
- Snap ring pliers with stop
- Laboratory power supply (16.5 VDC)

4.1.2 Required measuring instruments

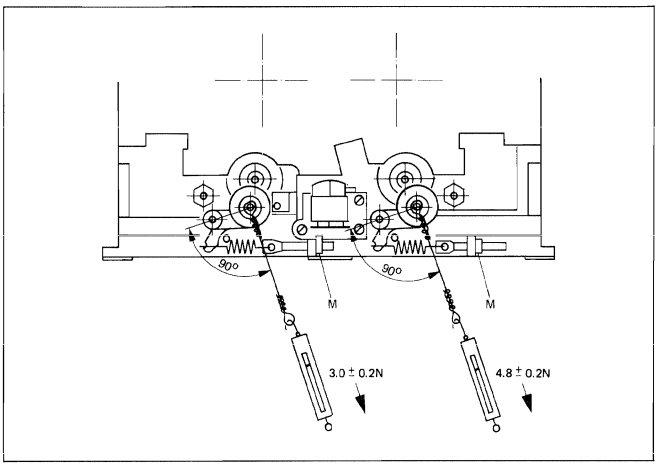
- Cathode ray oscilloscope (CRO)
- Audio generator (Ri < 600 Ω)
- Audio millivoltmeter (0.3 mV - 30 V / Ri < 100 kΩ)
- Selective voltmeter (bandwidth < 100 Hz) or distortion meter
- Frequency counter (up to 10 MHz)
- Digital voltmeter
- Demagnetizing choke
- Band-pass filter 1 kHz
- Wow-and-flutter meter
- Reference cassette IEC I 120 µs Part No. 10.206.093.06
- Reference cassette IEC II 70 µs Part No. 10.206.093.07
- Light barrier reference cassette Part No. 10.030.460.38
- Bias alignment unit Part No. 10.030.462.11

4.2 MECHANICAL ADJUSTMENTS

4.2.1 Adjusting the pinch rollers

The sintered sleeve bearings require no maintenance and must not be lubricated.

- Remove the cassette deck (Section 2.4.1).
- Set the cassette deck into the service holder.
- Check the axial play of the pinch rollers and arms; it should be 0.1 mm. The play can be adjusted by shifting the snap ring (always use the snap ring pliers with a stop in order to prevent damage to the ring).
- The pinch rollers must be clean and undamaged. They should rotate freely. Adjust the pinch roller force as follows with the pivoting carrier engaged:
- Feed approx. 20 V from the laboratory power supply to the pinch roller (because of the free-wheeling diode, check that the polarity is correct).
- By means of a string or wire loop, attach the spring dynamometer to the pinch roller shafts.
- Pull the spring dynamometer so that an air gap is created between the pinch roller and the capstan shaft.
- Adjust the pinch roller force to the following values by adjusting the square nut [M]:
  Left-hand pinch roller 3.0 N ± 0.2 N (300 g ± 20 g)
  Right-hand pinch roller 4.8 N ± 0.2 N (480 g ± 20 g)
- The pinch roller arms have a different lever ratio: left: 1.1, right 0.7:1.

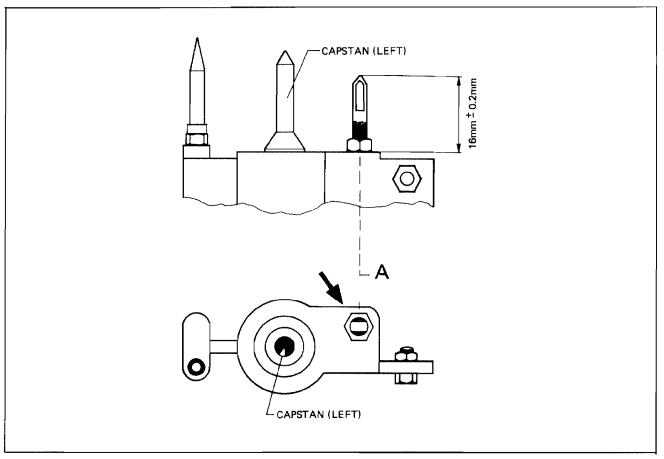


4.2.2 Checking the pinch roller arms

- Remove the cassette deck (Section 2.4.1).
- Set the cassette deck into the service holder.
- The pinch roller arms should move freely
- If necessary lubricate the bearings lightly with "PDP 65".
- The pinch roller arms should not move with a jerky motion (bind) when they engage.

