NAGRA T-AUDIO

T-AUDIO Time Code

transportable studio recorder

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NAGRA T-AUDIO INSTRUCTION MANUAL

KUDELSKI S.A.

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Nagra Tape Recorders Manufacture

CH-1033 Cheseaux Switzerland

USER MANUAL
TAPE TRANSPORT AND AUDIO ELECTRONICS 1

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1.1 FIRST TIME OPERATION

Before connecting the T-Audio to the mains power supply for the first time, ensure that the voltage selector is correctly set. It is located behind the front cover of the machine and may be set to 110 or 220 volts (+ 15% - 10%). The mains cable may then be connected and the power switched on.

THREADING THE TAPE

Quick release adaptors permit the use of tape reels having NAB, AEG or cinema-type hubs. Each of the hub adaptors is fitted with diametrically-opposed spring-loaded retaining catches which must be fully compressed before the adaptor can be fitted to the recorder. The supply and take-up reels have two alternative spindle positions, to accommodate small reels of up to 20 cm (8") diameter, or large reels of up to 30 cm (11.8") diameter. The outer spindles should only be used with large reels.
Always check that the hub retaining catches have latched correctly before using the recorder.
Having fitted the tape reels, press one of the "Loading" buttons (see page I.1.2-3) and thread the tape as illustrated. The tape passes inside the guide rollers when using large tape reels, and outside the guide rollers when the reel size is less than 20 cm (8").

KEYBOARD

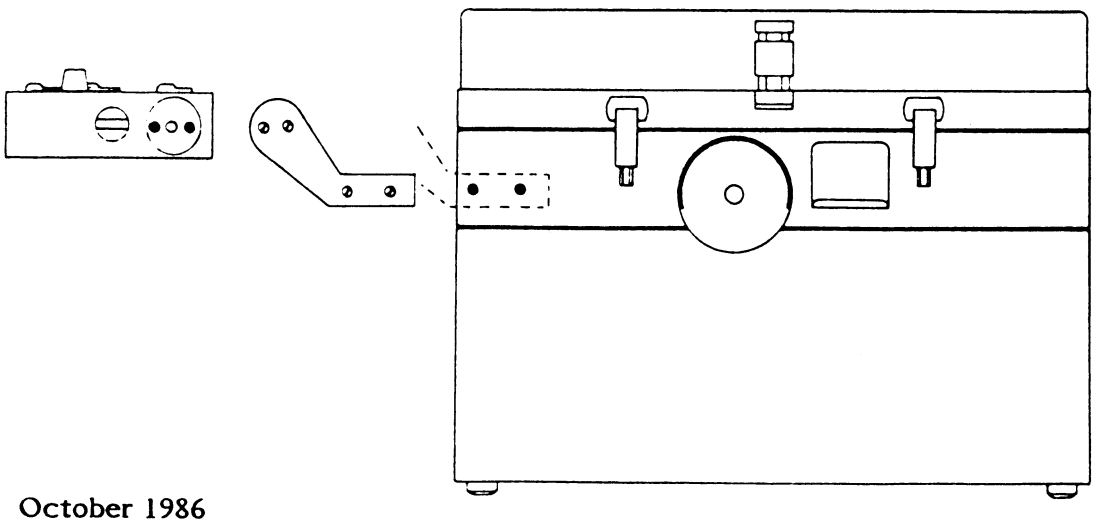
The NAGRA T-Audio can be controlled by two separate standard keyboards connected to either of the two sockets on the side of the machine as well as through the "Remote control Input/output" rear socket (see chapter 1.7) to which any appropriate control device may be connected (additional keyboard, computer, etc.).

CONNECTION OF THE KEYBOARD

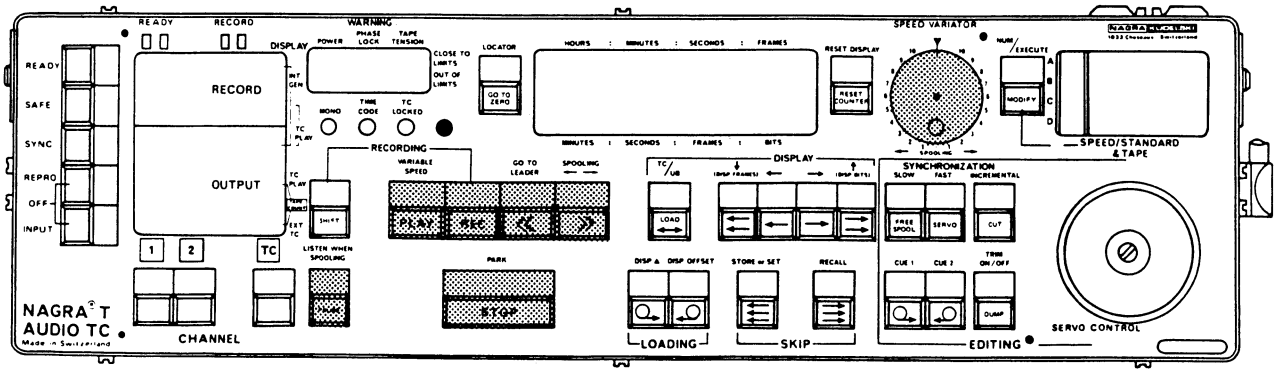
To use the keyboard on the NAGRA T-Audio, connect the cable to the socket on the right-hand side.

To use the keyboard as a remote control, connect the cable to either socket. It must be noted that the left socket is not wired to allow playback or spooling speed variation. A 5 meter extension cable (TAC-5 code no. 09498) is available. The two connectors linking the keyboard cable to the extension cable can be fixed on the upper side of the keyboard by their screws.

NOTE: The length of the remote control cable should not exceed 50 meters (with low noise cable).



1.2 KEYBOARD DESCRIPTION



Each of the five main keys has two different functions, the direct access function marked on the key itself and the shifted function marked above it. The shifted functions can be selected by first pressing the "SHIFT" key and then, the desired main key while still holding down the "SHIFT" key.

NOTE: The LED's inside the keys indicate the direct access function selected. The LED lighting ensures that the selected function is correctly received and decoded.
No function will be accepted if either tensiometers are at end-stop position, except "LOADING" function.

PLAY

The PLAY button starts playback in the twin capstan mode at the speed selected by the SPEED and STD SELECTOR.
The output signal is muted during the start up time. (see page I.2.1-2).

VARIABLE SPEED

SHIFT+PLAY

When selected, it offers up to ± 6% variation by means of the speed variator control.

NOTE: This is operative only if the toggle switch on the speed stabilizer is in its timing variator position (see page I.2.1-5).

RECORD

When the desired channels to be recorded have been set to READY; press SHIFT + REC to start recording, according to the SPEED STANDARD & TAPE setting.

NOTE: See also I.2.1-2 "Record delay".

NOTE: THE functions LOADING - SKIP - EDITING - SPEED/ /STD/TAPE modify and GO TO ZERO are inhibited.
To prevent accidental recording the record function can be inhibited by means of the red switch "Rec. Inhibit" on the right-hand side of the Logic PC board A 02 (see page I.2.1-4).

FAST REWIND

«

By pressing this key the tape will rewind until another key is pressed or until the tape is fully rewound. The value displayed on the counter will be frozen as soon as the tape is fully rewound.

GO TO LEADER

SHIFT + «

This function uses the clear tape detector to stop the recorder when light passes through the tape. For example, leader tape.
When SHIFT + « is pressed, the tape will reverse at the preselected speed until this occurs.

FAST FORWARD

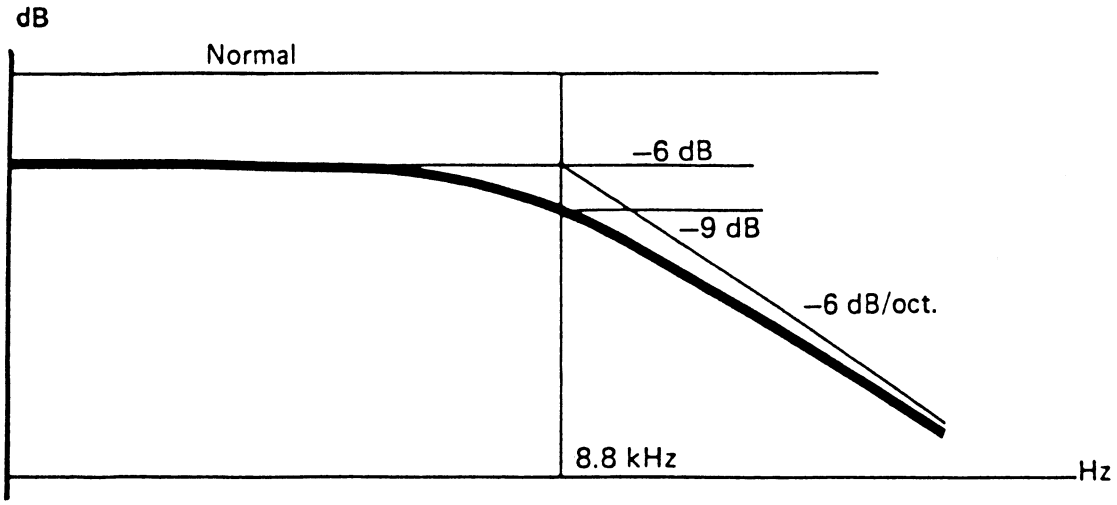
»

This key operates in the same way as Fast rewind but in the opposite direction.

SPOOLING

SHIFT + »

Variable speed spooling in either direction may be selected by pressing SHIFT and the » key. The tape direction and speed is now controlled by the speed variator potentiometer.
To monitor the tape while in variable spooling mode, hold down the PAUSE key. The monitored signal is automatically filtered and attenuated by -6 dB at low frequencies and is increased by a low pass filters having a -3 dB point at 8.8 kHz for comfort.



STOP

Pressing the STOP key overides any function. The machine will stop. This is the recommended start position prior to RECORD or PLAY.

PARK

SHIFT+STOP

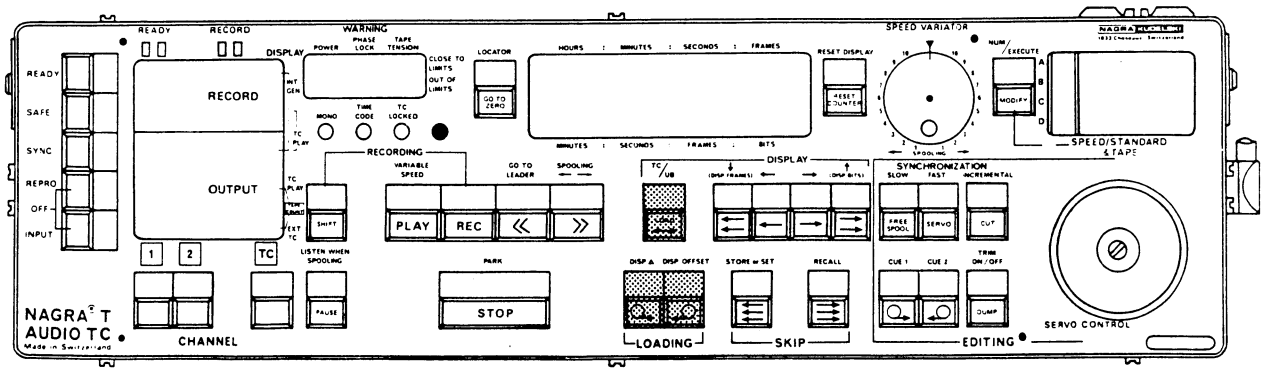
This is the mode automatically selected on power up. This is a standby position with minimal current drain, and should be selected before handling the tape or before power down.

PAUSE

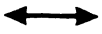
The PAUSE key is non-latching and may be activated in PLAY, RECORD or PLAY with variable speed. Pressing this immediately stops (followed by a small backward movement) the tape until it is released when it continues in the previous mode.

If "SPOOLING" is selected, pressing "PAUSE" will cause the pinch-wheel assembly to move forward bringing the tape into contact with the record head (except on machines without the TASIM option). (See "Spooling").

LOADING FUNCTIONS



Threading a reel of tape on the NAGRA T-AUDIO can be done in three ways either:



A light brake is applied to the reel motors and both tensiometers are inhibited thus permitting easy threading of the tape. When the tape is threaded, rotate the take-up reel until both tensiometers leave their end-stop position and select STOP or PARK.

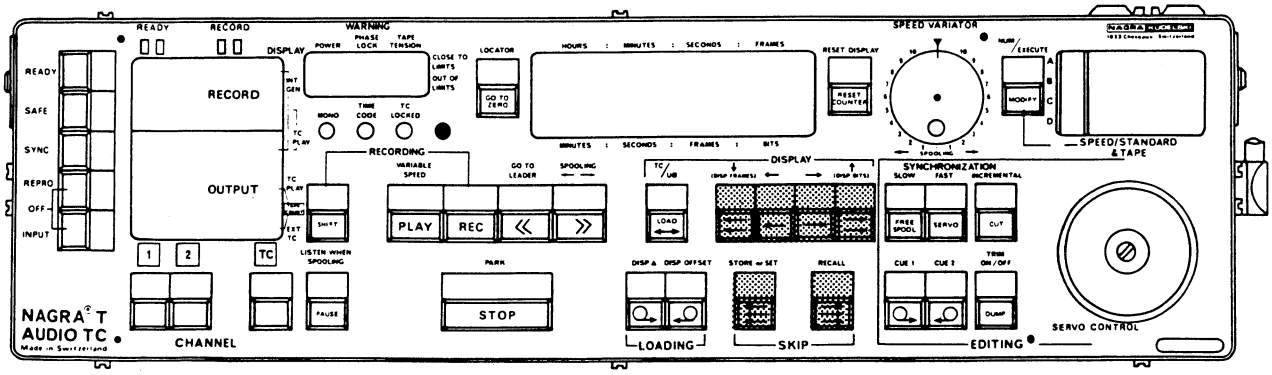
OR

When loading a full left-hand tape reel and an empty right-hand reel, press the Q→ button. The brakes on both tape reel hubs are released, permitting easy threading of the tape and attachment of the tape end to the right-hand take-up reel. When the right-hand reel is rotated a few turns to take up the slack, the left-hand tape tensioning arm leaves its end stop. This provides tension to the tape, then press "STOP" or "PARK"

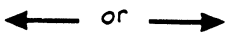
OR

When loading a full right-hand tape reel and an empty left-hand reel, press the ←Q button. The tape may be then threaded in a similar manner as previously described above but this time from right-to-left.

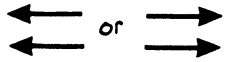
SKIP FUNCTIONS



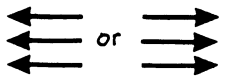
The SKIP functions on the NAGRA T-Audio are divided into three groups each driving the tape at a different speed. These functions stop as soon as the key is released, and the recorder returns automatically to the previous mode.



The tape is always driven by the right capstan only, in either direction at the selected A B C D speed. Monitoring is only active if "REPRO" is selected.



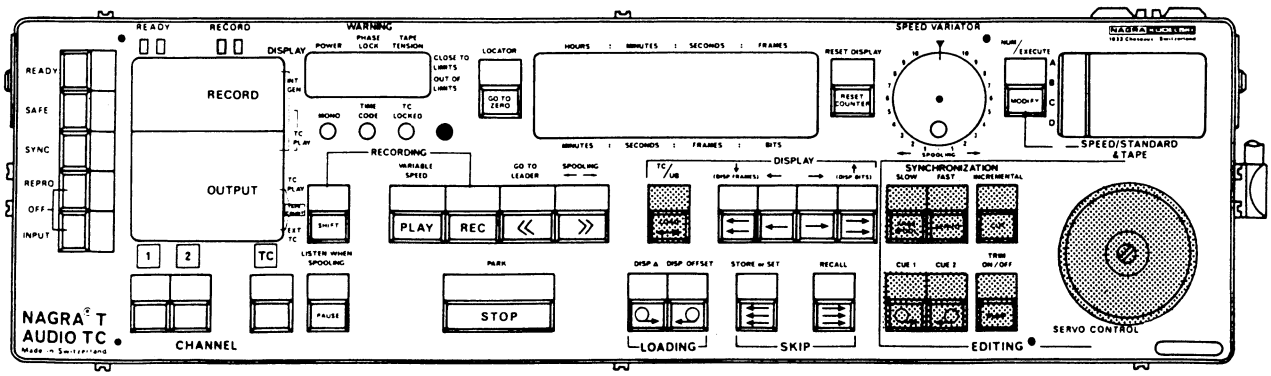
The tape is driven in either direction by the right capstan at 30 ips. Monitoring is active only if "REPRO" is selected with 6 dB attenuation. The 30 ips speed can be internally modified (see page I.2.1-4).



The tape is driven in either direction at approx. 10 m/s. The pinch-wheel assembly is completely disengaged.

NOTE: "Listen" function can be activated in this mode by putting Dil switch S201 in "ON" position.

EDITING FUNCTIONS (for keyboards fitted with editing facilities)



In all editing functions monitoring is enabled if REPRO is selected on the matrix.

FREE SPOOL Function for manual editing of the tape. Pressing the Free Spool button closes the pinch-wheel assembly thereby bringing the tape into contact with the heads. The brakes on both tape reels are released and the tensiometers blocked enabling the reels to be turned by hand.

SERVO Optional servo-controlled editing function (built-in accessory TASC). If the keyboard is not fitted with TASC, pressing the Servo key will only allow the right pinch-wheel to come into contact with its capstan. Pressing the SERVO key closes the pinch-wheel assembly. The reel motors, the tensiometers and right-hand capstan motor are energized. The tape movement is activated by the control-wheel both in direction and in speed. The tape speed is constantly proportional to the rotary speed of the wheel. However, the tape speed cannot exceed 15 ips.

CUT The CUT button moves the tape from directly in front of the replay head to directly above the scissors mounted on the deck.
To operate the scissors, rotate the black button to unlock them.
The tape will then be cut at an angle of 30°.
Remember to relock the scissors after use.

NOTE: Assuming the TASC SERVO option is fitted if not, the tape will just advanced.

After cutting, there are two possibilities for further editing:

A. Servo editing facilities.

Hold the tape with your right hand and locate the second edit point using the servo-control. Press the CUT button while keeping the tape taught over the scissors and cut the tape with the built-in cutter. Select LOADING, the pinch-wheel assembly moves backwards disengaging the tape from the head unit and permits easy splicing of the tape.

NOTE: If the tape length to be removed is long, make use of the "TAPE DUMP" button to find the approximate position and then finely locate the exact position with the servo control.

CAUTION: Be careful not to touch the right tensiometer to avoid unwanted fast winding of the right reel.

B. Manual editing facilities:

Hold the tape with your right hand, select  and pull the tape until the second edit point is found. Press SERVO then CUT to align the tape with the cutter and cut the tape. Then select LOADING to disengage the pinch-wheel assembly.

Handpull to the right. This function can be used for manual editing, using only one hand to hold the right reel. If the right reel is released, the tape will move backwards, accelerate and the recorder will automatically go to the PARK position.
This function is to be used after the tape has been cut to locate the second edit point.

Same function as above but to the left.

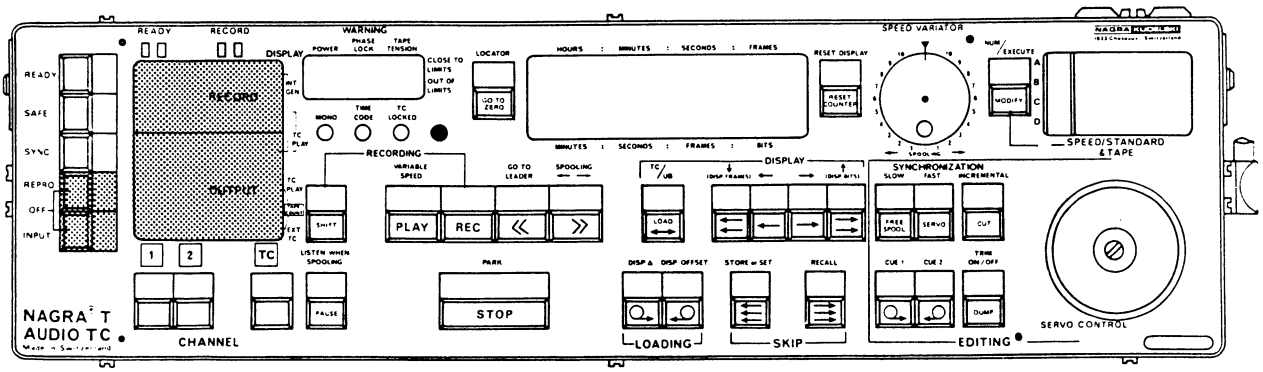
"TAPE DUMP" function. When pressing this key the tape will move from left to right, driven by the right capstan only. The take-up reel motor is not powered causing the tape to fall off recorder. The tape counter value is frozen during this operation.

NOTE: This key is non-latching and when released the recorder returnes to the SERVO function.

1.3 CHANNEL STATUS MATRIX

The LED's on the matrix display clearly show the status of the machine. On power up the status indicated, will depend on position of initialization switches on control logic board (see page I.2.1-1).

STEREO MACHINES



RECORD — The two LED's are illuminated when SHIFT+REC is selected and indicate that bias is applied to the head.

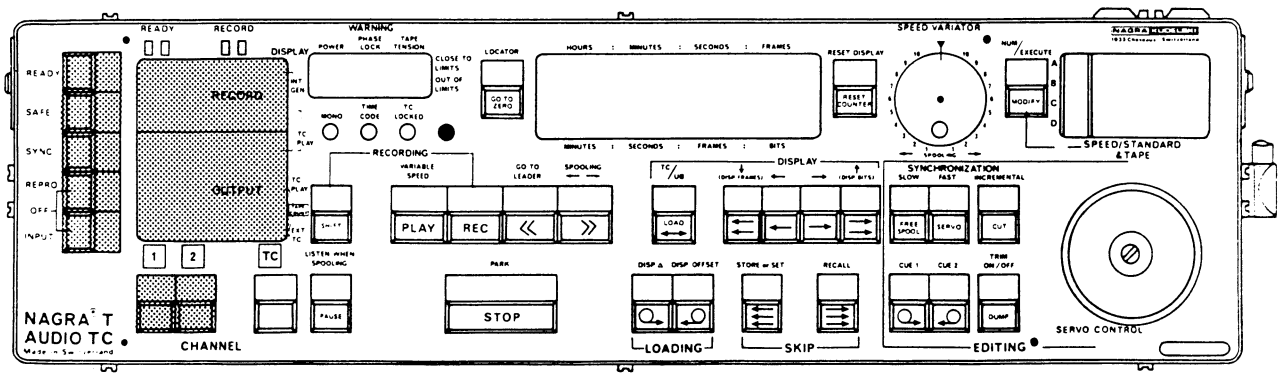
OUTPUT

REPRO — The LED indicates that the line output is connected directly to the playback amplifier.

INPUT — The LED indicates that the line output is connected to the line input amplifier.

OFF — When pressing simultaneously REPRO and INPUT the line output is switched OFF.

TWO TRACK MACHINES



On multitrack machines channel status can be selected for each channel independently. Therefore depress the desired channel key and the status key simultaneously.

RECORD

READY — The LED indicates that the corresponding channel is ready for recording.

SAFE — The LED indicates that the recording is inhibited on the corresponding channel. (See also page I.2.1-4 "REC. INH").

NOTE: Recording is active only if the two LED's marked "Ready" are on. To start recording either:
- Select Ready on matrix and press "SHIFT + RECORD"

or

- Select "SHIFT + RECORD" (the LED inside the REC button lights up) then press READY.

OUTPUT

SYNC — To be used on machines fitted with "Sync" facilities (TASIM optional circuit). The LED indicates that the corresponding channel line output is directly connected to the record head.

REPRO — The LED indicates that the corresponding channel line output is connected directly to the playback amplifier.

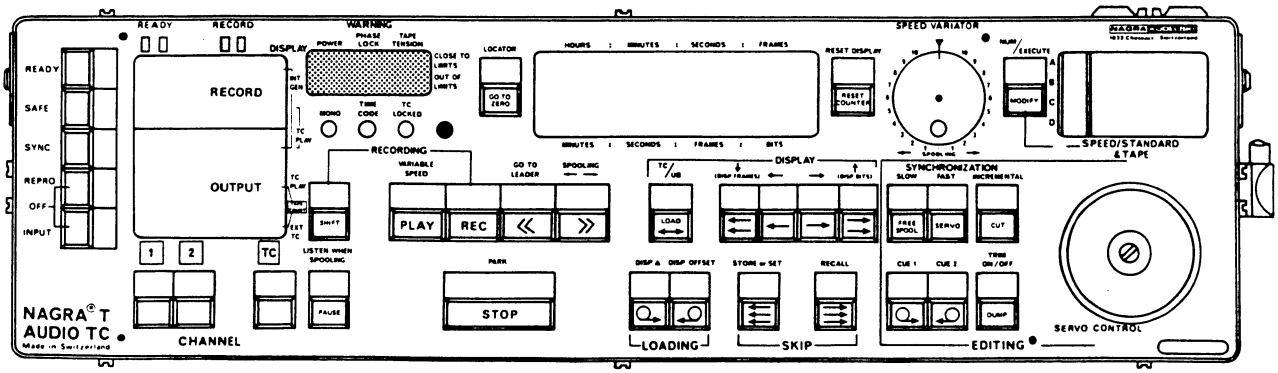
INPUT — The LED indicates that the corresponding channel line output is connected to the line input amplifier.

OFF — When pressing simultaneously REPRO and INPUT the corresponding channel line output is switched OFF.

NOTE: Depending on the selected function, the line output is automatically switched to SYNC, INPUT or OFF without LED indication.
REPRO is switched to OFF during starting up time of "RECORD", "PLAY" and "Variable Speed". It can be programmed to be switched to "INPUT" for "STOP", "FAST FORWARD", "FAST REWIND", loading functions and "PARK" and/or to SYNC during listen operation.

SYNC can be programmed to switch automatically to INPUT or OFF if the channel concerned is in RECORD (see page I.2.1-5 "Sync switch-over).

1.4 WARNING DISPLAY



The warning display indicates two levels of alarm. Close to limits (the upper LED) indicates that there is an error, however the recorder can continue to operate, but should be checked. Out of limits (the upper and lower LED simultaneously) indicates that the error requires immediate attention as the recorder can no longer operate correctly.

POWER Warning indicator for the internal power supply.

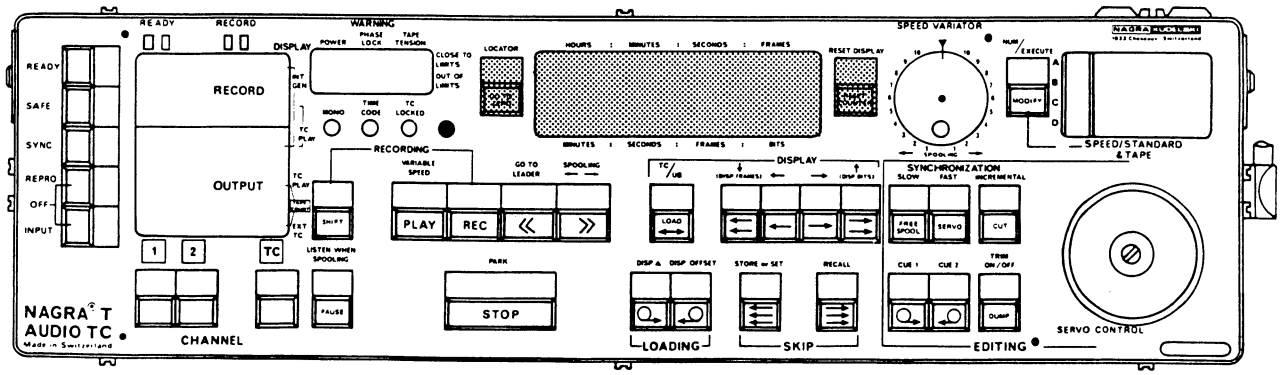
PHASE LOCK Warning indicator for a phase shift between the right capstan motor and internal X-tal generator.

NOTE: The phase-lock LED will always light up during Variable Speed play.

TAPE TENSION Warning indicator for faulty inter capstan tape tension.

MONO LED Light up when the MONO/Multitrack/stereo switch on board A02 is in Mono position (see page I.2.1-1).

1.5 COUNTER FUNCTIONS



The NAGRA T-Audio has a time counter indicating the time in hours, minutes and seconds at all speeds thus allowing exact location of the same "0" point even at a different tape speeds.

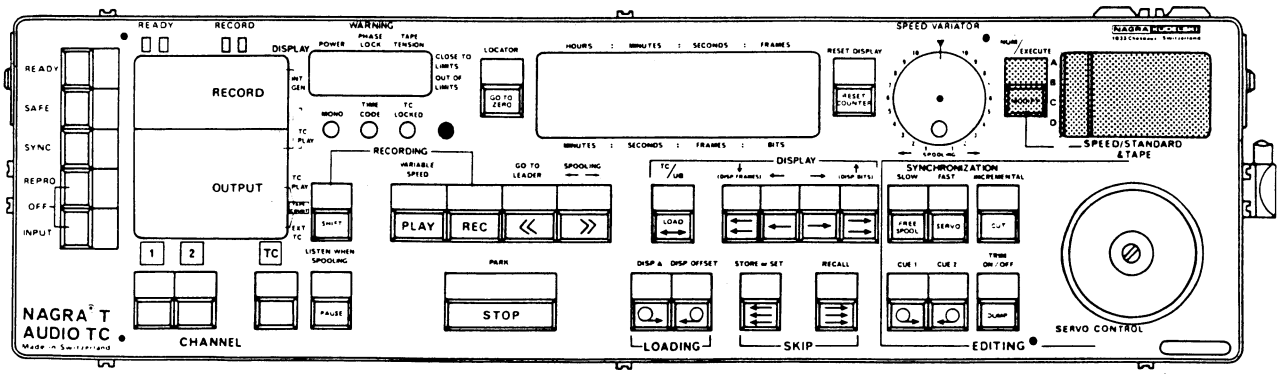
The T-Audio TC uses the same display for time code applications (hours -minutes - seconds - frames).

RESET COUNTER Resets the counter display to zero and starts the count again at any desired point on the tape.
"—" indicates time before the zero point.

GO TO ZERO This function returns the tape to zero point, in all modes except record.

SHIFT+SKIP Holding down the SHIFT key and pressing on the SKIP keys permits entry of any desired time value onto the counter display.
Triple arrow key changes the hours, double arrow key the minutes and single arrow key the seconds.

1.6 RECORDING CALIBRATION SWITCHING



The NAGRA T-AUDIO recording circuits are factory preadjusted to allow the use of up to four recording calibrations for any combination of speed, standard and type of tape. For recording calibration modification or optimization refer to calibration manual.

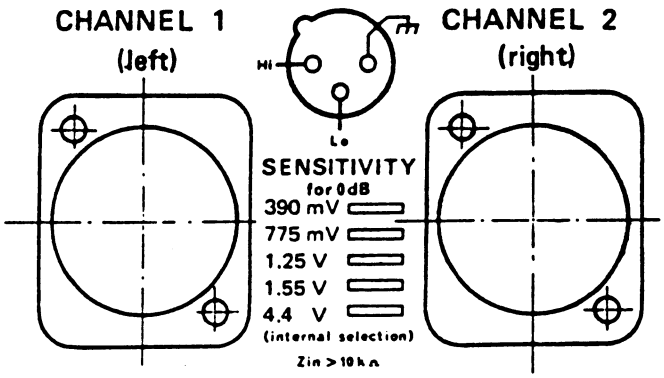
MODIFY

Any of the 4 pre-set recording calibrations can be selected by means of the "MODIFY" key which is marked by a LED. Switching goes from A through D, then repeats itself. When switching ON the recorder, the preset calibration A is automatically selected.

NOTE: This function is also used for selecting the playback speed (see page I.2.1-3 REPRO SPEED-STD SELECT).

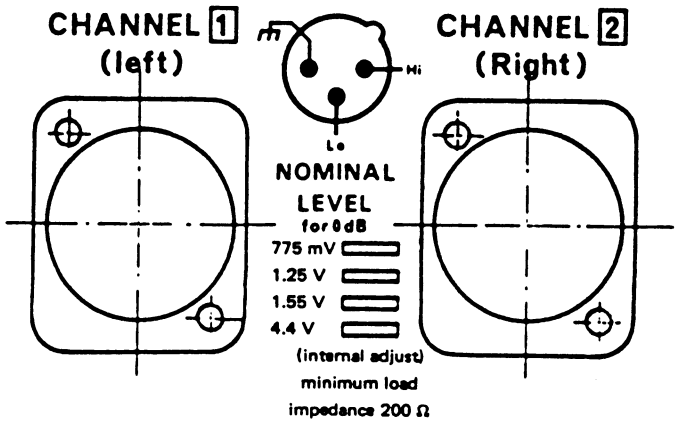
1.7 CONNECTIONS

BALANCED LINE INPUT



For modification of input sensitivity see page I.2.1-5.

BALANCED LINE OUTPUT



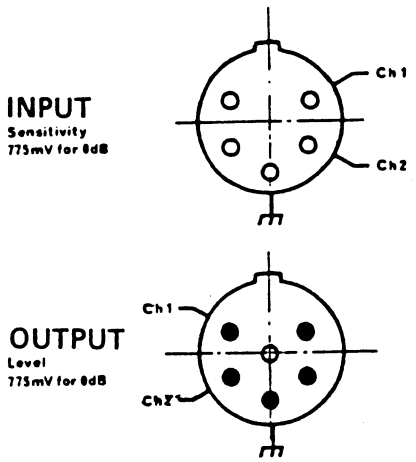
For modification of nominal output level see page I.2.1-6.

HIGH SPEED COPY INPUT AND OUTPUT (Optional TA-PCR)

See also page I.2.1-6.

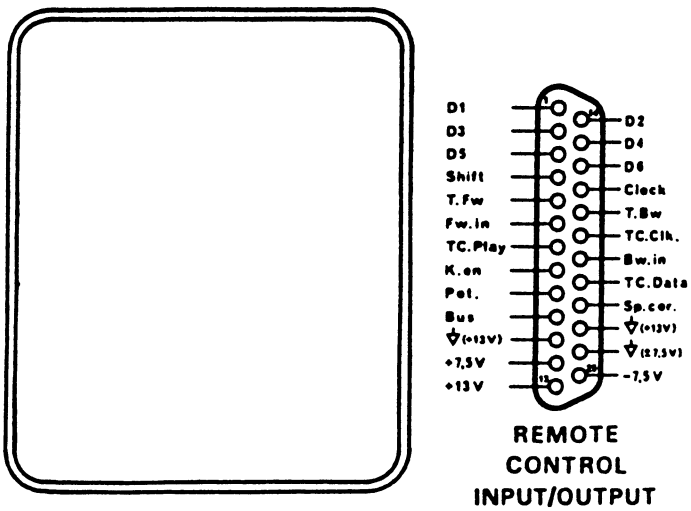
These sockets allow high speed copying (2 or 4 times nominal speed) between two NAGRA T-Audio machines

The input sensitivity and output level are fixed at 775 mV for 0 dB.
The frequency response is 50 Hz - 60 kHz ± 2 dB.



REMOTE CONTROL INPUT/OUTPUT

This socket permits full remote control of the NAGRA T-Audio with an external control device via an appropriate interface (TAERP) or with a supplementary standard keyboard.



Other special remote facilities are also provided. They are:

T Fw (tape forward and T Bw (tape backward) indicates the tape direction.
Fw in (forward) Bw in (backward) when the NAGRA T-Audio is fitted with optional servo-controlled editing, enables the same functions as the servo editing control knob (see page I.1.5-1).

Pot (speed variator pot. pin 9) speed correction value corresponding to the setting of the speed variator control (OV to + 5V)

Sp.cor. (speed correction, pin 22) input of a playback or spooling speed correction signal (- 7.5 V to + 7.5 V).

K en (keyboard inhibit, pin 8) inhibits the use of the keyboard connected to the recorder when grounded.

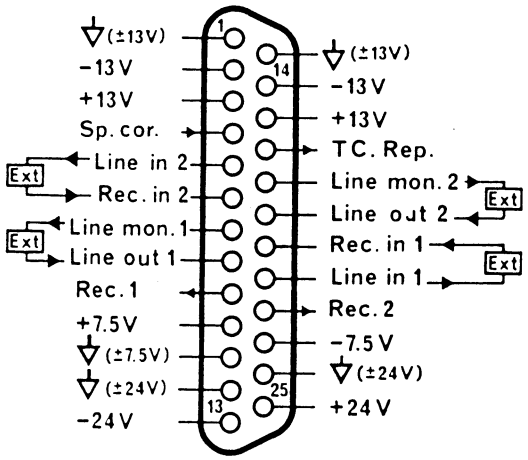
TC play (pin 7) playback or monitoring of the reference signal recorded on the tape.

TC data (pin 21) TC Clk (time code clock, pin 19) output signals from the internal reference generator.

Pin 11 to 13 and 23 to 25 stabilized supply outputs except pin 13 (+ 13 V) which is unstabilized.

AUDIO MONITORING OUTPUT

This socket provides connection for external monitoring console, and external time code devices.
The following connections are possible:



(BJ4)

In 1 and In 2 monitoring of the input signal on balanced line input, after input preamplifier.

Rec 1 and Rec 2 monitoring of the input signal before being recorded on the tape.

Rep 1 and Rep 2 monitoring of the signal recorded on the tape

Li 1 and Li 2 monitoring of the output signal before the output transformer.

NOTE: The signals present at the above outputs are analogue, the nominal level is 775 mV for = 0 dB.

TC In external reference signal input.

TC Rep monitoring of the reference signal recorded on the tape.

Au Rec (Audio Record). The information present at this output can be used to switch on an external indicator to indicate that the NAGRA T-Audio is in Record mode.

Bus serial digital bits input and output. Identical to the one used by the keyboard.

Pin 10 to 13 and 23 to 25 stabilized supply outputs to feed the monitoring console.

The upper six pins of this connector are in view of the TACO-M1 monitoring unit wired as follows as from machine number 195:

1	and	14	⏚ 13 V	
2	and	13	- 13 V	unregulated power supply
3	and	12	+ 13 V	unregulated power supply

2.1 INTERNAL SWITCHINGS

The bridges and other adjusting devices not mentioned in this chapter are reserved either for servicing or adjustment to be carried out at the factory.

ACCESS TO THE PC BOARD

Turn the two quick-release screws located at both upper corners of the front panel.

PC BOARD LOCATION

(Refer to NAGRA T-Audio Set of Schematics code number 2009012 263)

From top to bottom

1. Channel 1 Audio Record/Reproduce circuit + provision for Noise Reduction System
2. Channel 2 Audio Record/Reproduce circuit (empty space in mono machines) + provision for NRS
3. Main Control Logic
4. Speed stabilizer and Tape Transport (servo control of motors)
5. Tape Counter and servo-controlled editing (TASC option)
   Provision for 3rd track record/reproduce circuits
6. Time Code and synchronizer

NOTE: In order to avoid possible damage to the circuits, switch off the recorder before removing any PC Board.

CONTROL LOGIC BOARD

(The switches are listed from left to right)

MONO/MULTITRACK/STEREO switch

Stereo machine

MONO	Input signal on channel 1 recorded on both tracks. Input on channel 2 not taken into account. The mono LED on the keyboard lights up
MULTITRACK	Inoperative in stereo machines
STEREO	Stereo recording

Two-track machine

MONO	Input signal on channel 1 recorded on both tracks. Input on channel 2 not taken into account. The mono LED on the keyboard lights up.
MULTITRACK	Multitrack recording (on channel status matrix)
STEREO	Stereo recording (channel selection keys on the keyboard are coupled)

REPRO SPEED-STD SELECT

Playback speed selector permitting playback of a tape recorded at a speed and standard differing from those preadjusted for recording.
For example, if the preset combinations are 15 ips CCIR, 15 ips NAGRA master, 7.5 ips CCIR and 30 ips AES and the tape you wish to play back was recorded at 7.5 ips NAB.

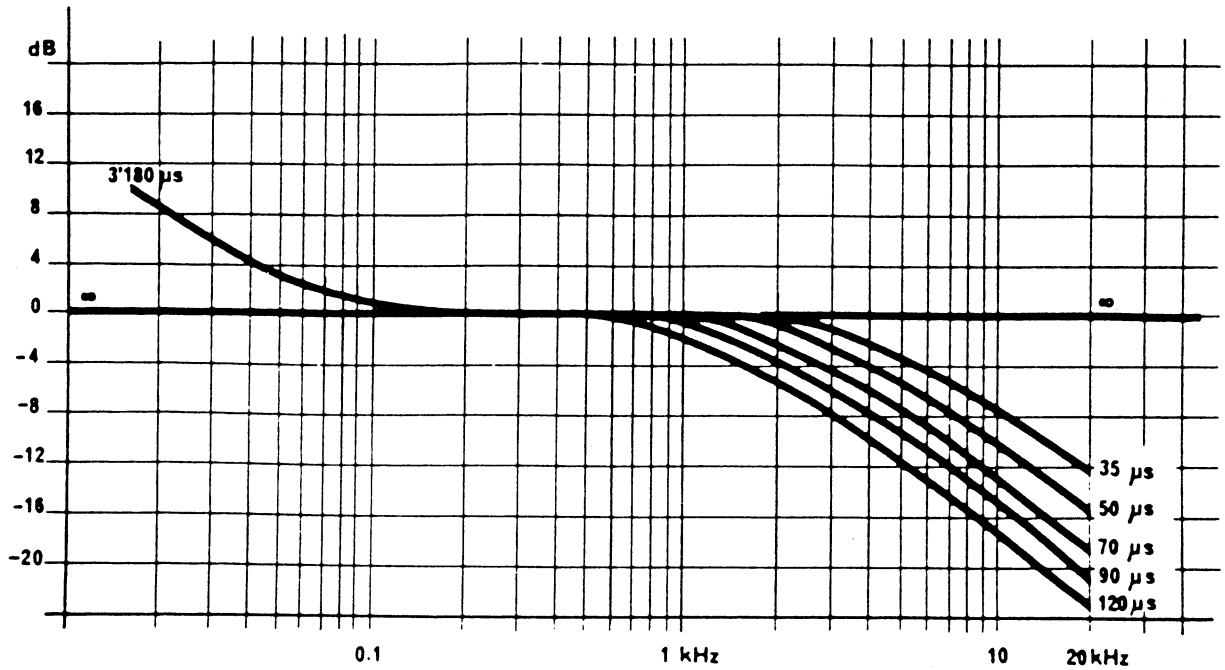
Each switch corresponds to the A B C D positions marked on the keyboard. The numbered position of the switches corresponds to:

Position	Speed cm/s	ips	Standard	IEC designation	Time Constant (us) HF	BF
0	9.5	(3.75)	NAB/CCIR	-	90	3180
1	19	(7.5)	CCIR	IEC 1	70	°°
2	38	(15)	CCIR	IEC 1	35	°°
3	76	(30)	CCIR	IEC 1	35	°°
4	19	(7.5)	NAB	IEC 2	50	3180
5	38	(15)	NAB	IEC 2	50	3180
6	38	(15)	Nagramaster	-	13.5	3180
7	76	(30)	AES	IEC 2	17.5	°°

In the above axample, the position of the switches would be:

A	B	C	D
2	6	1	7
15 ips	15 ips	7.5 ips	30 ips
CCIR	Nagramaster	CCIR	AES

whereas to play the 7.5 ips NAB recording on of the switches should be set to position 4.



NOTE: As the switch settings also correspond to preset recording speeds, switch back to the original position before recording.

INITIALIZATION

Switches located on the main logic board A02 control the initial matrix-selected function when the recorder is switched on.
To select the function, set the switch to ON.

NOTE: These switches have no effect in the time code version.

1 Ready	Initialization to be used only with multitrack machines.
2 Safe	For stereo and mono machines set Ready ON and Safe OFF. If Safe is switched ON the recording is inhibited.
	NOTE: If both switches are in the ON position, the Safe function will be active.
3 Repro	Line output initialization.
4 Input	
5 Off	If more than one switch is in ON position, the further right will be taken into account i.e. Input or Off.
6 Inh Sync	To be used on machines fitted with "Sync" playback facility. Set to ON position, it inhibits the selection of "Sync" on matrix display.
7	Slows down the maximum speed in fast forward or fast rewind.
8	Listen function when using skip (three arrows) function.

CLEAR TAPE FUNCTION

Selects the automatic function when a transparent/translucent portion of tape is detected during Play or Record.

Stop	The recorder selects the STOP mode
Off	The clear tape detector is inhibited
Rewind	The recorder rewinds the tape at high speed until another function is is selected or the tape is fully rewound.

Stop, Off and Rewind: the recorder selects "Stop" if "Go to leader" is selected.

REC INH

Inhibits the recording function independently from Ready of Safe initialization. If SHIFT + REC is selected the recorder goes into PARK mode.

SKIP SPEED MODIFICATION

As mentioned in the Keyboard Function chapter the speed corresponding to the skip key can be modified. The skip speed modification depends on the playback speed selected on the control unit (see below).

First switch off the recorder and remove the control logic PC Board. Locate the two diods CR205 and CR 204 in the line of components labeled "G" (fifth line from the front of the PC board)

	Playback speed (ips)			
CR205 and CR204 in place (ex works preset)	3.75	7.5	15	30
CR205 removed	30	30	30	30
CR204 removed	15	30	15	30
Both CR205 and CR204 removed	7.5	7.5	30	30

SYNC SWITCH OVER

The switches are located in the upper left-hand corner of the board (B line).

On machines fitted with TASIM option (playback through record head) automatically switches the sync playback output to the input or to OFF when Ready is selected on channel status matrix. In machines not fitted with TASIM option, set to Input position.

SPEED STABILIZER BOARD

SYNCHRONIZER/TIMING VARIATOR

Synchronizer — Automatic playback speed variation when an internal or external synchronizer or an external speed vatiator is used. The external device must be connected to pin 22 (speed correction) of Remote control Input/output connector. Control signal level must be between + and - 7.5 V.

Timing Variator — Manual playback speed variation using the speed variator of the keyboard or control through external device with low output impedance connected to pin 9 Pot. of Remote Control Input/Output connector. Control signal level must be between 0 and 5V.

AUDIO BOARDS

CAUTION: On stereo machines do not interchange audio boards 1 and 2, as only board 1 has active erase circuitry.

REPRO/INPUT

Switches the LED modulometer display either to Input signal or Playback signal

INPUT Sensitivity Selection

The input sensitivity is modified by moving a bridge located to the right of the two transformers.

The following connections may be established:

1 input sensitivity = 4.4 V for 0 dB (+15 dBm)
2 input sensitivity = 3.1 V for 0 dB (+12 dBm)
3 input sensitivity = 1.55 V for 0 dB (+ 6 dBm)
4 input sensitivity = 1.25 V for 0 dB (+ 4 dBm)
5 input sensitivity = 0.775 V for = dB (0 dBm)

if the bridge is removed input sensitivity = 0.390 V for 0 dB (-6 dBm).

OUTPUT Sensitivity Modification

The output sensitivity is factory set to 4.4 V for 0 dB. It can be modified by altering the position of the jumper on the output amplifier. The level adjustment RP1 trimmer is located in the right-hand corner of the board behind the modulometer circuit.

ST-1	0.775 V
ST-2	1.25 V
ST-3	1.55 V
Without bridge	4.4 V

NOTE: A soldering bridge is used for this selection on machines with serial numbers up to 0900190.

HIGH SPEED COPY (30 ips) Switchings
(If option is fitted)

Switch one is located on the left-hand side of the board, behind a trimmer and switch two in the middle, near two IC's. Both must be set in the same way: either NORM or COPY

NORM Normal configuration

COPY Configuration for 30 ips high speed duplication

The High Speed Copy facility permits duplication of a tape at high speed with a frequency response of up to 60 kHz if the recorder is fitted with a preset recording circuit for the 30 ips speed (position D on SPEED/STANDARD & TAPE display).