4.2.3 Checking the centering pin position

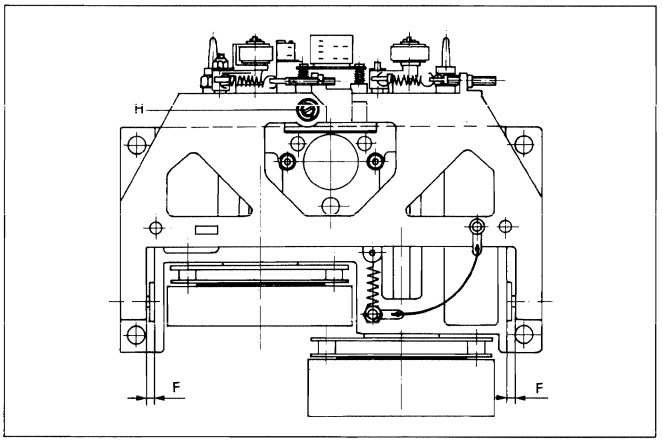
- Remove the cassette deck (Section 2.4.1).
- Set the cassette deck into the service holder.
- The protruding length of the centering screw should be adjusted to 16 mm ± 0.2 mm.
- The milled parts must be aligned perfectly horizontal.

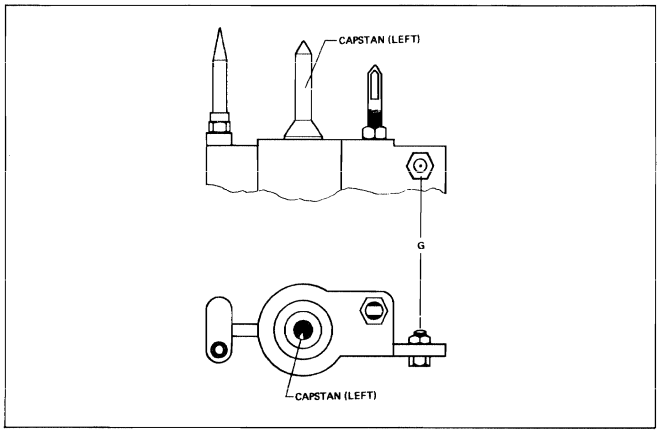


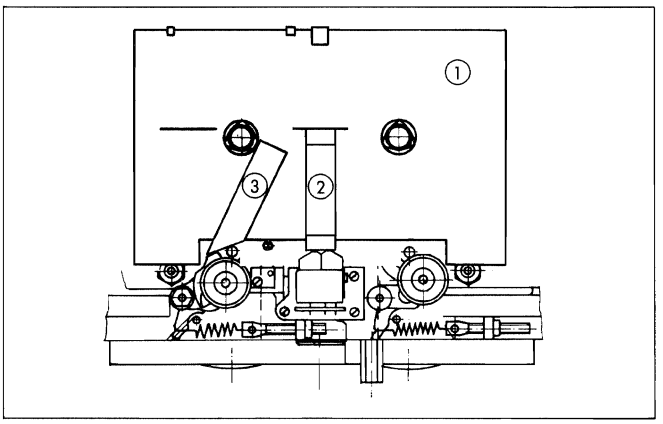
4.2.4 Adjusting the pivoting carrier

The pivoting carrier should not be removed and the engaged length not be altered. It is not necessary to remove the pivoting carrier for removing the soundheads, pinch rollers, etc.
The pivoting carrier is connected to the chassis ground by means of a special stranded ground conductor.

- Remove the cassette deck (Section 2.4.1).
- Set the cassette deck into the service holder.
- Remove the SENSOR FLEX BOARD (Section 2.4.2).
- The headless screws on the pivot of the carrier should be adjusted in such a way that the distance [F] between the pivoting carrier and the die-cast deck chassis is identical on both sides.
  If adjustment is required, loosen the slotted nuts on the headless screws by means of the double-end screwdriver, adjust the headless screws, and retighten the slotted nuts.
- The pivoting carrier should move freely and without play in its pivots.
- If the pivoting carrier has been shifted laterally it is necessary to readjust the centering screw [G].
- Lightly loosen the nut of the centering screw.
- Push the pivoting carrier upward until the headless screw [H] plunges into the centering screw and thereby repositions it. Retighten the centering screw nut in this position.
- Reinstall the SENSOR FLEX BOARD.
- Insert the soundhead alignment gauge [1] into the cassette deck and set the square end of the slide for measuring the engaged length [2] on the record/reproduce head.
- Change the engaged length of the pivoting carrier on the adjusting screw [H] in such a way that the upper end of the measuring slide [2] is flush with the milled marking on the alignment gauge.
  In order to engage the pivoting carrier, feed approx. 20 V from a laboratory power supply to the pinch roller solenoid. Ensure that the polarity is correct (because of the free-wheeling diode).
- Remove the soundhead alignment gauge.
- For precision alignment of the engaged length, pull one of the pinch rollers of the engaged pivoting carrier lightly downward until an air gap is created between the capstan shaft and the roller.
- Turn the adjusting screw [H] until the pinch roller is exactly parallel to the capstan shaft (check both rollers).
- Secure the adjusting screw by tightening the slotted nut.







4.2.5 Adjusting the pinch roller solenoid

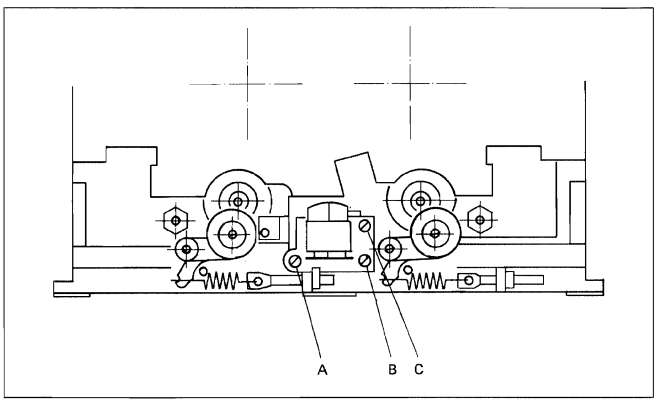
This adjustment should only be made when the pinch roller solenoid is cold (at room temperature)!
When performed correctly, this adjustment prevents that the armature of the pinch roller solenoid plunges completely into the coil when the pivoting carrier is engaged, thus losing some of its pulling force.
Shift the pinch roller solenoid only by pressing against the armature, but never against the changeover lever, because this would result in an incorrect adjustment.

- Loosen (do not remove) both fixing screws of the pinch roller solenoid.
- Tighten the hexagon nut on the armature.
- Pull the electrical leads off the solenoid.
- From a laboratory power supply feed 16.5 V to the pinch roller solenoid (because of the free-wheeling diode ensure that the polarity is correct).
- Loosen the hexagon nut on the armature by 90x.
- Press against the hexagon nut of the armature in order to push the magnet against the rear stop, and tighten both fixing screws.
- Interrupt the voltage to the pinch roller solenoid and tighten the hexagon nut on the armature. The resulting air gap for the armature is now 0.18 mm.
- Switch the 16.5 V on again. The pivoting carrier should move to the PLAY position.
- Disconnect the power supply from the pinch roller solenoid and reestablish the electrical plug connections (black conductor = positive pole).
- Alternately press the PLAY and STOP keys and observe the movement of the pivoting carrier. It should move smoothly and without binding from one position to the other.

4.2.6 Aligning the record/reproduce head.

If the pivoting carrier is adjusted correctly, this alignment can be made on the installed cassette deck. For this purpose unfasten the two screws so that the cover of the SENSOR FLEX BOARD can be removed.

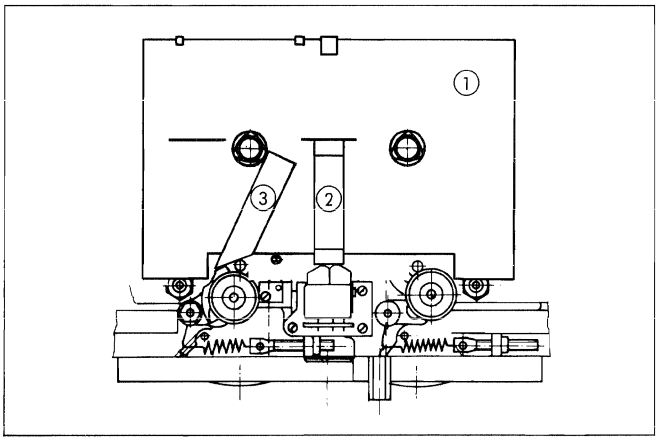
- Adjust the height of the headblock to 5 mm by means of screws [A], [B], and [C].
- Insert the soundhead alignment gauge into the cassette compartment.
- Adjust the two screws [B] and [C] in such a way that when the pivoting carrier is engaged the measuring slide [2] can be pushed through the tape guidance (on the right-hand side of the soundhead) without binding.
- With screw [B] adjust the headblock in such a way that the soundhead is perpendicular to the alignment gauge at the height of the head gap.
  This can be checked with the measuring slide [2]. When the milled side of the measuring slide points against the soundhead, the soundhead and the face of the slide should be parallel.
- Recheck the height of the soundhead and correct it if necessary.