This position allows either normal recording of a tape at 30 ips or tape duplication at 30 ips.

- signals are injected into the two balanced inputs on the back of the machine.
- both red switches on the audio board(s) are set to the NORM position.

NOTE: The frequency response is limited to 20 kHz and the HIGH SPEED COPY input is disconnected.

For high speed copying (30 ips):

- signals are injected into the HIGH SPEED COPY input on the back of the machine.
- both red switches of the audio board(s) are set to the COPY position.

NOTE: The frequency response is extended to 60 kHz and the BALANCED LINE INPUTS are not connected.

The position of the switches must be taken into account only for the 30 ips speed. It does not affect recording at other speeds.

2.2 STANDARD EX FACTORY SETTING

STEREO MACHINES (NTA-S)

Control logic board	Stereo	
	Rec delay: tape length	
	Initialization:	1 on
		2 off
		3 on
		4 off
		5 off
		6 off
	Clear tape function:	off
	Rec Inh:	off
Speed Stabilizer	Timing Variator	
Audio board	Input	
	Input sensitivity: 1.55 V	
	Output sensitivity: 4.4 V	
	High speed copy: Copy if fitted with 30 ips AES/Copy preset calibration	

TWO TRACK MACHINES (NTA-2)

Control logic board	Multi track	
	Rec delay: tape length	
	Initialization:	1 on
		2 off
		3 on
		4 off
		5 off
		6 off
	Clear tape function:	off
	Rec Inh:	off
Speed Stabilizer	Timing Variator	
Audio board	Input	
	Input sensitivity: 1.55 V	
	Output sensitivity: 4.4 V	
	High speed copy: Copy if fitted with 30 ips AES/Copy preset calibration	

OPTIONS

3.1 TAHP Phones output

This optional circuit allows monitoring of the recorded signal using either headphones or the built-in loudspeakers.

The controls on the right side of the machine permit monitored channel selection, phones or loudspeaker output selection and volume adjustment. A standard stereo jack is provided on the same side as well as two monitoring speakers located on the front of the machine.
The last position of the monitored channel selector has two possibilities (stereo or mixed). The desired possibility is selected using the blue micro switch on the TAHP board inside the machine.

NOTE: The signal can also be motioned using an external amplifier connected to pin 7 Li. 1 and pin 18 Li.2 of the rear Audio Monitoring Output connector.

3.2 TASIM Self-Sync amplifier

The TASIM optional circuit permits monitoring of the recorded signal directly through record head. This function is mainly used for simultaneous recording purposes on two track machines. To operate a simultaneous recording simply select SYNC output and SAFE for the channel to be monitored, on the keyboard and select Ready on the channel to be recorded.

The signal of the monitored channel is present on TAHP phones output or loudspeaker, on balanced line output of on pin 7 Li.1 or pin 18 Li.2 of the Audio Monitoring Output rear connector.

NOTE: The TASIM circuit is only a monitoring facility consequently its bandwidth is limited to about 60 Hz-12 kHz $\pm$ 3 dB at 15 ips.

3.3 TASIM-2 Self-Sync amplifier

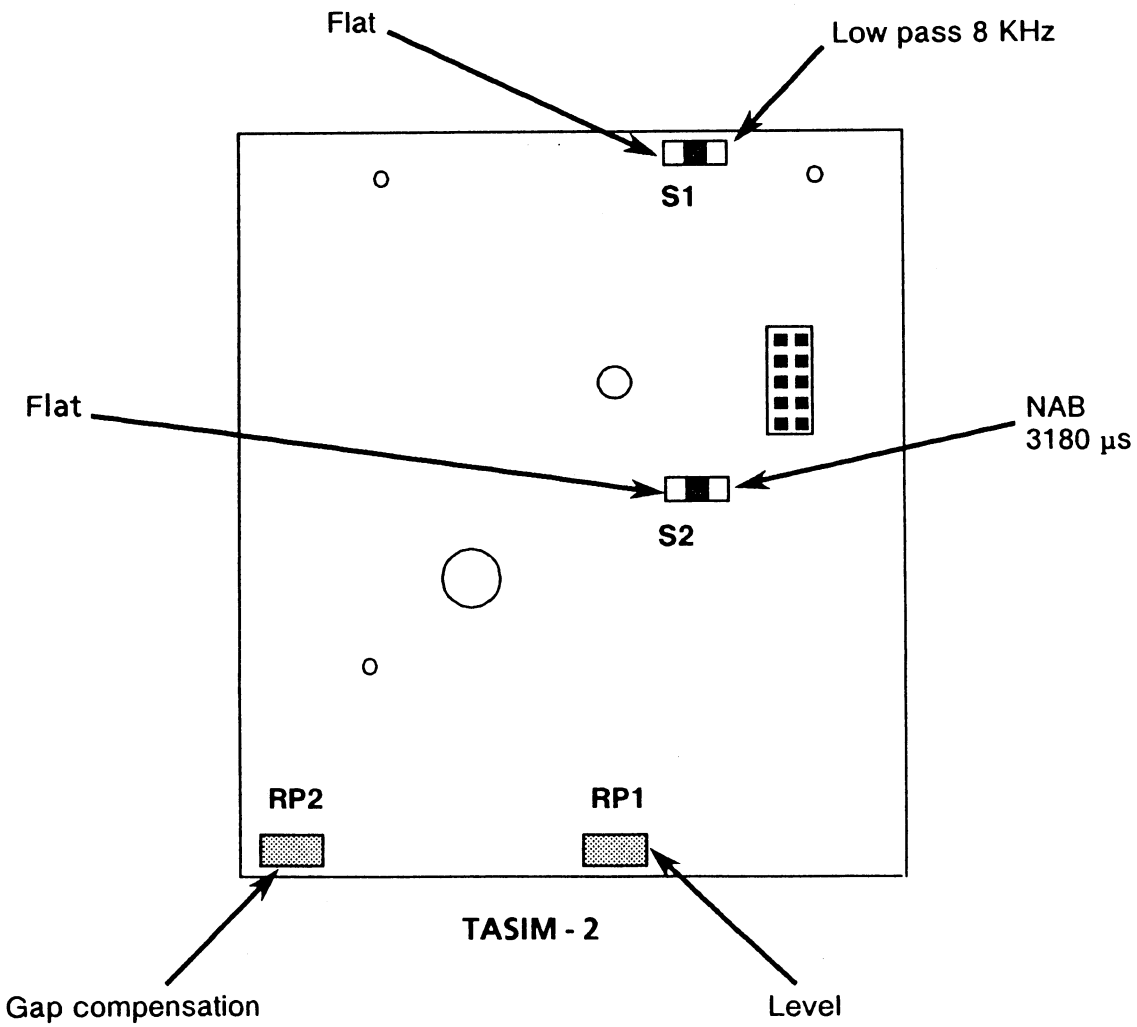
The TASIM-2 is a new and considerably improved version of the TASIM which it replaces.

The main areas of improvement are a more than 25 dB better signal-to-noise ratio and an extended bandwidth (provided the new 10 micron gap record head is used).

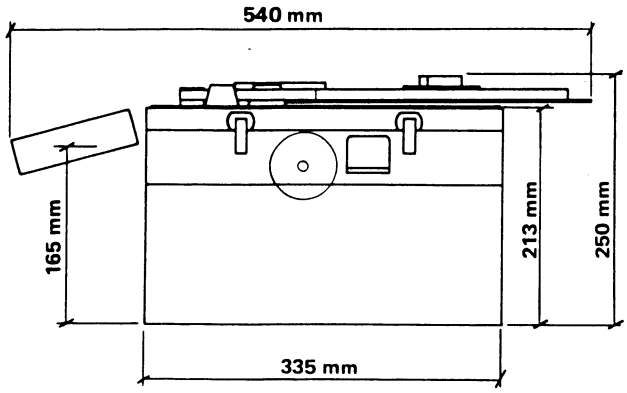
The TASIM-2 is functionally identical to the TASIM and its operation is the same except for two new internal switches.

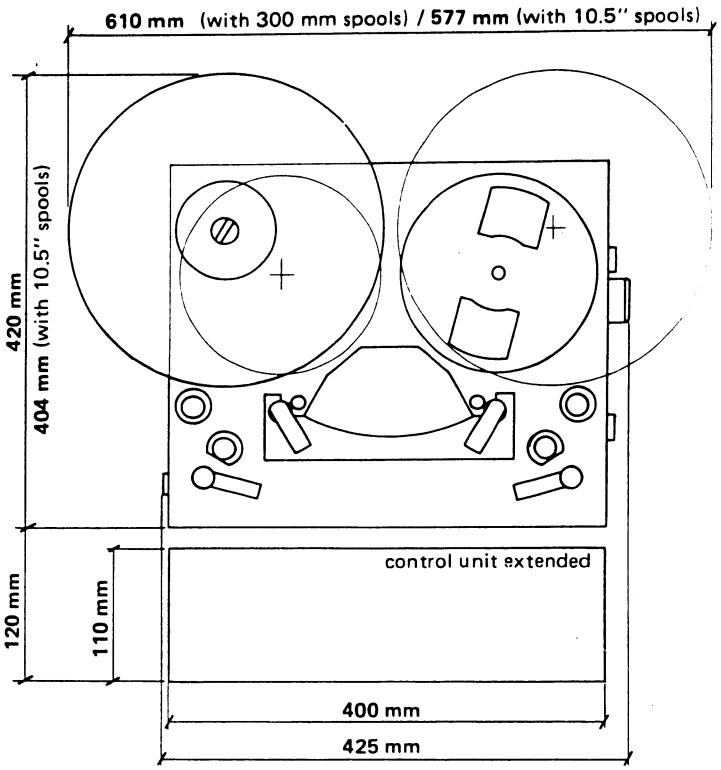
Switch or bridge S1 (on the edge of the board) connects a low-pass filter at 8 kHz (low-pass position) or leaves the upper end of the band flat.

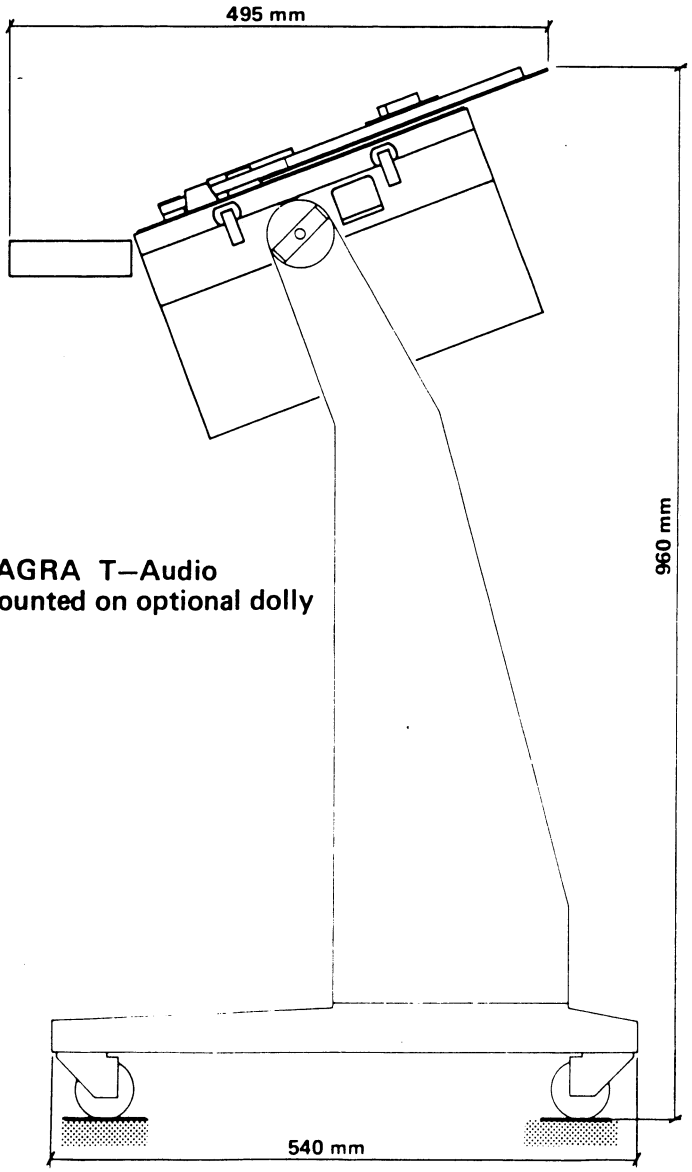
Switch or bridge S2 (in the middle of the board) enables a low-frequency 3180 microsecond equalization for the NAB standard (NAB position) in any speed or standard, or disables it (flat).



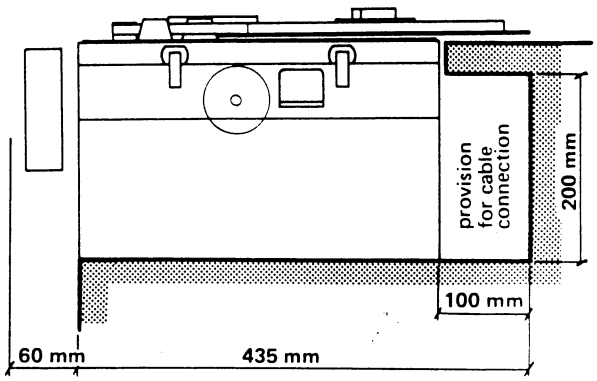
NAGRA T–Audio DIMENSIONS







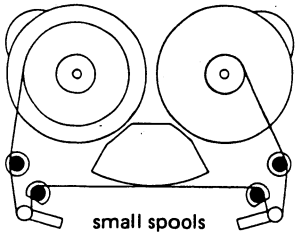
NAGRA T–Audio
mounted on optional dolly

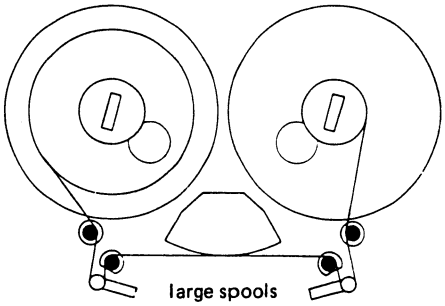


Installation dimensions for fixed or semi–fixed applications
(control unit folded)

TAPE THREADING

OXIDE IN

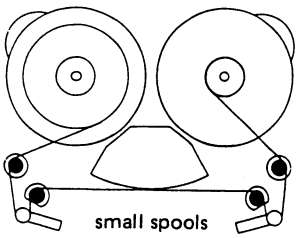


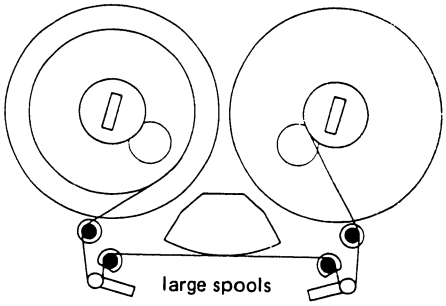


TAPE OXIDE POSITION

TAPE THREADING

OXIDE OUT

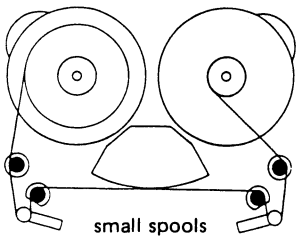


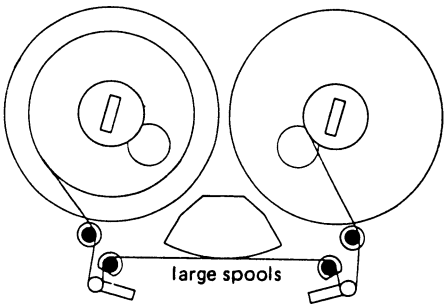


TAPE OXIDE POSITION

TAPE THREADING

OXIDE IN
OXIDE OUT

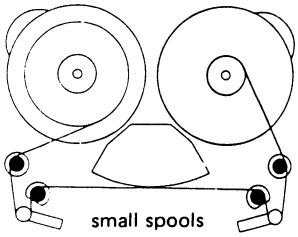


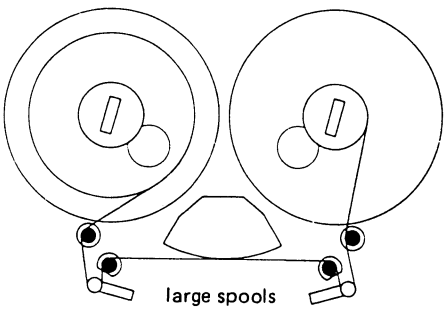


TAPE OXIDE POSITION

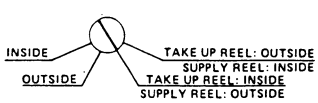
TAPE THREADING

OXIDE OUT
OXIDE IN





TAPE OXIDE POSITION



USER MANUAL
TIME CODE SECTION AND PILOT OPTIONS 2

TABLE OF CONTENTS

1.0 INTRODUCTION

The NAGRA T-Audio exists in three mechanically identical versions.
The only feature which differentiates the T-Audio Timecode from the other versions is a center track for time code recording and the necessary electronics to generate, record and read time code signals according to the SMPTE/EBU standard.
This section only describes the time code and pilot functions of the NTA.2.TC.
For information concerning the tape transport and audio electronics refer to section 1 of this manual. Consequently anyone not yet familiar with the characteristics of the machine should read that section first.

CONFIGURATION

The NAGRA T-Audio TC is equipped with two time code readers, a time code generator, and optionally with a time code synchronizer and insert editor. One microprocessor performs all these tasks.
As a result, most functions are in software, which makes the system very flexible with respect to any future improvements. A number of sheets to add or to replace in this manual will follow every software upgrade. Each page is therefore marked with the date of its issue or last important modification.
Appendix C describes the operational differences between the software versions and the date of their issue.

PERMANENT MEMORY

The time code board is fitted with a back-up battery (Lithium). It powers a permanent memory in which all stored data is preserved when power is switched off. The time code generator's real time clock also continues to run, even when the board is removed from the machine.

AUTOMATIC PHASE SHIFT OF TIME CODE SIGNALS

Timecode and audio signals are recorded and read through seperate heads in the T-Audio TC headblock. The standard prescribes that both time code and audio must be recorded on tape in accurate phase (max. allowed error 0.5 ms) and, for ease of operation, time code and audio must be available in phase at the output connectors. In both record and playback modes the microprocessor therefore shifts the time code signal (by calculation) in order to obtain the proper phase correlation obviously taking into account the selected tape speed.

SYNCHRONIZER

The optional time code synchronizer is remarkably rapid due to the fact that T-Audio TC has a low inertia tape transport and also that the synchronizer is not a separate device but integrated in the control logic system of the machine.
The synchronizer can synchronize on the audio record or playback head depending on the mode of operation.
OFFSET is automatically calculated in the INCREMENTAL mode which allows rolling back from a scene into the preceding one, and play forward again to the selected take with immediate synchronization at the very first frame.
See page II.4.0-1.

AUTOMATIC EDITING

Edit entry and edit exit memories are provided for automatic editing. These features allow integration of the machine in an automated post-production system through the use of the optional RS-422 remote control port. See pages II.5.0-1 and II.7.0-1.

CUSTOMIZING

A number of switches for the selection of operating modes are located mainly on the front edge of the T-Audio time code board. As most of these selectors are taken into consideration only during power up of the machine, make sure to push the "CPU-RESET" key after any modification, in order to have their position read by the microprocessor. (From software version 1.6 up, this "CPU-RESET" is done automatically).
Some operational modes are software selected through the execution of numerical commands. See page II.8.0-1.
Switching mains power on or manually resetting the microprocessor will automatically result in display of the status display menu. See page II.1.4-1.
For further details on the customizing selectors see page II.1.3-1.

PILOT OPTIONS

The NAGRA T-Audio time code is the first machine designed as a time code chasing audio tape recorder, specifically intended for video post-production. In order to maintain compatibility with existing pilot systems, optional hardware is available for playback of pilot tapes. This makes the NAGRA T-Audio TC a universal transfer recorder.
A unique combination of features provides the possibility to stripe synchronously a NEOPILOT tape with time code.
For further details see page II.6.0-1.

1.1 SPECIFICATIONS

This chapter only describes the specifications related to the time code and pilot sections of the T-Audio. For audio and tape transport specifications refer to the first section of this manual.

TIME CODE GENERATOR

Frame rates	24 fps, 25 fps and 30 fps 29.97 fps (with or without drop frame) with optional TAHSX
Stability	50 ppm from -10°C to +70°C with optional TAHSX: 1 ppm from +10°C to +40°C 2 ppm from -10°C to +60°C

The internal time code generator permits the use of an external time reference. See page II.3.2-1.

TIME CODE RECORDING

Trackwidth:	0.35 mm
Track position:	middle of tape
Recording level:	700 nWb/m peak-peak (rms equivalent 250 nWb/m)
Rise and fall time:	65 microseconds ± 10 microseconds
Audio/TC coincidence:	better than 0.5 ms (approx. 1 bit)

TIME CODE PLAYBACK

Lowest speed:	0.25 x Nominal speed
Highest speed:	60 x Nominal speed for frame rates of 24 fps and 25 fps 50 x Nominal speed for 29.97 fps and 30 fps

The actual maximum shuttle speed depends on the reel size and hub diameter. At any speed automatic dropout compensation occurs with the use of pulses from the high resolution tape counter roller.

CROSSTALK

Residual time code signal on the Audio outputs, with 2 mm audio tracks, when measured with 1/3 octave filter set at 1 kHz and 2 kHz must have a signal to noise "deterioration" better than 1 dB with the Time code.

TIME CODE DECODING

With a tape machine as an external time code source, the limits of decoding its output depend entirely on the quality of the tape transport and the bandwidth of the playback head and amplifiers of the machine. Below, concerns only the limits of the T-audio TC electronics.

Lowest speed:	0.02 (1/50)x Nominal speed
Highest speed:	70 x Nominal speed for frame rates 24 and 25 fps 60 x Nominal speed for 29.97 and 30 fps

SYNCHRONIZER

Accuracy at nominal speed	better than ± 25 microseconds
Manual phase tuning	± 6 time code bits (approx. ± 3 ms)
Possible offset programming:	1/80 th frame steps to maximum 23:59:59:29
Acceleration/stabilization time 19 cm/s tape:	from STOP to nominal speed and LOCKED with a typically 2.5 sec
Dropout and wow protection:	user programmable integration time (factory calibrated at 15 frames)

EDITOR

Duration of insert crossfade: 20 ms
Two memories are available for automatic editing.
Accuracy of auto-editor: ± 5 ms
For more details see page II.5.0-1.

TAPE COUNTER

Accuracy: better than ± 0.2 % (using 50 um back coated tape)

POWER CONSUMPTION

Timecode board in operation:	120 mA on + 13 V unregulated
Draft from back-up battery in standby (idle) mode:	0.015 mA

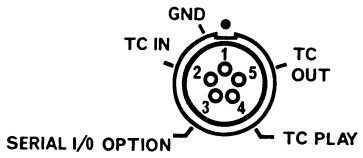
1.2 CONNECTORS

Front side of machine:

TC INPUT/OUTPUT LEMO size A, 5 pin, female

1 Ground
2 TC IN, input of time code, parallel to pin 2 of main time code input
3 SERIAL I/O OPTION, used only when TAIRS option is fitted.
4 TC PLAY, direct output of off-tape time code, paralleled to pin 17 of the "AUDIO MONITORING OUTPUT" connector.
5 TC OUT, output of time code, paralleled to pin 2 of main time code output and pin 13 of the "THIRD TRACK INPUT/OUTPUT" connector.

Fig 1a



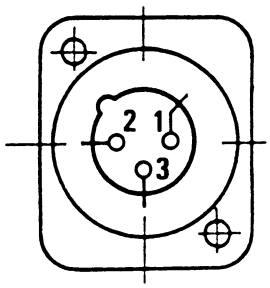
Rear of machine:

TC INPUT XLR, 3 pin, female

1 earth
2 time code input, high
3 time code input, low

Sensitivity: 100 mVpp to 24 Vpp
Impedance: 5 kOhm

Fig 1b

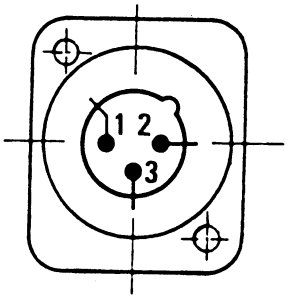


TC OUTPUT XLR, 3 pin, male

1 earth
2 time code out, high
3 time code out, low

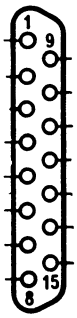
Level. 2 Vpp
Impedance: 300 Ohm

Fig 1c



THIRD TRACK INPUT/OUTPUT

Cannon D-type, 15 pin, female
(mating plug, order No 40.25.015.000)



(BJ 11)

Fig 1d

1 **Cue out,** output from optional TAPFM pilot circuit.
Filtered approximately 200 Hz - 3 kHz.
Level: 1.2V rms for ± 20 % modulation at 1kHz
Impedance: Z-load minimal 1 kOhm.

2 **Ext.ref.,** input of external reference signal for optional TAPFM pilot circuit and/or time code generator/synchronizer.
With TAPFM installed:
Sensitivity : 0.8 V to 14 Vpp
Impedance: 47 kOhm
Without TAPFM, with bridging jumper between pins 1 & 8 of XA25 P-2 on A-05 board: 5 V logic square wave

3 **BWD Ext.rol.,** used by TACO-R bi-phase interface

4 **Sp.1,** Spare remote input/output, see page II.7.4-1.

5 **TC/Pilot,** logic signal indicating the position of the TC/Pilot switch on the TC board, used in the TACO-D Time code & Pilot monitoring module + 5 V = Time code
0 V = Pilot

6 **+ 5 V,** stabilized power supply output.

7 **50/60 Hz** pilot output signal derived from off-tape time code during playback.
Level: + 5 V logic square wave
Impedance: 1 kOhm (Zload min. 5 kOhm)

8 **Direct TC in,** input of external time code, to be recorded without going through the microprocessor first. Only in use when the time code record source switch is set to "EXT UNPROCESSED". (See page II.1.3-1)
Sensitivity: 500 mV
Impedance: 100 kOhm

9 **Pil.out,** output from TAPFM optional pilot circuit.
Level: 1.7 Vrms
Impedance: Z-load min.1 kOhm

10 **FWD Ext.rol.,** Used by TACO-R bi-phase interface.

11 **Sp.2,** Spare remote input/output, see page II.7.4-1.

12 **TC out unprocessed,** output of time code from playback chain, reshaped but without any time shift applied.
Available at all speeds including fast shuttle.
Level: 5 V logic square wave
Impedance: 1 kOhm

13 **TC out,** parallel to main time code output (XLR) and thus dependent on position of the status matrix.
The bit rate of this output is always nominal, independent of tape speed.
Level: 5 V logic square wave
Impedance: 1 kOhm

14 ⏚ **(+5v),** Logic ground

SERIAL REMOTE CONNECTORS

These connectors are used only when the optional serial remote interface TAIRS is installed. All specifications conform to the existing standards for computer communication lines.
For further details see pages II.7.2-1 and II.7.3-1 and section VI of this manual.

RS-232 Canon D-type, 25 pin, female

1 Ground (chassis)
2 TxD
3 RxD
4 RTS
5 CTS
7 Ground (logic)

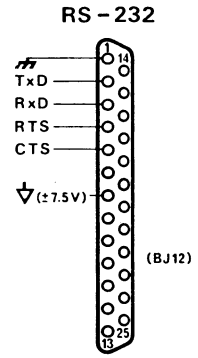


Fig 1e

RS-422 Canon D-type, 9 pin, female

1 Ground (chassis)
2 TA
3 RB
4 Ground (logic)
5 External reference input, paralleled to pin 2 of the THIRD TRACK connector (See page II.1.2-2)
6 Ground (logic)
7 TB
8 RA
9 Ground (chassis)

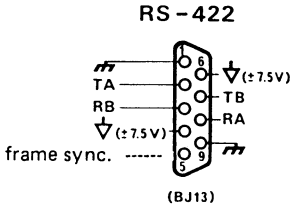


Fig1f

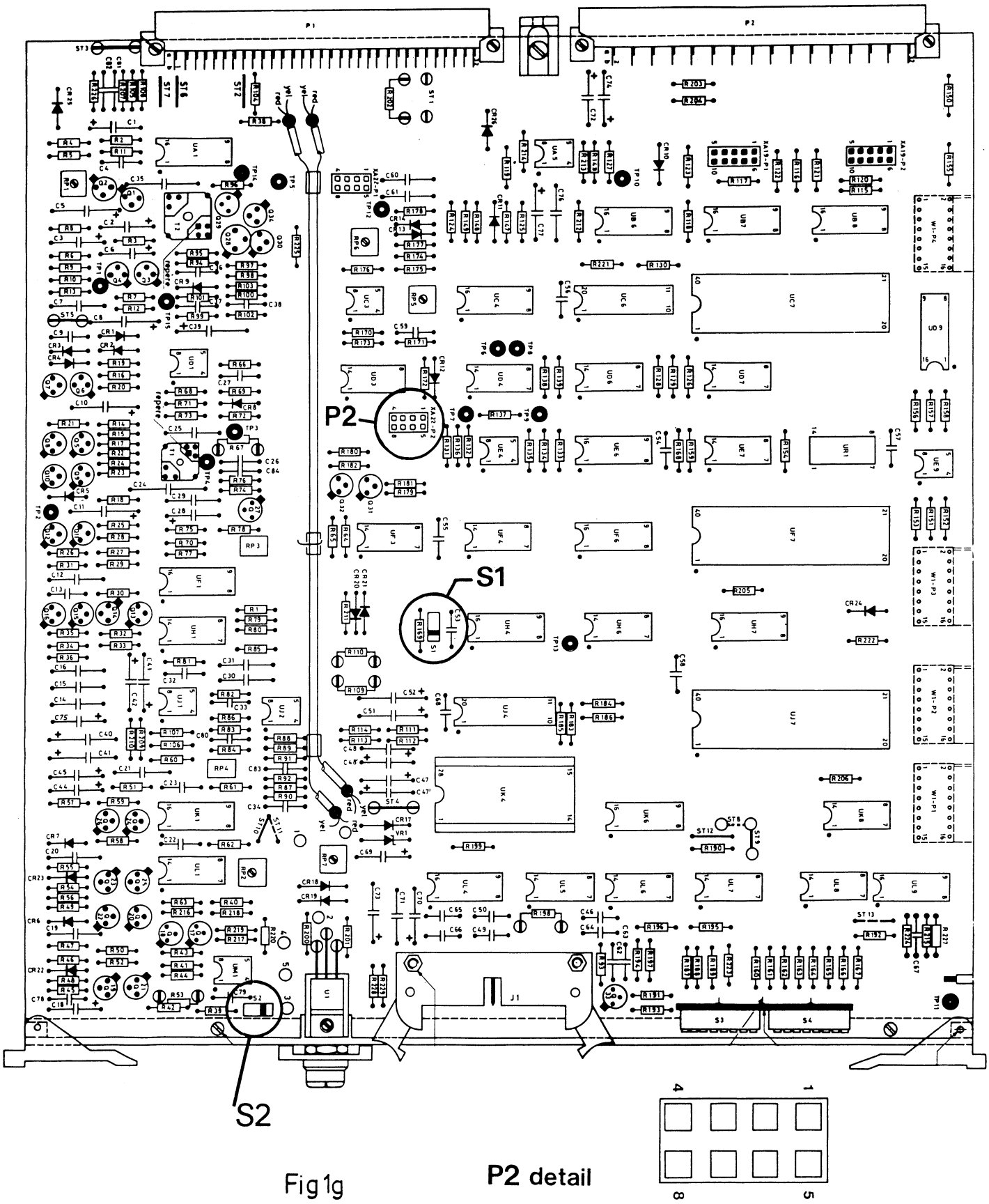


Fig 1g

P2 detail

1.3 CUSTOMIZING SELECTORS

The switches to set the machine to the desired operating mode, are located inside the NAGRA T-Audio TC. To reach these, rotate the keyboard upwards and remove the front panel by loosening its two screws half a turn counterclockwise.

The setting of the operational status of the T-Audio TC is partially made by the execution of numerical commands. See page II.8.0-1.

The switch functions on boards A-01.1 , A-01.2 and A-02 are explained in the section: "SERVICE MANUAL, tape transport and control logics." (Section III).

Tape transport speed stabilizer board A 03 :
Synchronizer/speed variator: selects the speed correction input of the speed stabilizer to the manual speed variator control on the keyboard or to the output of the time code synchronizer or TAPFM pilot resolver.
In order to prevent mistakes, always return to "synchronizer" after use of the manual speed variator.

Time code board A 05 :
All switches are located on the leading edge of the electronics, with one exception:

S 1, INTERNAL/EXTERNAL REFERENCE.

In order to reach this switch, the time code board must be removed from the machine. Proceed as follows:

- Make sure that the power is switched OFF:
- Remove the colored flat cable from its socket by pushing the two black levers on the connector.
- Remove the circuitry from the body of the machine by pulling gently the two black levers on the front edge of the board.

S1 is the red switch located approximately in the center of the board. See Fig.1g. Slide the switch towards the rear of the machine for internal reference or towards the front of the machine if an external reference for both time code synchronizer and pilot resolver must be applied.
In the last case the external reference should be fed to pin 2 of the THIRD TRACK INPUT/OUTPUT connector, or to pin 5 of BJ-13 (RS-422).
For details see pages II.1.2-2 and II.3.2-1.
Before switching the power on again, make sure that the board is completely inserted in its place, the two catches should fold over the front panel of the circuitry. It might be easier to reinstall the flat cable before completely reinserting the circuit into the machine.

NOTE: Ex factory setting of S1 switch is in "external" and should remain like that if a TACO-D (TC/PILOT DISPLAY MODULE) is connected to the T-Audio T.C.

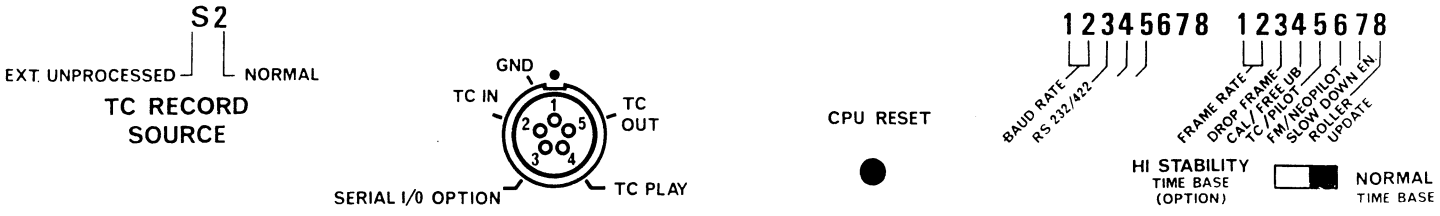


Fig 1h

Timecode board A 05, from left to right:

S2 TC RECORD SOURCE

When set to NORMAL, the time code recorded, will be the signal generated by the internal generator. In order to obtain proper phase coincidence between audio and timecode on tape, an external time code will be regenerated and thus shifted in time (and cleaned from any dropouts).
When set to EXT UNPROCESSED, an external signal may be applied to pin 8 of the THIRD TRACK INPUT/OUTPUT connector and this signal will be fed directly into the record amplifier without any correction or compensation.
About 5 cm behind this switch a soldered jumper is provided through which it is possible to use the standard TC INPUT connector (XLR) for such a direct feed.

This input may also be used to record digital information other than time code.
The baudrate of such a signal should not exceed 4000 bits/sec.
Playback signal will be available at pin 12 of BJ-11 (Third track in/out) only.

CPU RESET

This is not a mode selector but a key which, when pressed, makes the microprocessor perform a total reset, as if mains power has just been switched on. With the software version older than 1.6, push this key when one of the following switches has been altered:

S3 SELECTOR FOR OPTIONAL SERIAL REMOTE INTERFACE

(left-hand block of 8)
These switches are used only when the optional serial remote interface TAIRS is installed.

Switch 1 & 2: Determine the baud rate of the RS-232 input/output according to the table below:

switch 1	switch 2	Baud rate
OFF	OFF	2400
ON	OFF	4800
OFF	ON	9600
ON	ON	19200 (+4%)

Switch 3
OFF: RS-422 input/output activated
Baudrate: always 19.200 (+ 4%)
ON: RS-232 input/output activated

Switch 4 to 8 Not used

For more details see page II.7.2-1.

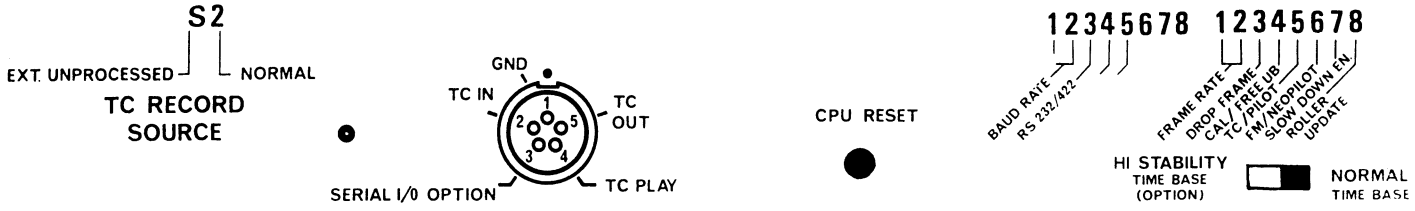


Fig 1i

S4 TIME CODE SYSTEM MODE SELECTOR
(right-hand block of 8)

Note that a number of mode selections are made through the execution of numerical commands as described on page II.8.0-1.

The position of most of the switches below is only read by the microprocessor during power up; alternatively push CPU RESET after modification with Eprom version older than 1.6. The first line of the status menu will then appear on the display. Use SHIFT+ ↓ or ↑ to scroll through the various lines.
The indications between [ ] relate to the abbreviations used in the status display.

Switch 1 & 2: The position of these switches determines the frame rate for which the T-Audio TC is set. This does not only influence the generator but also the reader and synchronizer. Therefore, always verify the proper setting of these selectors. Since the internal generator may also be used as a reference to resolve pilot tapes, these switches also determine the pilot reference frequency:

switch 1	switch 2	Frame rate	Reference frequency
OFF	OFF	24 fps.	48 Hz
ON	OFF	25 fps.	50 Hz
OFF	ON	29.97 fps. [29]	59.94 Hz [59] *
ON	ON	30 fps.	60 Hz
* **Exact figures:**		29.97002617	59.95005234

* **NOTE:** This frame rate can only be obtained with the use of the optional TAHSX high stability time base. In this case the time base selector should be put in "HI STABILITY" position.

Switch 3 : This switch only relates to the frame rates 29.97 and 30 fr/s
ON: Drop frame mode [dF]
OFF: Normal frame count [FF]

For further explanation on Drop frame time code, refer to Appendix B.

Switch 4 : Selects the user bits to be used in the DATE format or not.
OFF: Free use of user bits. [FrEE_Ub_]
ON: User bits in calendar mode. [dAtE_Ub_]
In this mode the T-Audio TC while setting its generator will only accept user bits that conform to the date format:
DD : MM : YY : xx
The automatic incrementation is also executed whenever the time code generator passes over midnight.

Switch 5: This switch puts the system in pilot operation.
OFF: Pilot operation. [Pilot] or [FM_Pi]
ON: Timecode operation. [tc]
Do not select OFF when no TAPFM pilot resolver board (optional) is installed.

Switch 6: Once in pilot mode, this selector determines the choice between neo-pilot or center track pilot (NAGRA SYNC or STELLA-pilot).

OFF: NEO-pilot [PiLot]
ON: Center track pilot. [FM_Pi]

Do not select OFF when the machine is not equipped with the optional TAONP NEO-pilot head. When in center track mode, the choice between NAGRA FM-pilot or STELLA-pilot is made with a switch on the TAPFM circuit directly. See page II.6.3-1.

Switch 7: The NAGRA T-Audio TC tape transport can shuttle at speeds higher than a time code can be read. In order to assure reliable time code reading, the time code system automatically limits the highest spooling speed to 60 x nominal for 24 fps and 25 fps frame rates, or to 50 x nominal for 29.97 fps and 30 fps. This function may be inhibited:

ON: Normal operation. [SLo._on_]
OFF: Shuttle speed unlimited. [SLo._oFF]

Switch 8: Normally, the off-tape time code reader is updated with pulses from the tape counter roller. In order to enable, for example, checks on dropouts, this function can be inhibited:

OFF: Automatic updating inhibited. [UPdA. oFF]
ON: Normal operation. [UPdAtE_ _]

TIMEBASE SELECTOR

The T-Audio TC is factory fitted with a low power consumption crystal time base for the real time clock, having a stability of approximately 50 ppm. This standard time base provides the necessary time information for normal operation on 24 fps, 25 fps and 30 fps. If a higher stability and/or the 29.97 fps frame rate are desired, the system may be equipped with the TAHSX option. This is an additional board with two 1 ppm crystals which also provides the necessary reference frequency to generate 29.97 fps. time code.
1 ppm stability is considered to be sufficient for cable free synchronization of picture and sound. (Typical maximum error of 1 frame over 8 hours of operation).

Set the switch to HIGH STABILITY to activate the TAHSX.

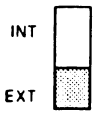
NOTE: The TAHSX is only powered from the mains power supply. If power is switched off, the standard crystal takes over.

See page II.3.1-1.

TC BOARD customizing selectors

EX FACTORY CONFIGURATION

S1 INTERNAL / EXTERNAL REFERENCE



S1 set in external position

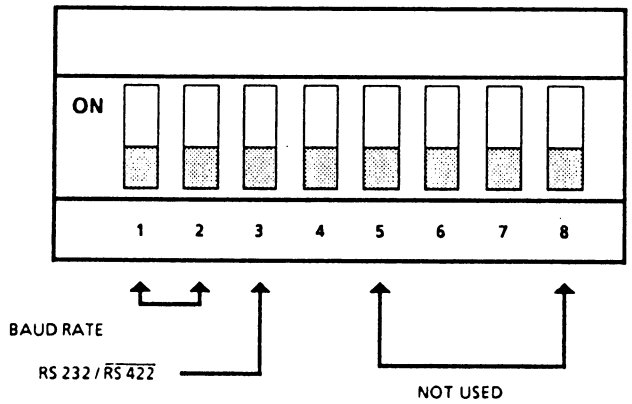
S2 TC RECORD SOURCE

S2 set in normal position

EXT UNPROCESSED NORMAL

S3 SERIAL REMOTE INTERFACE

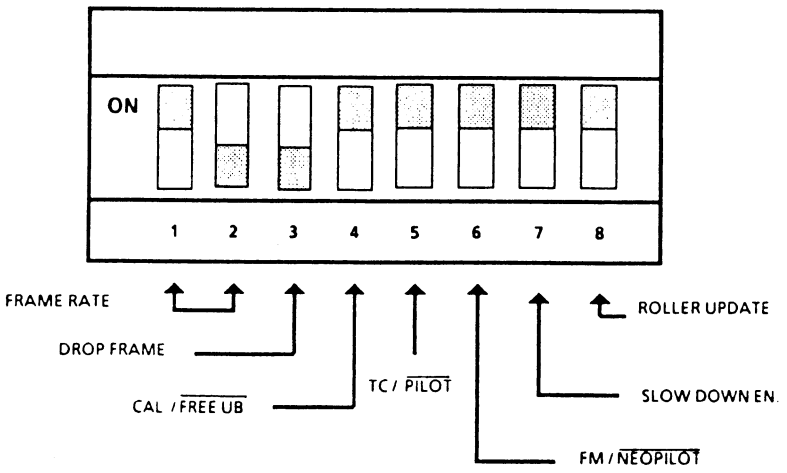
S3.1	S3.2	S3.3	S3.4	S3.5	S3.6	S3.7	S3.8
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF



S4 TIME CODE SYSTEM MODE

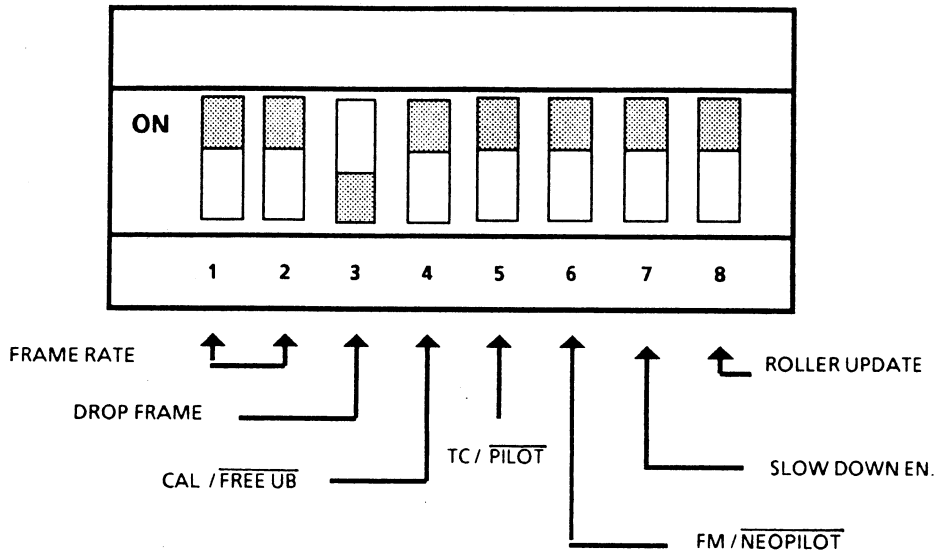
CCIR CONFIGURATION : 25 frames / second

S4.1	S4.2	S4.3	S4.4	S4.5	S4.6	S4.7	S4.8
ON	OFF	OFF	ON	ON	ON	ON	ON



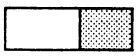
NAB CONFIGURATION : 30 frames/seconds non drop frame

S4.1	S4.2	S4.3	S4.4	S4.5	S4.6	S4.7	S4.8
ON	ON	OFF	ON	ON	ON	ON	ON

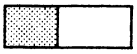


NOTE : Selectors with blue color have the ON position inverted
(ON is downwards)

S1 TIME BASE SELECTOR



NORMAL : if no TAHSX (high stability time base option) is installed



HIGH STABILITY : if TAHSX (high stability time base option) is installed

1.4 STATUS DISPLAY MENU

A special display menu is provided to monitor the setting of the operational mode of the T-Audio TC.

Some of the modes are selected by switches, see page II.1.3-1 and others are set by the execution of numerical commands as explained on page II.8.0-1.

The first line of this display menu will be shown when power is switched on, or when the manual CPU RESET key is pressed, or when numerical command 000 is executed. The line relating to the last modification will be shown after execution of any other numerical command.

Use SHIFT+ ↑ or ↓ to scroll through the consecutive lines of the menu.
The display returns to time when one of the main tape transport keys is used or when SHIFT + DISP TC or DELTA or OFFSET is pushed.

LINE	EXAMPLE	MEANING	SEE PAGE
1	tc____25	general mode, time code or pilot, and frame rate or pilot frequency	II.1.3-3
2	FrEE_Ub_	operating mode of user bits section, free use or automatic date incrementation	II.3.5-1
3	SLo._on_	automatic shuttle speed limitation	II.1.3-4
4	UPdAtE__	updating of time code reader with the use of tape counter pulses	II.1.3-4
5	MUtE_on_	automatic muting of audio outputs during synchronizer operation when the tape transport is not LOCKED	II.4.0-1
6	rEF._tc_	setting of the time code synchronizer's reference (time code, square wave or bi-phase)	II.6.6-1
7	rEH.rEP.	edit rehearsal being executed with audio channels in REPRO or alternatively SYNC	II.5.3-1
8	tc_run__	state of internal time code generator	II.3.0-1
9	Prot.oFF	modification of internal generator allowed or inhibited	II.3.3-1
10	SP2_oFF_	effect of SPARE-2 remote input	II.7.4-1
11	1.5 SYNC	version of software installed	Appendix C

2.0 KEYBOARD DESCRIPTION

Two keyboards can be used simultaneously on one T-Audio TC with the TA-PPA option (supplementary keyboard input).
Extension cables up to 10 meters may be used between the keyboard and the machine (50 meters with low resistance cable).

Most of the time code related functions have been added to the standard T-audio by using shifted functions on the already existing keys. These functions are printed in yellow above each key while the direct functions are marked in white on the keys themselves.
Shifted functions are activated by pressing first the yellow "SHIFT" key and then the desired key while holding the "SHIFT" key down.

The channel status matrix keys don't have any shifted functions.

Some functions have no direct access but can be executed through numerical commands.
See page II.8.0-1.

On the top side of the keyboard, close to the speed/standard selector, there is a rotary switch which inhibits or enables the keyboard and/or the parallel remote bus.
An external device connected to one of the serial remote inputs always has access.
See page II.7.0-1.

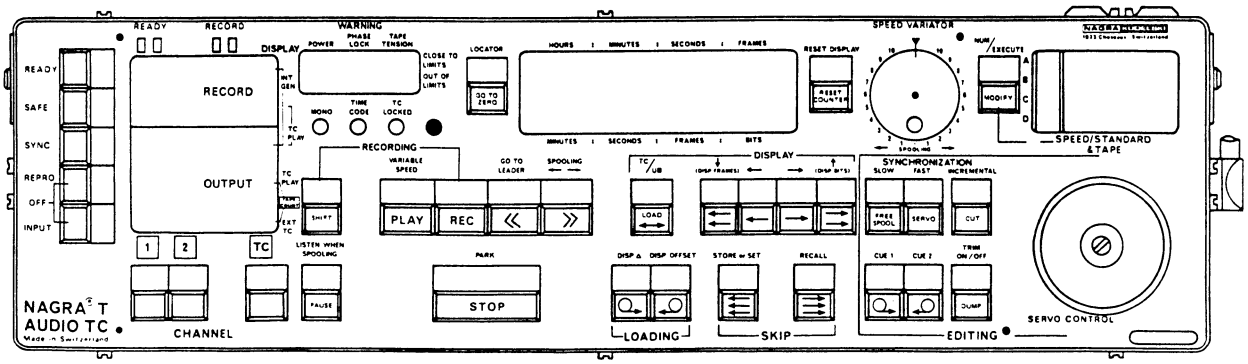


Fig 2a

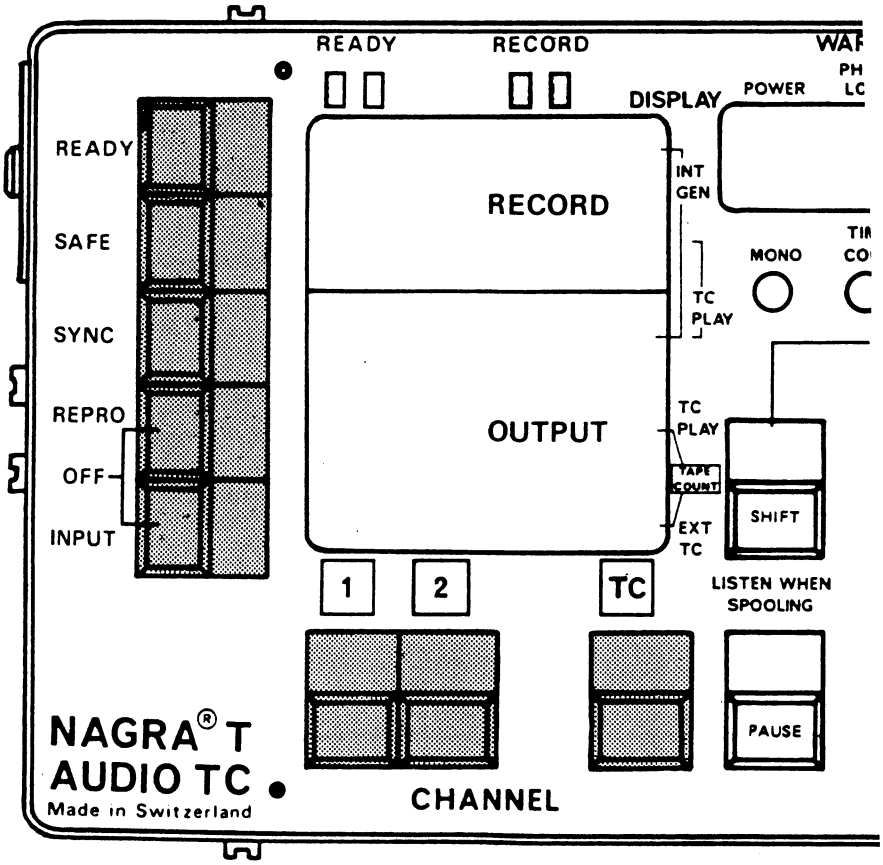

READY
RECORD
DISPLAY
POWER
READY
SAFE
SYNC
REPRO
OFF
INPUT
RECORD
OUTPUT
INT GEN
TC PLAY
TC PLAY
TAPE COUNT
EXT TC
MONO
SHIFT
1
2
TC
LISTEN WHEN SPOOLING
PAUSE
NAGRA® T
AUDIO TC
Made in Switzerland
CHANNEL

Fig 2b

2.1 CHANNEL STATUS MATRIX

The third position of the matrix is reserved for the time code channel. It functions as similarly as possible to the switching of the audio channels. However, since the time code channel serves different purposes to the audio channels, it is obvious that there are some significant differences. For instance, during record the position of the output section of an audio channel does not influence the current recording. For the time code channel, however, it is the output part of the matrix that determines the time code source to be recorded.

The table below shows how the matrix influences the time code track:

	SAFE		READY	
	DISPLAY	**TC-OUTPUT**	**DISPLAY**	**TC-OUPUT**
OFF	Tape-counter	Off-tape TC REP.head (shifted)	Tape-counter	NO signal
INPUT	External TC	Off-tape TC REP.head (shifted)	External TC	External TC
REPRO	Off-tape TC REP.head (shifted)	Off-tape TC REP.head (shifted)	Off-tape TC REP.head (shifted)	Off-tape TC REPRO (shifted)
SYNC	Off-tape TC REC.head (shifted)	Off-tape TC REC.head (shifted)	Internal GEN.	Internal GEN.

NOTE: The above shows clearly that the difference between REPRO and SYNC during time code playback is similar to the audio channels. This means that the synchronizer will phase the tape to the audio playback head when the matrix is in REPRO or INPUT, but it will synchronize to the record head when the matrix is set to SYNC. Refer to section 5 of this manual for the timing involved in automatic time code displacement.

NOTE: Switching between REPRO and SYNC, while the machine is parked, does not show any change on the display because the head phase computation is made only when the tape is in motion.

2.2 TAPE TRANSPORT KEYS

STOP is the NAGRA T-Audio TC EMERGENCY BRAKE:
It will not only bring the tape transport to a stop from whatever mode, but it will also interrupt any data modification operation and recover the original values.
The only other keys in this section of the keyboard that are related to time code and/or pilot operation are SHIFT+PLAY and SHIFT+REC:

The T-Audio TC is able to record audio during playback of time code. Obviously the synchronizer can lock the tape transport using this time code. Record will only be accepted in this mode when the tape transport is in the LOCKED status (See pages II.4.0-1 and II.5.1-1).
SHIFT+REC will activate the record and erase amplifiers of the audio channel(s) previously selected to READY, without interrupting the synchronizer.
SHIFT+PLAY will switch the audio electronics to playback again, without interfering with the synchronizer.

In pilot mode SHIFT+ PLAY is used to start the tape transport with the optional resolver TAPFM activated. See pages II.6.5-1 and II.6.6-1.

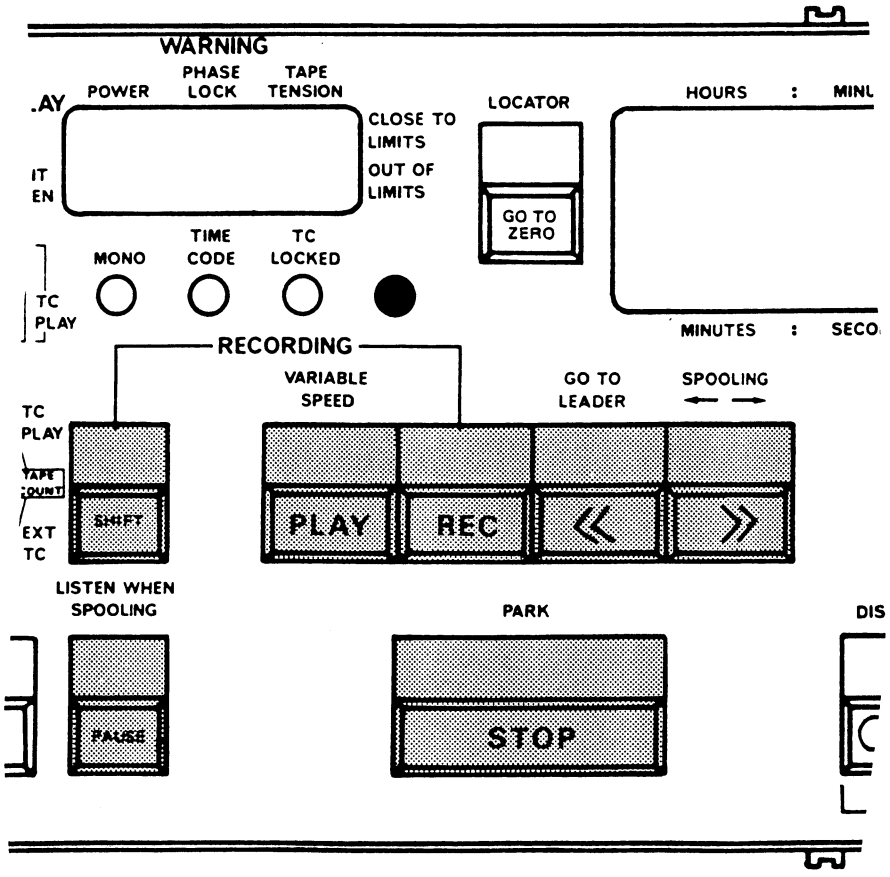


Fig 2c

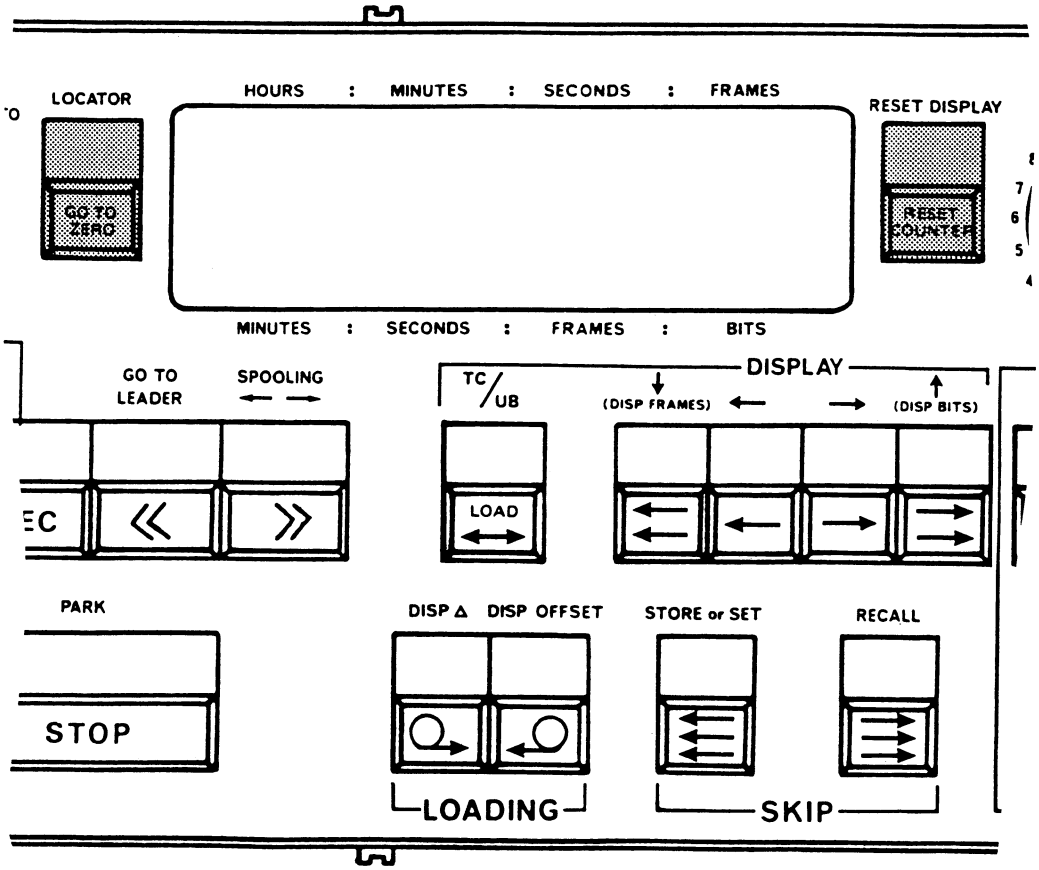

LOCATOR
HOURS : MINUTES : SECONDS : FRAMES
RESET DISPLAY
GO TO ZERO
RESET COUNTER
MINUTES : SECONDS : FRAMES : BITS
GO TO LEADER
SPOOLING
DISPLAY
TC/UB
(DISP FRAMES)
(DISP BITS)
LOAD
PARK
STOP
DISP Δ
DISP OFFSET
STORE or SET
RECALL
LOADING
SKIP

Fig 2d

2.3 LOCATOR

The locator enables automatic searching for any position on the tape using the tape time code as a reference. SHIFT + GO-TO-ZERO will make the T-Audio TC shuttle to the time code value which is shown on the display at the moment the keys are pressed. This time code value may be from any source, except of course time code from the T-Audio TC's own tape. There are 5 memories available in which CUEs can be stored. See pages II.2.6-1 and II.5.2-1.

Numerical command 010 gives access to a pre-programmable preroll time to CUE 1. This value is initially set to 5 seconds but may be modified through the blinking mode as described on page II.2.5-1. When the locator is sent to find CUE 1, the tape will be parked at a point which is located this preroll time before CUE 1.

It is possible that the calculated preroll position before CUE 1 is non-existent on the tape because of time code discontinuities. This will cause the locator to malfunction. Reset the preroll time to zero if this occurs.

NOTE: The T-Audio TC tape transport is able to shuttle at speeds higher than time code can be read. This occurs especially when operating at frame rates 29.97 and 30 fps. The maximum shuttle speed is therefore automatically limited in both locator and synchronizer modes to maintain reliable time code reading.
This function may be inhibited by putting customizing selector 7 of the right-hand block in the OFF position. Monitor line 3 of the status display menu.
It should read: S L o . _ o n _ for normal operation.

In the case of discontinuous time code on the tape, the T-Audio TC may be sent to locate a time code value which is non-existent on the tape. If this occurs, ERROR 5 will be shown on the display and the tape transport will be parked as close to the interruption of the time code track as possible.

When the DELTA (See page II.2.4-1) appears to be bigger than 12 hours when in locator operation, the T-Audio TC will shuttle in the opposite direction, presuming that the time code recorded on the tape is discontinuous.

NOTE: In spite of the fact that the tape counter won't be displayed most of the time during time code operation, it still takes into account all tape movements. Consequently, RESET COUNTER will still set the counter to zero and GO TO ZERO will still make the T-Audio TC shuttle to counter zero, even when time code is displayed.

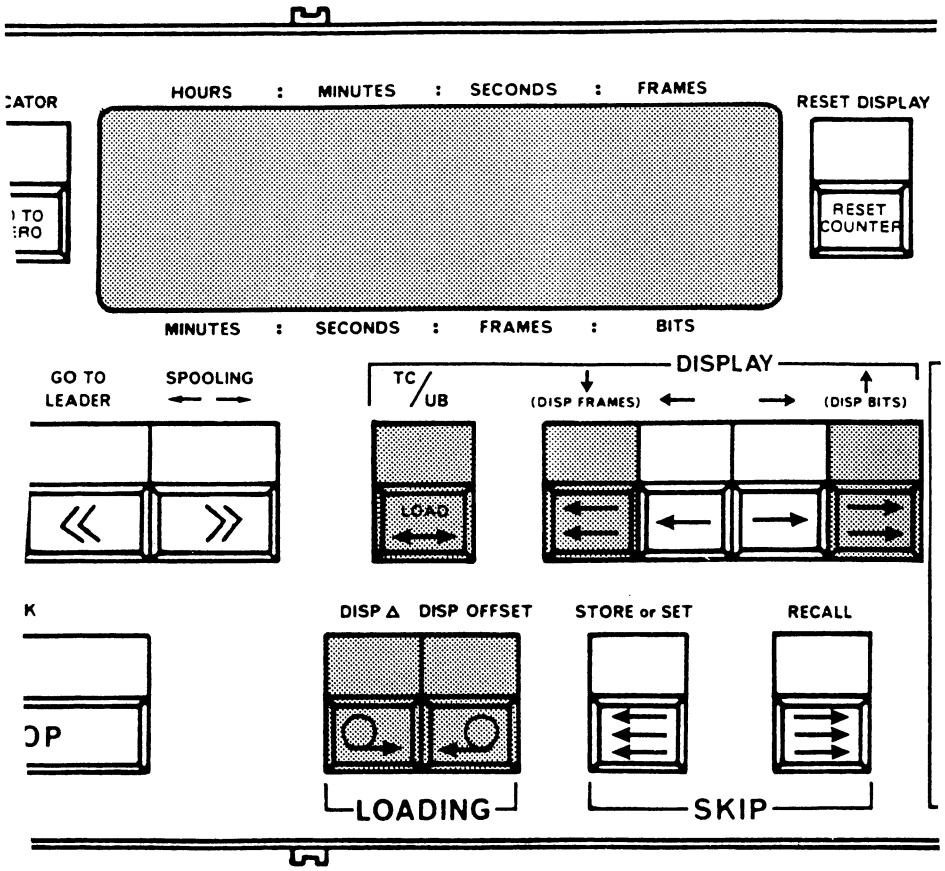

HOURS : MINUTES : SECONDS : FRAMES
RESET DISPLAY
RESET COUNTER
MINUTES : SECONDS : FRAMES : BITS
GO TO LEADER
SPOOLING
TC/UB
DISPLAY
(DISP FRAMES)
(DISP BITS)
LOAD
DISP Δ
DISP OFFSET
STORE or SET
RECALL
LOADING
SKIP

Fig.2e

2.4 DISPLAY

The eight digit LED display on the keyboard can be used to display all sorts of information such as time code or user bits to error messages and diagnostic indications.

When power is switched ON, the display shows the first line of the status display menu. Use SHIFT + ↑ or ↓ to go through the consecutive lines.
For details see page II.1.4-1.

The next three keys are used for further selection:

TC/UB Shows alternately time code or user bits. The signal source to be monitored is determined by the position of the matrix, see page II.2.1-1. Timecode is displayed with decimal points between hours, minutes, seconds and frames, while user bit values are shown without.
One decimal point between the 6th and 7th digit will indicate that the user bits are in the DATE mode.

DISP DELTA Shows DELTA, which is the calculated distance between off-tape time code and external time code, taking into account the programmed OFFSET.

DISP OFFSET Shows the programmed OFFSET. See page II.4.3-1.

Both DELTA and OFFSET values can be negative. As soon as their values are negative and bigger than 9 : 59 : 59 : 23 (or 24, or 29), the minus sign will be replaced by a decimal point below the far left digit.

Both DELTA and OFFSET can be displayed in the "high resolution format":
SHIFT + DISP BITS the first time will shift all displayed information two positions to the left. Thus the two last digits on the right show BITS. A time code BIT is 1/80 th of a frame which corresponds to 0.5 msec for 25 fps time code or 0.416 msec for 30 fps. SHIFT + DISP FRAMES a second time will return the display to normal format.

On the left of the numerical display there are three red LEDs two of which give further indications on the functioning of the T-Audio time code system:

MONO This LED lights up when the audio channel mode switch located on the control logics board A-02 is set to MONO.

TIME CODE When this LED lights up, a readable time code is received by the reader that is selected by the status matrix. (See page II.2.1-1). Dropouts will cause this LED to flicker.
This LED reacts in a way that is similar to the above, for off-tape pilot signals and pilot reference when the machine has been set to pilot operation.
This LED also lights up when an external frame pulse reference or bi-phase signal is applied and the time code channel has been set to INPUT on the matrix.

TC LOCKED In synchronizer mode this LED will light up as soon as both master and T-Audio TC are close to nominal speed and DELTA has decreased below 5 bits.

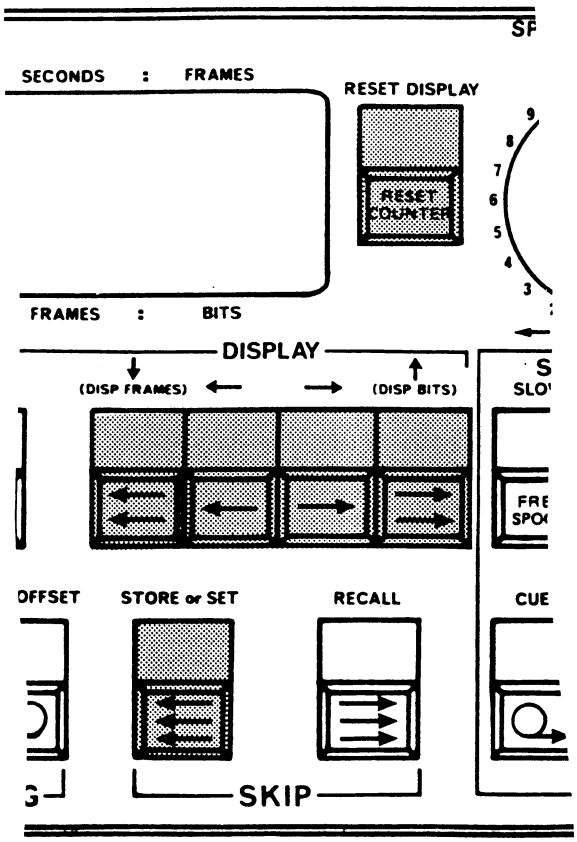

SECONDS : FRAMES
RESET DISPLAY
RESET COUNTER
9
8
7
6
5
4
3
FRAMES : BITS
DISPLAY
(DISP FRAMES)
(DISP BITS)
OFFSET
STORE or SET
RECALL
CUE
SKIP

Fig.2f

2.5 RESET, DATA MODIFICATION

Any value stored in the T-Audio TC memories can easily be modified by first calling it to the display and then using the following keys:

RESET DISPLAY Will set to zero all digits of the memory actually on display.
In the case of DELTA or OFFSET also the part not shown on the display (hours or bits) will be reset.
The internal generator will not be brought to a stop during reset.
This key also serves to deactivate the automatic insert editor when pressed immediately after SHIFT + CUE 1.
See page II.5.3-1.

BLINKING MODE

→ Will start the blinking mode from the left side of the display. Any consecutive pressing will shift the blinking cursor one position to the right. After the extremity of the display has been reached, the blinking cursor jumps back to the opposite end.

← As →, but in the opposite direction.

↑ Once the blinking mode has been started by SHIFT + ← or → each stroke on this key will increase the blinking digit by 1. The maximum value of each position is automatically limited. For instance, frames tens may never exceed 2.

↓ As ↑, but decreasing.

NOTE: In order to be able to program a negative value in the offset memory, the first digit on the left may also be put to the -2, -1 or -0 values.

NOTE: If a mistake has been made, it is always possible to recover the original value and to stop the blinking mode by simply hitting one of the main tape transport keys.

STORE: After the desired value is reached, hit SHIFT + STORE to introduce it into the previously selected memory.

This method is also used to introduce numerical commands.
See page II.8.0-1.

2.6 STORE, RECALL, MEMORIES

The NAGRA T-Audio TC offers 5 independent cue-memories. Two of them, CUE 1 and CUE 2, are reserved for editing purposes and are accessible by their designated keys. For automatic editing see pages II.5.2-1 and II.5.3-1.
The other 3 memories are scratchpad memories that are selected by means of the output section of the time code channel status matrix:

STORE

Will store the value actually on display in the scratchpad memory of the time code reader in use. This may be either TC-SYNC, TC-REPRO, or TC-INPUT.

Will also confirm a data modification after the blinking procedure has been completed. See page II.2.5-1.

Will also set the internal generator from an external source when the matrix was previously set to READY+INPUT. See page II.3.2-1.

RECALL

Will display the value of the scratchpad memory of the time code reader actually in use. This function may be followed by LOCATOR, for instance. The memory value will be displayed until DISP.TC or any of the main tape transport keys are pressed.
LOCATOR will also make the display return to off-tape time code.

Will also recall the value of CUE 1 or CUE 2 to the display if either key were previously pressed.

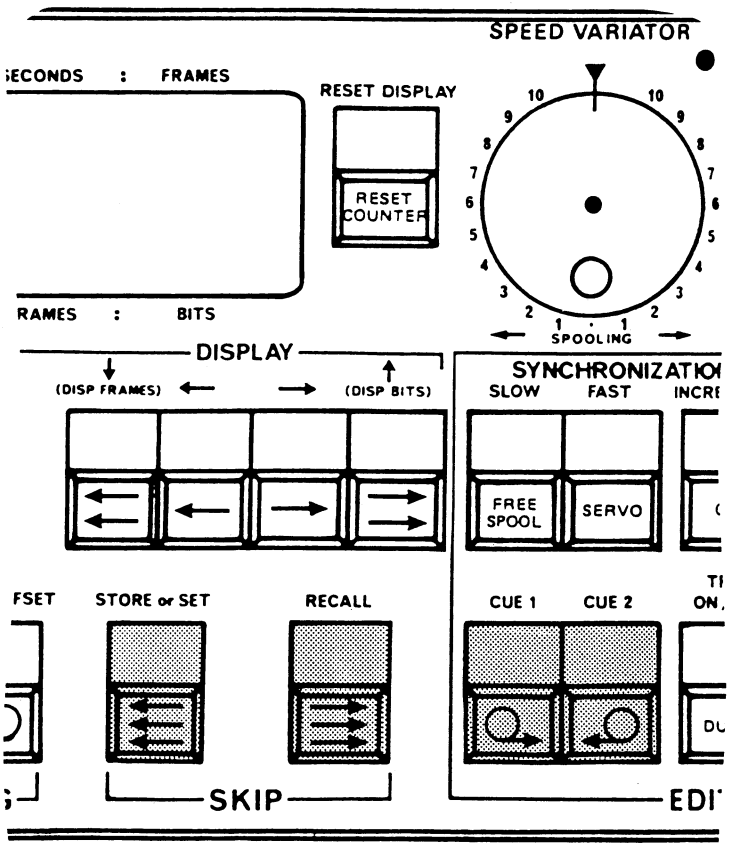


Fig 2g

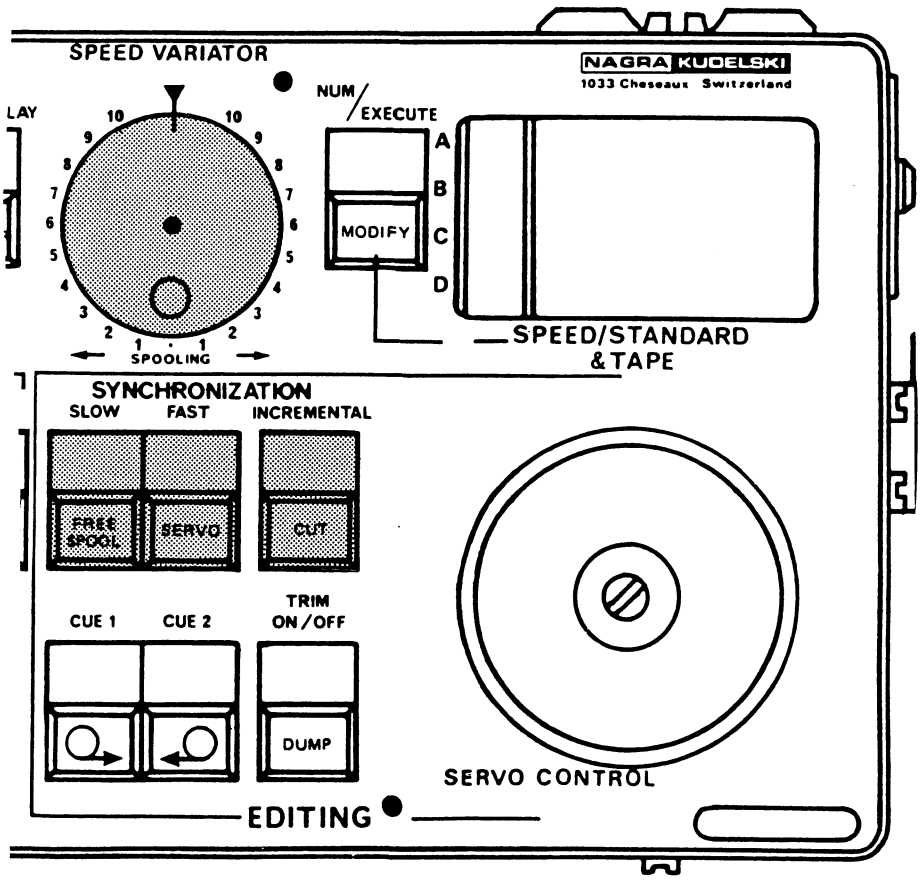

SPEED VARIATOR
NAGRA KUDELSKI
1033 Cheseaux Switzerland
LAY
NUM/EXECUTE
MODIFY
A
B
C
D
SPOOLING
SPEED/STANDARD
& TAPE
SYNCHRONIZATION
SLOW
FAST
INCREMENTAL
FREE SPOOL
SERVO
CUT
CUE 1
CUE 2
TRIM
ON/OFF
DUMP
SERVO CONTROL
EDITING

Fig 2h

2.7 SYNCHRONIZATION

For details on synchronizer operation see page II.4.0-1.
The NAGRA T-Audio TC synchronizer has three different operating modes:

SLOW

This is the standard mode of the synchronizer. The T-Audio will try to stay as close as possible to the connected master at any speed. When the master is at nominal speed, the T-Audio will synchronize itself very accurately, and the TC LOCKED indicator will come on as soon as DELTA has decreased to 5 bits.

From this state the T-Audio TC will not react immediately on speed variations of the master. An integration time (which is initially set to 15 frames) is applied, thus preventing wow & flutter from the master to be copied by the T-Audio TC and providing protection against dropouts.
Numerical command 012 allows access to the integration time.
See page II.4.2-1.

FAST

As SLOW but without integration in LOCKED state. The T-Audio TC will react instantaneously on any speed variation from the master.

INCREMENTAL

This mode is identical to SLOW as far as tape transport behaviour is concerned. Additionally, automatic adjustment of OFFSET is made at the moment the key is pressed. When a discontinuity is detected in either master or off-tape time code, with the T-audio at nominal speed and LOCKED, the same will be provided spontaneously.
For more details see page II.4.4-1.

SYNCHRONIZER PHASE ADJUSTMENT

When synchronizing audio to audio, exact phase control between machines may be required. This adjustment can be made in any synchronizer mode by means of the SPEED VARIATOR control. Monitor the applied correction by displaying DELTA in the "high resolution format" (DISP-BITS) with the tape transport at nominal speed and LOCKED.
See chapter page II.4.5-1.

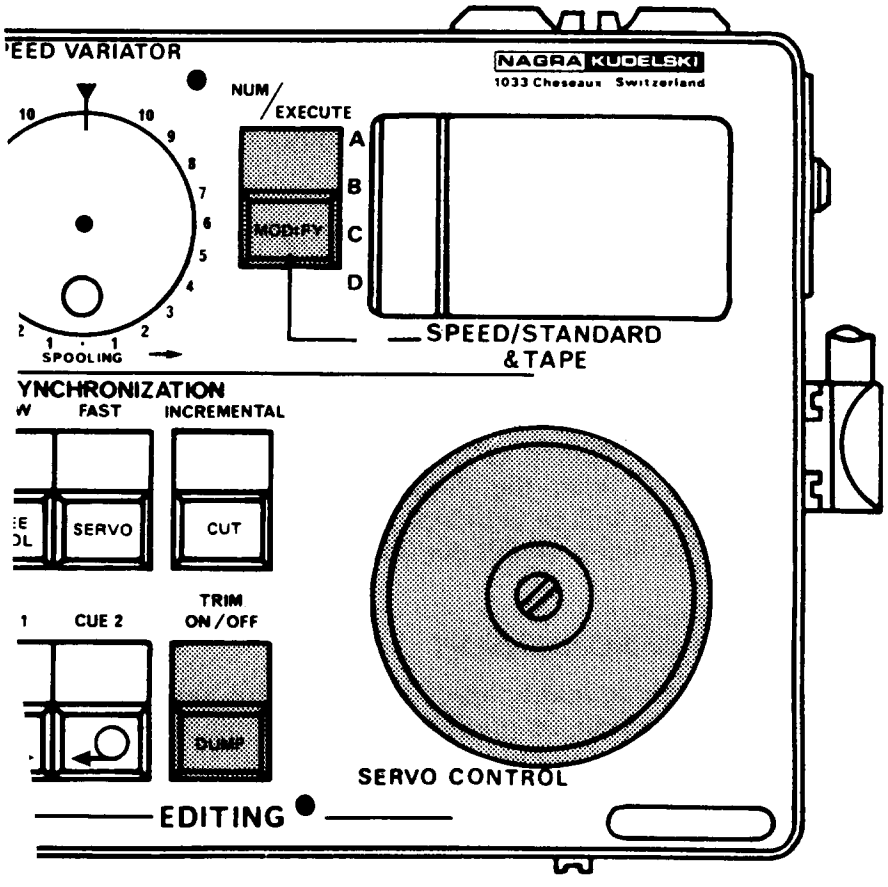

EED VARIATOR
NAGRA KUDELSKI
1033 Cheseaux Switzerland
NUM/EXECUTE
A
B
C
D
MODIFY
SPOOLING
SPEED/STANDARD
&TAPE
YNCHRONIZATION
FAST
INCREMENTAL
SERVO
CUT
CUE 2
TRIM
ON/OFF
DUMP
SERVO CONTROL
EDITING

Fig 2i

2.8 OFFSET TRIMMER

The synchronizer OFFSET can be stored automatically using the INCREMENTAL key or manually by means of the BLINKING mode (page II.2.5-1) or dynamically with the:

TRIM CONTROL This rotary control gives direct access to the OFFSET-memory in steps of only 1 bit. Turn to the right to advance the T-Audio TC, or to the left to delay the T-Audio with respect to the master. This adjustment may also be made when the T-Audio is LOCKED to its master.

This control is only active when OFFSET is on the display and activated by:

TRIM ON/OFF Alternately enabling and disabling the OFFSET TRIMMER. When ON, the right-hand digit of the display flashes.

After the desired OFFSET value is reached, select TRIM OFF or anything other than OFFSET on the display to prevent accidental modification.

For details on OFFSET programming see page II.4.3-1.

2.9 NUMERICAL/EXECUTE

All normal functions are obviously directly accessible through the keyboard. There are, however, functions that will not be used every day, such as special diagnostic display formats or operational mode selections.
These functions are accesible through NUMERICAL COMMANDS:

NUM/EXECUTE When this key is struck for the first time, the display will show three zeros the left of which is blinking. Now a command number may be keyed in by means of the data modification keys ↑, →, ← and ↓. (page II.2.5-1). When the desired number is reached, press SHIFT + NUM/EXECUTE a second time to execute the command.

When power is switched ON, or when CPU-RESET is pressed, numerical command 000 which sets display to the status menu, is automatically executed.
See page II.1.4-1.

For the available numerical codes see page II.8.0-1.

3.0 INTERNAL GENERATOR

The T-Audio TC is fitted with an internal generator for a number of reasons:

- In many cases it will be necessary to use "pre-striped" tapes, virgin tapes on which only a continuous time code track has been recorded. The T-Audio TC can "stripe" tapes independently, while the rest of the studio equipment is in use for other purposes.
- With the optional high stability time base, TAHSX, the T-Audio TC may also be used as a production recorder without cable link to other equipment on the set.
- Also with the high stability time base the internal generator can be used as a resolver reference for transfer and playback recording applications.
- During the recording of an external time code, the internal generator is used to compensate for dropouts in the source signal. The time code recorded on the T-Audio TC is therefore always completely clean from dropouts and jitter.
- One of the main application fields of the NAGRA T-Audio TC is in video post-production. For integration of a tape machine in a video editing or sound post-production system, the presence of an internal generator is in any case handy, and in many cases an absolute requirement.

The most important features of the T-Audio TC internal generator are:

There is a crystal time base with a very low power consumption, which is powered by a lithium back-up battery when mains power is switched OFF. Real time is maintained even when the time code board is removed from the machine.

Optionally, a high stability time base can be installed to enable synchronous, cable free recording sessions, and acurate self resolving.

Chapter II.3.1-1

Manual setting is provided so as to be able to set the generator at any desired time.

Chapter II.3.3-1

USER BITS can either be used in free mode or in calendar mode which provides automatic date incrementation when the time code generator passes midnight.

Chapter II.3.5-1

JAM-SYNC from an external source is possible in order to synchronize the T-Audio TC generator to a master clock.

Chapter II.3.4-1

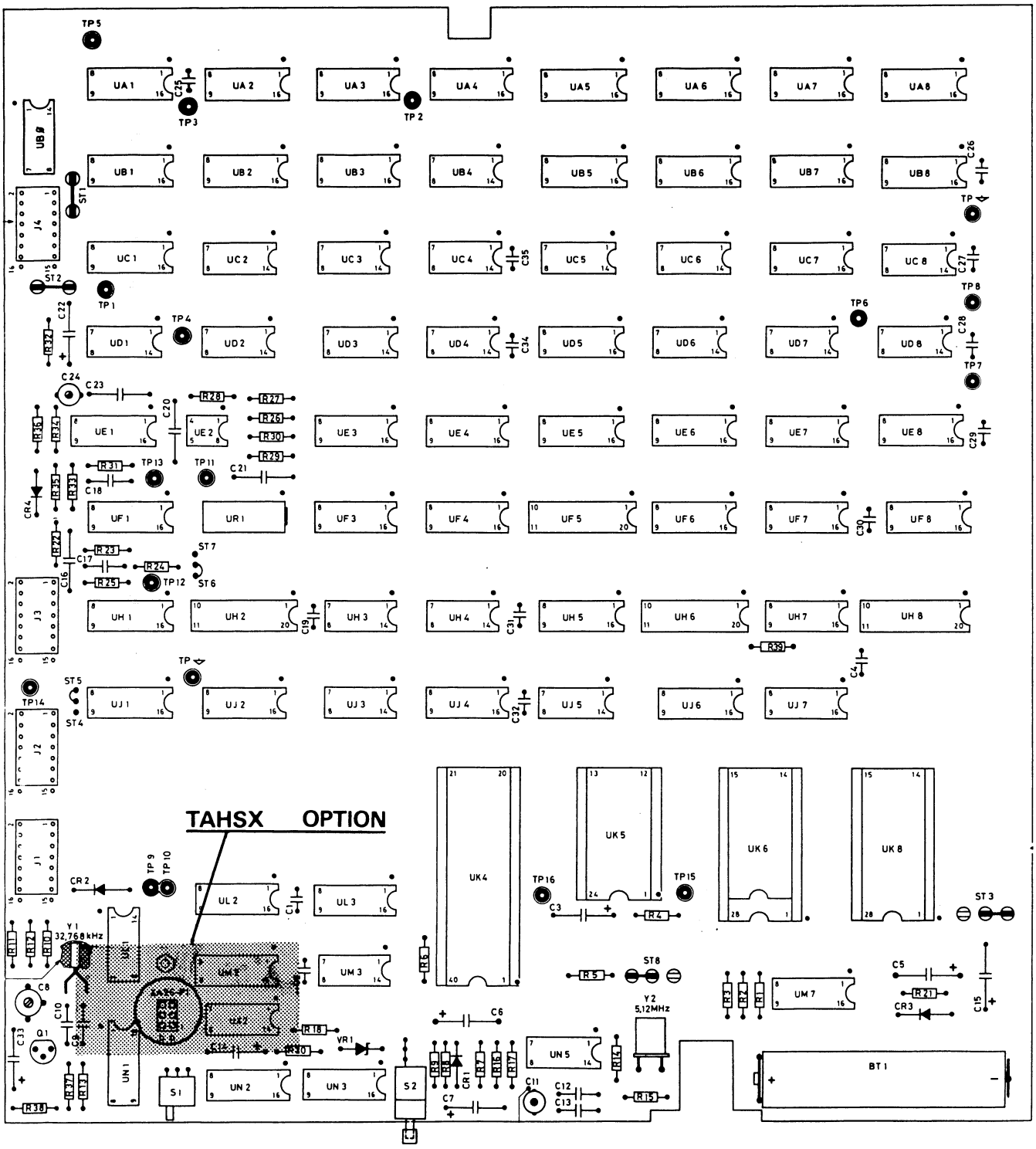
Internal switches switch the generator to any existing standard frame rate.
NOTE: 29.97 fps only with TAHSX option installed.

Chapter II.1.3-1

An external reference input is provided to run the generator from, for instance, a video studio "house reference".

Chapter II.3.2-1

Numerical command 100 stops the generator. Line 8 of the status display menu will show: t c _ H O L d _ The output signal is still available at the preset frame rate, but the time does not change; all words contain the same time information. Numerical command 101 restarts the generator from its original time.


TAHSX OPTION

3.1 TAHSX, OPTIONAL HIGH STABILITY TIME BASE

The NAGRA T-audio TC is fitted with an internal time code generator that normally runs referenced to a 50 ppm crystal. This timebase consumes very little power and is powered from the back up battery when mains power is switched OFF.

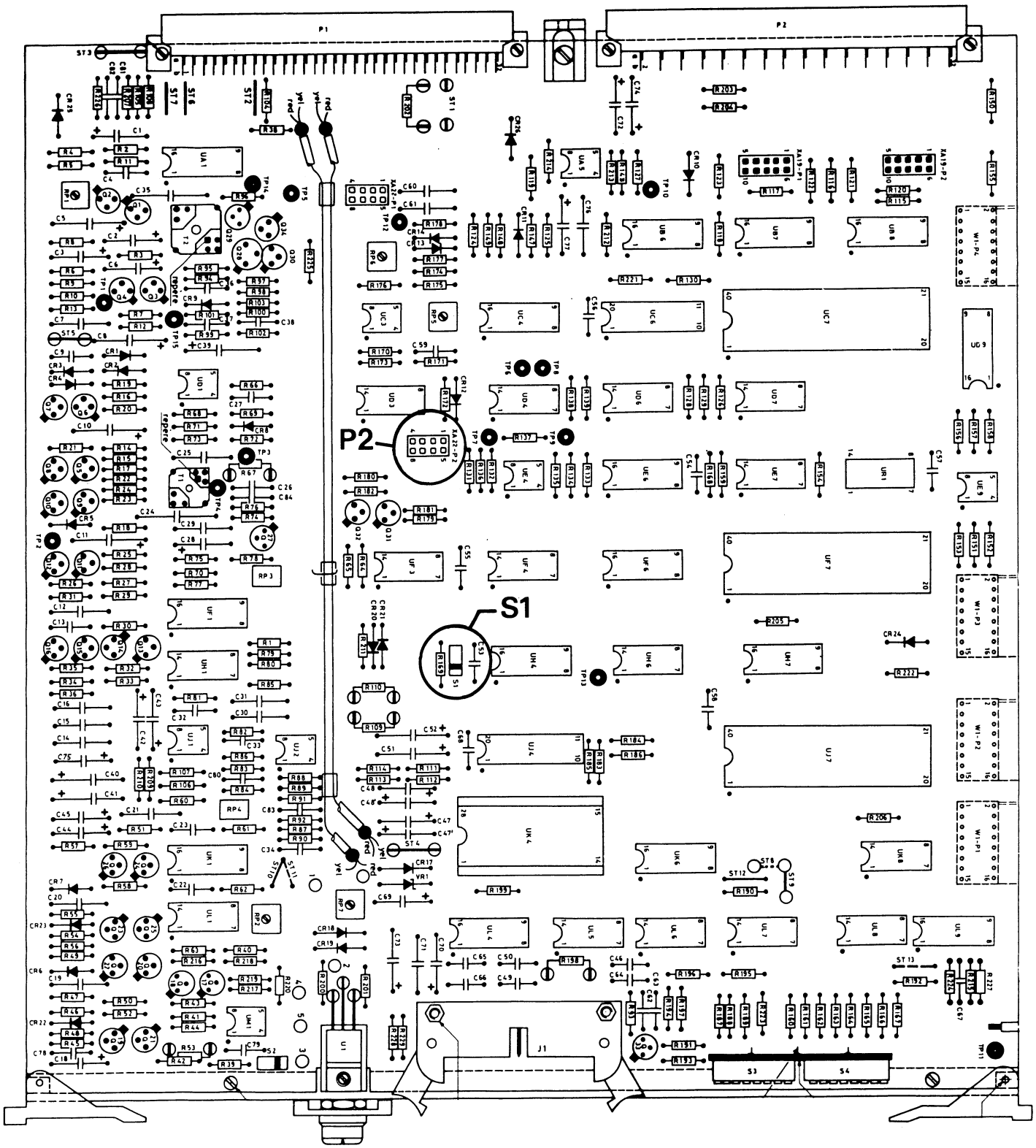
The optional TAHSX board is essentially a double oscillator equipped with two crystals with a stability of 1 ppm. One of these crystals is used for frame rates of 24 fps, 25 fps and 30 fps. The other has an odd frequency as required for generation of 29.97 fps time code.
Thus the presence of the TAHSX option in the T-Audio TC is an absolute necessity when working at 29.97 fps.
It is also strongly recommended to install a TAHSX when the internal generator is used as a resolver reference in transfer or playback shoot applications.

INSTALLATION

Make sure that power is switched OFF.
Remove the front cover of the T-Audio TC by unscrewing the two screws that are located right under the keyboard. Only half a turn counterclockwise is sufficient to undo them.

Remove the colored ribbon cable by pushing the two plastic catches outwards that hold the connector in place.
Remove the time code board from the T-Audio TC by pulling the two plastic levers on the front corners of the board.
The connector that takes the TAHSX, is located on the lower half of the time code board, as shown in figure 3a. Once the option is in place, secure it with a screw for which a special nut is provided (approximately 1 cm behind the connector on the board).
Now the timebase selector may be put in the HI STABILITY position.
No calibration is required as this accessory is factory set.
Reinstall the time code board in the machine and switch the power ON after making sure that the board is fully inserted in its place. The two black plastic levers should fold over the front rail of the board.

NOTE: The TAHSX is powered only when mains power is available. After power down, the standard time base takes over, and the accuracy of the generator is 50 ppm again. And if the machine was in use at 29.97 frame rate, the exact real time relation in the generator may be lost.



P2 detail

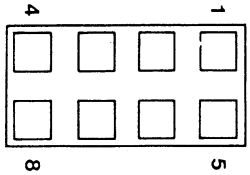


Fig 3b

3.2 EXTERNAL REFERENCE

The internal time code generator, the time code synchronizer and the optional pilot resolver can all be locked to an external reference. In the case of time code resolving this reference should be a frame pulse signal (1 pulse per T.C. frame). For pilot resolving this reference should be a pilot signal.

Such a reference should be fed to pin 2 of BJ-11 (THIRD TRACK INPUT/OUTPUT) as described on page II.1.2-2, or to pin 5 of BJ-13 (RS-422)
If the optional pilot resolver TAPFM is installed, the external signal will go through an automatic level compensation circuit, which allows the input signal to be of any shape and of any level between 0.8 and 14 Vpp. Without the TAPFM the external reference should be a +5 V logic square wave. In this case pins 1 & 8 of connector P-2 on the time code board A 05 must be bridged as shown in figure 3b.