4.2.7 Adjusting the erase head position

- Insert the soundhead alignment gauge [1] into the cassette compartment.
- With the bevelled measuring slide (3) recheck the height adjustment of the erase head.
- The height can be corrected by means of erase head shims with a thickness of 0.1 mm (part No. 1.710.122.02).

Note:
- The perpendicularity of the erase head cannot be changed. The manufacturing tolerance is ± 1.5°.



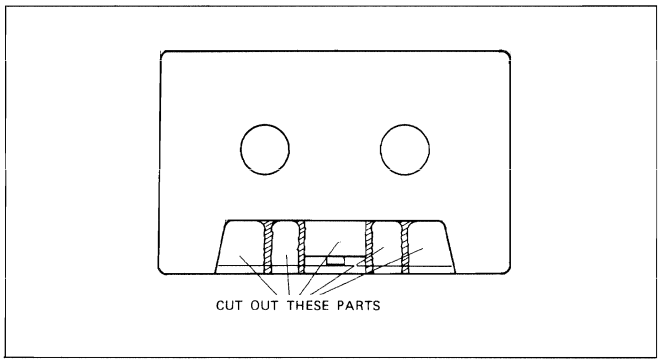
4.2.8 Checking the tape transport

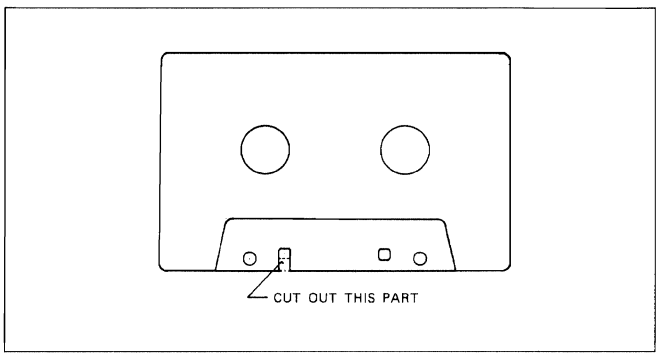
The following cassettes can be prepared in place of the mirror cassettes.

Cassette A:
C90 IEC II (CrO_2) with tape guidance cover removed.

Cassette B:
C60 IEC II (CrO_2) with a notch in the cover between the erase head and the record head.

- Clean the cassette deck with a moist felt stick (included in the STUDER cleaning kit).
- Insert the mirror cassette or cassette A into the cassette compartment.
- Start the cassette recorder in play mode.
- The tape should neither brush against the tape guides nor become deformed in any other way. By means of the mirror surface of the tape, any deformation becomes immediately visible.
- Insert cassette B
- With the aid of a small screwdriver pull a loop with a length of approx. 5 mm between the erase head and the record head in play mode.
- Because the diameter of the right-hand capstan shaft is slightly larger, the tape loop should disappear within 100 s.





4.3 Electrical alignments

4.3.1 Adjusting the tape end sensor

For cassettes with high red-light transmittance and a leader with a low light transmission rate, the sensitivity must be adjusted symmetrically to the switching threshold.
The corresponding adjustment should preferably be made with the light barrier reference cassette (Part No. 10.030.460.38). The transmitter diode current is factory aligned by means of the trimmer potentiometer (R4) on the SENSOR FLEX BOARD. Realignment is only necessary after the light barrier has been replaced.

The fine-adjustment is made on the SYSTEM CONTROL A721 by means of trimmer potentiometer (R63) and can either be performed by means of the aforementioned measurement cassette according to (1) or with a conventional cassette according to (2).

- Insert the light barrier reference cassette into the cassette compartment.
- Connect the digital voltmeter to TP2 (IC7, pin6), and the ground to TP1 (C12) and with R63 adjust to 1.55 V.
- Insert the cassette into the compartment.
- Connect the voltmeter to TP2 (IC7, pin6), and the ground to TP1.
- Readings: oxide coating < 1 V
  Leader > 4 V
- With the trimmer potentiometer (R63) adjust the voltages in such a way that they are symmetrical to the switching threshold of 2.5 V.
- Rewind the cassette completely. The cassette recorder should stop when the leader is reached. In play mode it should park at the beginning of the oxide coating, enter stop mode, and reset the real-time counter to zero.

4.3.2 Aligning the tacho signals

The four tacho signals of the spooling motors should be aligned in spooling mode to a nearly symmetrical square-wave signal.

- Connect the CRO to the test points on the SYSTEM CONTROL A721. Connect the ground to TP1 (C12).
- Insert a cassette into the compartment and rewind it.
- Align the square-wave signal symmetrically by means of the trimmer potentiometer specified in the table.

TP	Test point	Trimmerpotentiometer
TP3	IC10, Pin2	R15
TP4	IC10, Pin1	R16
TP5	IC10, Pin14	R17
TP6	IC10, Pin13	R18

4.3.3 Adjusting the line level

- Connect the audio generator to the INPUT [35].
- For adjusting the left-hand channel connect the audio voltmeter to test point TP2 (C52) on the NR-SYSTEM; for adjusting the right-hand channel connect the audio voltmeter to TP3 (C47). Connect the ground to TP1 (C82).
- With the CAL/UNCAL key [15] change over to calibrated level (UNCAL indicator [12] is dark).
- Switch to SOURCE with the MONITOR [9] key.
- Feed a 500 Hz sine wave voltage from the generator with a level that should produce line level with a magnetic flux of 200 nWb/m.
- On the BALANCED IN/OUT A721 set the test point voltage to 580 mV. Trimmer potentiometer R23 adjusts the left-hand channel, R19 the right-hand channel.
- Connect the audio voltmeter to the line OUTPUT [36].
- Set the desired line level with the aid of the trimmer potentiometer R144 (left) and R143 (right).

Note:
The cassette tape recorder is shipped ex factory with the following settings:
A line level of +4 dBu = 1.23 V gives a magnetic flux of 200 nWb/m.

4.3.4 Adjusting the peak meter

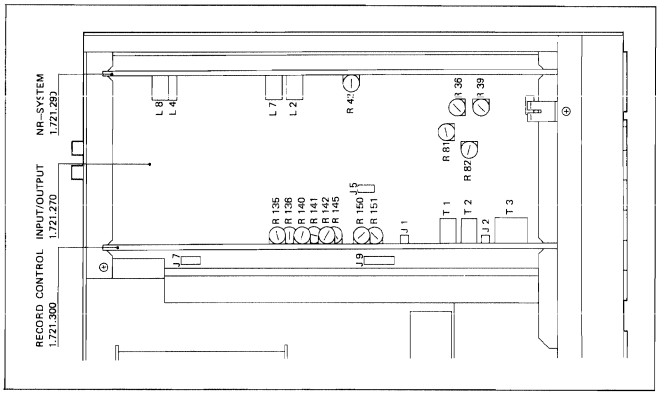
- Adjust the line level (Section 4.3.2).
- Using the same audio generator setting (line level, 500 Hz) and recorder settings (SOURCE, CAL) as described in Section "4.3.3 adjusting the line level", align the peak meter to 0 dB by means of trimmer potentiometer (R26).

Notes:
- With the monitor switch in the SOURCE position, the peak meter indicates the calibrated line level, in the TAPE position the actual line level. (The changeover has no influence on the output level, only the indication changes).
- When the jumper J1 on BALANCED IN/OUT is in position A, the calibrated value is always displayed in record mode, i.e. also when the monitor switch is in the TAPE position.
- In record mode the peak meter operates with a treble boost that depends on the tape type.