To apply the external reference to the pilot resolver, slide switch S 1 on time code board A-05 towards the front of the machine (See page II.1.3-1).

The relationship between time code frame rate and external reference frequency is shown in the table below.

TC-Frame rate	**Pilot/reference**	
24 fps	48 Hz	
25 fps	50 Hz	
29.97 fps	59.94 Hz	*
30 fps	60 Hz	

* Exact values:

29.97002617	59.94005234

An external reference can also be applied to the internal time code generator and the synchronizer for resolving of time code tapes.
Proceed as described above but additionally, numerical command 004 should be executed. This also sets the synchronizer in the resolver mode, in this case the external reference should have a frequency ratio of 1:1 to the time code frame rate. The status display should show: "r E F . _ P i L" (in software version up to 1.6) and "rEF.Fr.P" (in software version from 1.6) onwards.
Execute numerical command 005 to return to normal operation.

3.3 MANUAL SETTING

To set the T-Audio TC internal generator manually, proceed as follows:

Select the time code channel to READY/SYNC on the channel status matrix in order to activate the generator and to visualize it on the display, use SHIFT+TC/UB to select either user or time information to the display; only the displayed memory can be modified by the following procedure.
Hit ← or → in order to start the blinking modification process.
This will freeze the display but will not interrupt the time code which is actually being generated and is still available on the output.
Now using the blinking mode as described on page II.2.5-1, enter the desired value. During all this the generator is still generating the original time code. At any stage it is possible to return to the original time setting by pressing one of the main tape transport keys. SHIFT+PLAY may be used when the synchronizer is not to be interrupted.
Once the desired value is reached, SHIFT+STORE will introduce the new time to the generator without stopping it.

To restart the generator from zero, select the generator to the display and press SHIFT+RESET. This operation is effective immediately, and does not need to be followed by SHIFT+STORE. SHIFT+RESET may also be used during the blinking mode, in this case only the display is reset and the actual time code generator is not influenced until SHIFT+STORE is pressed.

The generators' USER BITS memory can be set or reset by the same procedure.

NOTE: The user bits may be set to hexadecimal numbers when not in calendar mode.

The generator can be protected from accidental modification with numerical command 102. In this case, ERROR 04 will show on the display if an attempt to modify it is made.
Numerical command 103 enables setting.

3.4 SET FROM EXTERNAL

The internal generator of the NAGRA T-Audio TC can easily be set (jam-synced) from an external source. Before attempting to apply the following procedure make sure that the frame rate setting of the T-Audio TC generator corresponds to the frame rate of the external source.
For details on the frame rate selector see page II.1.3-3.

SETTING PROCEDURE

Connect the external source either to the XLR input at the back of the machine or to the five pin LEMO connector on the front. For details on the connectors see page II.1.2-1. Set the display to time code and the status matrix to READY -INPUT for the time code channel. Check that the external time code is indeed being received by the T-Audio TC; the TIME-CODE LED on the keyboard should be lit without any interruptions. Press SHIFT+STORE. After a maximum of one second the matrix will change to SYNC showing the internal generator on the display now running parallel to the external source. The cable link may then be removed.

Time and user information are considered separately in this procedure, only one value can be set at a time. To set the user-bits, proceed as above but set the display to user-bits first. (SHIFT + TC/UB)

ERROR-04 will appear on the display when the above procedure is executed while the generator is protected from accidental setting by means of numerical command 102. Execute numerical command 103 to authorize modification.

ERROR-03 will appear when the user bit section of the T-audio TC generator has been set to the CALENDAR mode and the user bits as contained in the external signal do not conform to the date format. See page II.3.5-1.

ERROR-09 will appear if the CPU is unable to synchronize the real time clock properly.

3.5 USER BITS

The time code that is generated by the NAGRA T-Audio TC conforms to the SMPTE/EBU standards. These standards prescribe the presence of eight groups of four user bits in each and every time code "word". See appendix B.
These positions may be used for the recording of any type of information. Only their presence is standardized, their use is not. (Except in calendar mode).

The T-Audio TC accepts hexadecimal values in the user bit memory of the time code generator. The blinking mode as described on page II.2.5-1 may be used for this programming.

SET FROM EXTERNAL

The user bits can be taken from an external time code source. To do so, proceed as follows:
Apply the external signal to either the five pin LEMO connector or to the XLR time code input. Set the display to user-bits and the time code channel to READY and INPUT, the TIME CODE LED on the keyboard should light up without interruption to indicate the presence of a proper signal. Press SHIFT+STORE, after a maximum of one second the matrix changes to SYNC confirming that the setting has been accomplished. The cable may then be removed.

CALENDAR MODE

Switch 4 of the frame rate selector on the time code board selects the user bits memory of the generator between FREE or DATE mode.

ON = DATE (calendar mode)
OFF = FREE use of user bits, including hexadecimal information.

Monitor the second line of the status display menu to check this.
If the system has been set in the calendar mode, the user bits will be shown on the display with one decimal point between the sixth and the seventh digit. (Normally they are displayed without any points).
In this mode the first six digits of the eight user bit groups are reserved for the recording of dates in the time code signal, according to the format:

DD : MM : YY : xx

When the generator passes midnight, the date as stored in the user bits memory will be automatically increased. When a setting of the internal generator is attempted and the new user bits do not correspond to the above format, **ERROR-03** will appear on the display and the setting will be refused. This is valid for both manual setting and set from an external source.
Numerical command 102 protects both user bits and time from accidental modification. **ERROR-04** will be shown if an attempt is made to modify this.
Execute numerical command 103 to enable setting.

3.6 JAM SYNC ON TAPE

This feature makes it possible to extend a prerecorded time code track without causing numerical discontinuities. Only the time code "word" during which the recording was started will be destroyed, but old and new code will be perfectly sequential. Which means that the distance between the beginning of one time code frame and the beginning of the next one remains constant across the switching point.
It is to be noted, however, that this procedure is non-synchronous. This means that a change of the time code recording speed may occur on the switching point when the tape has been stretched, or if it was recorded on a transport which was not properly calibrated for speed.

Procedure:

Make sure the tape is in a position where there is still a few seconds of time code track ahead.

Set the time code channel to READY/REPRO on the channel status matrix.

Start the T-Audio TC in PLAY.

Check that the TIME CODE LED lights up without interruptions (no drop-outs).

Press SHIFT + REC before the end of the time code track is reached.

The machine will continue to record time code until one of the main tape transport keys is used.

End recording by first pressing PLAY before any other key when it is required to make a record exit as clean as possible. (It will be obvious that the end of such a recording is by no means sequential).

The internal time code generator is only used as a reference for this operation, its real time relation will not be modified.

4.0 SYNCHRONIZER

The optional TASYN time code chaser/synchronizer cannot be recognized as a hardware circuit in the T-Audio TC electronics. The time code board A-05 inside the T-Audio essentially contains a microprocessor with peripheral hardware performing all time code tasks, and partially controls the logic of the machine's tape transport.
The latter allows the microprocessor immediate access to all tape transport functions and detailed status information, which is essential for rapid synchronizer operation. This in combination with the double capstan, low inertia, tape transport, makes the T-audio TC a very fast synchronizing machine.
Typical acceleration time from STOP to nominal speed and LOCKED: 2.5 sec. (with tape recorded at 19 cm/s (7,5 ips.) and with a generator as master).
No complicated wiring or interfacing to the master is required; the T-Audio TC synchronizer only needs a time code signal to be fed to its external TC input.

NOTE: Only software versions marked with the letters SY contain the relevent software for synchronization. Inspect the last line of the status display menu (see page II.1.4-1) to check that the correct software is installed in your machine.

Once the synchronizer has been activated, the T-Audio TC will park within an accuracy of one frame when the master is parked. During shuttle, the T-Audio TC will use varispeed shuttle to always stay as close to the master as possible to avoid excessive delay in reaching LOCKED status when the master decelerates and immediately continues at nominal speed.
LOCKED status is indicated by the LED marked TC-LOCKED just above the PLAY key on the keyboard. This light will come on when both master and T-Audio TC are stabilized at nominal speed, and when DELTA is decreased below 5 bits.
The T-Audio TC can also LOCK itself to the master on reversed nominal speed.
Chasing is accomplished using only the numerical values of the two time code tracks until LOCKED state has been reached. Once LOCKED, phase resolving is done between the bit streams of the two signals in order to ensure exact, phase stable synchronization, steady enough for audio-audio synchronization. For this application phase adjustment of the synchronizer is possible, see page II.4.5-1.
DELTA is the numerical difference between off-tape and external time code, minus the preprogrammed OFFSET. DELTA is negative when the T-Audio TC lies behind the master. If DELTA is bigger than 12 hours, the T-Audio TC shuttles in the opposite direction to what normally would be expected, presuming a discontinuity across midnight in the on tape recorded time code track(s).
OFFSET is a programmed numerical difference between master and off-tape time code. Any value up to 24 hours (minus one frame) may be stored, positive or negative. For more details see page II.4.3-1.

It is possible to record audio while playing back the time code track. The synchronizer will not be disturbed by audio channels being in record which enables synchronized insert editing. See page II.5.0-1.

The audio outputs are normally muted when the synchronizer is active and when the machine goes out of LOCKED. This function may be inhibited by execution of numerical command 003. Line 5 of the status display menu will show:
M U t E _ o F F .Execute numerical command 002 to return to normal operation.

4.1 CONNECTION TO MASTER

As stated in the previous chapter, the only information the T-Audio TC needs from the master tape transport is a time code feed. The decoder of the external time code reader can decode a signal at speeds varying from 0.02 x nominal up to approximately 70 x nominal speed (60 x nominal speed for frame rates 29.97 and 30 fps).
The signal level may be anything from 100 mVpp to 24 Vpp and the signal does not need to be "reshaped" before feeding it to the T-Audio TC. In many cases, it is necessary to avoid regeneration of the time code because generators usually produce only a usable signal at nominal speed. It will be obvious that the T-Audio TC needs to receive the time code signal over a spectrum of speeds as wide as possible. For the same reason the use of audio outputs of a time code channel should be avoided. Normally an audio channel output is filtered at 20 Hz to 20 kHz which limits the maximum speed of a time code feed to only 5 x nominal. For this reason most of the video tape recorders are equipped with two outputs on the channel used for time code recording. One is audio filtered and another one comes from a wideband amplifier which usually also reshapes the signal into a square wave. In many cases, a link has been made between this output amplifier and the tape transport control logics to assure some sort of dropout compensation.
For details on specific equipment see the connection sheets in appendix A.

4.2 SYNCHRONIZER SLOW MODE

In SLOW mode all caracteristics of the synchronizer are essentially the same as in FAST mode except for when the transport is LOCKED. In this state an integration time is applied on the phase lock loop of the synchronizer.

The integration time is initially set to 15 frames but modification is possible through numerical command 012. Execution of this command shows the integration time in the display which may then be modified using the "blinking"mode as described on page II.2.5-1.

This feature does not only prevent the copying of any master tape transport imperfections but also provides powerful dropout protection.
When a time code track interruption needs to be overcome, increase the integration time to a value corresponding to the length of the interruption plus 10 frames.
The T-Audio TC will now run over this interruption using its tape counter information to remain synchronous.

Modification of integration time may be made with the tape in motion. The new integration time, however, will only be taken into consideration by the synchronizer when it is switched ON. Modification of the integration time will not have any influence when this is done during synchronizer operation.

When the master machine stops, the T-Audio TC continues at nominal speed for about the same time as the integration time, and only then returns to the master position. Now synchronizer operation remains FAST until LOCKED state is reached again.
The synchronizer will LOCK just as well as in both FAST and SLOW modes, at nominal speed both forward and reversed.

The SLOW mode is to be considered as the standard operational status of the time code synchronizer.

NOTE: The T-Audio TC reacts immediately to all speed variations of the master when the synchronizer is set to the FAST mode. To some extent even wow & flutter from the master may be copied through the synchronizer on the T-Audio TC tape transport.

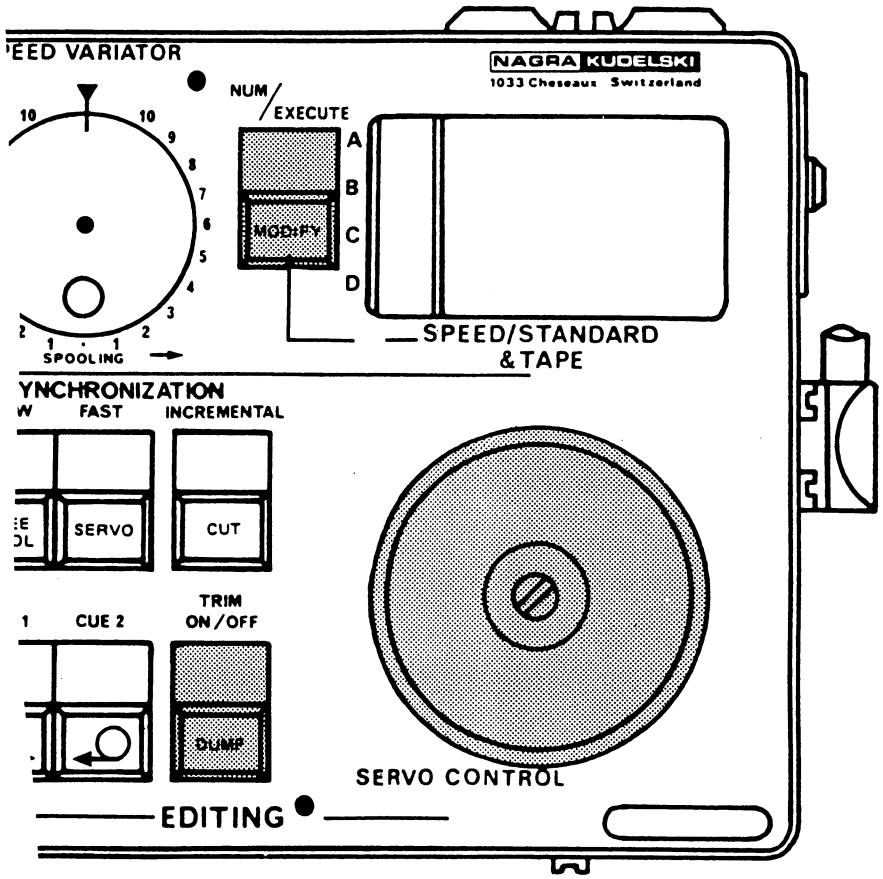

'EED VARIATOR
NAGRA KUDELSKI
1033 Cheseaux Switzerland
NUM/EXECUTE
A
B
C
D
MODIFY
SPEED/STANDARD
& TAPE
SPOOLING
YNCHRONIZATION
W FAST INCREMENTAL
SERVO
CUT
TRIM
ON/OFF
1 CUE 2
DUMP
SERVO CONTROL
EDITING

Fig 4a

4.3 OFFSET PROGRAMMING

OFFSET is a pre-programmed numerical difference between two time code tracks that are to be synchronized. An OFFSET of any value up to 24 hours (minus one frame), positive or negative, can be stored in the T-Audio TC. A negative OFFSET means that the T-Audio TC is put behind the master.
A stored OFFSET value will be maintained in the memory during power off.

MANUAL INTRODUCTION OF AN OFFSET

Display the OFFSET by pressing SHIFT+DISP OFFSET.
Press SHIFT+ ← or → to start the blinking mode as described on page II.2.5-1.
The bit section of the OFFSET register can be modified when the display is set to the high resolution format before the blinking mode is started.
If an error was made during this modification, use STOP to interrupt the modification mode and to recover the originally stored value.
Confirm the modification with SHIFT+STORE when the desired value has been reached.
When an OFFSET modification is performed while the synchronizer is switched on, nothing will happen to the tape transport until the new OFFSET is confirmed by SHIFT+STORE.

FINE ADJUSTMENT OF OFFSET

The OFFSET can be trimmed frame by frame as follows:
Select OFFSET on the display by pressing SHIFT+ DISP OFFSET.
Activate the trimmer by SHIFT+TRIM ON/OFF, this key switches the trimmer function alternately ON and OFF. If the trim function is ON, the right-hand digit of the display blinks. Now the adjustment can be made by rotating the servocontrol/offset trimmer wheel on the right-hand side of the keyboard. This adjustment does not need to be confirmed by STORE, it is effective immediately. When the desired value has been reached, press SHIFT+TRIM ON/OFF or set the display to any other mode except OFFSET to avoid accidental modification.
The above function may also be used during synchronizer operation. If the T-Audio TC is LOCKED, for example, exact sychronization of speech can be easily achieved.
Counterclockwise rotation will delay, and clockwise rotation will advance the T-Audio TC with respect to the master.

AUTOMATIC OFFSET PROGRAMMING is available by the use of the INCREMENTAL key, as described on page II.4.4-1.

4.4 INCREMENTAL MODE

As far as all tape transport reactions are concerned, INCREMENTAL mode is identical to SLOW mode. The INCREMENTAL function essentially provides automatic storing and/or updating of OFFSETs.
The SHIFT+INCREMENTAL function can be used in two ways:

AUTOMATIC CALCULATION OF OFFSET

When two tapes with different time code tracks need to be synchronized, proceed as follows:
Park both machines at a clapper or other synchronization reference point. Press SHIFT+INCREMENTAL on the T-Audio TC, this will instantly load the actual numerical offset between the two time code tracks in the OFFSET memory and activate the synchronizer in SLOW mode. This operation may also be done "on the fly", with one, or even both machines at any speed. The stored OFFSET value is now probably only approximate and can be trimmed as described on page II.4.3-1.

INCREMENTAL SYNCHRONIZATION

During normal synchronizer operation, the T-Audio TC starts chasing as soon as a time code discontinuity occurs in either master or slave time code track. INCREMENTAL mode can be used to prevent this. When the T-Audio TC is in the LOCKED state, a discontinuity in either tape will not cause any audible speed variation. (The integration of the synchronizer provides the necessary safety).
In this case, the difference between the last time code value before, and the first one after the discontinuity is calculated and added to the OFFSET. And the T-Audio TC will remain LOCKED, but with a new OFFSET.
This operation results in a resolving like synchronization, seemingly without the numerical values of the time code track taken into account. In reality however, these values are indeed processed, providing dropout protection and absolute safety when going from PLAY through STOP into PLAY-reversed. Since the T-Audio TC synchronizes just as well in backward motion as in forward, this function allows it to roll backwards out of a scene into the precedent, and to play forward again into the selected scene with immediate synchronization at the very first frame.

In this mode, an unlimited number of discontinuities may be crossed, provided that the tape transport is in LOCKED state when a discontinuity is reached. For this reason be sure not to stop too close to a discontinuity. Practical safety margins are 3 secs for 7.5 ips (19 cm/s) and 5 secs for 15 ips (38 cm/s) tape speed.

NOTE: Calculation and introduction of the new offset takes some time. A second discontinuity which occurs during this procedure can not be taken into account by the T-Audio TC. Re-record a new portion of time code if discontinuities happen to be closer than some 10 frames.

If it is necessary to switch between synchronizer INCREMENTAL and SLOW modes during a transfer, do this only when the LOCKED state is indicated, or, when both master and T-Audio TC are parked. Doing so prevents accidental entry of OFFSET or audible tape speed variations at the moment of switching.

4.5 PHASE TUNING

The previous chapters describe how to load and finely adjust an OFFSET in the T-Audio TC memory. These functions are more than acurate enough for sound to picture synchronization. For synchronization of sound to sound, (multitrack operation from more than one machine for example) access to synchronizer phase is required.
Continuous variation of the phase of the synchronizer is offered without any special commands by the use of the SPEED VARIATOR potentiometer. A correction of approximately ± 6 bits (± 3 msecs) is possible and can be made visible by selecting DELTA to the display in the high resolution format (SHIFT+DISP BITS).

The center (zero) position of the rotary control corresponds approximately to phase adjustment 0 as shown by the display. This is due to the fact that this potentiometer also serves as manual speed correction and its center position is calibrated to obtain nominal speed in that mode.

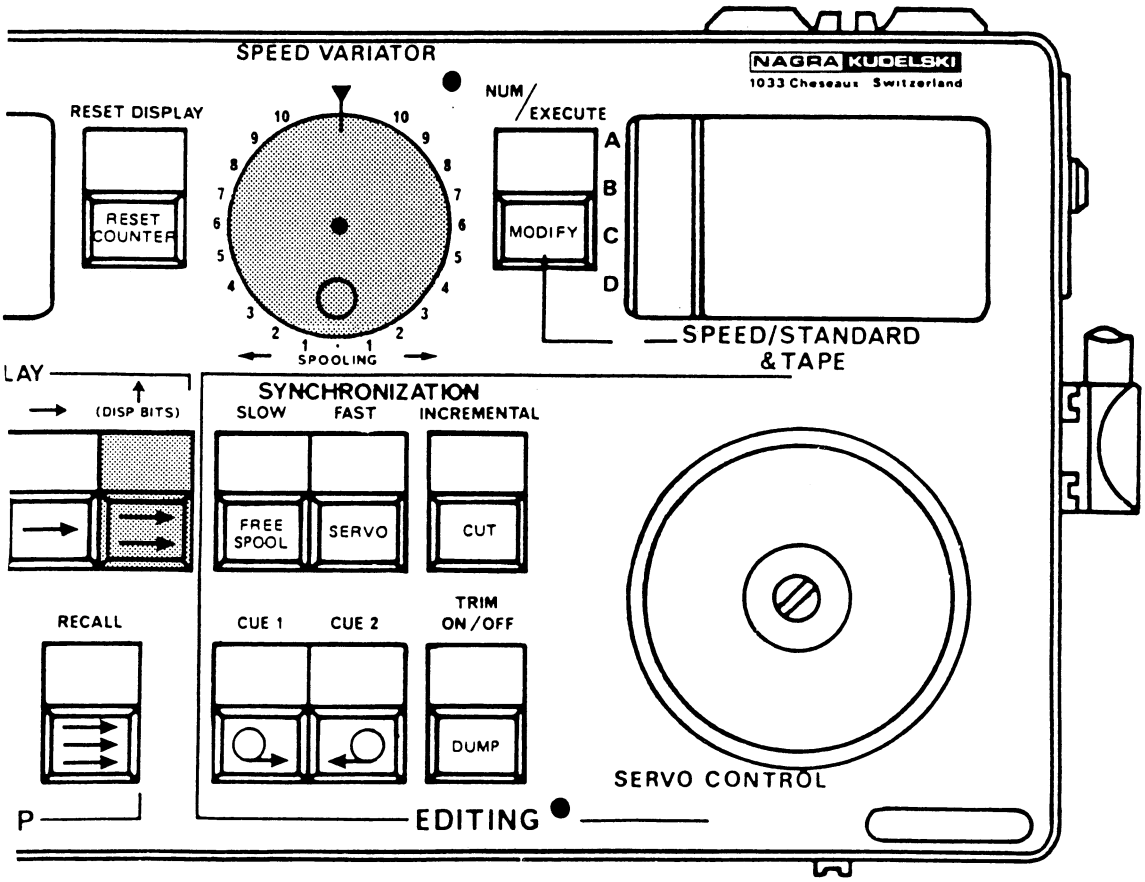


Fig.4b

5.0 EDITOR

The three channels of the NAGRA T-Audio TC are completely independent. The channel status matrix as described on page II.2.1-1 shows the functions of the time code channel. Due to this independence it is possible to record a time code on the center track of an audio tape on which sound is already recorded without the risk to damage any of the sound tracks. It is also possible to playback time code during recording, on one or both audio tracks. The synchronizer may very well use this time code to lock the tape transport to a master signal during audio recording.
This is the basis of the editing features of the T-Audio TC. A machine may be locked to any other device and synchronous transfers in either direction are possible. Page II.5.1-1 explains how to switch manually between REC and PLAY, without disturbing the synchronizer, in whatever mode it is activated. Chapters II.5.2 and II.5.3 explain how to perform an automatic insert-EDIT with the use of the CUE 1 and 2 memories as pre-determined EDIT-IN and EDIT-OUT points.

For almost all edit operations the tape needs to be "pre-striped" with a preferably continuous time code track. This can be done from an external time code source, but it might be easier to set the T-Audio TC up to stripe its own tape independent of other equipment. Page II.3.3-1 describes how the internal generator can be employed for this.

The switching between REC and PLAY during editing operations won't ever result in an audible "click" in the sound track. The bias, erase and record amplifiers are controlled in such a way, that a miniature crossfade occurs during the switching. Timing circuits take account of the relation between the tape speed and the distance between erase and record heads automatically. The drawing 5a shows this feature schematically.

In order to ensure proper timing, the tape needs to move at, or close to, nominal speed. If the T-Audio TC is started in RECORD directly from STOP, or manually stopped when in RECORD, clicks may be recorded on tape. In automatic EDIT mode, RECORD will be switched off as soon as the synchronizer dictates a tape speed other than nominal, which may be audible.

5.1 MANUAL EDITING

When the tape transport is LOCKED or stable in non-synchronized PLAY, manual "punch-in" and "punch-out" may be done on any audio channel previously selected to READY. The switching will result in a click on the audio monitoring outputs, but no audible defect will be recorded on tape. The result of the timing of erase, bias and record amplifiers is shown in drawing 5a.

MANUAL EDIT WITHOUT SYNCHRONIZER

Select the audio channel (-s) to be used to READY.
Park the T-Audio TC with sufficient preroll time before the point where the punch-in should take place. Since the T-Audio TC tape transport has very low inertia this preroll may be very short.
Start the machine in normal PLAY, and execute SHIFT+REC on the desired punch-in point.
To exit the record mode properly, first go from REC to PLAY before stopping the transport.

MANUAL EDIT, SYNCHRONIZED

Select the audio channel(-s) to be used to READY.
Select the time code channel status matrix to SAFE and SYNC: this will make the synchronizer phase the tape on the record head instead of on the reproduce head, on which synchronization normally takes place.
Activate the synchronizer in SLOW or INCREMENTAL mode, and park the machines through manipulation of the master with sufficient preroll time before the edit point. The necessary length of preroll largely depends on the characteristics of the master transport behaviour. A preroll of only 3 secs will be sufficient at tape speed 19 cm/s (7,5 ips) and if a generator is used as master.
Start the master in PLAY and punch the T-Audio TC to record by executing SHIFT+REC. Make sure not to punch-in when the LOCKED state has not already been reached; this may cause improper audio switching.
At the punch-out point, return to synchronous playback by pressing SHIFT+PLAY. This will switch the audio channel(s) back to playback without disturbing the synchronizer and without recording an audible click on the tape.
If the synchronizer detects a speed other than nominal speed during this operation, the T-Audio TC returns automatically to synchronized playback. This switching, however, is not necessarily "clean".

Page II.7.4-1 explains how above described editing can be remote controlled by simple contact closure.

5.2 CUE PROGRAMMING

The NAGRA T-Audio TC provides a total of five cue or "scratchpad" memories. The use of the three "scratchpad" memories is described on page II.2.6-1.
The memories CUE 1 and CUE 2 can also be used for cue storing , but essentially reserved for automatic editing as explained in the next chapter. CUE 1 is used as memory for the EDIT-IN point, while CUE 2 will be the EDIT-OUT point.

TO STORE A VALUE

A time code value to be stored in one of the cue memories may either be read from the tape on the T-Audio TC, or from the external time code signal. Selection is effected by first selecting time code on the display, and then INPUT or REPRO on the channel status matrix.
Press SHIFT+CUE. The entire display will flash indicating that a CUE memory has been "opened". At the moment that SHIFT+STORE is pressed, the displayed value is stored in the cue memory. The tape from which the value is taken needs not be parked, it is possible to load values "on the fly", the tape speed may even be maximum shuttle.
Storing a value in CUE 1 automatically activates the editor. This is indicated by a decimal point flashing on the left of the display.
The status of the audio channels is also automatically modified when necessary.

MEMORY MODIFICATION

Press SHIFT+CUE, SHIFT+RECALL to display the stored value. The blinking mode as described on page II.2.5-1 may now be used to modify the contents of the memory.

CUE REPLACEMENT

The value stored in the CUE 2 memory can easily be transferred into the CUE 1 memory by the following key sequence:
SHIFT+CUE 2 , SHIFT+RECALL , SHIFT+CUE 1 , SHIFT+STORE .
This method can also be used to transfer any of the scratchpad memories into either cue register.

LOCATING OF A CUE POSITION

Press SHIFT+CUE, SHIFT+RECALL to display the stored value. SHIFT+LOCATOR will make the T-Audio TC automatically shuttle to the memorized tape position.
If the locator is sent to CUE 1, the tape will be parked at a preroll distance from the actual CUE 1 value.
Numerical command 010 gives access to the stored preroll time which may be modified in the "blinking" mode as described on page II.2.5-1.

TO CLEAR A CUE, simply press SHIFT+CUE directly followed by SHIFT+RESET.

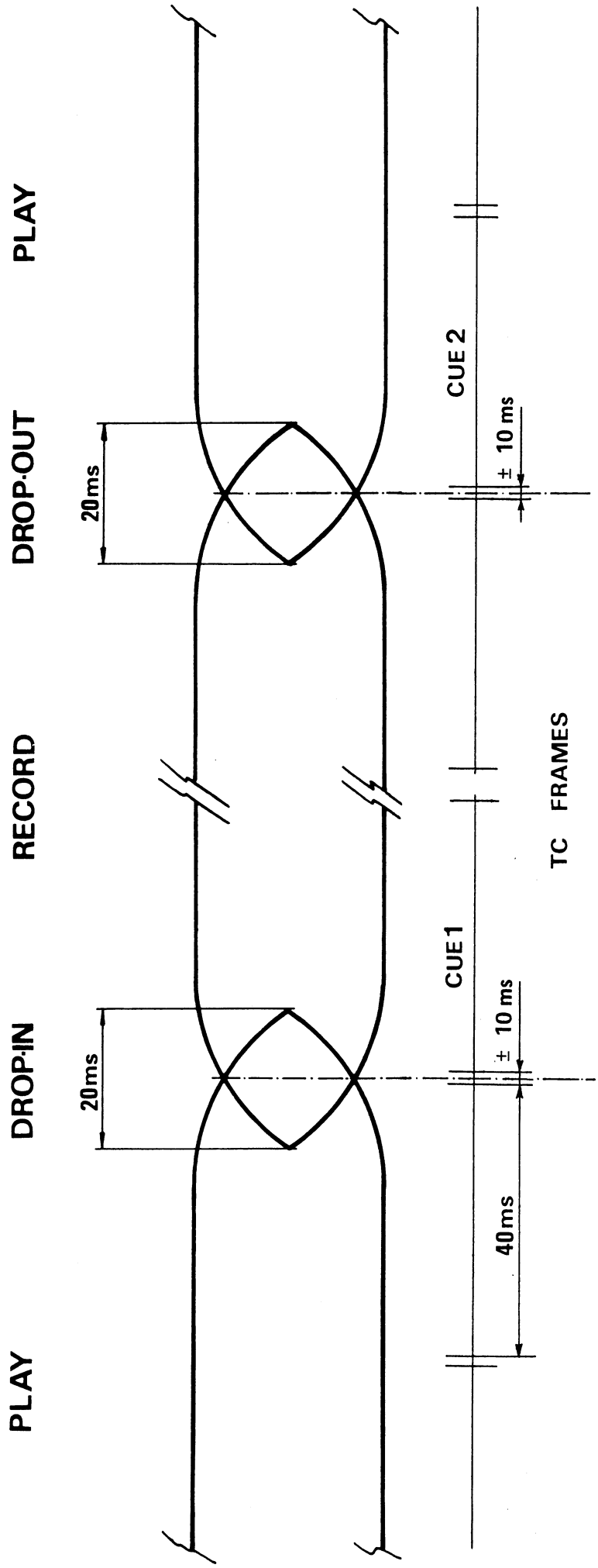


Fig.5a

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5.3 AUTOMATIC EDITING

Once the EDIT-IN and EDIT-OUT points are loaded in the CUE 1 and 2 memories as described in the previous chapter, the T-Audio TC is ready for editing.
The channel status matrix is automatically modified when a value is stored in CUE 1. Storing an EDIT-IN point in CUE 1 will also automatically switch ON the editor. This is indicated by a flashing decimal point on the left of the display.

The T-Audio TC editor is essentially developed for sound to picture post production. The editor operation is consequently very similar to the system incorporated in professional video tape recorders. Chapter II.7.2 explains that all functions, including editing, are accessible through the optional serial remote port which makes integration of the T-Audio TC in a post-production system possible.

REHEARSAL

A rehearsal (preview) can be made by simply setting all channels to SAFE and rolling the T-Audio TC across the loaded edit points in any synchronizer mode. At CUE 1, the audio channels will be switched to INPUT (EE) and at CUE 2 returned to their initial position.
The rehearsal can be made with all channels in SYNC or in REPRO.
Execute numerical command 008 for REPRO or command 009 for SYNC.

Status display: rEH.rEP. rEH.SYnC

The time code channel will be set like the audio channels in order to synchronize the tape on the selected audio head.
Make sure to allow enough preroll time; the editor will only function properly when the cue points are reached at nominal speed in LOCKED state.
The edit-exit point may be loaded "on-the-fly" into the CUE 2 memory: Make sure to reset CUE 2 to zero or to load a value considerably higher than desired. Start a rehearsal as described above and press SHIFT+CUE 2; the display shows the off-tape time code while blinking. Hit SHIFT+STORE at the desired exit point. The audio channels will return to REPRO (or SYNC) and the exit value is loaded in the CUE 2 register.

EDIT PASS

An automatic edit will be made when the above procedure is repeated with one or more audio channels set to READY. The machine will drop into record at CUE 1 and will return to playback at CUE 2. The audio switching is timed as shown in drawing 5a. Since the audio switching results in an inaudible, miniature crossfade, there is no objection to fix an EDIT IN or OUT point in the middle of the program material.

NOTE: The audio outputs are set to REPRO during the edit to allow an after tape confidence monitoring on the edit switching. Consequently, the output is not in synchronism with the picture because the synchronizer is set to synchronize the tape on the record head during editing.

Also the automatic editor is switched off, when the tape reaches CUE 2 during an edit pass; the blinking decimal point in the display disappears.
The stored values remain available for locating or repetition of the same event.
All channels return to REPRO (or SYNC) when any of the main tape transport keys (or LOCATOR) is used.

REPETITION

When an edit has to be repeated using the same entry and exit values press SHIFT+CUE 1 twice.
This will reactivate the editor, the blinking decimal point reappears, without modifying the present cue values.

CUE REPLACEMENT

When a new edit needs to be assembled "head to tail" to the previous one, proceed as follows to load the present CUE 2 value into CUE 1:
Press SHIFT+CUE 2 , SHIFT+RECALL , SHIFT+CUE 1 , SHIFT+STORE .
Note that now CUE 1 and 2 are identical; modify CUE 2 before attempting a rehearsal or edit.
This sequence may also be used to copy the contents of a scratchpad memory into one of the CUE registers.

CANCELLING OF EDIT

If the editor is switched ON accidentally, cancel CUE 1 by pressing:
SHIFT+CUE 1 , SHIFT+RESET
This will switch OFF the editor and reset the CUE 1 memory to zero.
The CUE 2 value remains in the memory.

NOTE: Automatic editing may be performed with the synchronizer in either SLOW or INCREMENTAL mode. Do note however that the OFFSET modification in INCREMENTAL mode takes some time; during which no other functions can be executed. Make sure not to place an EDIT ENTRY or EXIT point closer than 10 frames behind a discontinuity.

NOTE: Any time code value may be loaded into a cue memory for editing except 00:00:00:00. Zero is considered as register empty so the editor will not react on this value.

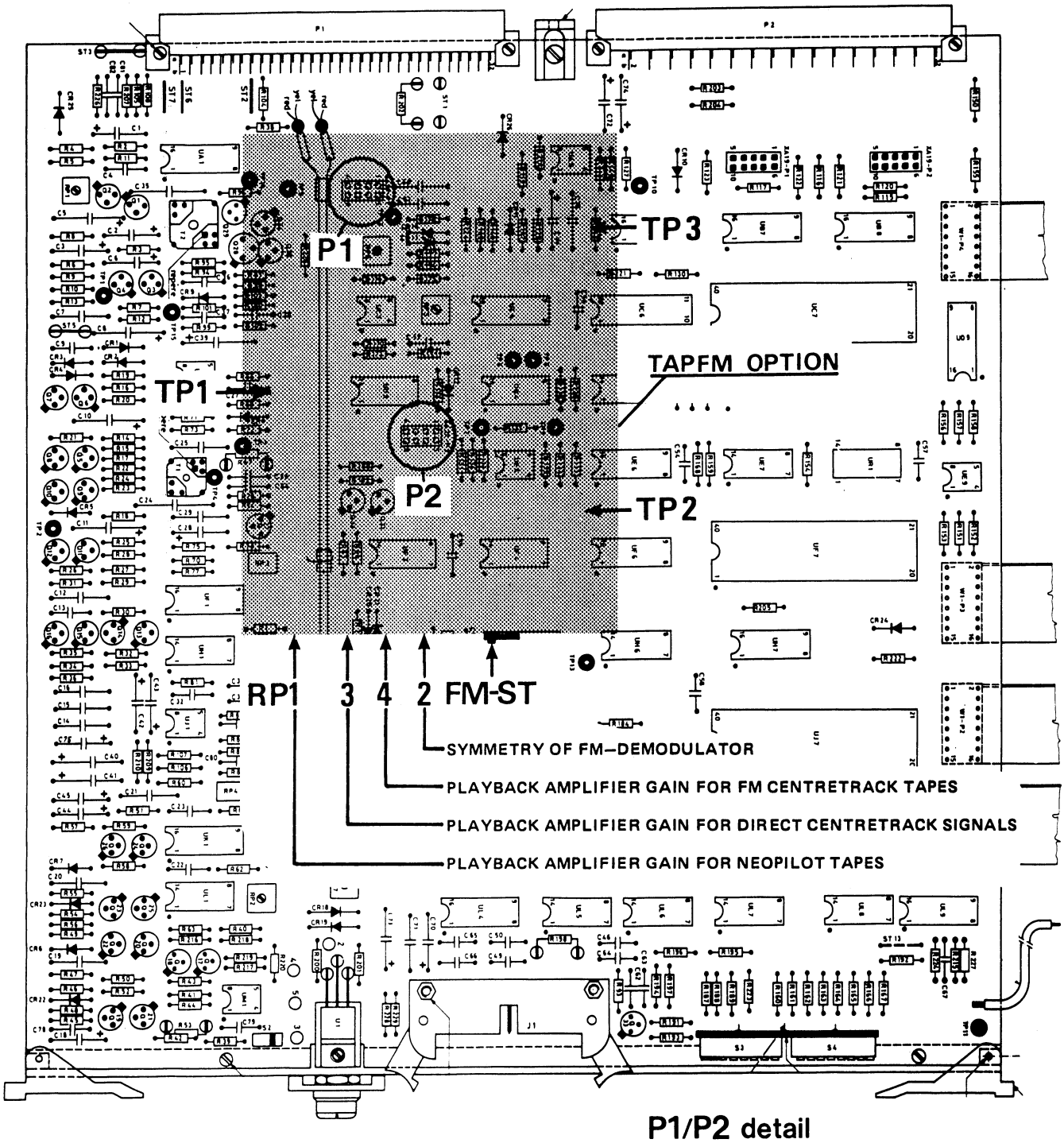
6.0 PILOT OPERATION

The NAGRA T-Audio TC accepts two options which make resolved playback of pilot tapes on any existing standard possible:

TAPFM Is a circuit to be installed in the T-Audio TC which permits resolved playback of tapes with center track pilot using the time code head. The circuit is compatible with both direct recorded pilot tapes (STELLAPILOT) and FM-recorded pilot tapes (NAGRA SYNC). Resolving is possible using either the internal generator (when fitted with the TAHSX, optional high stability timebase) or an external pilot signal as a reference.
If commentary is recorded on the center track of a NAGRA IV-S-L, the signal will be decoded and amplified to an asymmetrical line output.

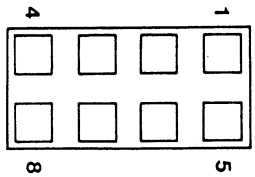
TAONP Is a miniaturized NEOPILOT head which can be fitted to the T-Audio TC headblock to read mono neopilot tapes and to resolve them using the TAPFM electronics.

The T-Audio TC is fitted with an output of pilot signal derived from off-tape time code. This output is available in any operating mode.
A second feature, enabling time code versus pilot synchronizations is the possiblity of feeding the T-Audio with a frame pulse signal as an external reference. Such a reference can be used to resolve a time code tape against a pilot reference. This resolving is done by the time code synchronizer, the presence of a TAPFM board is not required for this feature.



P1/P2 detail

Fig.6a



6.1 INSTALLATION

INSTALLATION OF TAPFM CIRCUIT

The TAPFM is to be installed on top of the time code circuitry A-05 of the T-Audio TC.
Proceed as follows:

Make sure that power is switched OFF.
Open the front cover of the machine by loosening the two screws located under the keyboard. To gain access, rotate the keyboard upwards. Half a turn counterclockwise should be sufficient to undo these bayonet type screws.
Remove the colored ribbon cable from the front of the time code board by pushing outwards the two black plastic catches that hold its connector in place.
Remove the board from the machine chassis by pulling gently the two black plastic levers on the front corners of the circuit.
Plug the TAPFM board on the two 8 pin connectors as shown in figure 6a.
A screw hole is provided close to each connector to secure the circuit in place.
The shield should be fitted between the special bolts at the corners of the board by slightly bending it and slipping it in the slots.

INSTALLATION OF TAONP OPTION

This option is essentially a miniaturized neopilot head which is to be added to the head block. It is fixed on the side of the tape tension sensor as indicated in figure 6b. After installation of this head a recalibration of the entire headblock is necessary. Consequently it is strongly advisable to have this option factory installed.

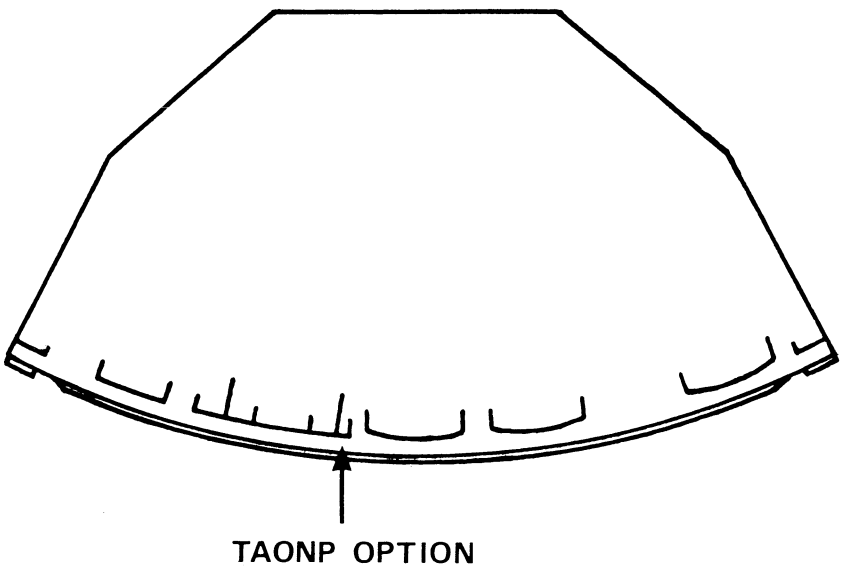


Fig 6b

6.2 CONNECTIONS

All connections relative to pilot operation are found on the THIRD TRACK INPUT/OUTPUT SOCKET:

1 **CUE OUT** — Output of commentary or other information decoded from the FM-modulated center track from tapes recorded on a NAGRA IV-S-L. This output is filtered at approximately 200 Hz to 3 kHz in order to separate pilot and cue information when these signals are recorded mixed.

Level: 1.2 Vrms for ± 20 % modulation at 1 kHz.
Impedance: Z-load minimum 1 kOhm

2 **EXT.REF.** — Input for an external reference signal routed to the TAPFM TAPFM resolver circuit, and to the time code generator and synchronizer. The signal is first routed through the TAPFM for level adjustment and wave shaping.

Sensitivity: 0.8 to 14 Vpp.
Waveform: Anything, only 50% duty cycle is required.
Impedance: bigger than 47 kOhm

If no TAPFM is installed it is still possible to feed an external reference. A jumper has to bridge pins 1 and 8 of TAPFM connector P-2, and the reference needs to be a 5 V logic square wave because no level adjustment is made by the T-AudioTC itself.

7 **50/60 from TC** — Output of the pilot signal derived from off-tape time code.
In pilot mode the output of pin 7 is phase lock looped to the T-Audio T.C. internal generator.
In the time code mode with the time code channel status matrix in SYNC + READY the output of pin 7 is phase lock looped to the internal generator.
In time code mode with the time code channel status matrix in READY + INPUT the output is phase lock looped to external time code.
In time code with the time code channel status matrix in REPRO the output is phase lock looped to time code play signal.
For the relationship between time code frame rates and pilot frequencies see page II.1.3-3.

Level: + 5 Volt logic square wave
Waveform: Square
Impedance: 1 kOhm, Z-load should be greater than 5 kOhm

9 **PILOT OUT** — Output of the pilot signal read off tape by the TAPFM decoder circuit. This output is available at all speeds close to nominal, with resolver active or not. A low pass filter is provided, to separate cue information in the case of mixed recordings on an FM modulated center track.

Level: approximately 1.7 Vrms
Waveform: Sine
Impedance: Z-load minimal 1 kOhm.

14 GROUND

6.3 SET-UP

The switches used to set the pilot electronics to the desired mode are located on the right-hand block of eight switches on the upper surface of the leading edge of the time code board, and on the TAPFM circuit itself.

REFERENCE SELECTOR

It is located in the middle of the upper surface of the time code board A-05. For its operation see page II.1.3-1. When an external reference needs to be applied to resolve a time code tape, numerical command 004 should be also executed, and the reference must be a frame pulse not a pilot signal.
Execute numerical command 005 to return to normal operation.

CENTER TRACK DIRECT / FM

This switch is located on the leading edge of the the TAPFM circuit. See figure 6a. Slide to the left for playback of FM recorded NAGRASYNC tapes. Slide to the right for playback of direct recorded signals (STELLAPILOT). These positions are marked FM and ST on the board itself.

PILOT FREQUENCY

The pilot frequency is selected by the same selectors as used for the time code frame rate.
For their setting and for the relation between time code frame rate and pilot frequency see page II.1.3-3.