4.3.5 Aligning the MPX filter

- Switch to calibrated level by pressing the CAL/UNCAL [15] key (UNCAL [12] indicator is dark).
- Switch to SOURCE by pressing the MONITOR [9] key.
- Connect the audio generator to the INPUT [35].
- Connect the audio voltmeter to the line OUTPUT [36].
- From the audio generator feed 19 kHz ±20 Hz with line level (0 dB).
- Activate Dolby-B or Dolby-C by pressing the NR SYSTEM [19] key.
- Switch on the MPX filter (MPX [23] key).
- With the tunable inductors L2 (left-hand channel) and L4 (right-hand channel), align the output voltage to the minimum.
- The attenuation of the filter should be > 30 dB.

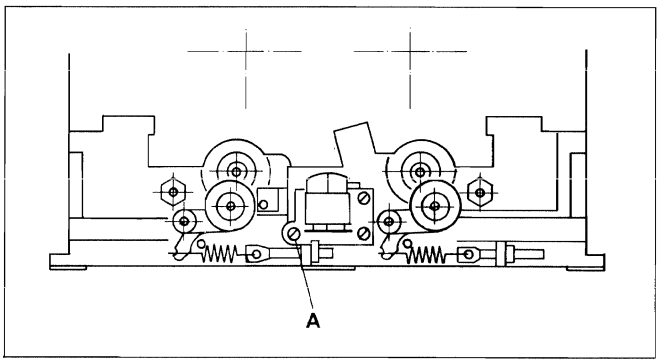
Note:
It is easier to align these two inductors when the RECORD CONTROL A721 module is removed first.



4.3.6 Adjusting the azimuth of the soundhead

- Switch off the cassette tape recorder.
- Use a moist felt stick (included in STUDER cleaning kit) to clean all parts that come in contact with the tape.
- With the demagnetizing choke demagnetize the capstan shafts, pinch rollers and shafts, soundheads, centering and retaining pins.
- Insert the reference cassette IEC I into the cassette compartment and play the section "azimuth alignment 10 kHz".
- Connect the line OUTPUT [36] of both channels either
  - to the inputs of the 2-channel oscilloscope and while playing the reference cassette, align for minimal phase difference in the output signal by means of adjusting screw [A] on the head block,

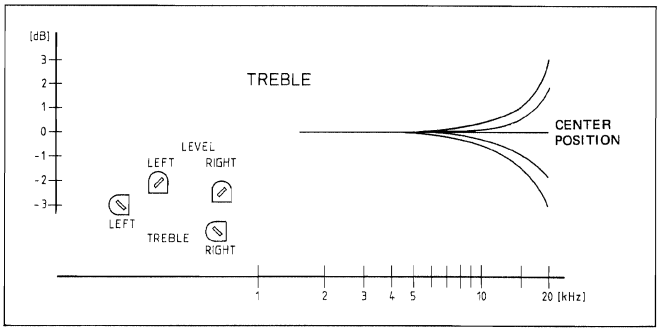
  or
  - to the inputs of a millivoltmeter with summing facility, and while playing the reference cassette adjust for maximum aggregate level of the outputs by means of adjusting screw [A] on the head block.



4.3.7 Reproduce level and frequency response

- Switch of the cassette tape recorder, clean all parts that come in contact with the tape and demagnetize them.
- Connect the AF millivoltmeter to the line OUTPUT [36].
- Insert the reference cassette IEC I into the cassette compartment and play the "level tone" section.
- At the level tone with a magnetic flux of 250 nWb/m, adjust the output level on the BALANCED IN/OUT module to 1.55 V by means of the trimmer potentiometers R71 (left-hand channel) and R69 (right-hand channel) to obtain a standard level setting von +4 dBu at 200 nWb/m.
- The upper end of the reproduce frequency response can be linearized with the trimmer potentiometers R224 (left-hand channel) and R75 (right-hand channel) on the BALANCED IN/OUT module.

Note:
The output level can also be measured at the input to the balanced line amplifier:
- Connect the audio voltmeter on the NR-SYSTEM module to TP1 (left-hand channel) or TP2 (right-hand channel), ground to TP3 (C82).
- With the trimmer potentiometers R71 and R69 on BALANCED IN/OUT adjust to a level of 730 mV.



4.3.8 Aligning the oscillator frequency

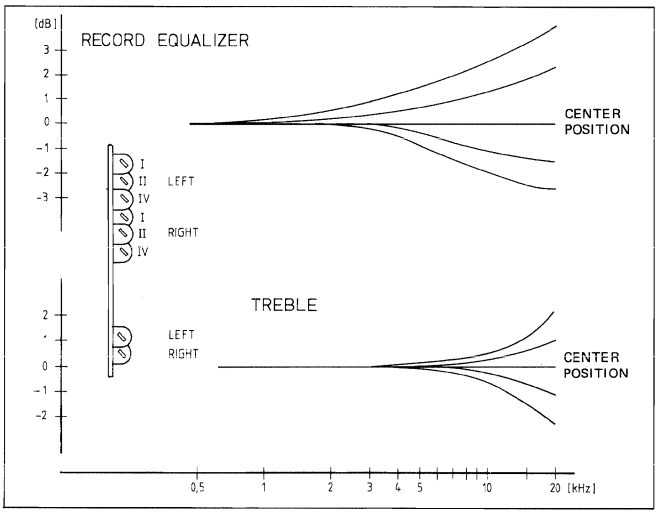
This adjustment is only necessary after the transformer T3 or the erase head has been replaced.

- Insert any cassette into the cassette compartment.
- Connect the frequency counter to test point P3 or P4 on the RECORD CONTROL A721 and connect the ground to TP1 (C33 or C34).
- Switch the unit to record preparation (simultaneously press REC [2] and PAUSE [1]).
- With the tunable oscillator-transformer (T3) align to a frequency of 105 kHz.
- Connect the audio voltmeter to P3 (left-hand channel) or P4 (right-hand channel); connect the ground to TP1.
- Align the tunable transformers T1 (left-hand channel) and T2 (right-hand channel) to minimal voltage.

4.3.9 Basic record equalizer/treble setting

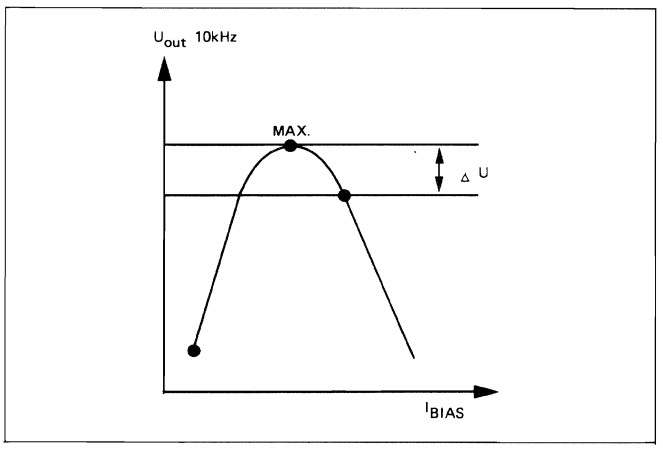
A bias alignment device can be built in accordance with the diagram in Section 5 or be ordered from STUDER INTERNATIONAL AG.

- Connect the bias alignment device to connector J1 on the RECORD CONTROL A721.
- Insert a cassette of the tape type to be calibrated.
- From the audio generator feed a 10 kHz (sine wave) signal to the INPUT [35] sockets with a level that is approximately 20 dB below the line level.
- Connect the audio voltmeter to the OUTPUT [36] sockets.
- Switch off the Dolby noise reduction system.
- Start the unit in record mode (simultaneously press REC [2] and PLAY [4].
- Slowly increase the output voltage of the bias alignment device until the maximum level is measured.
- Write down this maximum level.
- Continue to increase the output voltage of the bias alignment device until the output level has dropped by ΔU depending on the tape type.



Tape type	ΔU
IEC I:	
TDK AD-X	ca. -6,5 dB
Maxell XL I-S	ca. -6,5 dB
BASF LH-M I	ca. -6,5 dB
IEC II:	
BASF CR-S II	ca. -6,0 dB
TDK SA	ca. -7,0 dB
TDK SA-X	ca. -6,0 dB
Sony UCX-S	ca. -7,0 dB
IEC IV:	
Revox Metal	ca. -5,0 dB
BASF Metal IV	ca. -5,0 dB
TDK MA-X	ca. -6,0 dB
Sony Metallic	ca. -6,0 dB

- Leave the settings of the bias alignment device at their current values.
- With the audio generator record at frequency of 500 Hz at the same level.
- Write down the measured output level.
- Set the audio generator back to 10 kHz.
- On the RECORD CONTROL A721 module adjust the trimmer potentiometer that corresponds to the channel and tape type to the same output level as measured with the 500 Hz signal.
  IEC I: R135 (left); R141 (right)
  IEC II: R136 (left); R142 (right)
  IEC IV: R140 (left); R145 (right)



- Set the audio generator to 18 kHz.
- With the trimmer potentiometer R150 (left) or R151 (right) on the RECORD CONTROL A721, adjust to the same output level as measured for the 500 Hz signal.
- The frequency response should be as linear as possible. The absolute level is not relevant.
- Switch OFF the bias alignment device and start the automatic calibration (simultaneously press REC [2] and PAUSE [1]; press ALIGN [22].