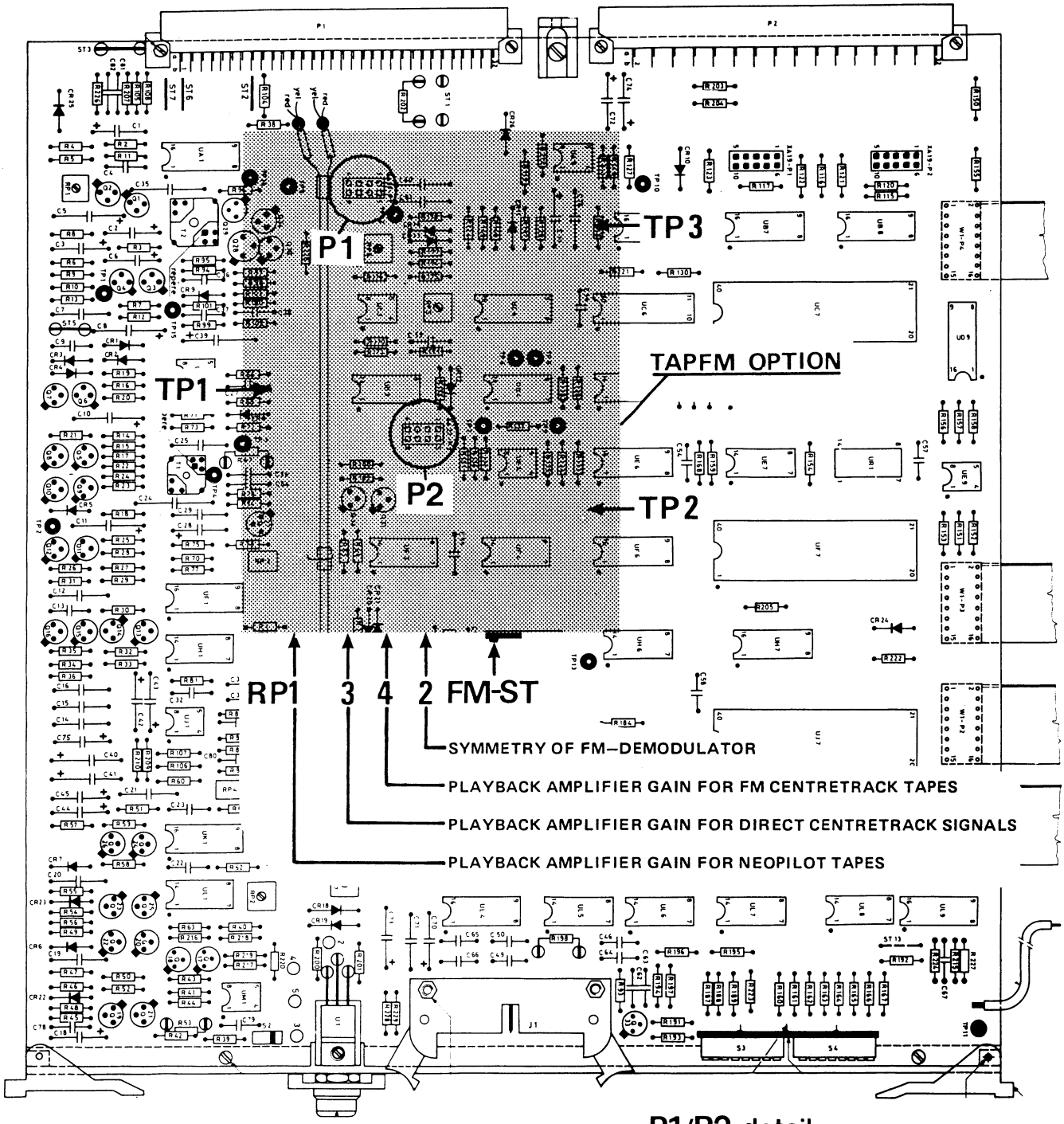
TIME CODE/PILOT SELECTOR

This is the main mode selector. This is switch number 5 of the right-hand block of eight switches on the time code board. Select ON for time code operation and slide to OFF when the TAPFM is to be activated.

NOTE: The LED marked TIME CODE also serves as off-tape signal indicator in pilot mode. It does not light up when the wrong tape speed has been selected.

NEOPILOT / CENTERTRACK

This is switch number 6. Select ON for center track pilot, in which case the choice between FM or DIRECT recorded tapes needs to be made with switch FM/ST on the TAPFM board. Set to OFF for NEOPILOT tapes.
Status diplay: Centre track: F M _ P i _ . .
NEOpilot: P i L o t _ . .
To assure proper cancellation of Neopilot signals in the audio output, set switch S-101 on the left of the board A-02 to MONO position.



P1/P2 detail

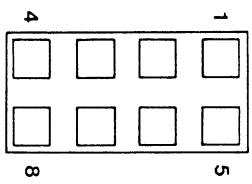


Fig. 6c

6.4 CALIBRATION

This is only a condensed description of the calibration procedure of the TAPFM circuit. More details can be found in the "Timecode and pilot options" section of this manual (Section 5).

As test tapes for calibration, use pilot tapes that were recently recorded on a well calibrated pilotone recorder.

Make sure that the machine is properly set for the tape on which a calibration is to be done. Follow the instructions given on page II.6.3-1.

TEST POINTS

For the location of the test points refer to drawing 6d.

TP-1 Neopilot playback signal before RP-1.
Should show 21 mV rms.

TP-2 Symmetry of FM-demodulator
Should show the FM decoded signal symmetrical with respect to earth.

TP-3 Final output stage of circuit
Should show approximately 450 mV pp from all three tape types.
Equivalent to 1.7 V rms output on pin 9 of third track input/output.

POTENTIOMETERS

Refer to drawing 6d on the opposite page for their physical location.

RP-1 Playback amplifier gain for neopilot tapes.
RP-2 Symmetry of FM-demodulator, FACTORY ADJUSTED.
RP-3 Playback amplifier gain for direct center track signals.
RP-4 Playback amplifier gain for FM center track tapes.

6.5 RESOLVING, PILOT TAPES

First make sure that the operational mode of the T-Audio TC corresponds to the tape to be played back. Refer to page II.6.3-1 for the selector positions.
The TIME CODE LED on the keyboard normally lights up when a proper pilot signal is read off tape. This indication will fail, when the wrong tape speed has been selected.
The T-Audio TC should be in normal synchronizer mode for the procedures mentionned below. (numerical command 005, status display: r E F . _ t c _)

RESOLVING TO AN EXTERNAL REFERENCE

Feed the reference signal to pin 2 of the THIRD TRACK connector as described on page II.6.2-1 and set switch S-1 to EXTERNAL position. (See page II.3.2-1 for further information).
Make sure that the tape signal frequency is identical to the reference.
(Mixed use of 59.94 Hz and 60 Hz is however allowed).
Start resolving by pressing SHIFT+PLAY or SHIFT+INCREMENTAL.

RESOLVING TO THE INTERNAL GENERATOR

The use of the optional high stability timebase TAHSX is strongly recommended for this operation because of the relatively low stability of the standard timebase. See page II.3.1-1.
Make sure that switch S-1 (See page II.1.3-1) is in INTERNAL position, and that the generator frequency is set to the same value as the signal on tape. (See page II.1.3-3).
(Mixed use of 59.94 Hz and 60 Hz is, however, allowed).
Press SHIFT+PLAY or SHIFT+INCREMENTAL to start resolving.

NOTE: It is possible to record on one or both audio channel(s) while resolving the tape transport on a prerecorded center track pilot signal. This may be done against either an internal or an external reference. This is not possible on a NEOPILOT tape because of the width of the audio erase effect; the pilot tracks are also erased (before they reach the neopilot head).

TIME CODE STRIPING OF NEOPILOT TAPES

A NEOPILOT tape can be striped with time code for postproduction purposes.
This can be done using either an external time code source or the internal generator. It is recommended, however, to use the latter because an accurate synchronization between on-tape pilot and the new recorded time code signals can only be guaranteed by doing so.
Set the mode selectors for neopilot resolving and check that S-1 is in the INTERNAL position. Select the time code channel to SYNC and READY in the status matrix.
Start resolving by pressing SHIFT+INCREMENTAL, and start the recording of time code by pressing SHIFT+REC as soon as the tape transport is stable.

NOTE: The erasure of the center track also decreases the NEOPILOT signal level by some 5 to 6 dB. This means this operation can only be performed on tapes having a good pilot level to start with. In case of difficulties increase the pilot playback gain temporarily as described on page II.6.4-1. Also avoid repeating this operation several times on the same tape; the legibility of the pilot signal can not be guaranteed after the second pass.

6.6 RESOLVING OF TIME CODE TAPES

In spite of the fact that a time code signal contains a lot more information, it can still be applied as a pilot frequency to execute simple resolving.
This resolving is performed by the time code synchronizer TASYN which means that the features mentionned below are available without the optional pilot resolver TAPFM.

The synchronizer is set to resolver mode by executing numerical command 004. Line 6 of the status display menu should show: "r E F . _ P i L" (in software version up to 1.6) and "rEF.Fr.P" (in software version from 1.6 onwards).

EXTERNAL TIME CODE REFERENCE

The synchronizer may be left in the normal (chaser) mode for this operation.
Feed the reference time code signal to either the XLR connector at the back, or to the LEMO connector on the front of the machine.
Check receipt of this signal by setting the time code channel to SAFE and INPUT on the status matrix. The values of the signal should now be visible on the display and the indicator light marked TIME CODE should light up without interruption.
Check that the frame rate of reference, off-tape time code and machine setting are identical. (Mixed use of 29,97 fps. and 30 fps. is allowed). For the frame rate selectors see page II.1.3-3.
Start resolving by pressing SHIFT+INCREMENTAL, the LOCKED indicator lights up as soon as resolved play speed is reached.

EXTERNAL PILOT REFERENCE

Execute numerical command 004 to set the synchronizer in the resolver mode.
Feed the reference signal to pin 2 of the THIRD TRACK connector as described on page II.6.2-1 or to pin 5 of BJ-13 (RS-422) and set the reference selector S-1 (See page II.6.3-1) to external.
Make sure that the reference frequency, and the frame rates from off-tape time code and the machine setting match. The reference signal should provide one pulse per frame. (Mixed use of 29,97 fps. and 30 fps. is allowed).
Start resolving by pressing SHIFT+INCREMENTAL, the LOCKED indicator lights up as soon as resolved play speed is reached.

NOTE: It is possible to switch one or both audio channel(s) to RECORD as soon as the LOCKED indicator has come on in any of the above modes. This allows the resolved recording of sound on a tape that was previously "striped" with time code. Automatic insert editing, as described on page II.5.3-1, is also possible. This is **not** true for the last resolver mode; using the internal generator (See page II.6.6-2). To switch to RECORD in this mode would result in the erasure of the time code track since this channel has to be set to READY to make the internal generator signal available.

Return the synchronizer to its normal (chaser-) mode by executing numerical command 005. Line 6 of the status display menu should show: r E F . _ t c _

RESOLVING AGAINST INTERNAL GENERATOR

Execute numerical command 005 to set the synchronizer in the standard mode.
(Line 6 of the status display menu should show: r E F . _ t c _)
For this operation check that switch S-1 is set to the internal reference position.
The use of the optional high stability timebase TAHSX is strongly recommended because of the limited accuracy of the standard timebase.
Check that the machine frame rate setting corresponds to the signal recorded on tape. (Mixed use of 29,97 fps. and 30 fps. is allowed).
Provide a loop between the machines time code input and output. Use a standard XLR cable between the connectors at the back or connect pins 2 and 5 of the five pin LEMO connector on the front.
Set the status matrix to READY and SYNC for the time code channel.
Press SHIFT+INCREMENTAL to start resolving. The LOCKED indicator lights up as soon as the resolved playspeed is reached.

NOTE: Do not attempt to record audio in this operation. This would result in the erasure of the time code track.

NOTE: Recording of audio is however possible by putting the time code channel in the safe position.

7.0 REMOTE CONTROL

The NAGRA T-Audio TC keyboard may also be considered as a remote control because it may be seperated from the tape transport with an extension cable up to 10 meters (50 meters when low resistance cable is used).
It is equally possible to connect a second keyboard to a machine when the machine is fitted with the TA-PPA option (supplementary keyboard input).

Direct access to the control logic bus is possible through the REMOTE CONTROL INPUT/OUTPUT on connector BJ-3. For details on the control logic bus see page II.7.1-1 of this section and the page III.3.0-1 of this manual.

NOTE: The remote control connector is part of TA-RAM option which is not included in the standard configuration of the non-time code versions of the T-Audio.

The optional (TAIRS) RS-232 port allows the T-Audio TC to communicate with a personal computer. The protocol and other details can be found on page II.7.2-2.

The TAERS is an external device specially developed for integration of a T-Audio TC in a computer assisted post-production system. It communicates with the T-Audio TC through the TAIRS option, which is therefore switched to RS-422 format.

For further information on protocols see chapter II.7.3 and section VI "External accessories".

Special remote control features such as fader start are possible through the SPARE inputs on the THIRD TRACK connector. TC machines only. See page II.7.4-1.

7.1 PARALLEL REMOTE CONTROL

The parallel remote control of the T-Audio is only possible through the interface TAERP, of which a description can be found in Section VI.

All internal information exchanges are routed through a 6-bit parallel bus, and a single wire, bi-directional serial bus is used to connect the keyboard(s).

Both buses are accessible through connector BJ-3 "Remote control" of which description can be found in Section III, chapter 3.2. Simple remote control functions such as fader start can be done using the "spare" inputs of the time code system. See chapter II.7.4-1.

7.2 SERIAL REMOTE, OPTION TAIRS

A Nagra TA-TC can be remote controlled from any external computer-like device either through the RS-232, or the RS 422 port, when fitted with option TAIRS. This option is a combination of both hardware and additional software.
The hardware part consists of an IC type NSC-858N which has to be fitted in the socket provided at position UK-4 on board A-05/A-23 (which is the upper half of the TC circuitry).

The necessary software package is present in all software versions marked .....RS. Check the last line of the status display menu to make sure that the right software version is installed in your machine (See page II.1.4-1).

The switches described on page II.1.3-1 select between either the RS-232 or the RS-422 port. The baud rate is variable from 2400 to 19200 the first case, but fixed at 19.2 kBauds (+4%) for use of RS-422. The communication protocol on the following pages is valid for both ports.

An external interface (TAERS) is available to allow the integration of a NAGRA TA-TC in an audio/video edit/production system. A description is found in Section VI of this manual.

NOTE: Until software version 1.6 only the RS-422 port can be used.

RS-422 / RS-232 PROTOCOL OF TAIRS OPTIONS

GENERAL

The signaling rate is 20.0 kBaud (about 4% higher than the standardized 19.2 kBaud), however this should not be a problem for systems having a 19.2 kB rate.

Each character consists of a START bit, EIGHT DATA bits, a PARITY bit and a STOP bit. The parity bit is such that the sum of the ONES in the data and the parity bit itself is an EVEN number.

The connectors, voltage levels, source impedances, etc., described in the documents are similar to RS 422 and RS 232 standards. See also page II.1.2-3.

WARNING: For the time being the RS 232/422 switch on the front pannel of the time code board is not operational. The switching between RS 232 and 422 ports will only be done in software version 1.6. Until the 1.6 version becomes available, use only the RS 422 port.

MESSAGE STRUCTURE:

to NAGRA T-AUDIO:

STX (Hex 02):	at the start of every message
Byte count of the message:	does not include the STX itself, or the checksum
The message:	variable length, 250 bytes max.
The checksum:	the two's complement of the one-byte sum, without carry, of the message and the byte count.

Several commands may be put onto one message line, as follows:

STX
Byte count of all the commands
Command 1
.....
Command N
Checksum

From NAGRA T-AUDIO, each frame:

STX (HEX 02)	Hexadecimal value 02
Byte count	Hexadecimal value 17

23 bytes of status
The checksum, which includes the byte count and the status byte.

NOTE: On power up the T-AUDIO sets itself in standby (idle) mode. It will not accept any command or send back the above mentionned status before having received a break character.
The sending of these status, is in the present software, dependent upon the presence of an external reference signal (whether time code in rEF. tc mode or an external square wave at the frame rate in "rEF. Pil" or "rEF.Fr.P" from Eprom version 1.6 onwards. To transmit these 23 bytes of status, it requires approximately 16 ms (half a NTSC frame) with a signaling rate of 19.2 kBauds therefore a slower signaling rate should not be used.

TIME CODE FORMAT

Time code values are transmitted as fields of 4 bytes in packed BCD, hours byte first. Most significant nibble (4bits) is tens, least is units.

COMMANDS

The following are all the commands decoded in the NAGRA T-AUDIO. Numbers are hexadecimal values.

NOTE: A + sign in the following text indicates data to follow the command.

27 DEFER COMMANDS

+ 4 bytes of time code which is the time of execution.
+ 1 byte which is the byte count of the command(s) to be defered
+ N bytes of command(s) to be deferred

2E TIME LINE STOP

Stops incrementing the software counter

2F LOAD TIME LINE

+ 4 bytes of time code data.
This value must be earlier than the first deferred command.

30 TIME LINE CLEAR

All events associated with the time line are cleared.

41 STOP

Sets the T-Audio to STOP or PARK according to the READY status (command 48).

42 SLOW PLAY

Play with variable speed from 0 to nominal speed.
+ 2 bytes of data, most significant first:
-512 = nominal speed backwards / 0 = steady /+512 = nominal speed forward

43 PLAY

Sets the T-Audio to PLAY

46 SHUTTLE

Variable speed mode for speeds greater than nominal speed
+ 1 byte of data
1 full speed backwards / 128 : steady / 254 : full speed forward

NOTE: Tape in contact with T.C head.

NOTE: Maximum values 0 and 255 produce respectively FAST REWIND and FAST FORWARD where tape is no longer in contact with any head.

47 **NOMINAL SPEED OVERRIDE**

Variable speed about nominal speed + 1 byte of data
0 : 12% / 128 : nominal speed / 225 : +12%

48 **READY ON/OFF**

+ 1 byte of data
0 = off (sets the T-AUDIO in park), 1 = on (sets the T-Audio in stop)

4A **EDITOR MODE**

+ 1 byte of data
0 = off, 1 = insert, 2 = assemble, 3 = rehearse, 4 = crash record.

4B **RECORD ENTRY**

+ 1 byte of data.
This causes the T-Audio to start recording on the specified channels if the editor mode is in INSERT or ASSEMBLE and the synchronizer is locked.
If the editor mode is in REHEARSE the specified channels will switch to input.
Bit 1: Audio channel 1 READY
Bit 2: Audio channel 2 READY
Bit 7: Time code channel READY

NOTE: This command requires prior sending of RECORD ENABLE (66) on the specified channels.

4C **RECORD EXIT**

+ 1 byte of data, same format as in 4B above.
Inversed process as RECORD ENTRY.
For a clean audio record exit, for example during an insert, the RECORD EXIT command must be applied to all recording channels. A partial exit, of one channel only will produce audible clicks on the concerned track.

4D **TCG TIME SOURCE**

+ 1 byte of data
0 = Stop time code generator / 1 = Start time code generator.

4E **TARGET SEARCH** (LOCATOR)

+ 4 bytes of time code data.
Causes the T-AUDIO to move to the specified location, ignoring preroll.

4F **PREROLL SEARCH**

No byte of data.
Causes the T-Audio to move to the point specified by the command SET CUE POINT, hexadecimal value 61.

50 **ROLL**

Play with synchronization providing the time line has been correctly started in INSERT, ASSEMBLE or REHEARSE mode. In CRASH RECORD mode this command starts the recording.

53 **CHASE**

Synchronization depending on syncro-mode set by command SYNCHRONIZE SELECT 54

54 **SYNCHRONIZE SELECT**

+ 1 byte of data:
00 : External time code, data dependent = SYNC SLOW
01 : External time code, data independent = SYNC INCREMENTAL
02 : External frame pulse reference = SYNC INCREMENTAL
03 : External time code, data dependent = SYNC FAST

55 **SET SYNC OFFSET**

+ 4 bytes of time code data
Stores synchronization offset

5A **TAPE / EE**

+ 1 byte of data
0 = Audio channels 1 and 2 : REPRO / 1 = Audio channels 1 and 2 : INPUT

5C **COLOR FRAMER**

+ 1 byte of data
Read but not presently used.

60 **SET PREROLL**

+ 4 Bytes of time code data
Suggested minimum for NAGRA T-AUDIO TC is 2 1/2 seconds at 19 cms/sec and 3 1/2 seconds at 38 cms/sec.

61 **SET CUE POINTS**

+ 4 bytes of time code data

62 **SET SYNC POINT**

+ 4 bytes of time code data
Not presently used.

63 **SET TIME CODE**

+ 4 bytes of time code data
Sets the internal time code generator to the specified value.

64 **SET USER BITS**

+ 4 bytes of user bits data, most significant byte first.
Sets the internal user bits generator to the specified value.

65 **SET TAPE TIMER**

+ 4 bytes of "time code" data
Sets the tape timer to the specified value.

66 **RECORD ENABLE**

+ 4 bytes of data, same format as in command 4B above.

69 **JOG FORWARD**

Causes the T-Audio to advance one frame. The T-Audio automatically sets itself to SERVO mode.

6A **JOG BACKWARD**

Causes the T-Audio to reverse one frame. The T-AUDIO automatically sets itself to SERVO mode.

6B **TIME SOURCE SELECT**

+ 1 byte of data
0 : time source = time code / 1 : time source = tape timer.

Status sent back by the T-Audio .

At each frame, the T-AUDIO sends back 23 bytes of status with a constant format.

1 **DEVICE IDENTIFICATION:**

1 byte, T-Audio identification : hexadecimal value 1D.

NOTE: The used identification may also be set to 09 (Ampex VPR-3) by numerical command 205. Numerical command 204 returnes the machine to its standard behaviour.

2,3,4,5 **TIME CODE DATA**

4 bytes of time code data, hours first.

6,7,8,9 **USER BITS DATA**

4 bytes of user bits most significant first

10 **STANDARD**

Bit 0 : NTSC / PAL	(0 = PAL)
Bit 1 : Drop frame	
Bit 2 : Time line running	
Bit 3 : Deferred buffer full	
Bit 4 : Current event executing	
Bit 5 : Sense	(0 = forward)
Bit 6 : Still	(1 = T-Audio at rest)
Bit 7 : Error	

11 **TRANSPORT STATUS**

1 byte of data:

00 :	Stopped
01 :	Stopping
02 :	Playing
03 :	Nominal speed override on
04 :	Shuttle mode
05 :	Fast forward
06 :	Fast rewind
07 :	Synchronizing

08 : Synchronized and is a source
09 : Synchronized and is the master recorder
0A : Master edit period (not implemented)
OB : Record
OC : Cueing
OD : Cued (parked)
OE : Searching
OF : Search completed
10-12 : Reserved
13 : Slow play
14 : Power not on (not implemented)
15 : Not in remote control (not yet implemented)
16 : Unthreaded (from Eprom 1.6 on)

12 **EXTENDED STATUS**

Reserved for signaling error conditions not yet used

13 **READY STATUS**

1 byte of data: 1 = READY / 0 = READY OFF

14 **TAPE / EE STATUS**

1 byte of data : 0 = TAPE (REPRO) / 1 = EE (INPUT)

15 **TIME CODE STATUS**

1 byte of data : 0 = OFF / 1 = ON

16 **SYNCHRONIZATION MODE**

1 byte of data:
00 : External time code, data dependent = SYNC SLOW
01 : External time code, data independent = SYNC INCREMENTAL
02 : External frame pulse reference = SYNC INCREMENTAL
03 : External time code, data dependent = SYNC FAST

17 **EDITOR MODE STATUS**

1 byte of data
00 : OFF
01 : INSERT
02 : ASSEMBLE
03 : REHEARSE
04 : CRASH RECORD

18 **RECORD ENABLE STATUS**

Bit 1 : audio channel 1
Bit 2 : audio channel 2
Bit 7 : time code

19 **TC GEN MODE**

1 byte of data : 0 : TC hold / 1 : TC run / 2 : TC jam

20 **TIME SOURCE SELECT**

1 byte of data : 0 : time code / 1 : tape timer

21, 22 RS 422 ADDRESS

2 bytes of data : selected by use of numerical command 200

23 SPEED SETTING

1 byte of data

00 :	9.5 cm/s (3.75	ips)
01 :	19.0 cm/s (7.5	ips)
02 :	38.0 cm/s (15	ips)
03 :	76.0 cm/s (30	ips)

7.3 EXTERNAL INTERFACE TAERS

This option is an external 19" rack mount interface which allows the T-Audio T.C. (When used in conjunction with the TAIRS OPTION) to communicate with other microprocessors at baud rates of up to 38.4 Kbauds complying to the SMPTE/EBU standard.

In order to make the interface compatible with different protocols it is only necessary to change the software in the TAERS, the hardware remains the same for Sony and Ampex protocols.

The TAERS stores and re-arranges the status answer backs of the T-Audio T.C. according to these protocols. The TAERS can also contain the TAESV option which is a video SYNC stripper. (Video signal black burst extractor) to enable the T-Audio T.C. to be synchronized to the "HOUSE" reference signal normally used in all video applications (PAL, NTSC or SECAM).

For further information on TAERS and TAESV see section VI of this manual "EXTERNAL ACCESSORIES".

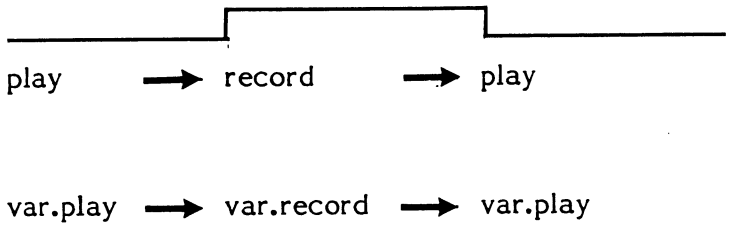
7.4 SPECIAL REMOTE CONTROL INPUTS

Two software programmable input/outputs are available for special remote control functions: SPARE-1 and SPARE-2 located on the THIRD TRACK connector are always internally connected to the microprocessor system but need to be activated by the execution of numerical commands.
The +5 V from pin 6 may be applied to the input through a normal switch, for example as fitted in a fader to execute the function.
Connected to ground or left open returns the T-Audio TC to its previous status.

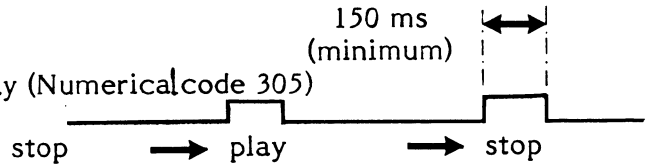
SPARE 1	This pin is programmed in standard software as an output following the logic values of the FM/Neopilot signal (+ 5 V = FM, O V = Neopilot). Spare 1 output is used in the TACO-D (TC/PILOT DISPLAY MODULE).
SPARE 2	
Fader start:	This pin is programmed in standard software as an input with programmable features: Execute numerical command 301. The display will show: S P 2 _ P L A Y . Position the tape on the desired cue point and push STOP. +5 V to SP-2 results in PLAY. 0 V returns the T-Audio TC to STOP.
Record switching:	Execute numerical command 302. The display will show: S P 2 _ r E C _ . +5 V to SP-2 will drop the T-Audio TC into RECORD. (At least one channel should to be in READY on the channel status matrix) 0 V will return the machine to record-OFF. The resulting edit is similar as explained on page II.5.1-1. This switching is possible at nominal PLAY-speed as well as in synchronizer mode when the transport is LOCKED.
End	Execute numerical command 300 to inhibit SPARE-2. The display will show:S P 2 _ o F F _ .
Pulse PLAY START/STOP	Numerical command 305 See II.7.4-2. For timing etc.
Pulse RECORD START/STOP	Numerical command 306 See II.7.4-2. For timing etc.

Spare 2 programmed play (Numerical code 301)

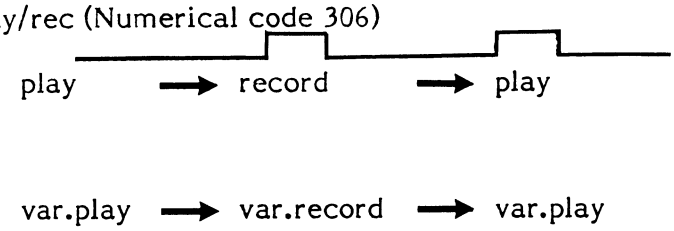
spare 2 programmed play/rec (Numerical code 302)



spare 2 programmed toggle play (Numerical code 305)



spare 2 programmed toggle play/rec (Numerical code 306)



8.0 NUMERICAL COMMANDS

Special functions and special mode selections are made through the execution of numerical commands.
Chapter II.8.1 lists the available command numbers and a short description of their effect. The underlined commands are the initial status in which the T-Audio TC is factory set or after an EPROM change.

The numerical commands are three digit numbers. The first digit indicates the number of the functional group:

Group 0xx: Functions in relation to the synchronizer and editor.

Group 1xx: Internal generator.

Group 2xx: Serial remote (TAIRS and TAERS options)

Group 3xx: General set-up and maintainance.

To execute a numerical command proceed as follows:

Push SHIFT + NUM/EXECUTE to start the numerical procedure.
The display will show three zeros the left of which is blinking.
Key in the desired command number using the "blinking"mode as described on page II.2.5-1.
After completion of the number hit SHIFT + NUM/EXECUTE a second time to execute the command.
In the case of status modification, the display will show the status menu on the line relative to the mode that has been just modified.
SHIFT + ↑ or ↓ can be used to check the other status of the T-Audio TC.
Hit any of the main tape transport keys or SHIFT + DISP TC to return to normal display.

COMMAND	FUNCTION	SEE PAGE
100	Stops internal generator Display : t c _ H O L d _	II.3.0-1
101	Starts internal generator Display : t c _ r u n _ _	II.3.0-1
102	Protection of internal generator from accidental modification of time or user bits information. Display: P r o t E C t .	II.3.3-1 & II.3.4-1
103	Authorization of modification. Display: P r o t . o F F	II.3.3-1 & II.3.4-1
200	Access to the machine identification number. Shows the present number which may be modified by the "blinking" method	II.2.5-1
202	Single frame JOG, forward	II.7.2-5
203	Single frame JOG, backward	II.7.2-6
204	T-Audio TC identifies itself as T-Audio, id.code 1D.	II.7.2-6
205	T-Audio TC identifies itself as VPR-3, id.code 09.	II.7.2-6
300	SPARE-2 no function Display: S P 2 _ o F F _	II.7.4-1
301	SPARE-2 for faderstart Display: S P 2 _ P L A Y	II.7.4-1
302	SPARE-2 for RECORD switching. Display: S P 2 _ r E C _	II.7.4-1
303	Inhibition of off-tape time code filter P-1380 (See Tech. information 09-5)	
304	Automatic switching of off-tape time code filter P-1380	
305	Toggle pulse start of play on SPARE 2 Display: SP2 _ P _ to	
306	Toggle pulse start of record on SPARE 2 Display: SP2 _ r - to	

9.0 ERROR MESSAGES

As soon as something unacceptable happens to the NAGRA T-audio TC, an ERROR message will appear on the display. The list below explains the meaning of the different messages and indicates a possible solution to the problem.

To return to normal display, push any of the main tape transport keys or SHIFT+DISP TC.

ERROR 01 Non existent numerical function has been executed. No action will be undertaken.

ERROR 02 Invalid time code. An unusable time code signal has been fed to the input of the machine for setting. Check frame rates.

ERROR 03 Invalid date. The T-audio has been brought to the calendar mode for its generator user bits. A set from external or a manual set has been attempted with user bits that do not conform to the date format. The setting has been refused. Modify the user bits to conform to the date format or change the user bits mode to FREE. (See page II.1.3-3).

ERROR 04 Inhibited entry. In spite of the fact that modification of the internal generator was inhibited, a setting has been attempted. Obviously, this setting has been refused. Execute numerical command 103 to authorize modification.

ERROR 05 Timecode not found. This message may appear in synchronizer mode or when the locator is used. It means that the time code position to which the T-audio TC was addressed, does not exist on its tape due to a discontinuity. When in synchronizer mode, this message will automatically disappear when the LOCKED state is reached.

ERROR 06 Non existent function. In some of the operational modes of the T-Audio certain functions are inhibited. For example, synchronizer SLOW and FAST when the machine is set to pilot operation.
No action is undertaken.

ERROR 07 Memory lost. The contents of the continuous memory has been lost. This is probably due to the back-up battery being empty or an EPROM version change.

ERROR 08 Invalid external reference. May appear when the machine is used in the resolver mode and the reference frame-pulse signal is not present or unstable. Also indicates malfunction in "timeline" synchronization when the T-Audio TC is controlled by an edit-controller through a serial remote port.

ERROR 09 The processor failed an attempt to synchronize the real time clock during an internal generator setting. Try again if this failure should occur.

APPENDIX C

SOFTWARE EVOLUTION

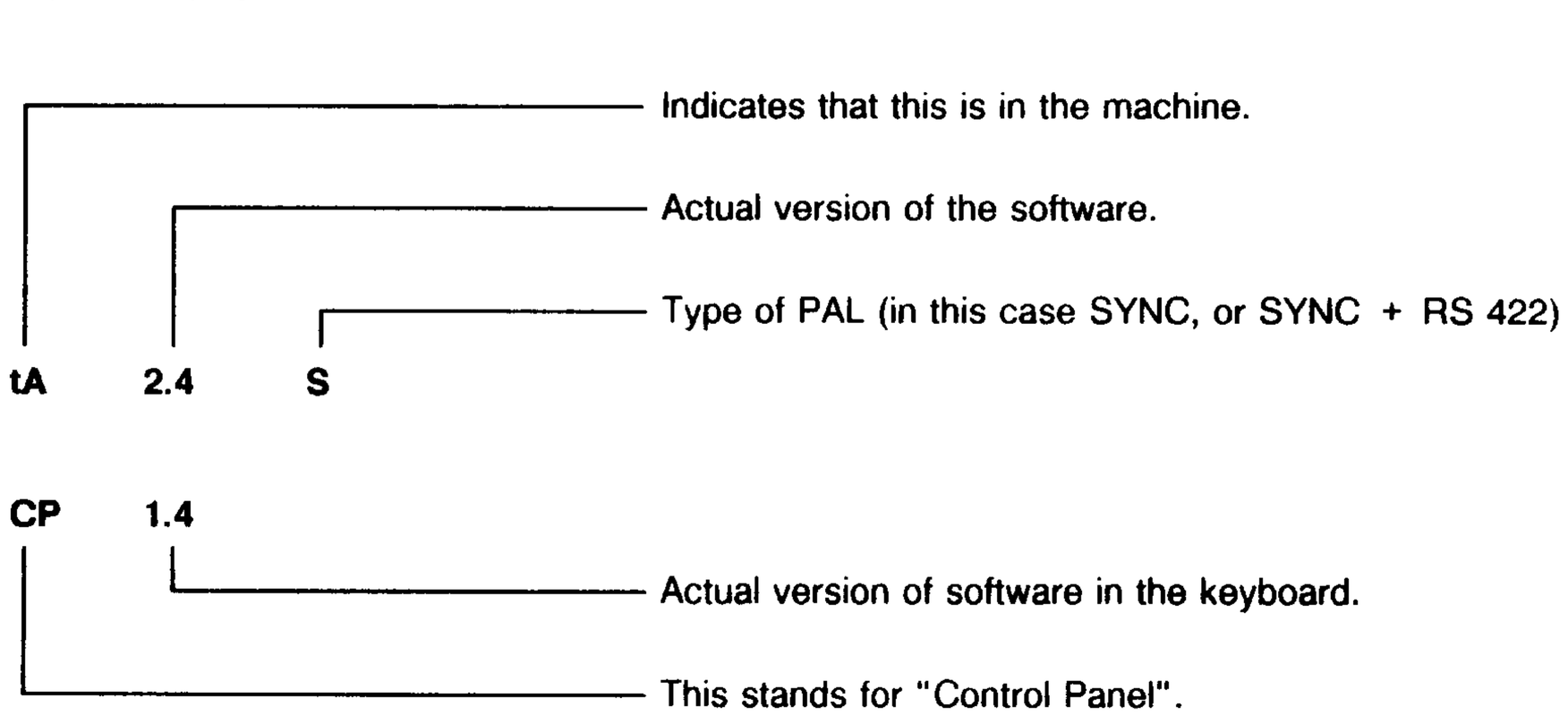
GENERAL

The time code system of the NAGRA T-Audio TC is essentially a software system which performs many functions and controls all parameters of the time code generator.

The system can therefore be regarded as a software based system, making it not only very flexible, but also allowing an update of the software as new features are developed, or as new operations require it. The resulting software updates have been grouped wherever possible in order to minimize the number of eprom changes. However it does mean that all machines throughout the world will not always have the same version of software installed.
This section of the manual is designed to give brief explanation of the differences between the various versions of the software.

It is not necessary to open the machine to see which version of software is fitted as this can be seen in the STATUS DISPLAY MENU. This mode will first show the version of software fitted to the time code circuit of the machine itself, and the following line will show the version of the software installed in the keyboard.

They are displayed as follows :



The first digit of the version indicates the hardware compatibility, thus as this version is 2.4 it cannot be installed in an older T-Audio which presently contains version 1.84 without a hardware modification (fitting of TACA-TC2 keyboard). However the version 1.4 in the keyboard can replace a version 1.3 without any hardware modification.

NOTE : It is important that the software in the machine itself remain compatible with the version of software in the keyboard. Thus version 2.4 in the machine requires version 1.4 in the keyboard, and likewise version 2.3 in the machine requires version 1.3 in the keyboard.

This section will give a brief description of the early software versions installed in the NTA.2 TC followed by much fuller descriptions of the software into the NTA.3 TC machines and related accessories.

VERSION 1.0 (JUNE 1985)

This version was the first version and not released in production machines. It made compensations for the distance between the audio and time code heads, and it initialized the time code channel in the position SAFE and REPRO automatically.

VERSION 1.1 (JUNE 1985)

This version of software for the NTA.2TC was again for internal factory use only. It contained the basic software for time code generation and reading.

VERSION 1.2 (JULY 1985)

Addition of the inhibition of the internal automatic editor upon reaching CUE 2. Also PLAY and RECORD functions controllable through the SPARE-2 input on the rear of the machine. It also switched from normal PLAY to VARIABLE PLAY when the SYNC INC mode was activated. This version was used for demonstrations and product evaluation only.

VERSION 1.3 (AUGUST 1985)

Compatibility with the NTSC frame rate of 29.97 f.p.s. in both DROP frame and NON DROP frame modes. Installation of the SYNC INCREMENTAL mode for synchronizing a time code tape to an external reference with an OFFSET. Installation of the possibility to make an edit pass with the audio channels switched to the SAFE and SYNC positions thus making a REHEARSE EDIT. Finally the introduction of the ERROR 05 message, which means the time code value hunted for does not exist on the tape.

VERSION 1.4 (MAY 1986)

Improvement of the synchronization when using drop frame time codes. Introduction of the CALENDAR mode to the internal generator for the USER BITS information.
Introduction of the ability to set the internal time code and user bits separately by means of a numerical command. Introduction of the ERROR messages 0 through 9 (see ERROR MESSAGES page 52). Introduction of the numerical commands 000-014, 100-103, 200-205 and 300-302 (see numerical commands). Automatic shuttle speed limitation introduced. Display of the STATUS installed. Selection between SYNC and REPRO during edit rehearsal installed. Possibility of re-making an edit using the same CUE values. Automatic muting of the audio outputs when in synchronizer mode but not in the LOCKED state. Possibility to resolve pilot tapes without the time code channel being selected to READY and SYNC. Possibility to resolve time code tapes using the internal generator as the reference. Programmable PRE-ROLL time to locator when searching for CUE 1. Variable integration time when in SYNCHRONIZER SLOW mode. RS-422 compatible with version 1.1 software in the external TAERS interface.

VERSION 1.5 (JULY 1986)

Operationally identical to version 1.4. Minor correction to synchronization when in drop frame modes. Provisional (non synchronous) jam-sync from tape. Compatible with version 1.2 (AMPEX) in the external TAERS interface.

VERSION 1.6 (This version is not accurately dated as it was revised several times)

Improvement of synchronization at speeds below nominal speed. Indication of ERROR 09 when the RTC cannot synchronize. Installation of a routine to make a CPU reset after modification of the dil switches on the front edge of time code circuit A 05. Indication of frame pulse reference in place of Pilot Reference.
Installation of the mode 30 frames per second in DROP FRAME. Installation of the reference BI-PHASE allowing use with a TACO-R and a telecine machine. Installation of the command "UNTHREAD" when working with the TAERS.
Improvement of the time line synchronization. Installation of toggle play and toggle record for the SPARE-2 input. Control of the offset with bit accuracy.
Accurate calculation of the delays due to the distance between the heads, depending on tape speed and frame rate.
Installation of the serial communication RS-232.
Improvement of the time code generation in reverse when the tape is moving backwards.

VERSION 1.7 (SEPTEMBER 1987)

This version requires the version 1.4 Ampex the TAERS for ACE/MOSAIC editors and the version 1.1 Sony for Sony protocol based editors to be fitted in the TAERS.

COUNTER :

Installation of tape timer reset upon reaching the value of 23:59:59:xx (according to frame rate) to 00:00:00:00 instead of 24:00:00:00. The same procedure is applied for negative values below -23:59:59:xx.
Counting through zero was changed. Until version 1.7 the series of values shown included –0 during part of a frame at the selected speeds of 38 cm/s and 76 cm/s. Now it discards the –0 value at all speeds, therefore the series of values shown are : 3, 2, 1, 0, –1, –2, –3 etc.

LOCATOR :

The action of the "PLAY" command pressed during a locator process (GO TO ZERO or LOCATOR) was changed in such a way that it does not interrupt the locator process but is memorized in order to initiate an instant PLAY at the end of the cueing process.

SPARE 2 REMOTE CONTROL :

"SKIP" commands no longer inhibit the pre-programmed functions of SPARE-2 (after pressing "STOP" it was necessary to reset the programming of the Spare 2 input).

SYNCHRONIZER :

Improvement of synchronizer operation with drop frame. In the previous method a random offset (transparent to the user) of 0, +2, or –2 frames could be added to the actual offset depending on where on tape the synchronizing process was initiated. It now works with de-drop framed time code.

EDITING :

Introduction of the possibility to realize "OPEN ENDED EDITS". No longer necessary to pass beyond the CUE 2 before starting a new edit pass (the "End of edit" process is called whenever the T-AUDIO TC detects it is not locked to the master).

RS-422 COMMUNICATION :

Improvement of the "Transport status" handling (Searching, Searched, Cueing, Cued, etc.). Improvement of the "Transport status" handling during a "Video only" insert. This is of particular interest when recording in parallel on a T-Audio and a VTR controlled by an ACE editor. Modification of the communication protocol between the T-Audio and the TAERS. The sending of status from the T-Audio no longer relies on the presence of a valid external reference (square wave or a TC) but is permanent with a period of about 45 ms. A new flag in the "Standard" status signals to the TAERS if a valid reference is present for the "Error led" management. As soon a valid reference is detected again the status sending process is re-synchronized with this reference.
In "SHUTTLE" mode at zero speed the servo loop was reintroduced to compensate for any miscalibrated T-AUDIO so the tape could not deviate too much from the standby position. Re-initialization of the status table when a memory corruption process occurs (due to invalid external high frequency on the external reference signal when the TAERS is powered down and there is no TAPFM installed to filter it). Display of ERROR 07 will occur.

MISCELLANEOUS :

Suppression of the possibility to display memory locations like CUE 1, CUE 2, REPRO, etc. in a "DISPLAY BITS" resolution. Hence only DELTA and OFFSET registers may be displayed in this high resolution mode.

VERSION 1.81 (JANUARY 1988)

This version requires the version 1.5 Ampex for ACE/MOSAIC editors and the version 1.2 Sony for Sony protocol based editors to be fitted in the TAERS.

COUNTER :

Tape timer counting as a time code. This means that negative values have been suppressed and that the displayed value will be 23:59:59:2x instead of –00:00:00:01 when the counter goes below zero. Its resolution has been increased as the software now takes each counter pulse into account (150 pulses/s at 19 cm/s). The tape timer will count correctly at the 24 frame/s rate and at drop frame rates.
On power up, the time code board will set the time code matrix to REPRO or OFF depending of the last status before power down (this means it will retain the time code mode or tape timer mode of operation after a power down or a reset).

LOCATOR :

The tape timer GO TO ZERO function has been merged with the time code LOCATOR function. Thus the GO TO ZERO process will from now on be done in the "Listen tc" mode where tape is in contact with the time code head instead of in "Rewind" or "Fast forward" mode. This allows the user to perform a tape timer based LOCATOR function to any desired tape timer target value present on the display as he hits "LOCATOR" when the time code matrix is in OFF.

TIME CODE DISPLAY :

Both playback and external time code are now direction interpolated (anticipation of one frame depending on the forward or backward direction of the time code). Altogether with the benefits obtained from the improved resolution of time code update by the tape timer (narrower fork of 1.5 frames instead of 2 frames before update) the consequence is a much more precise indication of the parked position of the T-Audio (precise to ± 0.5 frame instead of ± 1.5 frame).

SYNCHRONIZER :

Installation of synchronization using the tape timer, which includes the possibility of editing (rehearse, record edit) based on roller information. Creation of a new numerical code 007 for "color frame" synchronization. When this mode is activated any offset computed between playback and external time code upon hitting on "Sync incremental" will have its value rounded to the closest multiple of 4 frames in PAL and 2 frames in NTSC. This mode is indicated on the status menu display by "rEF. CF". This mode is now stored in permanent memory, consequently the machine will stay in the "rEF. CF" mode after a power down or a reset. Modification of the incremental synchronizer mode so as to never store an offset with non zero bits if the previous offset was not already trimmed to hold a non zero bits value. The offset is thus rounded to the closest frame at each discontinuity or upon pressing on the SYNC INC function.

EDITING :

Correction of the time code assembly operation while time code is being recorded during editing. The setting (by Start tc) was carried out incorrectly up to 7 frames 50 bits of offset at the entry point. Now the assembly is made with a precision of 1-3 bits. While editing with the tape timer, an offset (rounded to the closest frame) is added to correct for the distance between the replay head (standard reference for the tape counter) and the record head in insert or assemble mode as well as in rehearse with the "simulation in SYNC" mode on.
The editing process based on CUE 1 and CUE 2 has been modified in order to enable a non synchronous operation. It is no longer necessary to be locked to a master in order to perform a simulation or a real edit.

RS-422 COMMUNICATION :

Suppression of all possibilities via RS-422 to return the T-Audio to the position "REPRO TC" or "SYNC TC" if it is selected in "OFF TC", except for the command "Time source select".
Suppression of the verification of the timeline buffer temporal values in the event of a "Load timeline" command since the Mosaic editor can start the time line from 23:59:5x:xx when the edit "In point" is just before or after midnight. Values of the data parameter accompanying the "Synchronize select" command have been set back to the original table:

DATA VALUE	REFERENCE
00	External time code
01	Bi-phase
02	Frame pulse (extracted from a video signal)
03	External time code (color framed)

The tape speed override transfer function has been improved to compensate in a more accurate way the non linearity of the capstan speed at various variable speed commands. The actual capstan speed corresponds now to incoming speed commands between –12.8 % and + 12.7 % within + /–0.7 %.

PILOT :

Possibility to check the pilot resolver operation by means of the led "Tc locked" on the keyboard. The precision of the measurement makes it possible to measure differences in speed between the pilot and the reference signal in the order of 0.3 per thousand while filtering out a transition jitter of the pilot or reference signal in the order of + /–100 µ.

INTERNAL GENERATOR :

For compatibility reasons with the TACA-TC2 keyboard, it is now possible to put the machine in internal generator mode without putting the time code channel in SYNC + READY. This is done by pressing SHIFT + SYNC TC.

MISCELLANEOUS :

Introduction of two further numerical codes. "Auto park" active or not active. Introduction of two new numerical codes allowing the selection of the operational mode of the time code outputs of the T-Audio TC.
A new feature is foreseen to mute the time code output whenever the machine is not at nominal speed. This mode is designed to improve the interfacing of the T-Audio with external synchronizers such as the Q-Lock or the Adams-Smith which can be affected by a constant bit rate time code as fed out from the T-Audio in shuttle or slow motion modes.

Numerical command 206 = Time code output normal (default setting)
Numerical command 207 = Time code output muted.

Introduction of a new numerical code giving a new function to the spare 2 input. This code allows the machine to be switched between the STOP and LOAD function via a switch connected to the spare 2 input when the keyboard is being used as a remote control.

Numerical command 303 = Spare 2 : STOP/LOAD

VERSION 1.83 / 2.3 (AUGUST 1988)

Version 1.83 corresponds to machines not fitted with the TACA-TC2 keyboard and 2.3 corresponds to the machines which are fitted with the TACA-TC2.
Version 1.83 requires version 1.6 Ampex for ACE/Mosaic editors and version 1.2 Sony for Sony protocol based editors. The new 2.3 Version replaces the previous 2.2 Version for T-Audio time code machines with the new TACA-TC2 keyboard. Version 2.3 requires Version 1.3 to be installed in the TACA-TC2 keyboard.

NEW FUNCTIONS :

Two new numerical commands to enable or disable a new feature which automatically switches the audio output from "SYNC" to "INPUT" and back to "SYNC" depending on the commands sent to the T-Audio : Stop, Record, Rewind, Fast forward, Load, Park switch audio channels in "SYNC" mode to "INPUT". Play, Free spool, Cut, Skip, Shuttle, Jog, Go to leader, Go to display, Go to zero switch audio channels back from "INPUT" to "SYNC".

Numerical command 016 = Channel switching enabled
Numerical command 017 = Channel switching disabled (default setting)

Two other new numerical codes permit to enable or disable an automatic reset of the offset register at each power up of the T-Audio.

Numerical command 018 = Offset reset at power on
Numerical command 019 = No offset reset at power on (default setting)

These four new numerical codes do not (for the time being) display a status line.

EDITING :

"NON STANDARD SPEED" EDITS with editors using the Ampex protocol (Ampex ACE, AEG-TFK Mosaic) may now be performed. Depending on the variable speed requested by the editor, one of the three following modes is selected :

Speed range from 93.5 % to 106.5 %
True synchronization with a continually skewing offset.

Speed range from 87.5 to 93.5 % and from 106.5 to 112.5.
The T-Audio sets itself in variable speed play roughly at the requested speed (guaranteed speed accuracy +/–0.8 %).
There may also be a slight delay in the entry point due to the start up time of the T-Audio (approx.4 frames at 38 cm/s).
Speed range from –200 % to +200 % and out of the previously described range at 19 cm/s (limited to –112.5% to +112.5 % at 38 cm/s): the T-Audio sets itself in "slow motion" play roughly at the requested speed (speed accuracy is better than in variable speed play but wow and flutter is much greater).
Another improvement with Ampex protocol based editors consists in a better handling of audio to video split edits (previous software showed erroneous behavior with "Audio First" edits). However it should be remembered that the T-Audio is not designed to handle correctly audio 1 to audio 2 split edits. Separate audio 1 and audio 2 entry points may generate audible clicks at the position on the tape where the second channel starts to record.

RS-422 COMMUNICATION :

Improvement of channel 1 and channel 2 "record" status whenever one channel is switched from READY to SAFE or from SAFE to READY during a record via RS-422.

INTERNAL GENERATOR :

The internal generator "HOLD" mode has been modified so that the generator starts running as soon as the time code channel starts recording. This allows a presetting of the internal generator value which remains at the preset value until recording is initiated. At the end of the recording the internal generator returns to the "HOLD" mode retaining the last recorded time code value.
The setting of the internal generator by an external time code was one frame too early in version 1.81 / 2.2.

The new eprom version corrects this one frame error and improves the setting precision with the new keyboard when done with the tc matrix in INPUT + SAFE.

MISCELLANEOUS :

Correction of the control of the "Pot. enable" signal which was left active in some cases after a shuttle mode. This could generate conflicts with the TAERP parallel interface and with the pilot resolver.
Improvement of the timing of the audio channels switching from SYNC to INPUT at the start of a recording. This switching was performed too early (at the record command reception). It is now performed simultaneously with the "record head enable" signal 426 ms later at 19 cm/s). Time code was not recorded in version 2.2 when the tc matrix was switched directly from "OFF" to "INT.GEN". Switching first to "SYNC" or "REPRO" before "INT.GEN" was mandatory before going to record.
At the same time there is no modification of the reference selection when switching from time code to pilot mode and back. The time code output mute mode (when selected by numerical code 207) will now only switch off the time code output if the time code has originated from the tape. No mute is made while the time code circuit outputs the internal generator or external tc.

The checksum of these versions are as follows :

V2.3	eprom is D51E.
V1.83 SYRS	eprom is CFCC.
V1.83 SYNC	eprom is C300.
V1.83 RS	eprom is C291.
V1.83 NOSY	eprom is 0D69.

VERSION 1.84 / 2.4 (APRIL 1989)

Version 1.84 replaces the previous 1.83 Version for T-Audio time code machines which do not have the TACA-TC2 keyboard.
Version 1.84 requires version 1.6 Ampex for ACE/Mosaic editors and version 1.2 Sony for Sony protocol based editors to be fitted into the TAERS.

Version 2.4 replaces the Version 2.3 for T-Audio time code machines fitted with the TACA-TC2 keyboard.
Version 2.4 requires Version 1.4 to be installed in the TACA-TC2 keyboard.

NEW FUNCTIONS :

A new tape analysis system has been implemented by means of a numerical code. This function starts the loaded tape in playback and scrolls through the various signals and frame rates until it discovers the right selection, stopping the tape automatically at that point and displaying the selected mode. If no correct sync information is found on the tape or if the playback speed is incorrect it stops, and displays ERROR 13. Each possibility is analyzed during 5.5 seconds, which makes a maximum test time of 44 seconds (8 x 5.5 secs) so be sure there is enough tape on the machine to complete the entire test. The system scrolls through all possibilities in the following order :

tc 24, tc 25, tc df 29, tc ff 30, fm pi 50, fm pi 60, pilot 50, pilot 60.

Note : If the tape analysis system discovers some type of time code on tape it will not attempt to scroll through all the pilot configurations but will limit itself to the four time code varieties.

Note : The last two positions can only be analyzed if the FM / Neopilot dil switch has been put to OFF (Neopilot) before starting the test procedure.

Note : There is no way for the system of deciding between a tape recorded at 29.97 frames/sec and 30 frames/sec, it is only admitted that if the drop frame flag is set, there are good chances that the original frame rate was 29.97 and if it is not that it probably was 30.

Note : The leds showing which mode is selected on the TACO-D2 may not correspond to the mode in which the tape has been found.

As the time code board of the T-Audio has no access to change the playback speed itself, the user should change manually the T-Audio speed (to check all possibilities) as long as the results of the analysis are not positive.
This manual speed scrolling is only necessary with the old keyboard, the new keyboard automatically takes care of changing the speed of the T-Audio as long as the result is negative (ERROR 13) and this up to 4 times (corresponding to positions A, B, C and D).
If the result of the analysis is positive, it indicates which type of tape was loaded and will stay in the displayed mode (even if it is different from the mode selected by the dil switches or the TACO-DRS) as long as the position of these switches is not modified or a power down is not made.

Note : However if the result of the test shows an FM PILOT tape, no switch modification will be taken into account until a power down or a reset of the tc board is made.

Two other numerical codes permit to enable or disable a new feature which automatically mutes the audio output during the "GO TO ZERO" and "LOCATE" functions. However in order to mute effectively the audio outputs during the "SHUTTLE" or "SPOOL" part of the locate process, whether a hardware modification is required on the logic board or not (by implementing a priority of

the "Line out off" signal over the "Listen enable" signal) numerical code 022 must also be activated.

Numerical command 020 = Audio mute during locate enabled
Numerical command 021 = Audio mute during locate disabled (default setting)

Two other numerical commands allow enabling or disabling of the tape lifter during "LOCATE" functions. The main purpose of disabling head to tape contact during the "shuttle" part of the locate process is to reduce wear and tape oxide deposits on machines heavily employed in automatic processing situations where the time code on tape is continuous and where generally interpolation by the tape timer is sufficiently accurate to guarantee correct functioning of the "LOCATE" process.

Numerical command 022 = Tape lifter during locate enabled (no head to tape contact during shuttle time)
Numerical command 023 = Tape lifter during locate disabled (default setting)

Two other numerical codes permit to enable or disable a new feature which may specially be useful for customers using the Sony-2 mode where the T-Audio synchronizes itself to the time code of a master VTR which may have discontinuities in time code. Or if the tape loaded on the T-Audio has itself discontinuities. If this discontinuity handling mode is enabled the T-Audio switches from "SYNC" to "SYNC INC" mode as soon as the transport is locked and inversely switches back to "SYNC" when the transport is no longer synchronous. On returning to "SYNC" the software begins synchronization to avoid cumulative errors during each rehearse of edit. This new mode also correctly handles a new type of discontinuity (of the type : 10, 11, 12, 13, 13, 13, 14, 15 etc.) which previously did not ask for a new offset value to be computed at the discontinuous point.
024 = Discontinuity handling enabled
025 = Discontinuity handling disabled (default setting)

These ten new numerical commands as well as the four numerical commands introduced in eprom version 1.83/2.3 display the following status lines :

Numerical command 016 : "ChAn on " (Channel switching enabled)
Numerical command 017 : "ChAn oFF" (Channel switching disabled)
Numerical command 018 : "rESo on " (Offset reset at power on)
Numerical command 019 : "rESo oFF" (No offset reset at power on)
Numerical command 020 : "LoCM on " (Audio mute while locate enabled)
Numerical command 021 : "LoCM oFF" (Audio mute during locate disabled)
Numerical command 022 : "LIFt on (Tape lifter during locate enabled)
Numerical command 023 : "LIFt oFF" (Tape lifter during locate disabled)

code 024 : "dISC on" (Discontinuity handling enabled)
code 025 : "dISC oFF" (Dicontinuity handling disabled)

Another new numerical command has been included since eprom version 1.81/2.1 but has not been documented yet. This numerical command permits alteration of the frequency of the internal generator at 24 or 25 frames/sec. When the T-Audio is in the 25 frames/sec mode, this special command slows the generator from it's nominal speed of 2000 bits/sec down to 1920 bits/sec (which corresponds to the 24 frames/sec time base). If the T-Audio is in the 24 frames/sec mode, this code will speed up the time base in the reverse manner. This conversion mode may be useful if for a reason or another a tape must be accelerated or slowed down by 4% (at the ratio of 25/24 or 24/25). This may be done in the following manner :

Resolve the original tape on a IV-S or a T-Audio (be it a pilot or a tc tape) while making a copy of the audio on a T-Audio with this code activated, simultaneously recording it's internal generator. The new tape will have a time code recorded in such a way that any subsequent synchronized playback of it will be done at the converted speed.

In order to have a nominal speed playback, it may be advantageous to alter the speed during recording in the opposite way by setting the variable speed to + or – 4% and activating the vari-speed key before going to record. The recording will go on at the preset var speed.

Note : This special code will only be cancelled after a reset of the tc board or a power down.

Numerical command 104 = 25/24 frames/sec up-or down conversion

SYNCHRONIZER :

The procedure (introduced in eprom version 1.81/2.1) which rounded up or down the new computed offset to the closest frame at each discontinuity in the SYNC INC mode was incorrectly made. This has been corrected. The pilot resolver analysis fork which checked the synchronization in pilot mode (which lights the "LOCKED" led) has been augmented by two to make it less critical. From now on, it will check that the speed of the pilot signal is not more than 0.6 per thousand apart from the reference.

EDITING :

Edit timing at the exit point has been advanced by one frame both during preview and insert. Up to now the software included the record exit frame. Now the edit timing is made in such a way as not to record or preview the last frame.

RS-422 COMMUNICATION :

To manage the additional status lines described above, some modifications have been made to the RS-422 protocol between the T-Audio TC and the TACA-TC2 keyboard which make it mandatory to use 2.4 with 1.4 in the new keyboard.

MISCELLANEOUS :

Variable speed record has been made available (since eprom version 1.81 actually). When entering the record mode, the software checks if the T-Audio TC was previously in the var speed mode playback and at which percentage. It thereafter keeps that preselected speed until the end of the recording (no speed modification during recording is possible).
After reverting from pilot mode to time code mode, previous eproms did not restore the time code channel matrix to the REPRO position. This has been corrected.

Park time (when in auto park mode) has been increased from one minute to three minutes.

When the time code output mode is activated (Numerical command 207) the internal generator could on some occasions also be muted. This has been corrected.

The checksum of these versions is as follows :

V 2.4	eprom is DE7C
V 1.84 SYRS	eprom is EOF2
V 1.84 SYNC	eprom is DF59
V 1.84 RS	eprom is E188
V 1.84 NOSY	eprom is ODBD

EBU TIME-AND-CONTROL CODES FOR TELEVISION TAPE-RECORDINGS

(625-LINE TELEVISION SYSTEMS)

Tech 3097 - E

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PART A

LONGITUDINAL TIME-AND-CONTROL CODE (LTC)

1. Scope

This part specifies the format and modulation method for a digital code recorded on a longitudinal track which is to be used for timing and control purposes on television tape machines and on the associated audio tape-machines, if any, for recordings made in accordance with the 625-line/50-field television systems defined in CCIR Report 624-2 [3]. The document also specifies the relationship of the longitudinal code signal to other associated signals before and after recording on the tape.

2. Modulation method and bit-rate

2.1. *Type of code*

The modulation method shall be such that a transition occurs at the beginning of every clock period. In the case of a "zero" there is no second transition within the clock period. In the case of a "one" there is a second transition in the middle of the clock period. This system, commonly known as *bi-phase mark*, is illustrated in *Fig. 1*.

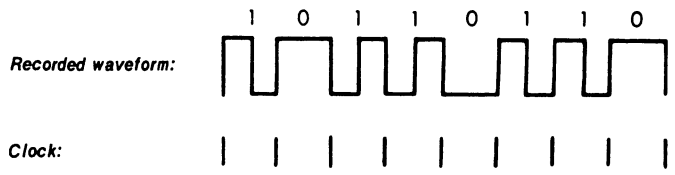

Fig. 1.– Modulation system "bi-phase mark".

2.2. *Bit-rate*

The bit-rate at nominal speed shall be 80 bits per picture, i.e. 2000 bit/s.

3. Code format

3.1. *Rate of change of the code word*

Each television picture, comprising an odd-numbered field followed by an even-numbered field*, shall be identified by a complete code word.

3.2. *Composition of the code word*

Each code word shall consist of 80 bits, numbered from 0 to 79 inclusive.

3.3. *Bit assignment*

The bits shall be assigned as shown in *Fig. 2* and as described below:

0 - 3	Units of pictures
4 - 7	First binary group
8 - 9	Tens of pictures
10	Unassigned bit (see § 4.6)
11	Colour lock flag bit (see § 4.4)
12 - 15	Second binary group
16 - 19	Units of seconds
20 - 23	Third binary group
24 - 26	Tens of seconds
27	Binary group flag bit (see § 4.3)
28 - 31	Fourth binary group
32 - 35	Units of minutes
36 - 39	Fifth binary group
40 - 42	Tens of minutes
43	Binary group flag bit (see § 4.3)
44 - 47	Sixth binary group
48 - 51	Units of hours
52 - 55	Seventh binary group
56 - 57	Tens of hours
58	Unassigned bit (see § 4.6)
59	Bi-phase mark phase correction bit (see § 4.5)
60 - 63	Eighth binary group
64 - 79	Synchronising word: 64 - 65: fixed zero 66 - 77: fixed one 78 : fixed zero 79 : fixed one

* *Odd-numbered fields* : fields 1, 3, 5, 7
  Even-numbered fields: fields 2, 4, 6, 8
  } defined in CCIR Report 624-2 [3]

80 bits per picture

32 user binary spare bits

16 sync bits

26 time address bits

4 flag bits

2 unassigned address bits

All unassigned bits are zeros. Assignment of these bits is reserved to the EBU

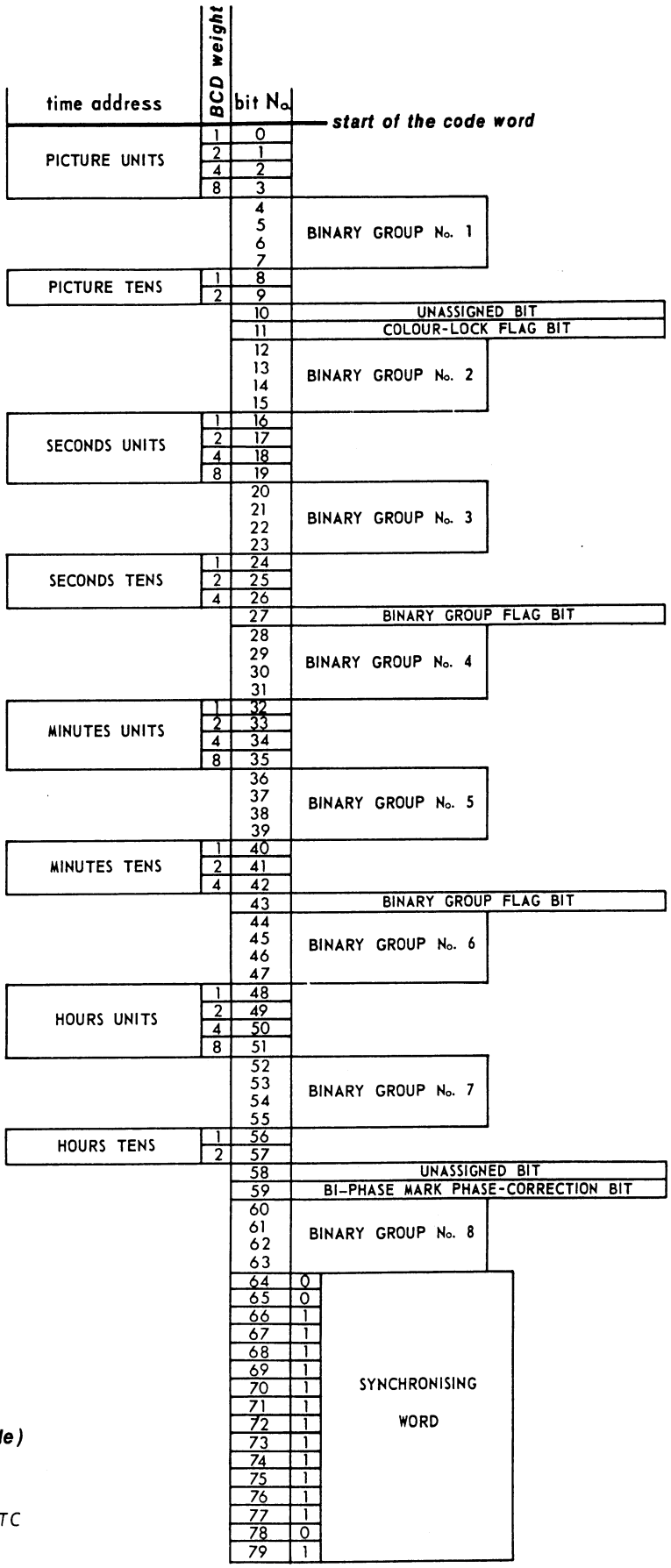

Fig.2.– Constitution of the code word (longitudinal code)

The relationship between LTC and VITC is shown in Fig. 7, page 16

4. Structure of the coded data

4.1.* *Structure of the time label*

The basic structure of the time label is based upon the *Binary Coded Decimal (BCD)* system. In those cases where the count does not attain 9, only 2 or 3 bits are required, rather than 4 bits as is normal in the BCD code.

4.2.* *Assignment of the time bits*

Pictures			
Units	Bits	0 - 3	: four-bit BCD arranged 1, 2, 4, 8 count 0 to 9.
Tens	Bits	8 - 9	: two-bit BCD arranged 1, 2 count 0 to 2.
Seconds			
Units	Bits	16 - 19	: four-bit BCD arranged 1, 2, 4, 8 count 0 to 9.
Tens	Bits	24 - 26	: three-bit BCD arranged 1, 2, 4 count 0 to 5.
Minutes			
Units	Bits	32 - 35	: four-bit BCD arranged 1, 2, 4, 8 count 0 to 9.
Tens	Bits	40 - 42	: three-bit BCD arranged 1, 2, 4 count 0 to 5.
Hours			
Units	Bits	48 - 51	: four-bit BCD arranged 1, 2, 4, 8 count 0 to 9.
Tens	Bits	56 - 57	: two-bit BCD arranged 1, 2 count 0 to 2.

(The 24-hour clock system is used.)

4.3.* *Use of binary groups*

The binary groups are intended for the storage of supplementary data by the users. The thirty-two bits within the eight binary groups may be assigned in any way without restrictions if the character set used for the data insertion is not specified and the binary group flag bits Nos. 27 and 43 both are zero.

If an eight-bit character set conforming to ISO 646 [4] and ISO 2022 [5] is signalled by the binary group flag bits Nos. 27 and 43, the characters should be inserted in accordance with *Fig. 3*. The information carried by the user-bits is not subjected to any regulation.

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* These points are identical in both the longitudinal and vertical-interval time-codes, with the exception of the bits numbers which are different in the two codes.

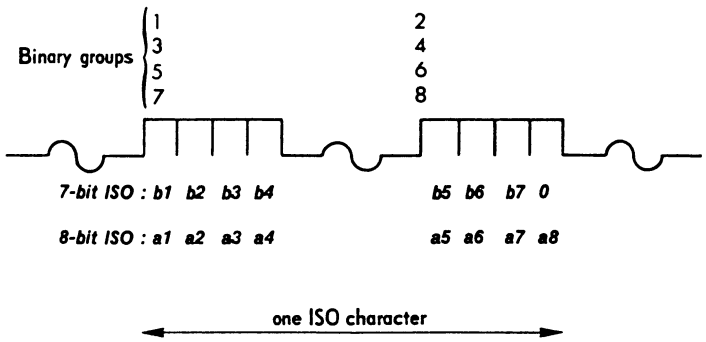


Fig. 3.– Use of binary groups of the time-and-control code to describe the ISO characters coded with 7 or 8 bits

At present, the following truth-table applies:

	Bit 27	Bit 43
Character set not specified	0	0
Eight-bit character set conforming to ISO 646 and ISO 2022	1	0
Unassigned	0	1
Unassigned	1	1

The unassigned states of the truth-table cannot be used and their assignment is reserved to the EBU. If it becomes clear that no use is to be expected for them, it is possible that bit No. 43 can again become unassigned and thus available for other applications, while still retaining bit No. 27 to signal the presence of eight-bit ISO characters.

It should be noted that, in each time code word, some user bits will be decoded before bits Nos. 27 and 43 are encountered. The data in these earlier user-bit locations must not be lost.

Note. - The International Standard ISO 646 [4] defines two 7-bit Latin character code tables:

a) the basic code table with control and alpha-numerical characters including punctuation marks, ten free positions for national use and some positions with more than one graphic symbol;

b) the international reference version (referred to as IRV), where the national positions are filled and a choice is made where more than one graphic symbol is shown in the basic code table.

The International Standard ISO 2022 [5] gives code extension techniques from the 7-bit code of ISO 646 to 8-bit codes, based on the use of the "escape" command of the basic code table of ISO 646. With character-combinations following the "escape" command, access is given to a library of centrally registered character sets. This library consists of national character sets like the American ASCII although versions for special (e.g. broadcast) applications may also be included and registered. This central registration is done by the French national standardisation office AFNOR.

4.4.* *Colour-lock flag bit*

The colour-lock flag bit No. 11 shall be set to "1" when the time-code is locked to the associated PAL colour signal in accordance with the eight-field sequence, and when the video signal has the "preferred subcarrier-to-line-sync phase" (see § 5.1).

4.5. *Bi-phase mark phase-correction bit*

The purpose of the phase-correction bit it to compensate for phase reversals in the bi-phase mark modulation that could occur when code inserts are performed. Such compensation may be required when code inserts modify the content of any of bits 0 to 63, bit 59 excluded.

In order that the magnetisation transient between bit-cell 79 of one word and bit-cell 0 of the next shall always be in the same direction, bit 59 will be put in a state where every 80-bit word will contain an even number of logic zeros.

This requirement results in the following truth table for bit 59:

Number of logic zeros in bits 0 to 63 (59 exclusive):	Bit 59
Odd	1
Even	0

In drawing up this specification, the use of time-code write/read systems that have equal polarity relations between input/output voltage and the tape magnetisation is assumed.

This specification should not be understood as a requirement for time-code insert capability in television tape-machines in situations where tapes have to be interchanged, until further notice from the EBU.

4.6.* *Unassigned bits*

Bits 10 and 58 are reserved for future assignment and shall be zeros until specified by the EBU.

* These points are identical in both the longitudinal and vertical-interval time-codes, with the exception of the bits numbers which are different in the two codes.

5. Relationship between the code and the television signals prior to recording

5.1.* *Definitions relevant to the present section*

The numbering of PAL or SECAM television fields in the respective 4-field sequence is described in CCIR Report 624-2 [3].

The definition of field 1 in the eight-field sequence of the PAL signal is described in CCIR Report 624-2 [3] and in *Appendix 1*.

The stability conditions to be met by PAL video source equipment when sophisticated editing is required in post-production are detailed in *Appendix 2*.

To permit the sophisticated editing of PAL tapes, the video line-sync-to-burst phase on replay must be held within a certain tolerance. Recommendations on the tolerance required may be found in *Appendix 3*.

5.2. *Association of code words and television pictures*

In generating the code, each code word is associated with one particular television picture, with which it coincides in time. This relationship must be maintained throughout the whole post-production process.

The EBU Statement describing how this relationship can be maintained is reproduced in *Appendix 4*.

5.3. *Timing of the code word*

The code word shall start at the beginning of the clock period of the first bit (bit No. 0). The bits shall be evenly spaced, subject to the tolerances specified in Section 6, in such a way that the code word duration shall coincide with the period of one television picture.

The start of the code word shall occur within the period of the sequence of field-synchronising pulses [3], at the beginning of the picture with which the code word is associated (*Fig. 4*).

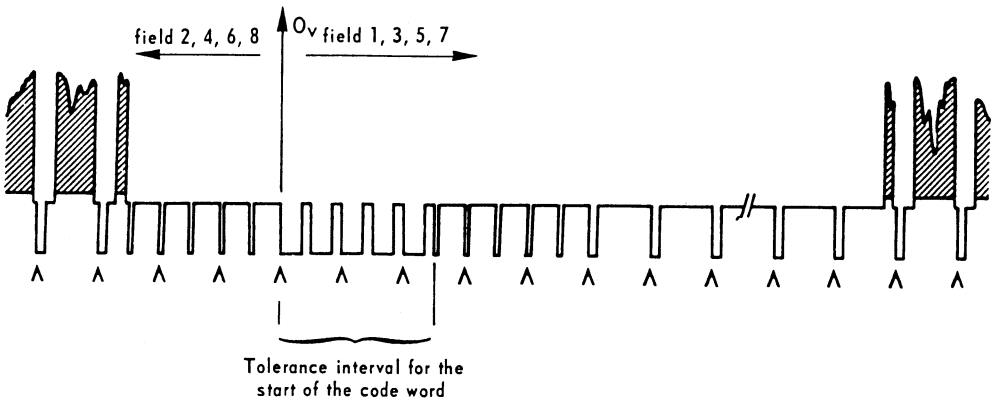


Fig. 4.– Start of the code word in the field-blanking interval

* This point is identical in both the longitudinal and vertical-interval time-codes.

5.4.* *Relationship between the time address and the associated colour television signal*

During electronic editing of colour signals recorded on television tape-machines, it is important that:

a) in the case of editing in SECAM or simple editing in PAL, the correct four-field sequence be maintained in the edited master**;

b) in the case of sophisticated editing operations on PAL signals, the correct eight-field sequence also be maintained in the edited master, and that the "in-phase" or "out-of-phase" position of a slave tape** can be controlled.

Condition b) does not apply to SECAM signals.

These sequences can be preserved with the aid of the time-and-control code, provided that there exists a fixed relationship between the time addresses of the code and the sequence of television fields.

Therefore, it has been agreed that, when necessary, the on-tape relationship between the time address-numbers of the EBU time-and-control code and the associated eight fields of the PAL video signal, shall be as follows:

If bit No. 0 is A, bit No. 16 is B, bit No. 1 is C,
bit No. 8 is D, bit No. 17 is E, bit No. 24 is F,

in order to fulfil condition a) above the code generator shall be locked to the associated video signal in such a way that:

a) $A \oplus B = \begin{cases} \text{"1" for fields 1 and 2 (and fields 5 and 6) constituting odd pictures} \\ \text{"0" for fields 3 and 4 (and fields 7 and 8) constituting even pictures,} \end{cases}$

where $\oplus$ = logical "exclusive or".

(For the numbering of fields, see CCIR Report 624-2 [3] and *Appendix 1*).

When it is also desired to fulfil condition b), in addition to condition a), the code generator shall, additionally, be locked to the associated PAL video signal in such a way that:

b) $(A + B) \oplus C \oplus D \oplus E \oplus F = \begin{cases} \text{"1" for fields 1 to 4} \\ \text{"0" for fields 5 to 8.} \end{cases}$

When the time-code is displayed in decimal numbers, S and P designating the numbers of seconds and pictures respectively, condition a) is expressed as:

a) $S + P$ is $\begin{cases} \text{odd for fields 1 and 2 and fields 5 and 6} \\ \text{even for fields 3 and 4 and fields 7 and 8} \end{cases}$

and condition b) is expressed as:

b) the remainder on dividing S + P by 4 is

0 for fields 7 and 8 2 for fields 3 and 4
1 for fields 1 and 2 3 for fields 5 and 6

---

* This point is identical in both the longitudinal and vertical-interval time-codes, with the exception of the bits numbers which are different in the two codes.

** *Edited master*: the video tape on the recording television tape-machine in an edit installation.
Slave tape: the video tape on a play-back television tape-machine in an edit installation.

6. Waveform of the time-and-control code signal

Although time code signals serve for the transmission of data, it is more advantageous, in studio practice, if such signals can be handled as ordinary audio signals. The characteristic described hereafter takes into account this pre-requisite*, as well as permitting unambiguous data recovery. This waveform is referred to as the "EBU Standardised characteristic of the time-and-control code signal", and the output of time code generators shall conform to it (*Fig. 5*).

Rise and fall time	:	50^{+15}_{-10} µs measured between the 10% and 90% amplitude points of the waveform
Shape of transition	:	similar to the edge of a sine squared pulse
Maximum overshoot, undershoot, tilt	:	5% of peak-to-peak amplitude
Clock period	:	500 µs (nominal)
Maximum timing error of any clock period	:	± 2.5 µs
Maximum timing error of "one" transition	:	± 2.5 µs

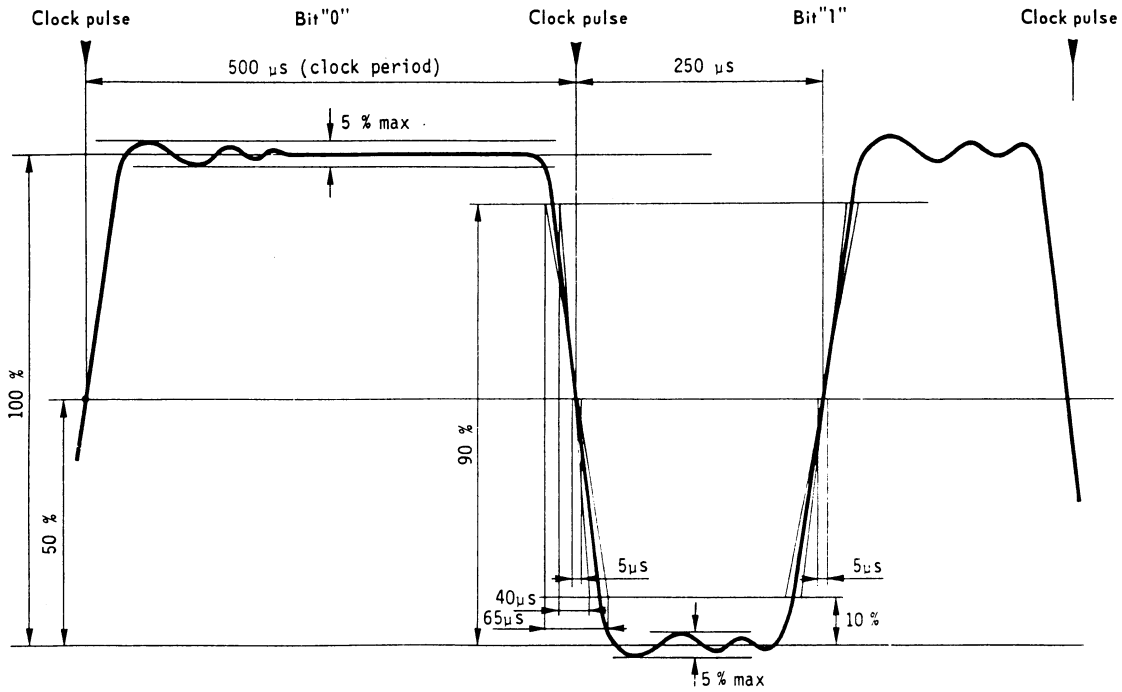


Fig. 5.– Waveform of the modulated code signal

The preferred specifications for the outputs of time code generators are described in the EBU Statement reproduced in *Appendix 5*.

* The signal described here has harmonics at least 40 dB down at 15 kHz.

7. Operational practices

7.1. *Conditions in the use of the code*

On tapes intended for international exchanges, the time code, if used, shall be recorded on a longitudinal track.

7.2. *Transverse-track recordings*

In the case of transverse-track recordings the code signal, if any, shall be recorded with bias on the cue track (see CCIR Recommendation 469-2 [7], § 3).

The recorded flux level shall be 700 ± 100 nWb/m, peak-to-peak.

7.3. *Format B recordings*

In the case of format B recordings, the code signal, if any, shall be recorded with bias on audio track 3 (see EBU Technical Information Sheet No. 7 [8], § 9.2).

The recorded flux level shall be 720 ± 70 nWb/m, peak-to-peak.

7.4. *Format C recordings*

In the case of format C recordings, the code signal, if any, shall be recorded with bias on audio track 3 (see EBU Technical Information Sheet No. 7 [8], § 9.2).

The recorded flux level is currently under consideration.

7.5. *Multitrack audio tape machines*

In the case of multitrack audio tape machines, the code signal, if any, shall be recorded with bias on the track having the highest number (see IEC Publication 94 [9], § 5).

The adjacent track should preferably remain unrecorded.

The recorded flux level has yet to be decided.

7.6. *Use of companding systems*

Companding systems should not be used when an audio track is used for recording the time-and-control code.

The EBU has issued a Statement on this subject, which is reproduced as *Appendix 7*.

7.7. *Specifications for the pulse response of audio tracks*

The specifications for the pulse response of audio tracks, which may be used to record either sound signals or the time-and-control code, have not been defined yet.

The EBU has issued a Statement on this subject, which is reproduced as *Appendix 7*.

ANSI/SMPTE 12M-1986
Revision and Redesignation of
ANSI V98.12M-1981

American National Standard for television— time and control code— video and audio tape for 525-line/60-field systems

Approved January 29, 1986

Sponsor: Society of Motion Picture and Television Engineers

1. Scope

1.1 The first part of this standard specifies a format and modulation method for a digital code to be recorded on a longitudinal track of video and audio magnetic tape recorders. The code is to be used for timing and control purposes.

1.2 The second part specifies the digital format to be inserted into the television signal vertical interval to be used for timing and control purposes in video magnetic tape recorders. This part also specifies the location of the code within the television baseband signal and its relationship to other components of the television signal and to the longitudinal track code described in the first part of this standard.

2. Referenced Standards

This standard is intended for use in conjunction with the following standards:

EIA Industrial Electronics Tentative Standard No. 1, Color Television Studio Picture Line Amplifier Output Drawing

International Standard ISO 646-1983, Information Processing — ISO 7-Bit Coded Character Set for Information Interchange

International Standard ISO 2022-1982, Information Processing — ISO 7-Bit and 8-Bit Coded Character Sets — Code Extension Techniques

3. Longitudinal Track Application

3.1 Modulation Method. The modulation method shall be such that a transition occurs at the beginning of every bit period. "One" is represented by a second transition one half a bit period from the start of the bit. "Zero" is represented when there is no transition within the bit period. (See Fig. 1.)

3.2 Code Format

3.2.1 Frame Make-up. Each television frame shall be identified by a unique and complete address. A frame consists of two television fields or 525 horizontal lines. The frames shall be numbered successively 0 through 29, except as noted in 5.2.2 (Drop Frame). If color frame identification in the code is required, the even units of frame numbers shall identify Frame A and odd units of frame numbers shall identify Frame B, as defined by EIA Tentative Standard No. 1.

3.2.2 Frame Address. Each address shall consist of 80 bits numbered 0 through 79.

3.2.2.1 Boundaries of Address. The address shall start at the clock edge before the first address bit (bit 0). The bits shall be evenly spaced throughout the address period, and shall occupy fully the address period which is one frame. Consequently, the bit rate shall be 80 times the frame rate in frames per second. (See 3.2.1 for definition of a television frame.)

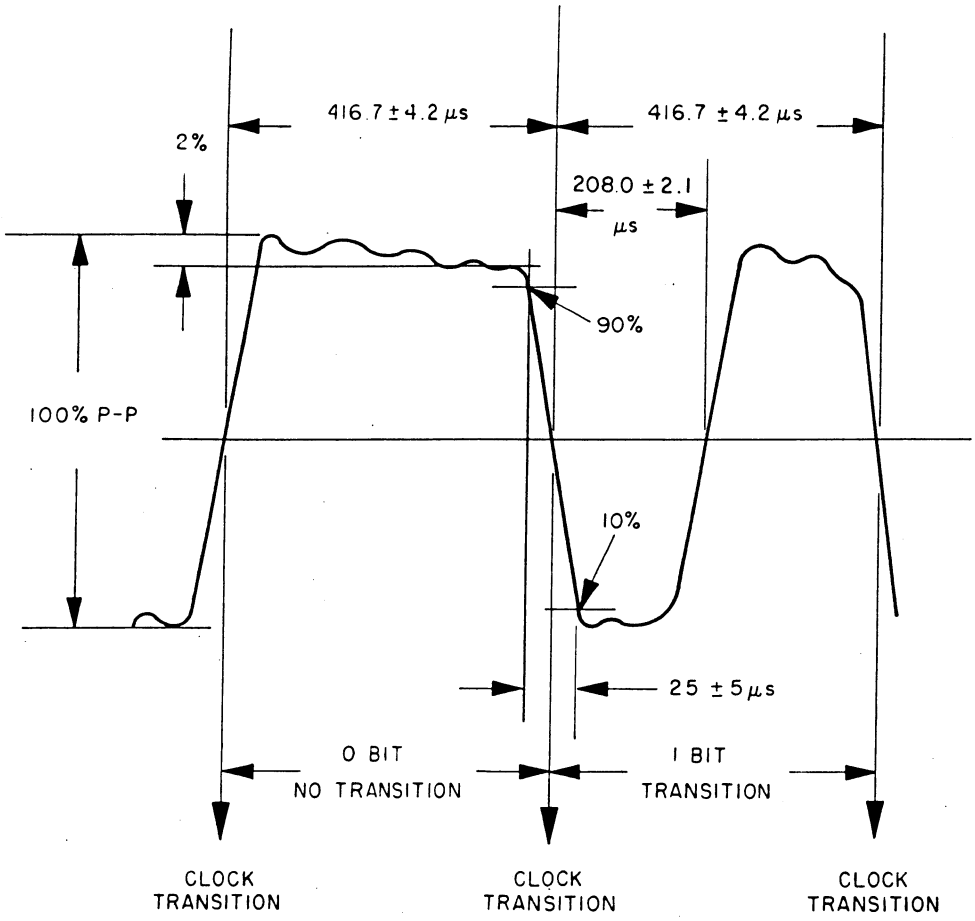


Fig. 1
Longitudinal Recorder Waveform

3.2.2.2 Start of Address. The start of the address shall occur at the beginning of line 5 in fields I and III, as defined in EIA Tentative Standard No. 1. The tolerance shall be ±1 line.

3.3 Longitudinal Recorder Input Waveform Characteristics (See Fig. 1.)

3.3.1 Rise Time. The rise and fall times of the clock and "one" transitions of the code pulse train shall be 25 ± 5 microseconds, measured between the 10 and 90 percent amplitude points on the waveform.

3.3.2 Amplitude Distortion. Amplitude distortion, such as overshoot, undershoot, and tilt, shall be limited to 2 percent of the peak-to-peak amplitude of the code waveform.

3.3.3 Time of Transitions. The time between clock transitions shall not vary more than 1 percent of the average clock period measured over at least one frame. The "one" transition shall occur halfway between two clock transitions within 0.5 percent of one clock period. Measurements of these timings shall be made at half-amplitude points on the waveform.

3.4 Use of Binary Groups. The binary groups are intended for storage of data by the users, and the 32 bits within the 8 groups may be assigned in any manner without restriction if the character set used for the data insertion is not specified and the binary group flag bits 43 and 59 are both zero.

If an 8-bit character set is used, the binary group flag bits 43 and 59 shall be set according to the following truth table:

	Bit 43	Bit 59
Character set not specified	0	0
Eight-bit character set	1	0
Unassigned	0	1
Unassigned	1	1

Unassigned states of the truth table cannot be used and their assignment is reserved to the SMPTE.

3.4.1 If an 8-bit character set conforming to ISO 646-1983 and ISO 2022-1982 is signalled by the binary group flag bits 43 and 59, the characters should be inserted in accordance with Fig. 2. Information carried by the user-bits is not specified.

3.5 Assigned and Unassigned Address Bits. Six bits are reserved within the address groups, 4 for identifying operational modes, 1 for bi-phase correction, and 1 unassigned bit reserved for future assignment and defined as zero until further specified by the SMPTE.

Bit 10 — Drop Frame Flag. If certain numbers are being dropped to resolve the difference between real time and color time, as defined in 5.2.2, a "1" shall be recorded.

Bit 11 — Color Frame Flag. If color frame identification has been intentionally applied, as defined in 3.2.1, a "1" shall be recorded.

Bit 27 — "Bi-phase Mark" Phase Correction. This bit shall be put in a state so that every 80-bit word will contain an even number of logical zeros. This requirement results in the following truth table for Bit 27:

Number of Logical Zeros in Bits 0 to 63 (27 exclusive):	Bit 27
Odd	1
Even	0

Bits 43 and 59 — Binary Group Flag Bits. These two bits shall be set in accordance with the truth table as specified in 3.4.

Bit 58 — Unassigned Address. "0" until assigned by the SMPTE.

The bits shall be assigned as shown in Fig. 3 and described below:

0-3	Units of frames
4-7	First binary group
8-9	Tens of frames
10	Drop frame flag (see 3.5)
11	Color frame flag (see 3.5)
12-15	Second binary group
16-19	Units of seconds
20-23	Third binary group
24-26	Tens of seconds
27	Bi-phase mark phase correction bit (see 3.5)
28-31	Fourth binary group
32-35	Units of minutes
36-39	Fifth binary group
40-42	Tens of minutes
43	Binary group flag bit (see 3.4)
44-47	Sixth binary group
48-51	Units of hours
52-55	Seventh binary group
56-57	Tens of hours
58	Unassigned address bit (0 until assigned by the SMPTE)
59	Binary group flag bit (see 3.4)
60-63	Eighth binary group
64-79	Synchronizing word
	64-65 Fixed zero
	66-77 Fixed one
	78 Fixed zero
	79 Fixed one

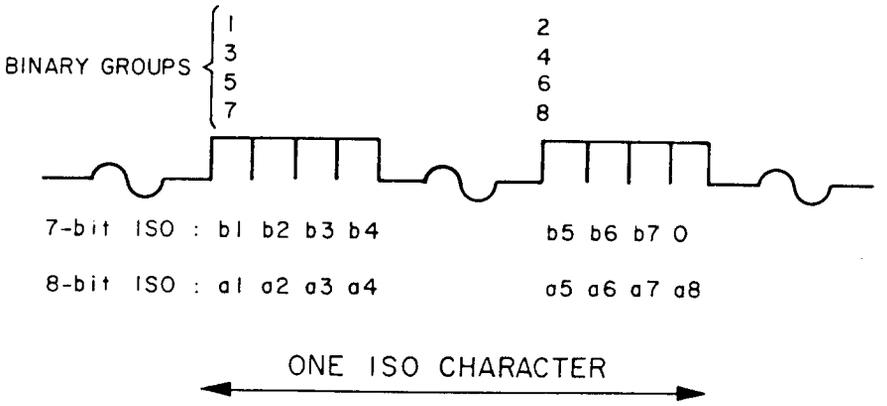
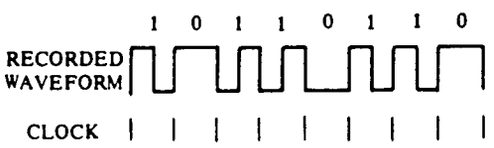


Fig. 2
Use of Binary Groups to Describe ISO Characters Coded with 7 or 8 Bits

80 BITS PER FRAME

32 USER BINARY SPARE BITS
16 SYNC
31 ASSIGNED ADDRESS
1 UNASSIGNED ADDRESS
THE UNASSIGNED BIT IS LOGICAL ZERO UNTIL ASSIGNED



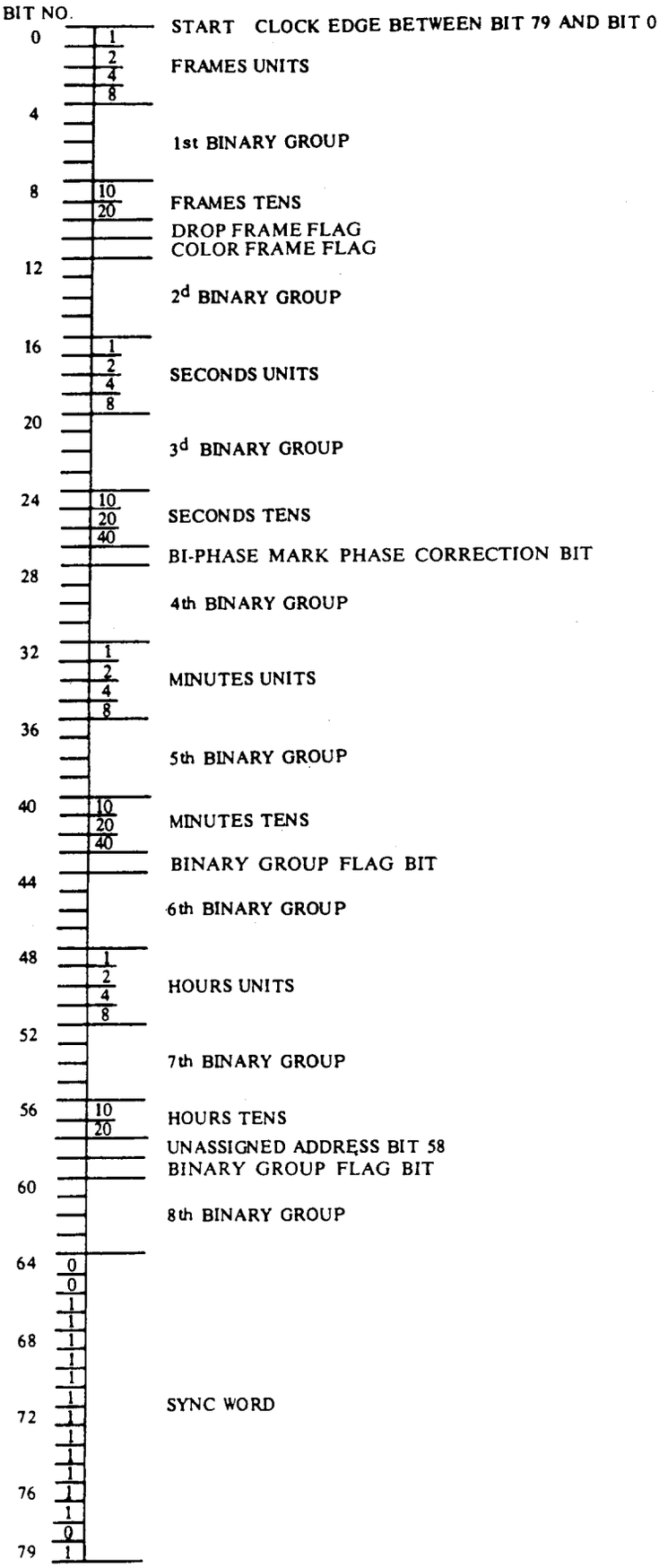


Fig. 3
Longitudinal Bit Assignment

4. Vertical Interval Application

4.1 Modulation Method. The modulation method shall be such that each state of the signal corresponds to a binary state and a transition occurs only when there is a change in the data contained in adjacent bit cells from a "1" to "0" or "0" to "1." No transitions shall occur when adjacent bits contain the same data. Synchronization bit pairs shall be inserted as required in 4.2.3 (modified NRZ).