4.4 MEASURING THE AUDIO DATA

The following measurements are to be performed individually for each channel (left-hand and right-hand).

4.4.1 Distortion (k_3 at 333 Hz)

- Connect the audio generator to the INPUT [35].
- Connect the selective voltmeter (1kHz band pass filter) to the OUTPUT [36].
- Switch the cassette recorder to calibrated mode (UNCAL [12] indicator is dark).
- Press the NR-SYSTEM [19] key to activate Dolby-B or Dolby-C.
- From the audio generator feed a 333 Hz sine wave signal with a level that corresponds to the magnetic flux of 200 nWb/m (=0 dB on the peak meter).
- Insert a cassette and start the unit in play mode (simultaneously press REC [2] and PLAY [4]).
- The measured value should be better than:
  IEC I < 1.0 %
  IEC II < 1.5 %
  IEC IV < 1.5 %

4.4.2 Signal-to-noise ratio with tape

This alignment should preferably be made after the distortion has been measured.

- Same test setup as for distortion measurement (Section 4.4.1).
- Increase the level of the audio generator until a distortion of 3% is measured.
- Connect the audio voltmeter to the OUTPUT [36]. The indicated level is the reference level (=0 dB).
- Switch off the audio generator but do not interrupt the recording. Switch the audio voltmeter to IEC-A or connect a weighting filter (IEC-A) to the incoming circuit. It indicates the weighted signal-to-noise ratio relative to the reference level. Without the filter, the linear signal-to-noise ratio is indicated.

Tape type	Weighted according to IEC-A		Unweighted	
	Dolby B	Dolby C	Dolby B	Dolby C
IEC I	> 63 dB	> 70 dB	> 56 dB	> 58 dB
IEC II	> 65 dB	> 72 dB	> 56 dB	> 58 dB
IEC IV	> 65 dB	> 72 dB	> 56 dB	> 58 dB

The values in this table apply to peak level recording (k_3 = 3 %) with modern tapes. If they cannot be attained, all metal parts (heads, shafts etc.) that come in contact with the tape should be demagnetized as a first remedial step.

4.4.3 Erase efficiency

- Connect the audio generator to the INPUT [35] and feed a 1 kHz sine wave signal.
- Connect the selective voltmeter to the OUTPUT [36].
- Insert a new or erased cassette type IEC IV into the compartment.
- Switch off the Dolby noise reduction system.
- Record a 1 kHz signal, recording level + 6 dBm, on a short tape section.
- Rewind the tape (press LOCATE [7]) and switch off the audio generator.
- Start the unit in record mode (simultaneously press REC [2] and PLAY [4]).
- The erase efficiency should be > 69 dB.

Note:
Measuring with the tape type IV ensures that when the specified measurements are attained, the required erase efficiency is achieved also for all other tape types.
If the erase head has been replaced, the oscillator frequency must be rechecked (Section 4.3.7).

4.4.4 Channel separation

- Connect the audio generator to the INPUT [35] of one channel and feed a 1 kHz sine wave signal.
- Connect the selective voltmeter to the OUTPUT [36] of the other channel.
- Insert a new or erased cassette type IEC IV into the compartment.
- Switch off the Dolby noise reduction system.
- Start the unit in record mode, recording level: 0 dB.
- The channel separation should be > 40 dB.

4.4.5 Wow and flutter

- Clean the capstan shafts and the pinch rollers.
- Connect the wow-and-flutter meter:
  - Connect the measurement oscillator to INPUT [35] and
  - the input of the measuring instrument to the OUTPUT [36].
- Insert a cassette and spool it forward to the middle of the tape.
- Start the recorder in play mode. Set the MONITOR [9] switch to TAPE. Recording level: 0 dBm.
- The measured values should be better than:

  Position: linear (bandwidth = 200 Hz) < 0.2%
  weighted < 0.1 %