4.2 Format

4.2.1 Make-up. The frames shall be numbered successively 0 through 29, except as noted in 5.2.2 (Drop Frame), with field identification as specified in 4.4.

The address recorded in each field shall relate directly to the field/frame identification as set forth in EIA Tentative Standard No. 1, and shall be related to the longitudinal code as shown in Fig. 4.

Bit Rate. The bit rate, F_c, at which the address is generated shall be as follows:

$$F_c = F_h \times \frac{455}{4} \doteq 200\,\text{Hz}$$

where F_h is the horizontal line rate.

Recorder Input Waveform Characteristics. The baseband video signal after address insertion shall be specified as shown in Fig. 5.

4.2.2 Address. Each address shall consist of 90 bits numbered 0 through 89.

4.2.2.1 Boundaries of Address. The address shall start at the leading edge of the first synchronizing bit (bit 0). The bits shall be evenly spaced throughout the address period, and shall occupy fully the address period which is 50.286 μsec nominal in duration.

4.2.2.2 Timing of the Start of Address. The half-amplitude point of bit 0 shall occur not earlier than 10.0 μsec following the half-amplitude point of the leading edge of the line synchronizing pulse. The half-amplitude point of the trailing edge of bit 89 logical 1 shall occur not later than 2.1 μsec before the half-amplitude point of the leading edge of the following line synchronizing pulse. (See Fig. 6.)

4.2.2.3 Location of the Address Code Signal in the Vertical Interval. The address code signal, generated at the bit rate F_c, shall be inserted on two non-adjacent lines of the vertical interval in both fields. Insertion of the address code shall not be earlier than line 10 or later than line 20, as defined in EIA Tentative Standard No. 1. The address code shall be on the same lines in all fields for a given recording.

User bits shall be the same in both fields of a frame to avoid confusion when transferring from the vertical interval to the longitudinal code.

4.2.3 The bits shall be assigned as shown in Fig. 6.

4.3 Use of Binary Groups The binary groups are intended for storage of data by the users, and the 32 bits within the 8 groups may be assigned in any manner without restriction if the character set used for the data insertion is not specified and the binary group flag bits 55 and 75 are both zero.

If an 8-bit character set is used, the binary group flag bits 55 and 75 shall be set according to the following truth table:

	Bit 55	Bit 75
Character set not specified	0	0
Eight-bit character set	1	0
Unassigned	0	1
Unassigned	1	1

Unassigned states of the truth table cannot be used and their assignment is reserved to the SMPTE.

4.3.1 If an 8-bit character set conforming to ISO 646-1983 and ISO 2022-1982 is signalled by the binary group flag bits 55 and 75, the characters should be inserted in accordance with Fig. 2. Information carried by the user-bits is not subject to any regulation.

4.4 Assigned and Unassigned Address Bits. Six bits are reserved within the address groups, 5 for identifying operational modes and 1 unassigned bit reserved for future assignment and defined as zero until further specified by the SMPTE.

Bit 14 — Drop Frame Flag. If certain numbers are being dropped to resolve the difference between real time and color time, as defined in 5.2.2, a "1" shall be recorded.

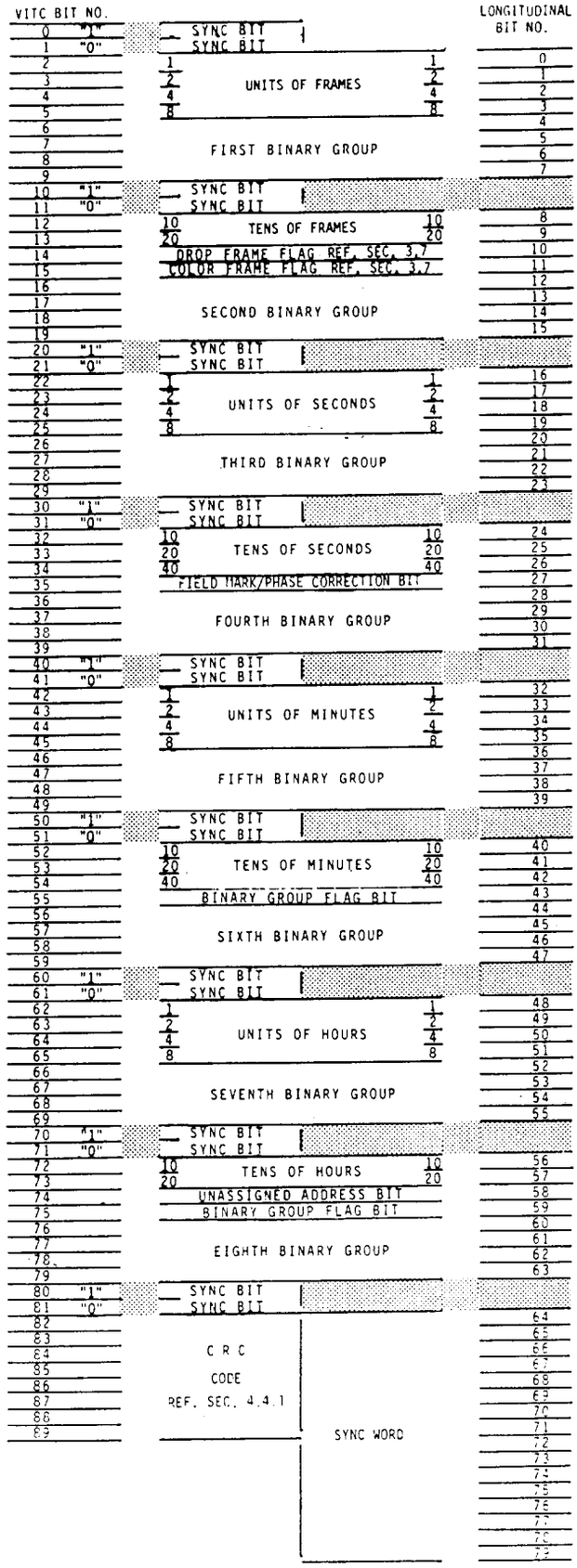


Fig. 4
Relationship of Vertical Interval Code to Longitudinal Code

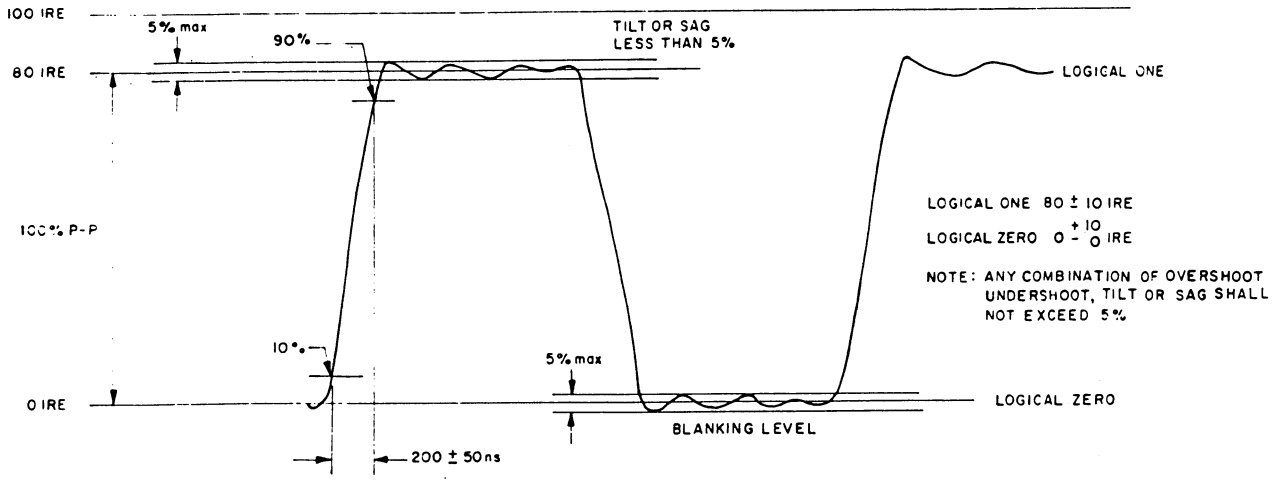


Fig. 5
Vertical Interval Recorder Waveform

Bit 15 — Color Frame Flag. If color frame identification has been applied intentionally, a "1" shall be recorded. Color frame identification of the code is defined as the even units of frame numbers identifying frame A and the odd units of frame numbers identifying frame B. Frames A and B correspond to color frames A and B as defined by EIA Tentative Standard No. 1.

Bit 35 — Field Mark. Field identification shall be recorded as follows: A "0" shall represent the field in which the first pre-equalizing pulse follows the preceding horizontal sync pulse by a whole line. This corresponds to monochrome field I and color field I or III. A "1" shall represent the field in which the first pre-equalizing pulse follows the preceding horizontal sync pulse by a half line. This corresponds to monochrome field II and color field II or IV. Color fields I and III and II and IV are defined in EIA Tentative Standard No. 1.

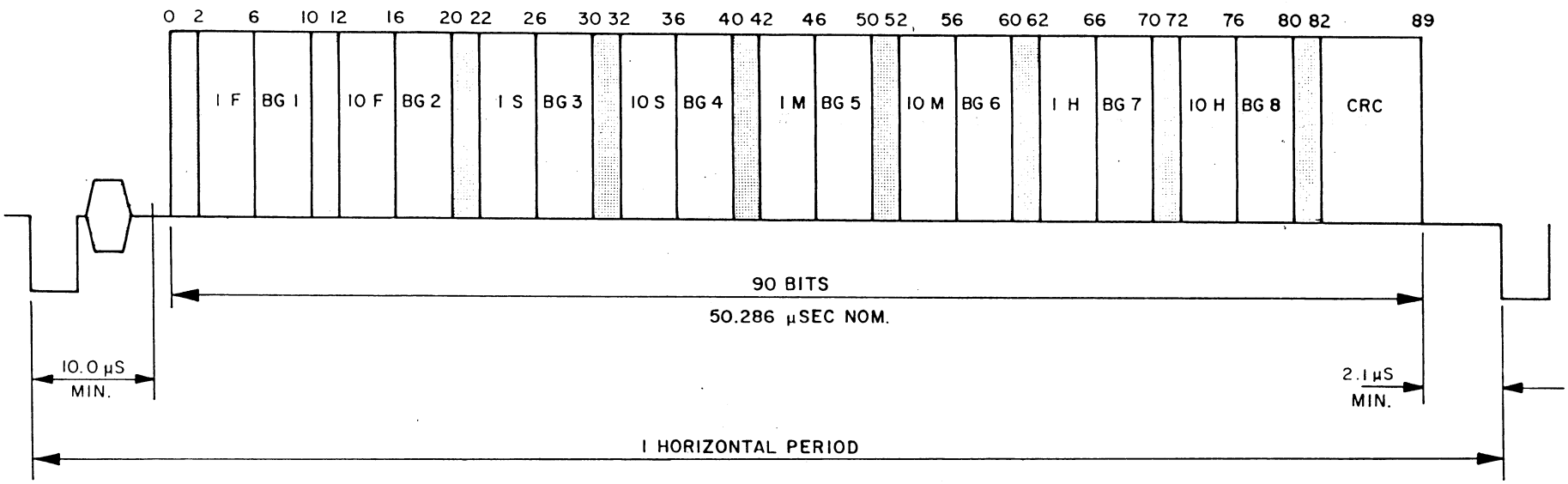
Bits 55 and 75 — Binary Group Flag Bits. These two bits shall be set in accordance with the truth table specified in 4.3.

Bit 74 — Unassigned Address. "0" until assigned by SMPTE.

4.4.1 Cyclic Redundance Check Code. Eight bits, 82 to 89, are set aside at the end of the code to provide for error detection by checking for cyclic redundance. The generating polynomial of the cyclic redunance check, G(X), will be applied to all bits from 0 to 81 inclusive and shall be as follows:

$$G(X) = X^8 + 1$$

The received data divided by the generating polynomial shall result in a remainder of "all zeros" when no error exists in the received data.



0-1	Synchronizing bits	0 Fixed one 1 Fixed zero
2-5	Units of Frames	
6-9	First Binary Group	(BG 1)
10-11	Synchronizing bits	10 Fixed one 11 Fixed zero
12-13	Tens of Frames	
14	Drop Frame Flag	
15	Color Frame Flag	
16-19	Second Binary Group	(BG 2)
20-21	Synchronizing bits	20 Fixed one 21 Fixed zero
22-25	Units of Seconds	
26-29	Third Binary Group	(BG 3)
30-31	Synchronizing bits	30 Fixed one 31 Fixed zero
32-34	Tens of Seconds	
35	Field Mark	
36-39	Fourth Binary Group	(BG 4)
40-41	Synchronizing bits	40 Fixed one 41 Fixed zero
42-45	Units of Minutes	
46-49	Fifth Binary Group	(BG 5)
50-51	Synchronizing bits	50 Fixed one 51 Fixed zero
52-54	Tens of minutes	
55	Binary Group Flag	
56-59	Sixth Binary Group	(BG 6)
60-61	Synchronizing bits	60 Fixed one 61 Fixed zero
62-65	Units of Hours	
66-69	Seventh Binary Group	(BG 7)
70-71	Synchronizing bits	70 Fixed one 71 Fixed zero
72-73	Tens of Hours	
74	Unassigned bit	(Zero until specified)
75	Binary Group Flag	
76-79	Eighth Binary Group	(BG 8)
80-81	Synchronizing bits	80 Fixed one 81 Fixed zero
82-89	CRC Code (Cyclic Redundance Check Code. See 4.4.1)	

Fig. 6
Address Bit Assignment

5. Time Discrepancies

5.1 Definitions of Real Time and Color Time

5.1.1 One-second real time is defined as the time elapsed during the scanning of 60 fields (or any multiple thereof) in an ideal television system at a vertical field rate of exactly 60 fields per second.

5.1.2 One-second color time is defined as the time elapsed during the scanning of 60 fields (or any multiple thereof) in a color television system at a vertical field rate of approximately 59.94 fields per second.

5.2 Because the vertical field rate of a color signal is approximately 59.94 fields per second, straightforward counting at 30 frames per second (60 fields per second) will yield an error of + 108 frames (+ 216 fields), approximately equivalent to + 3.6 seconds timing error, in one hour of running time. For correction of this time discrepancy, two methods of operation are allowed:

5.2.1 Nondrop Frame — Uncompensated Mode. During a continuous recording, no numbers shall be omitted from the chain of addresses. Each address shall be increased by 1 frame over the frame number immediately preceding it. When this mode is used, the drop-frame flag of each address shall be a "0" as specified in 3.5 and 4.4.

5.2.2 Drop Frame — Compensated Mode. To resolve the color time error, the first two frame numbers (0, 1) at the start of each minute, except minutes 0, 10, 20, 30, 40, and 50, shall be omitted from the count. When this mode is used, the drop-frame flag of each address shall be a "1" as specified in 3.5 and 4.4.

6. Structure of the Address Bits

6.1 The basic structure of the address is based upon the Binary Coded Decimal (BCD) system. Because the count in some cases does not rise to 9, conservation of bits is achieved because 4 bits are not needed as in an ordinary BCD code. (The 24-hour clock system is used; 2:00 p.m. is 1400 hours.)

6.2 Longitudinal Track and Vertical Interval Applications. Assignment of bits and binary coded decimal arrangements for both applications are shown in the following table:

Longitudinal Track and Vertical Interval Structure

Structural Member	Assignments of Bits		Binary Coded Decimal (BCD)		
	Longitudinal	VIT	No. of Bits	Arrangement	Count
Units Frames	0-3	2-5	4	1 2 4 8	0-9
Tens Frames	8-9	12-13	2	1 2	0-2
Units Seconds	16-19	22-25	4	1 2 4 8	0-9
Tens Seconds	24-26	32-34	3	1 2 4	0-5
Units Minutes	32-35	42-45	4	1 2 4 8	0-9
Tens Minutes	40-42	52-54	3	1 2 4	0-5
Units Hours	48-51	62-65	4	1 2 4 8	0-9
Tens Hours	56-57	72-73	2	1 2	0-2

SERVICE MANUAL
TAPE TRANSPORT AND CONTROL LOGICS 3

KUDELSKI S.A. CH-1033 CHESEAUX

NUMBER : PT-09-001

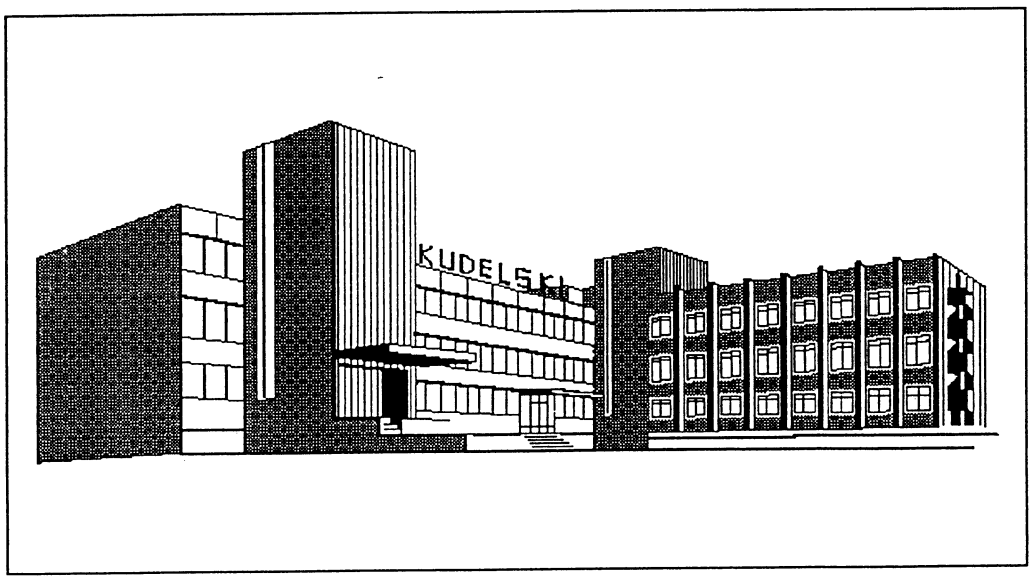
TITLE :PRODUCTION TEST SPEC. FOR NAGRA-TA
PRODUCT P.N. : K.S.A. 7009 017 000

-FPO-

INITIATOR	DESIGN ENG.	PRODUCT ENG.	QUALITY ENG.
L.van Zandycke		L.van Zandycke	.....

ISSUE HISTORY VERSION .A

ISSUE NO	DATE	INITIATED BY	CONTENT CHANGED
1	Apr.24.87	H.Bartels	First issue
2	Dec.29,93	L.van Zandycke	Translation



January 10, 1994

Production Test Specification

for FPO
KSA P/N 7009017000
TA

January 10, 1994

1.0 Scope

1.1 This test procedure provides the test requirements for the TA for First Power On.

1.2 **Documents**

The following documents have to be used with the TA item:

Schematic: .....
Layout: .....
Parts list: .....
Black box: .....
Data sheet: .....

January 10, 1994

2.0 Test equipment and standard conditions

3.1 **Temperature:**
Operating temperature range: from -..°C to +..°C.
Storage temperature range: from -..°C to +..°C.
Test temperature: +25°C ± 10°C with up to 90% relative humidity, non condensing.

3.2 **Performance:** Unless otherwise specified, the device shall meet all requirements specified herein.

3.3 **Recommended test equipment or equivalent:**

Oscilloscope:	Tek 2222
AC voltmeter:	Tek AA501
DC voltmeter:	Fluke 8060A
Generator:	Krohn-Hite 4300A
Frequency counter:	HP 5315B
AC voltm.:	Tek AA501
Wow-Flutter meter:	EMT-Franz

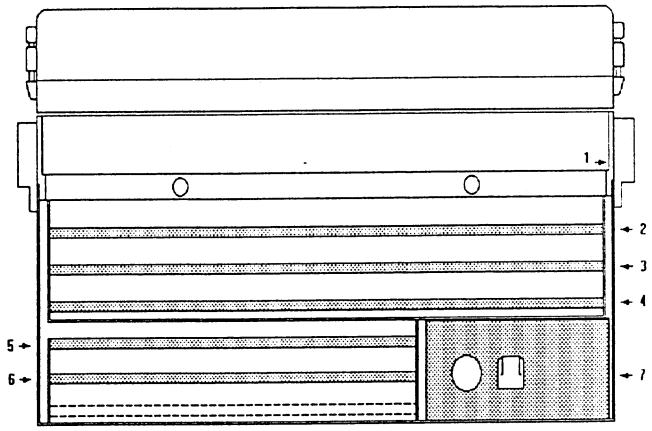
Tape tension equipment with 100grs Corex
Equipment for tension between heads with 100grs Corex
Equipment for guides height adjustment
Comparators for alignment table
Special tool of 5 and 10 degrees
Extension boards for A0-3,
2 audio pcb's for test purposes
Test tape 18cm (diameter)
Test tape 30cm
Clear tape
Reference tape for azimuth adjust (1 + 10kHz, 19cm/s)
Reference tape for speed adjustment (50 μm)
Calibration tape (depending on customer specs)
Standard tools

January 10, 1994

3.0 Test procedure: use data sheet **DS-09-01.**

3.0.1 Pcb localization inside the TA.

Front view



1 HP option

2 Audio pcb (AO 1)

3 Audio pcb (AO 1)

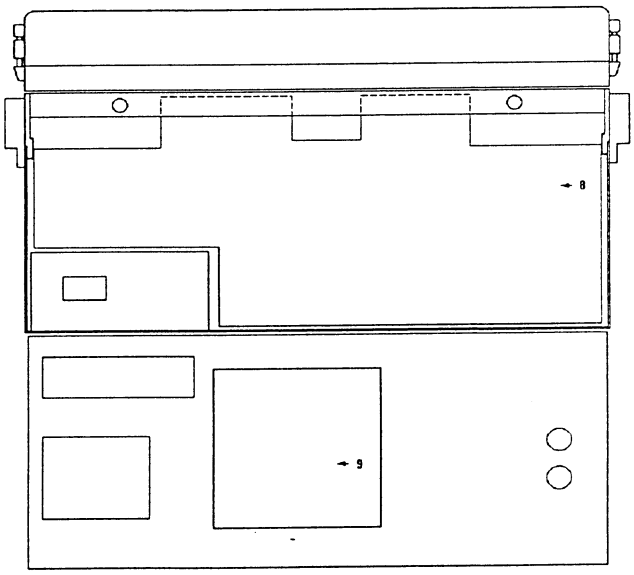
4 Logic pcb (AO 2)

5 Speed stab (AO 3)

6 Counter or TC
(AO 4) (AO 5)

7 Power supply (A30)

Backside view



8 Main interconnection
(B 5)

9 Line input / output transfo's
(A 9a)

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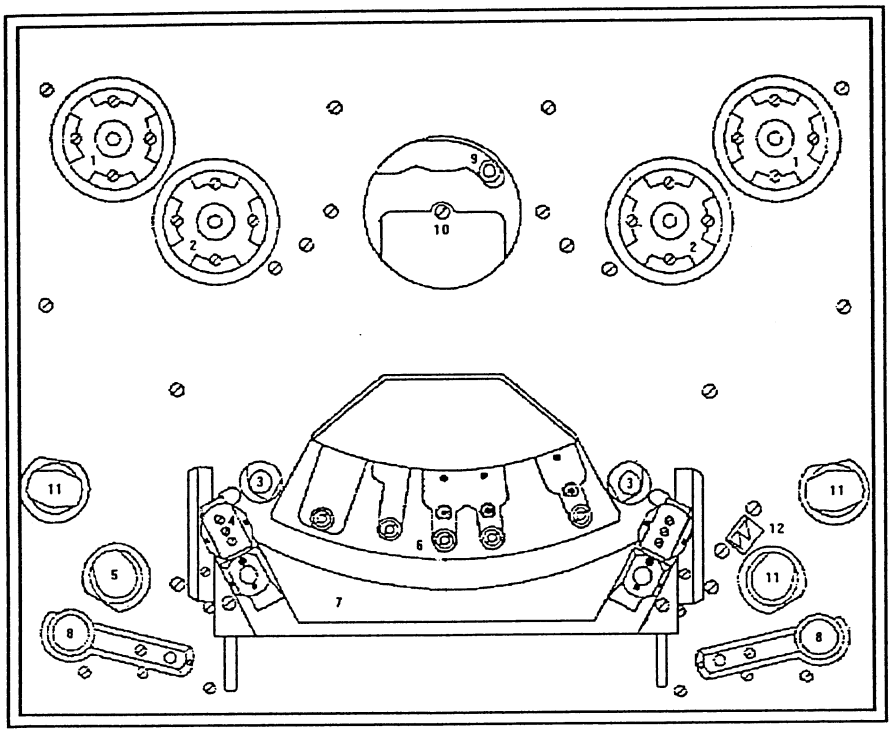
Tape deck top view



1 30cm Hub left and right

2 18cm Hub left and right

3 Left and right capstan

4 Left and right pinchroller

5 Counter roller

6 Headstack

7 Loading mech.

8 Left and right tension arm

9 Came guide roller

10 Came

11 Left and right roller guide

12 Scissors

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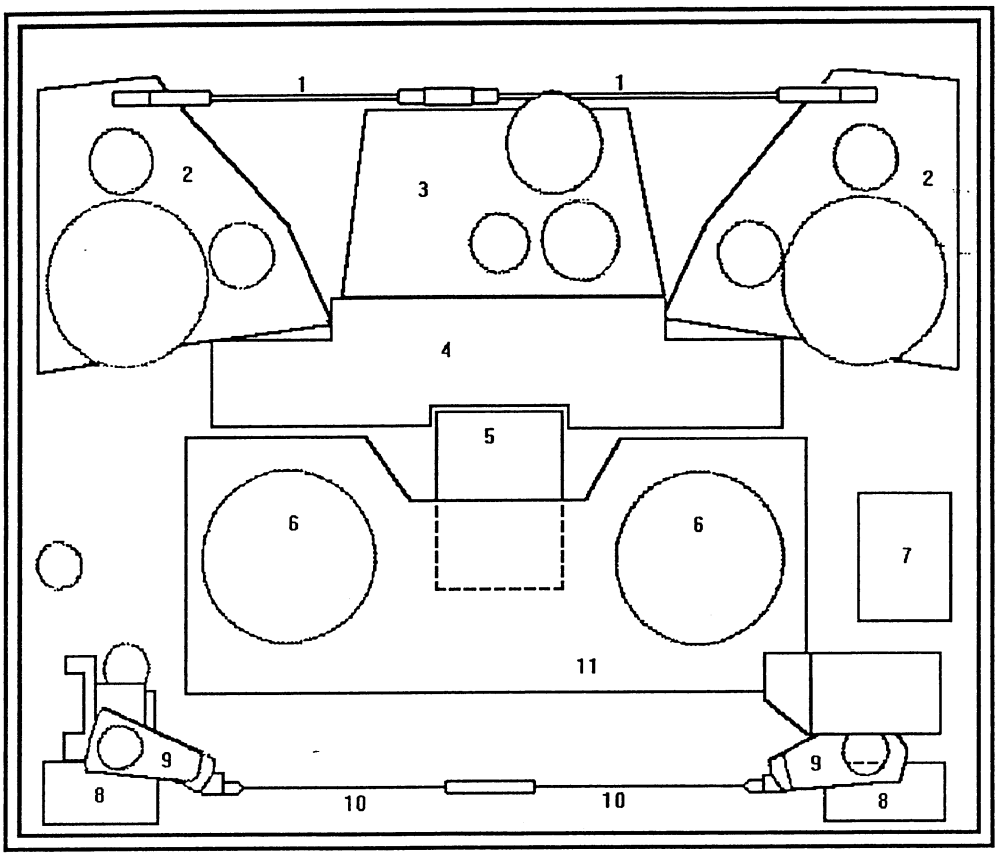
Tape deck underside view



1 Brake spindle

2 Left and right reel motor sub. assy

3 Came sub. assy

4 Interconnection pcb B 3

5 Interconnection pcb B 1

6 Right and left capstan motor

7 Interconnection B 2

8 Left and right tensiometer pcb A 12a and A 12b

9 Left and right tensiometer

10 Tensiometer spring

11 Sub. assy capstan motor

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Nagra TA options

HP	Loudspeaker and amplifier (A 20)
RAM	Remote and audio monitoring connecters (BJ 3 & BJ 4)
PCR	Fast copy input / output connecters
PPA	Connecters for second keyboard (left side)
ONP	Neo Pilot & PFM pcb
SC	Servo encoder (roller on keyboard) + pcb A 19
TACAL	Record preemphasis with anti distortion A 5
TACAL-S	Record preemphasis without anti distortion A 5
TACIM	Simultaneous playback A 7

1 Prechecks Mechanical part:

Check that the required options are corresponding to the set.
Install the headstack corresponding to the options.
Verify the main mechanical assy.
Check screws, gnd's (connect gnd Ωmeter to one of the yellow-green wires and check all others), solder joints connecters etc.
Check the wiring of the TC connecters (P1 connecter from TC pcb to the backside of the TA: BJ11 third track, BJ12 RS232, BJ13 RS422).

1.1 Inside of the machine.

Check the grounding of the reel motor shafts
Check that the tensionarms are locked in free spool mode (its a control to verify that the relays are free if no voltage is applied on them, activate them by hand and check once released that they immediately come back to the original position)
Verify that the tensionarms are moving free without spring loading (remove the spring and feel that there is no mechanical friction, put back the spring).
Verify that the reel motor brakes are moving free without the brake spindle (Remove the spindle from the motor and turn one of the reel holders by hand. verify that no brake is activated and afterwards, put back on the spindle).
Check that the audio heads are grounded (use as gnd for the Ωmeter one of the yellow-green wires).
The following is only needed if the reel motors become too noisy in forward or rewind mode or the servo becomes nervous when using 30cm reels (Check the tension on the reel motor belt. If the belt makes too much noise, file the lower and upper edges.Check the position of the belt security holder. Verify that the space between the belt and the holder is about the thickness of a visit card).
Check that there is not too much liberty between the table moved by the cam and the nylon rollers inside. Verify that the table is parallel with the cover in park position (Seen from inside, it is the metal part under the tensionarms spring which is moved by the cam, that needs to be parallel with the TA deck).

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1.2 Power supply checks.

Verify the fuses on the power supply. Install the power supply inside the TA and lock it with 3 bottom screws. Clean the connecters and connect to the machine.
No other boards are inside the machine.
Install the extension board A0-3 in place of the speed stabilizer.
Switch on the TA and measure the following voltages:

1.3 Check the voltages on AO 3, extension pcb. Take gnd on P1....

XA 03 P 1-28ab	-30V unreg.	-33V to -36V
XA 03 P 1-29ab	+30V unreg.	+32V to +36V
XA 03 P 1-4ab	safety brakes	+11V to +13V
XA 03 P 1-15ab	+30V unreg.	+32V to +36V
XA 03 P 2-8ab	+7.5V regulated	+7.5V ± 10mV
XA 03 P 2-12ab	-7.5V regulated	-7.5V ± 80mV

1.4 Voltage check on connecters.

Remote control (BJ 3)	Audio monitoring (BJ 4)
BJ 3-12 , +7.5V	BJ 4-2 , -15V
BJ 3-13 , +13V	BJ 4-3 , +15V
BJ 3-25 , -7.5V	BJ 4-10 , +7.5V
	BJ 4-13 , -24V
	BJ 4-15 , -15V
	BJ 4-16 , +15V
	BJ 4-23 , -7.5V
	BJ 4-25 , +24V

Switch off the TA.
Control the grounding connections on the connecters BJ 3 and BJ 4 by using an Ωmeter: gnd is one of the yellow-green wires.
BJ 3-11, 23 & 24
BJ 4-1, 11, 12, 14 & 24
Control the groundings on the balanced line in & output

1.5 Tape roller guides. Ref. is entrance guide on audio stack (left side).

Search on the tape deck (using the special reference table for measurements) for the highest point between the entrance and exit guide (ruby support on each guide, see next fig. point 5 (ref.) and 9 as well as 6, 7 & 8) on the audio stack.

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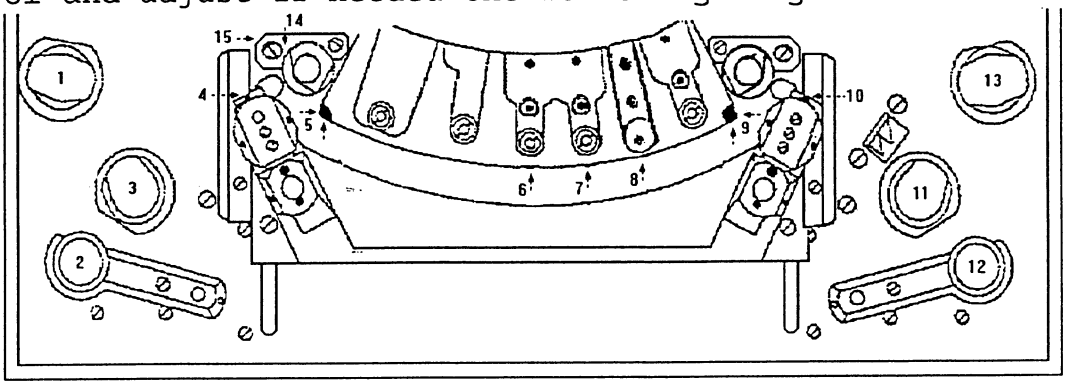
Reduce by hand drilling the highest point to obtain a delta equal to 0 (0 means inside ± 10µm).
Control and adjust if needed the following heights:



Attention: max. vert. shaft play = 0.02mm (check for free rotation)

Point 1	± 0.05mm	Point 2	± 0.05mm
3	± 0.02mm	4	± 0.01mm
5	0 = reference	6	± 0.01mm
7	± 0.01mm	8	± 0.01mm
9	± 0.01mm	10	± 0.01mm
11	± 0.02mm	12	± 0.05mm
13	± 0.05mm		

1.6 Loading sledge.

Verify that all rollers, pinch rollers included are rotating freely.
Verify when the sledge is fully engaged that the 2 taps on the front are entering smoothly inside part 14. If not adjust the part. Release the 6 pan screw 15. Part 14 can now move slightly. Engage the sledge and lock again the 6 pan screw. Check again on both sides.
Check the height of the 2 rubies (4 & 10) on the sledge (on top of the pinch rollers). They can slightly move if part 15 was readjusted. To adjust, loose the 6 pan No.2 screw beside the pinchroller assy to obtain the possibility of height adjustment. Adjust the 6 pan No.2 top screw behind the pinchroller the correct the height and lock again the side 6 pan screw. Pay attention to verify the height when the sledge is fully engaged before the pinchrollers are touching the capstan shafts.
Verify the perpendicularity of the capstan shafts.

1.7 Erase head tuning.

Used adjust capacitors need to be 100V min. voltage.
Connect a generator with a 10kΩ serial resistor to the right head. Short circuit the left head. Adjust Fo by changing the parallel capacitor to obtain max. voltage level for a freq. equal to 256kHz ± 1kHz. Typ. value is 470pF, add a second capacitor for fine tuning. A more accurate result can be obtained if a tape is in front of the head. Repeat for the left head with the right one shorted.
Repeat the same operation with the TC erase head. Adjust it for max. amplitude at a freq. equal to 160kHz ± 1kHz. Typ. value is 4.7nF. Add a second capacitor for fine tuning. Remove the short.

Install the following pcb's:

AO 1 (audio)
Check the bridges on A0 1
AO 2 (logic): Install ST301, set DIL switch A0 2, switch 2 & 3 to ON (Initialization on "REPRO" & "SAFE".
AO 3 (speed stab)
A0 4 (counter or TC)

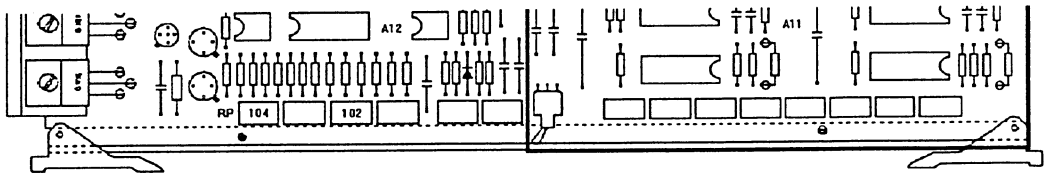
1.8 Main functions.

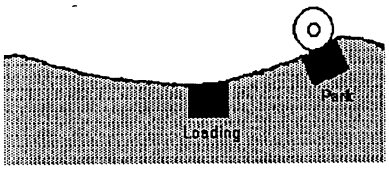
Connect a keyboard (following the specifications of the customer).
Switch on the TA and verify the following:
The audio matrix - The Modify button - The leds - The Stop, Play & Record button.
Verify all other functions:
Check the mono led, the light dimmer, the record inhibit switch (set audio matrix to Ready and push Record), the sledge comes back in Park position.
Verify the different initialization modes: Standard is "SAFE & READY".
Verify the keyboard function on the PPA option: Connect a second keyboard on the PPA option and verify the inhibits of the first or second keyboard depending on the switch: Remote, Remote + Local, Local. See table below: A = activated keyboard, D = disactivated keyboard.

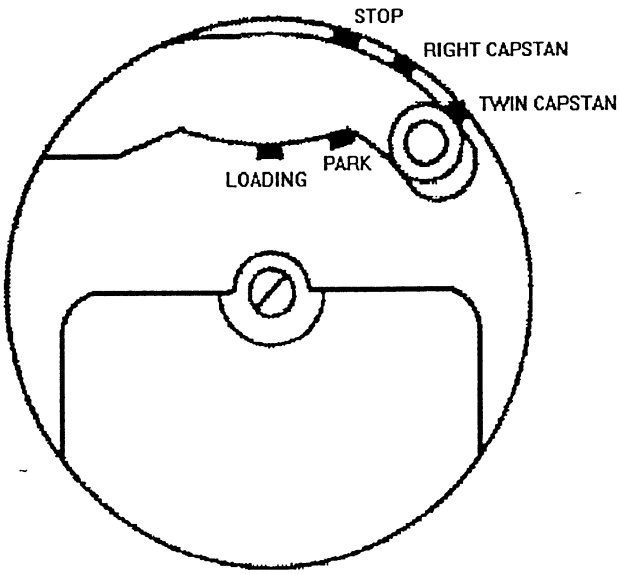
		Main keyboard		
Second keyboard		Local	L + R	Remote
	Local	A/A	A/D	A/D
	L + R	D/A	A/A	A/D
	Remote	D/A	D/A	D/D

1.9 Cam adjustment.

Verify that the cam is correctly secured on the shaft: two 6 pan screws on top and one 6 pan screw inside (turn the cam to find it).
Set on A0 3/A the potm. RP 102 & RP 104 in middle position. Leave the cam cover removed. Select Park and adjust with the cam potm. BRP 1, (inside) the roller until its stops right in front of the Park area silkscreen.







Select "LOADING" and adjust with RP 104 on A0 3 the loading position.
Select "PLAY" and adjust with RP 102 on A0 3 the right capstan posit.
Touch the tape tension head lightly (simulate tape) and verify that the cam moves to the twin capstan position. Release the tape tension head and verify in that position that the left pinchwheel is disengaged. Go to stop mode and verify that both pinchwheels are disengaged. Control all other camwheel positions.

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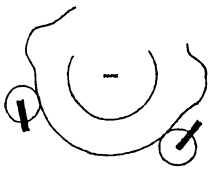
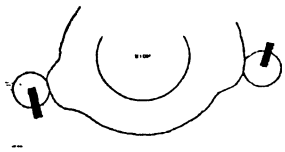
Control the pinchwheel commands depending from the camwheel (inside TA).

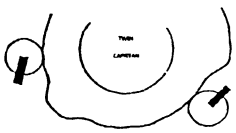
Park



Stop

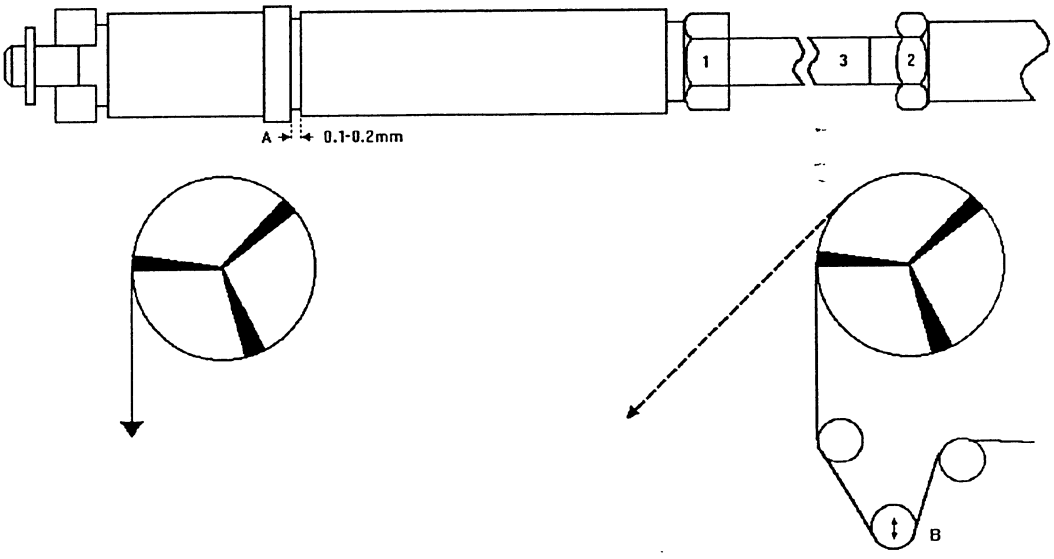


Right capstan Twin capstan



Verify that the sledge is sliding smoothly when "PARK" is selected, followed by play

2 Brakes.



Install an 18cm tape on the left side. Select "LOAD". Unlock nut No. 2 (5.5mm). Pull the tape with a PESOLA (see fig. above).
While pulling, verify that the tensionarm doesn't touch its limit. If yes adjust the shaft No. 3 until the PESOLA indicates min. 50 grs when pulling straight (without tensionarm, see dotted line on above picture). Verify that the space A is between 0.1 and 0.2 mm. Lock the nut No. 2.
Select "PARK" position and adjust the nut No. 1 to obtain a tape resistance of min. 180 grs.
Repeat this paragraph for the right side.

3 Tach heads.

Verify that both capstan motors are correctly secured on the TA deck. Verify the pressure on the ball bearings.

3.1 Capstan motor clutch.

Attention: Secure screw No. 1 with Loctite 222 and screw No. 2 with Loctite 601

1 = screw No. 1

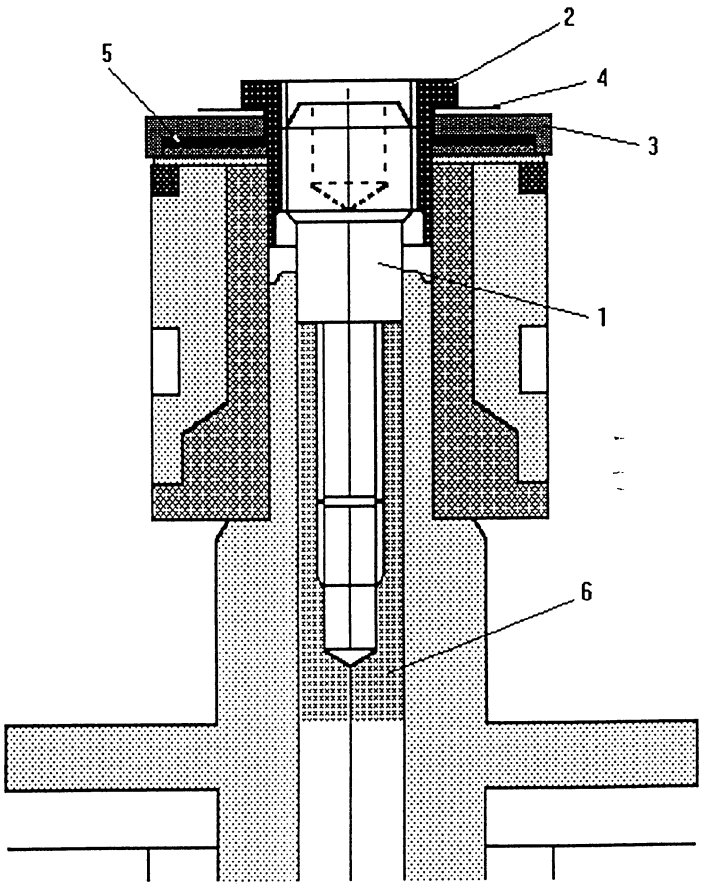
2 = screw No. 2

3 = cover

4 = washer

5 = elastic washer

6 = motor shaft



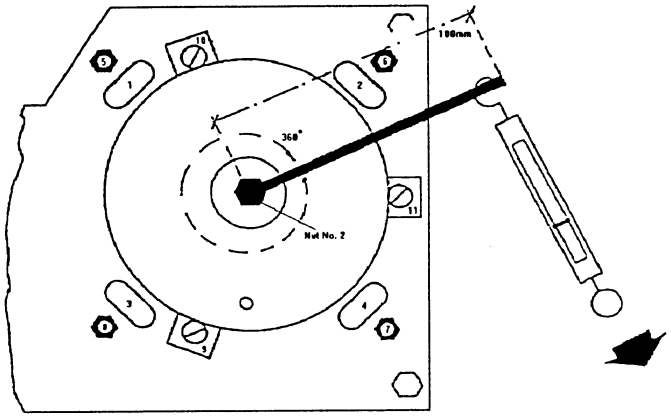
Remove the capstan motor shield.
Verify that there is no vertical play on the capstan shaft.
Close the TA and verify from top that the vertical play on the capstan shaft is minimum.

1, 2, 3 & 4 = holes for installing the spacers for the tach head centering.

5, 6, 7, & 8 = nuts which keep the tach head in place.

9, 10 & 11 = Motor holders

12 = hole to block the motor.



By turning the motor slowly by hand, find the place to block the motor shaft through hole 12 by introducing a small pin. Lock the screw No. 1 (6 pan 3.5mm)
Adjust the nut No. 2 to obtain the correct clutch torque of 180 grs ± 20 grs. The torque is measured with an arm length of 100mm. Remove the small pin to release the motor shaft. Repeat for the second capstan motor.

3.2 Capstan tach signal.

Verify that the static tach ring is correctly centered. Use the four special spacers (0.12mm) and slide them in the holes 1 to 4. If this is not possible, loose the four nuts 5 to 8 and recenter the tach ring using the four spacers. Don't forget to lock the four nuts before removing the spacers.

3.3 Tach phase ratio.

Put the TA in play mode 19cm/s. Put TP3 and TP4 from A0 3 to scope and verify that the phase relationship is 90 degrees ± 20 degrees. Repeat with the right capstan motor using TP 103 and TP 104.

3.4 Tach wow and flutter.

Capstan motors are running with pinch rollers engaged. Put TP7 from A0 3 to a B&K AC voltmeter using a filter 22Hz-22kHz and measure a voltage to max. 160mVrms.

3.5 Tach amplitude.

Measure with a B&K AC voltmeter on A0 3 TP1, TP2 (left capstan) and TP101 , TP102 (right capstan) the tach amplitude: Tol.: min. 250mVrms, max. 4.5Vrms.

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4 Tensiometers.

4.1 Vertical play.

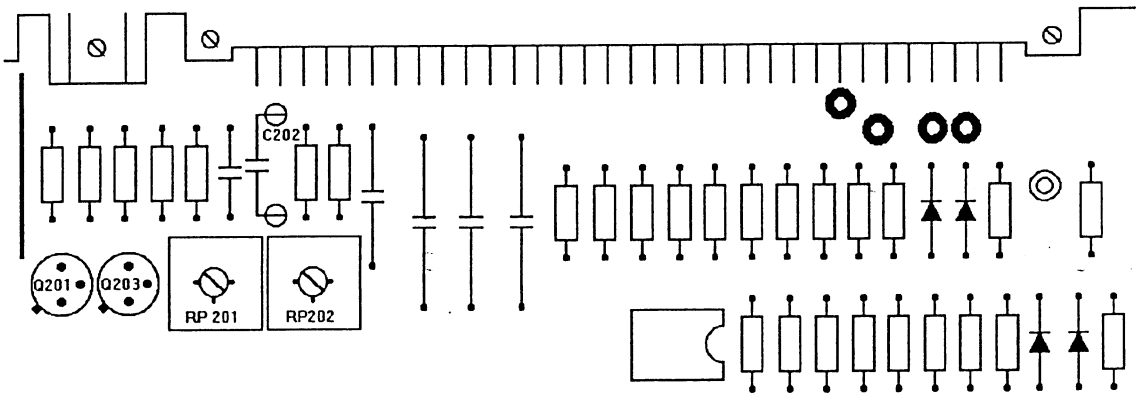
Verify that there is no vertical play on both tensionarms.

4.2 Arm height, electric end detector.

Verify that the space between the tensionarm and the TA deck is corresponding to 0.45mm ± ...mm. If not adjust the height. Take care to readjust the tensionarm roller by using the special ref. table if the space was wrong.
Check the electric end detector by using an Ωmeter. Check also that the reel motors are changing their sense when moving the corresponding tensionarm from one extreme to the other if the TA is in play mode without tape.

4.3 Frequency tuning.

Install the A0 3 pcb on the extension board and put the collector from Q201/A0 3-A2 to scope. Adjust C202 to obtain a voltage equal to 15Vpp ± 2Vpp (typ. value is between 470pF to 560pF).



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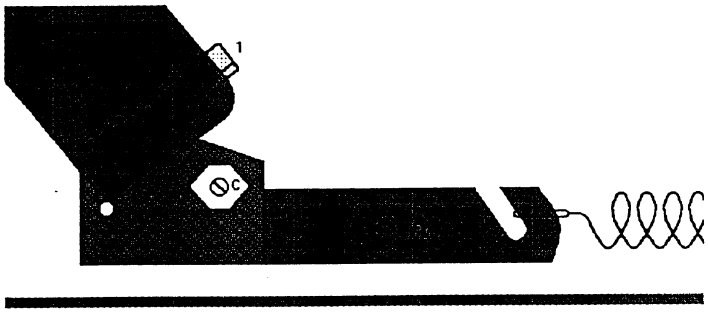
4.4 Park position.

Install the special 10 degrees tool on the left tensionarm.
Unlock screw No. 1
Adjust the hook A until it sits parallel with the support B. Lock again screw No. 1.
Unlock the nut C and adjust the eccentric screw inside the nut until it is just pushing the hook. Lock again the nut. Verify that A & B are parallel to the TA deck.



4.5 5 degrees tool adjust.

Install the 5 degrees tool on the left tensionarm. Set the TA in "STOP" mode. Adjust RP1 (on A0 3) until the left reelmotor stops. Repeat with the right tensionarm and adjust RP51.

4.6 Reel motors.

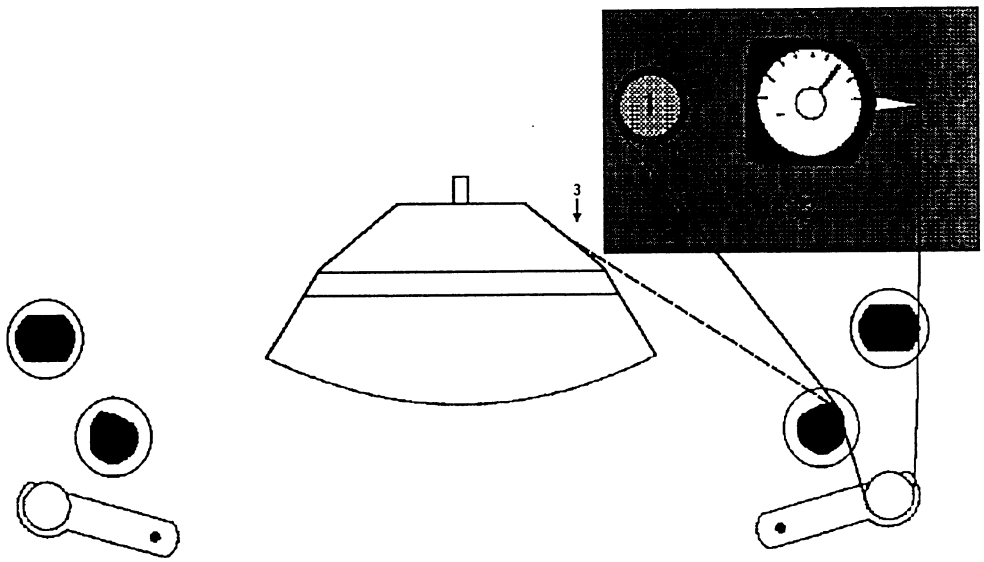
Keep the TA in "STOP" mode. Verify that the motors are not running (electric limit detection of the tensionarms).
Set the reels sense for "TAPE OXIDE INSIDE".
Move slowly the left tensionarm and observe that the left motor starts turning CW. Continue to move the tensionarm inwards and observe that the motor stops and restart turning CCW.
Move slowly the right tensionarm and observe that the right motor starts turning CCW. Continue to move the tensionarm inwards and observe that the motor stops and restart turning CW.

4.7 Tape oxide position.

	Inside	Outside	Take up inside Supply outside	Take up outside Supply inside
Left reel	CW	CCW	CCW	CW
Right reel	CCW	CW	CCW	CW

Set back to inside

5 Tape tension.



5.1 Adjustment.

Install the special tool 5 degrees on the left tensionarm. Adjustment with the special tool. Install the tape as seen on the picture above. Adjust with button No. 1 the tape length until the motor just stops running and measure the value (sample: 79 grs). Increase the tape tension with the same button and come slowly backwards until the motor just stops again (sample: 81 grs). Calculate the mean value ([79 + 81]/2 = 80) and adjust the button No. 1 to obtain that value. Adjust the tensionarm spring to obtain a reading of 75 grs ± 2 grs.

If no special tool available, glue tape at the back side of the audio stack (see dotted line (No. 3) on previous picture).

5.2 Remove ST 301 on A0 2.

Verify without tape on the TA that there is no action from the machine if STOP, PLAY, REWIND or FORWARD is pushed.

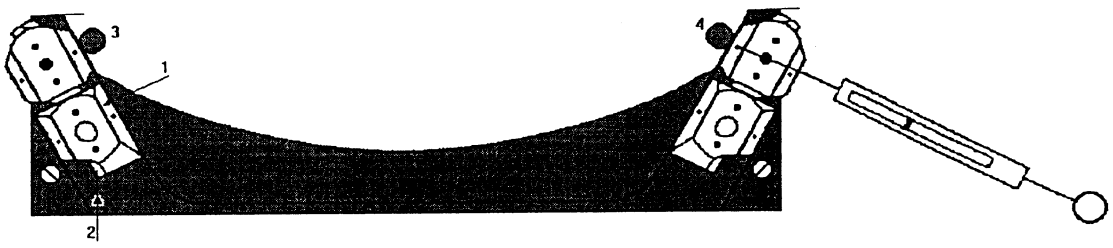
5.3 Tape path adjustment.

Install a worktape on the TA. Select "A" position. Select a tape speed of 38 cm/s. Put the TA in "PLAY" mode and verify that both pinchrollers are engaged. If not adjust the tape

tension head sensitivity with RP202 on A0 3.
Select alternately "PLAY" & "GO TO LEADER" and verify on both capstan motors shafts that the tape stays at the same height in the two directions. If not, recheck para 1.5 & 1.6.
Verify at all tape speeds.
Check that the tape stays between the ruby and lower edge guide on each pinchroller. If not adjust the pinchroller guide.
Verify that the tape just touches the rubies on the audiostack.
Repeat checks in position "B", "C" & "D".

5.4 Pinchroller pressure.

Set the TA for 19 cm/s and playback a worktape.



Start with the right pinchroller by unloading screw No. 2 totally to reduce the springloading to 0. Adjust screw No. 1 until the pressure becomes 450 grs. This can be checked by using a PESOLA (see picture above). Pinch by hand the left pinchroller, pull the right pinchroller with the PESOLA (under 90 degrees) until the moment that the tape speed just reduces and measure the value equal to 450 grs. Adjust again the screw No. 1 to obtain a total pressure of 800 grs ± 50 grs (this cancel the pressure on the pinchroller fork).
Repeat for the left pinchroller.
Verify that the record as well as the playback head are correctly centered on the tape in "PLAY" mode.

5.5 Azimuth adjustment (Playback).

Set the audio matrix in "REPRO" position.
Demagnetize the headstack. For test purposes only: Install if not specified the "TASIM" pcb's on A0 1.
Playback the ref. tape "AZIMUTH 1 + 10kHz, 19 cm/s"
Adjust the azimuth of the playback head (6 pan 2.5mm) observing the two output channels on scope, first for the lowest freq. Fine adjust for the highest freq. Tol.: ± 5 degrees.
In case of troubles, check para 9.

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5.6 Azimuth adjustment (Record).

Install a work tape. Set the TA for position "A". Select a tape speed of 19 cm/s.
Connect the line inputs to a gen. 1kHz 1.55Vrms.
Adjust the record head (6 pan screw 2.5mm) to obtain 0 degrees. Set the gen. to 10 kHz for fine adjust. Observe the jitter. Tol.: ± 7.5 degrees.
Check for position "B", "C" & "D". Tol.: ± 7.5 degrees.

6 Counter encoder.

Install the logic pcb A0 2 on an extension board.
Solder R 1/B 3 220Ω on the reel motor interconnection pcb.
Playback a worktape at a speed of 19 cm/s.
Verify the cycle ratio on UA 304 (A0 2) pin 1 and 2. Tol.: 50% ± 10%.
Verify the cycle ratio at max. forward and rewind speed. Tol.: 50% ± 10%.
Verify the phase ratio between the two signal in all speeds. Tol.: 90 degrees ± 20 degrees.
Control the counter drift: Mark the tape and set the counter to 0. Go in forward for a while and than back to 0. Verify that the mark on the tape is back in front at the same place as before.

6.1 Listen.

Check that the DIL switch 7 on A0 2 is in the "ON" position.
The following is only possible if the "TASIM" option is installed.
Put the TA in "SKIP" mode and adjust RP 103 on A0 3. The adjustment is done in such away that the sledge moves the tape to become only in contact with the record head. (touches the left ruby on the record head).

6.2 Listen when spooling.

Observe a tape speed reducement when the "LISTEN WHEN SPOOLING" function is activated.

6.3 Tasim.

TASIM	Bridge on logic A0 2	Tape position
Yes	ST 101	on record head
No	ST 102	on playback head

6.4 Clear tape.

Put the ref. tape "Clear tape" on the TA with no tape in front of the headstack. TA in "STOP" mode.
Adjust RP 301 on A0 2 to obtain 1.5Vpp on TP 317.
Control with the "Clear tape" in front of the heads.

Clear tape switch	Play mode	"Go to leader" mode
Stop	Stop	Stop
Off	No action	Stop
Rewind	Fast return	Stop

7 Speed stability (A0 3).

Put the TA in "PLAY" mode with a worktape.
Put the scope to TP 204 on A0 3 in DC mode.
Adjust the right capstan speed with the following potm.

Potm. on A0 3	Speed	Udc on TP 204
RP 104	9.5 cm/s	0V ± min.
RP 103	19 cm/s	0V ± min.
RP 102	38 cm/s	0V ± min.
RP 101	76 cm/s	0V ± min.

7.1 Skip forwards.

Set the tape speed to 19 cm/s. Put TP 203 from A0 3 to scope.
Adjust RP 201 from A0 3 depending on the specifications.

Standard equipped: Udc TP 203 = 0V ± min.
Copy UDC equipped: Udc TP 203 = +0.6V ± min.

7.2 Park.

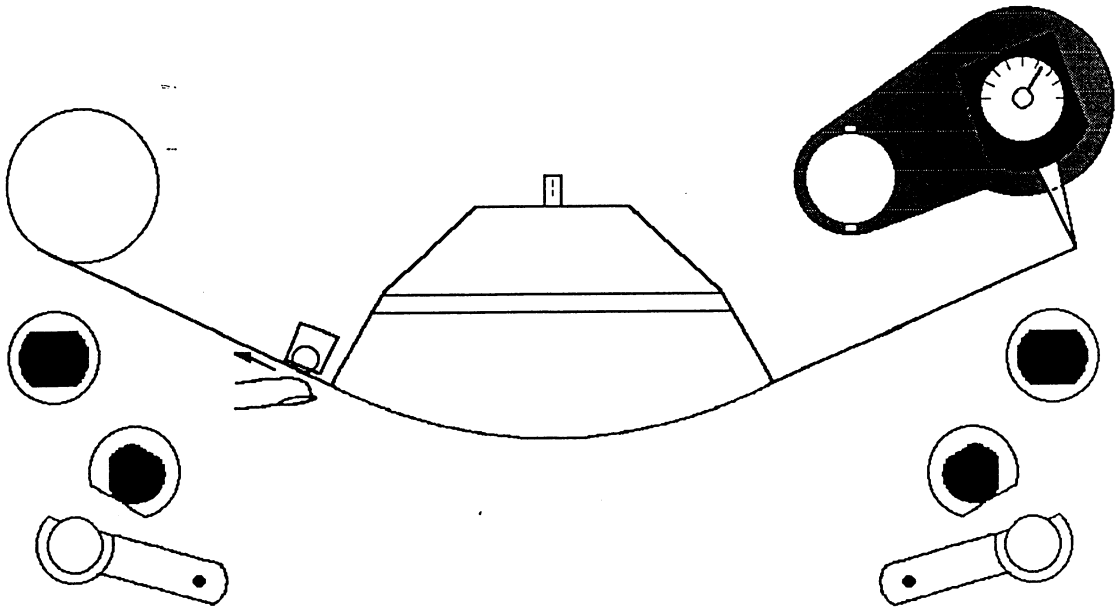
Adjust RP 202 on A0 3 to obtain 4Vdc on TP 203.
Recheck para 7.1 afterwards.

7.3 Play.

Scope stays on TP 203.
Adjust the left capstan motor speed following next table:

Potm. on A0 3	Speed	Udc on TP 203
RP 4	9.5 cm/s	0V ± min.
RP 3	19 cm/s	0V ± min.
RP 2	38 cm/s	0V ± min.
RP 1	76 cm/s	0V ± min.

7.4 Tape tension between heads with the special tool.



Install the special tool on the right reelholder. Leave the scope probe on TP 203 (on A0 3). Pull the tape using a finger on the left capstan shaft until the voltage on TP 203 becomes 0V. Verify that the tape tension on the Corex shows 80grs (typ. 82 grs).

7.5 Servo edition and counter.

Connect a DC voltmeter to BJ3 pin 9.
Adjust mechanically the 0 position for the speed variator on the keyboard. Verify the following table:

Potm. speed variator	New keyboard	Old keyboard
0%	2.5V ± min.	2.52V ± min.
+5%	0.87V ± min.	1.06V ± min.
-5%	4.2V ± min.	4.39V ± min.

7.6 Speed variator.

Set the TA in "VARIE SPEED"
Don't forget to set the switch S1 to speed variator.
Measure on TP 104 (on A0 3) the tach frequency.

Speed	Speed var. 0%	Speed var. +6%	Speed var. -6%
9.5 cm/s	1000Hz ± 2Hz	1060Hz ± 6Hz	940Hz ± 6Hz
19 cm/s	2000Hz ± 4Hz	2120Hz ± 12Hz	1880Hz ± 12Hz
38 cm/s	4000Hz ± 8Hz	4240Hz ± 24Hz	3760Hz ± 24Hz
76 cm/s	8000Hz ± 16Hz	8480Hz ± 48Hz	7520Hz ± 48Hz

Note the tach freq. from TP 104 at a 9.5 cm/s speed.
Control that the tape speed becomes 0 if the spooling button is set to 0 ± 1 division.
Use an 18 cm reel (set to midway).
Verify that the tensionarms are not oscillating when the spooling is started slowly. Check in both ways as well as in high speed.

7.7 Speed variator. (switch S1 on A0 3 set to SYNCHRO).

Run the TA in varie speed, 9.5 cm/s:
Inject a DC voltage on BJ 3 pin 22 and control the variation:

BJ 3 pin 22	Tach freq. on TP 104
+2Vdc	954Hz ± 2Hz
-2Vdc	1046Hz ± 2Hz

Verify with an Ωmeter the connection between BJ 3 pin 22 and BJ 4 pin 4.

7.8 Remote control.

Connect the scope to the remote connecter BJ 3 pin 5 (TFWD signal) and set the TA in "play" mode, 19 cm/s.
Verify that there is not too much jitter or irregular jitter due to bad roller counter.
Verify that the impulse length is approx. 500µs (neg. cycle) with a level of 7Vpp.
Select "Go to leader", 19 cm/s and check the presence of the TWBD signal.

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7.9 Counter pcb A0 4.

Install a counter pcb A0 4 in the TA.
Inject trough a 4.7nF capacitor on BJ 3 pin 6 (FWD in), a square wave signal, 1kHz higher than 7.5Vpp.
Verify that the TA starts in "FWD" mode with a stable speed.
Repeat the same by injecting on BJ 3 pin 20 (BWD in).
Verify that the TA starts in "BWD" mode with a stable speed.

8 Servo.

Set the TA in "Servo" mode, 38 cm/s.
Put TP 103 on A0 3 to scope.
Run the "Servo control wheel" as fast as possible in one way and afterwards in the other way. Check that the speed is stable in FWD and BWD. The square cycle is about 120μs 14Vpp (DC level = 0V).

8.1 Cut.

Put a mark on the tape in front of the playhead.
Select "Cut" and verify that the tape advances to have the mark in front of the scissors. Tol.: ± 1.5mm.
Repeat this 10 times.
Verify that the TA goes into "Servo" after "Cut".
Verify that the scissors are correctly working. Repeat 3 times.

8.2 Counter.

Set the TA in "Stop" mode, 9.5 cm/s. Verify the division by 2 every time the speed selection is increased from 9.5 to 19, 38 & 76 cm/s.
Verify the "Go to zero" function in both ways.
Verify the "Free spool" function:

Free spool	Right reel	Left reel
Right	Regulated	Free
Left	Free	Regulated
Right-Left	Free	Free

Verify that the tensiometer arms don't move if the relays are active.
Verify the "Dump" function. Control that the TA goes into "Servo" mode after "Dump".

8.3 Remote control.

Control the connecter BJ 3.
Reinstall A0 4.
Verify the presence of the small impulses:

BJ3 pin 1	D1	Play
BJ3 pin 14	D2	<< and >>
BJ3 pin 2	D3	Load ↔
BJ3 pin 15	D4	Free spool
BJ3 pin 3	D5	Reset counter
BJ3 pin 16	D6	Repro
BJ3 pin 17	Clock	Stop

Play until Repro = 8Vpp 20µs, Stop = 8Vpp 5µs.
Connect a decoder on BJ3 (hexa coder blackbox) and verify the following codes.

Play	01
<< and >>	02 & 03
Load ↔	14
Stop	00

8.4 30cm reels.

Measure the total winding time for a 30cm reel. Tol.: 3 min.
Simulate a power failure at high speed and verify the braking of the reelmotors.
Verify that the tensionarms are not oscillating in both sense when the TA is in high speed winding.
Put a mark on the tape in front of the record head. Reset the counter. Go in "FWD" (38cm/s) for approx. 12 mins. Activate the "Go to 0" function and verify that the tape mark is back in front of the record head. Tol.: 2 frames. Repeat the same in "BWD".
Verify the high speed winding inhibit with the DIL switch 8 on A0 2 to ON. Put the TA in high speed FWD and set after a moment the DIL switch 8 to ON, verify that the tape speed slows down.

9 Audio.

Put a 1kHz sinus wave 1.55Vrms (depending on customer spec.) to the line inputs.
Switch the audio matrix to "Input".
Control the line output levels equal to 1.55Vrms (depending on customer spec.).
Verify that the signal is present on the HP (option) without speaker vibrations.

9.1 Wiring verification.

Put the gen. signal only to CH1 and verify that the signal is present on line output CH1. Repeat for CH2.

10 Speed and Wow-Flutter.

10.1 Speed.

Install the speed ref. tape (50μm) on the TA.
Put the TA in "Play" mode and verify for all speeds the accuracy. Tol.: ± 0.05%

10.2 Wow-Flutter.

Connect an EMT 3150Hz gen. reader to the CH1 line in and output. Set the EMT for 0.1 % sensitivity, Norm DIN/IEC.
Measure the wow-flutter in play mode (after record) over a length of about 30s.
Disengage several times the pinchrollers during play and check. (calibration tapes following customer spec. for the positions A, B, C & D).

Speed	Typ. value	Tolerance
9.5 cm/s	± 0.030%	± 0.050%
19 cm/s	± 0.025%	± 0.035%
38 cm/s	± 0.020%	± 0.027%
76 cm/s	± 0.015%	± 0.025%

10.3 Tape slide.

Record a tape with 1kHz (precise) 1.55Vrms at a speed of 38 cm/s.
Playback the recorded part and measure the output freq. equal to 1kHz ± 0.05% (± 0.5Hz).
Verify if in "Listen when spooling" mode, the presence of the output signal if the input matrix is in "Sync".

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11 Burn in.

Connect an old keyboard version to the TA. Install a counter pcb instead of the TC pcb. Use an 18cm tape reel at a speed of 19 cm/s. Put scotch tape in front of the 3 heads as well as in front of the NEOPILOT head.

11.1 After burn in.

Recheck the following para's: 2, 3.1, 5.5, 5.6, 7, 7.1, 7.3, 7.4, 10.1, 10.2, 10.3.
Check all rollers and motors for min. bearing noise.

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5.0 Content change history

TABLE OF CONTENTS

1.0 PREPARATION

1.1 EQUIPMENT REQUIRED

Electronic

One Dual Trace Oscilloscope (preferably a storage oscilloscope)

One Spectrum Analyser with a third octave filter set (e.g. Bruel & Kjaer 2606/2608 and 1614/1615 type)

One Wow and Flutter meter, DIN 45507 (e.g. EMT Franz meter)

One RMS Voltmeter and one AC/DC Voltmeter

One Frequency Meter

Audio Signal Generator (sine, square wave)

One Extension Board for the following circuits: A02 Logic, A03 Stabilizer, A04 Counter, synchronizer and Time Code; order no. 91552

7" tape reels (with type of tape indicated on the "Speed/Standard & Tape" display under A position)

Speed Test Tape BVQ-1 (order no. 91730) or BVQ-3.15 (order no. 91731)

Mechanical

Template for tensiometers adjustment; order no. 01 90901 042

Template for the rotating guide height check; order no. 01 90901 021

Dynamometer 1.5 kg; order no. 20 99901 000

Dynamometer Correx KM, 250 g; order no. 20 99903 000

Grease tube SKL 100; order no. 20 99950 000

Oil, Isoflex PDP 38, 100 cc; order no. 20 99952 000

Tools, standard set (for details, see our Spare Parts Price List); order no. 20 99920 000

1.2 CLEANING

Before proceeding with checks and adjustments described in this section, it is important to:

Remove dust from inside recorder using compressed air.

Clean heads, capstans, pinch-rollers and guide-rollers with cotton tips or a soft rag moistened with alcohol or water. Take care that no liquid penetrates into capstan and pinch-roller bearings.

CAUTION: Do not use solvents such as trichloroethylene, tetrachloridecarbon, acetone or benzene.

Check the cleanliness of motor commutators and, if necessary, clean them with dry cloth.

1.3 SCREW AND CONTACT CHECK

Open the tape deck.

Check the wiring and that connectors are correctly mated.

Check that all screws are tightened correctly and retighten if necessary.

1.4 SPEED SELECTION

Refer to Calibration Manual (Section IV of this manual).

To make adjustments easier, it is adviseable to set speed switches, A, B C and D of "Repro-Speed-STD Select" on Logic Board A02 so that they correspond to an increasing speed sequence (Set A to O, B to 1, C to 2 and D to 3).
See page IV.1.3-1.

Do not forget to reset initial speed settings once the adjustments are completed.

1.5 GENERAL CHECKS

Initialization

Refer to page I.2.1-1 of this manual.

When switching on, the recorder should take up the PARK position, with the pinch-wheel assembly fully disengaged, the counter registers 00000, the "Speed/Standard & Tape" display points to A, the matrix display is initialized according to programming on Logic Board, as a general rule to:

SAFE and REPRO for two-track machines and time code machines
READY and REPRO for stereo machines

Check keyboard operation thoroughly.

NOTE: The logic board programming switches are overruled by the microprocessor on time code machines.

Supply voltages

a. Speed Stabilizer Board A03

Equipment

One extension board, for A02/A03/A04 circuits, code no. 91552.

The voltages can be measured either directly on connectors of Board A03 by means of the extension board on the rear of the recorder on interconnection board B5.

Select PARK.

Carry out the following measurements with ground reference ±7.5 V ground reference on P2 10 a-b.

Contact	Nominal value	Tolerance
P1 15 a-b	+30 V/+50 V* unregulated	32 V to 36 V
P1 29 a-b	+30 V unregulated	32 V to 36 V
P1 28 a-b	-30 V unregulated	-32 V to - 36 V
P1 4 a-b	Safety brakes control	14 V to 15.5 V
P2 8 a-b	+7.5 V logic	+7.5 V ± 10 mV
P2 12 a-b	-7.5 V logic	-7.5 V ± 10 mV

* The voltage is increased to 50 V in winding mode

b. AUDIO MONITORING Socket

25	+24 V Audio	+24 V ± 20 mV
13	-24 V Audio	-24 V ± 250 mV
10	+7.5 V Audio	+7.5 V ± 10 mV
23	-7.5 V Audio	-7.5 V ± 80 mV

c. REMOTE CONTROL Socket

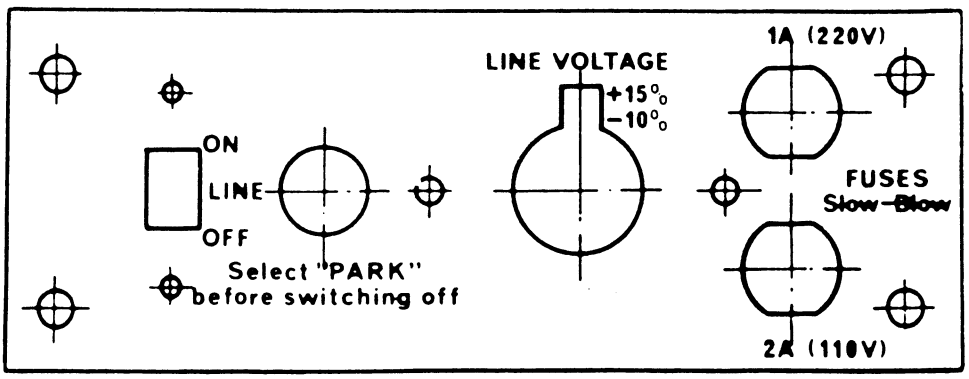
13	+13 V unregulated	14 V to 15.5 V

1.6 Fuses

Location	Features (KSA nr.)	Functions	Effects when the fuse blows out	Possible causes of breakdown
Power Supply Board A30				
Front Panel Fig. 1	2 A (110 V)/ø 6x32 mm (41 81321 200) BF1	Overall protection 110V/	·red lamp switched off ·recorder no longer powered	·wrong mains selection ·power cord half-plugged in
Front Panel Fig. 1	1 A (220 V)/ø 6x32 mm (41 81321 100) BF2	Overall protection 220 V/	· as above Note: BF1 is in series	·as above
Rear upper Board Fig. 2	125 mA/ (41 81591 250) Fast blow F1	Protection of + 12.5 V Unreg. supplied to the safety brakes relay (when mains is switched off) on board A03–A12	·electrical braking permanently applied to the reel-holder motors ·tape transport not correct	·overcurrent to the electrical braking system ·short and repetitive mains cut-off
Rear upper Board Fig. 2	1 A/ (41 81591 001) Fast blow F2	Protection of + 13 V Unreg. supplied to counter board A04-A21 and keyboard A16	·LEDs on keyboard switched off ·keyboard press-buttons do not operate	·overcurrent to the keyboard or counter ·a board is half-plugged in
Rear Upper Board Fig.2	Not fitted F3	Protection of –13 V Unreg. supplied to Board A05		
Keyboard A16				
Lower side board Fig.3	2.5 A/ (41 81592 501) Fast blow F1	Protection of +13 V Unreg. supplied to A16 (in series with F2/A30)	·keyboard LEDs switched off ·keyboard press-buttons do not operate	·overcurrent to the keyboard ·defective power supply
Interconnection B3				
Fig. 4	125 mA/ (41 81591 250) Fast blow F1	Protection of +30 V Unreg. supplied to both electromagnets for tensiometer locking	·when "Edit" function is selected both tensiometers do not block up and the tape slackens	·overcurrent to the electro-magnets (CAUTION: this fuse is rather sensitive!)

FIG. 1

FRONT PANEL



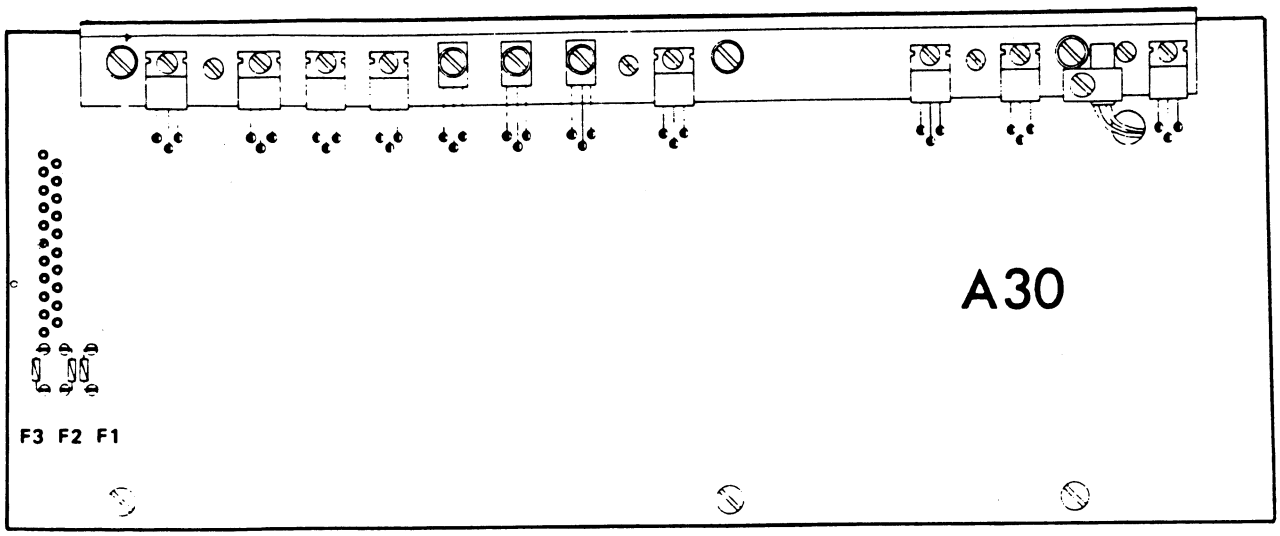


FIG. 2

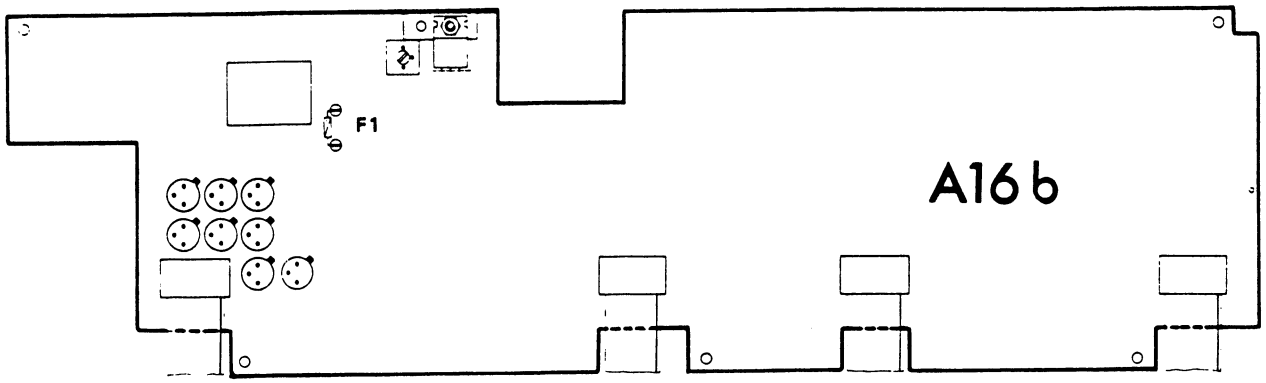


FIG. 3

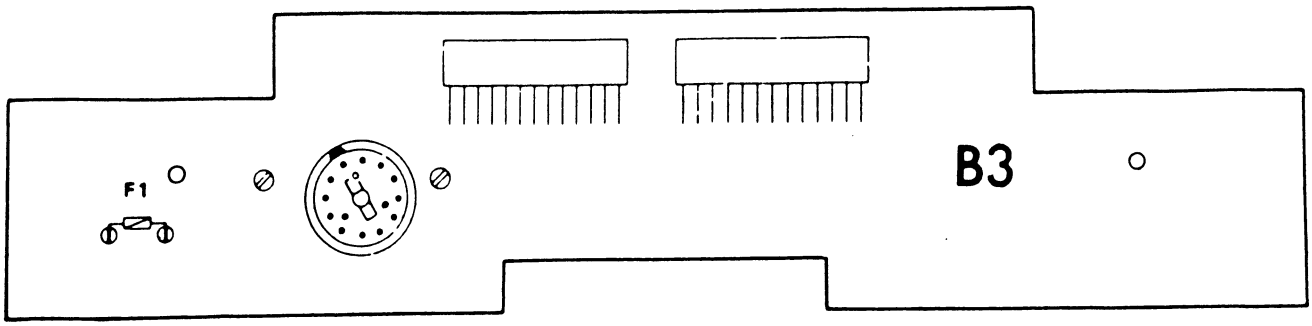


FIG. 4

2.0 MECHANICAL ADJUSTMENTS

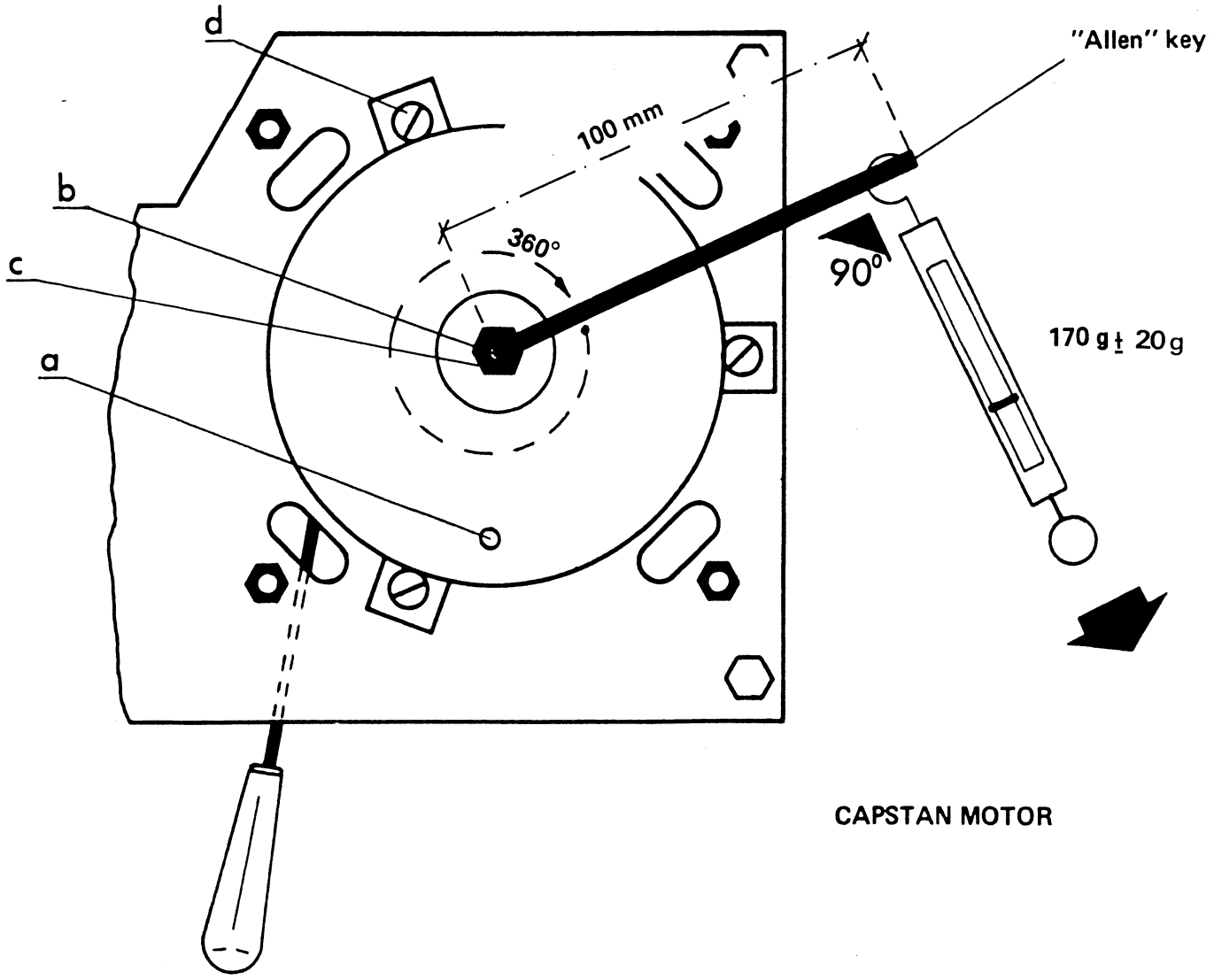
2.1 CAPSTAN MOTOR CLUTCH (Left and Right motors)

Equipment needed

Special key for clutch check (order no. 01 90901 050) or an "Allen" key (length 100 mm, ∅ 2.5 mm)

One 1.5 kg dynamometer (order no. 20 99901 000)

One plastic rod for locking of capstan motor rotor, ∅ 3 mm (order no. 01 90901 023)



Switch off the recorder.

Open the tape deck and set it in the vertical position.

Remove motor screening-can of the motor to be adjusted.

NOTE: Do not send or distort the can in any way as this will affect its magnetic properties.

Rotate the capstan to locate through hole (a) the gap in the rotor.

Insert the plastic rod into the hole to stop motor rotating.

Place a 100 mm long "Allen" key into (b) and attach the 1.5 kg dynamometer.

Check the clutch torque value through a 360° rotation while carefully maintaining a right angle between the dynamometer and the "Allen" key.
Value: 170 g $\pm$20 g

CAUTION: Do not forget to remove the plastic rod

Adjustment

The motor clutch is factory set and should not need further adjustment, as the brass counter-nut (c) has been secured with Loctite 601. But if necessary, proceed as follows:

Place the "Allen" key into (b).

With a 8 mm wrench, tighten brass counter-nut (c) to increase the clutch torque (loosen to decrease).

Lock with one drop of Loctite 222 between counter-nut (c) and the thread of (b). Wait until Loctite is dry.

Check the clutch as described above and repeat adjustment until the correct setting is achieved.

Lock with one drop of Loctite 601 between counter-nut (c) and the thread of (b).

Motor replacement

Loosen steel part (b) while holding tachometric wheel stationary by means of a screw-driver pressed against the flywheel under the motor-support plate.

Undo 3 motor fixing screws (d) on the motor-support plate.

Remove the defective motor and replace it with the new one.

Retighten screws (d).

Screw into place new steel part (b) (order no. 01 08145 104) and new brass counter-nut (c) (order no. 01 08145 006) (New parts are needed because it is most likely that counter-nut (c) has been damaged when removing the motor).

Lock with one drop of Loctite 222 between counter-nut (c) and the thread of (b). Wait until Loctite is dry.

Check the clutch torque as described above.

Lock with one drop of Loctite 601 between counter-nut (c) and the thread of (b).

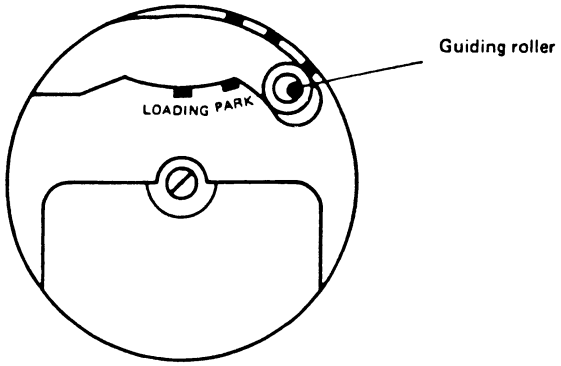
Check the tachometric wow and flutter described under III.2.7-1.

2.2 CAM POSITIONING

Install the jumper ST305 on A02/A15 to allow the transport to operate without tape.

NOTE: On older circuits this jumper is not fitted, so on such circuit boards short circuit C314.

Remove the cam protection cover by turning the two retaining screws through 90°.



Select PARK.

Make sure that the cam guiding roller is in the position marked PARK.

Select PLAY, the guiding roller moves to the position marked RIGHT CAPSTAN (TWIN CAPSTAN if the tape tension sensor is pressed or a tape is loaded).

Select STOP, the guiding roller moves to the position marked STOP; the pinch-wheels are slightly disengaged from the capstans.

Adjustment

PARK position

Select PARK.

Turn potentiometer RP104/A03-A11 to center the cam guiding roller on position marked PARK.

If the potentiometer reaches its end stop before or at correct cam position, the mechanical position of cam potentiometer BRP1 must be re-adjusted.

PLAY Position

This adjustment can only be carried out if PARK position is correct.
Select PLAY.

Turn potentiometer RP102/A03-A11 to center the guiding roller on position marked RIGHT CAPSTAN. The guiding roller should never reach its end stop (as there is a danger of burning out the cam motor). As the adjustment of RP102 also affects the STOP and RIGHT CAPSTAN positions, check them by selecting STOP and GO TO LEADER respectively.

NOTE: As a perfect centering at all three positions cannot be achieved, adjust RP102 to obtain the best compromise.

To adjust the cam guiding roller in LISTEN mode, refer to page III.2.8-1.

Cam potentiometer mechanical adjustment

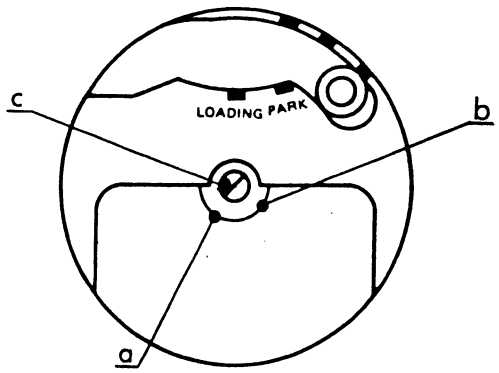
Set RP102/A03-A11 and RP104/A03-11 to mid-travel (slot vertical).

Switch off the recorder.

Disconnect the grey flat cable harness (untwisted harness) on Board B3 (Motor Interconnection).

Connect a DC voltmeter to C102/A03-A12 (+to condenser connection marked TP102).

Switch on the recorder.



Set the cam guiding roller in front of PARK (see drawing) black mark and loosen side screw (a); then push the guiding roller to expose other side screw (b) and loosen it also.

Adjust the cam potentiometer by means of slotted potentiometer shaft (c) to read 0 V $\pm$10 mV on TP102.

Retighten (a) and (b).

Switch off the recorder.

Reconnect the flat cable harness to Motor Interconnection Board B3.

Switch on the recorder and check again that the cam is correctly positioned.

Repeat tests from the beginning of Section III.2.2 if correct positioning is not achieved.

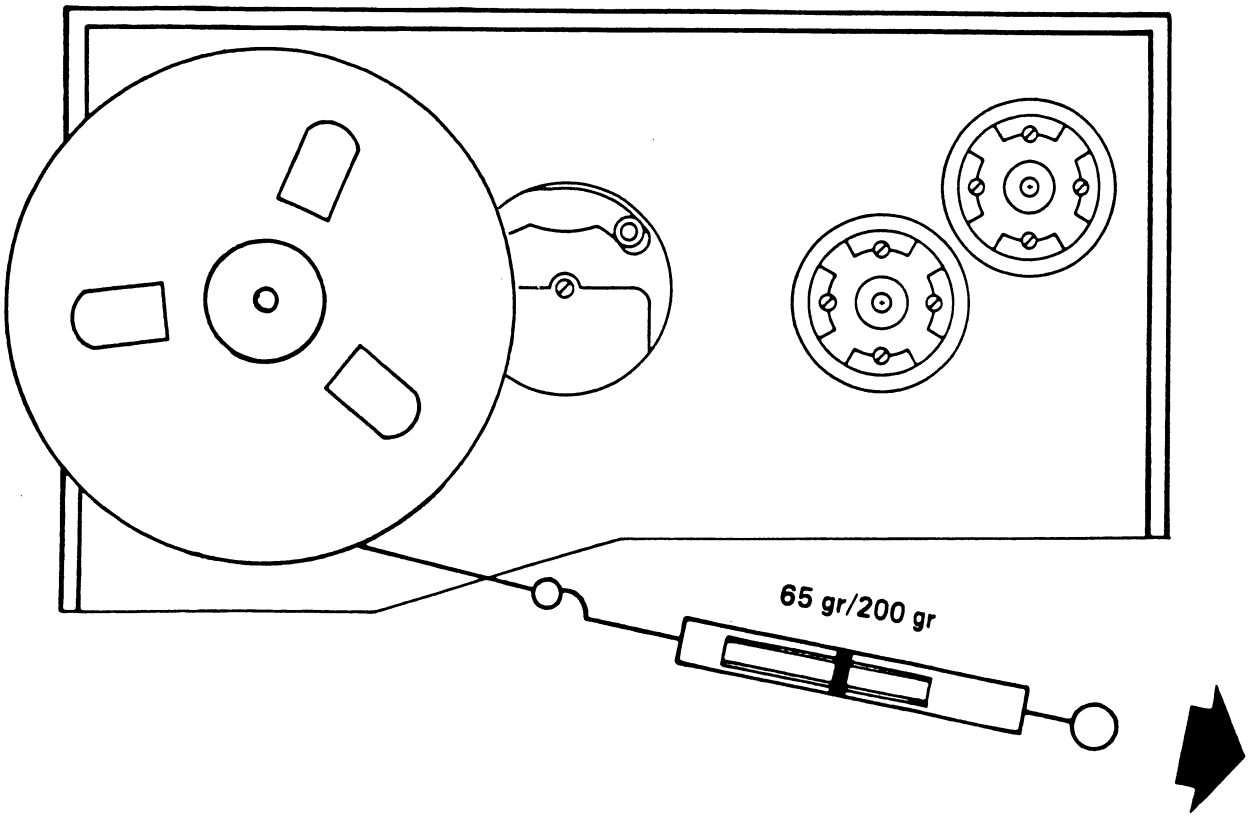
2.3 REEL-HOLDER BRAKES

Equipment

Dynamometer 100 g; order no. 20 99902 000

Dynamometer 1,5 kg; order no. 20 99901 000

It is advised to carry out all checks and adjustments with the type of tape indicated under position A on the "SPEED/STANDARD & TAPE" display



Select LOADING

Load a full 7" tape reel on the left reel-holder.

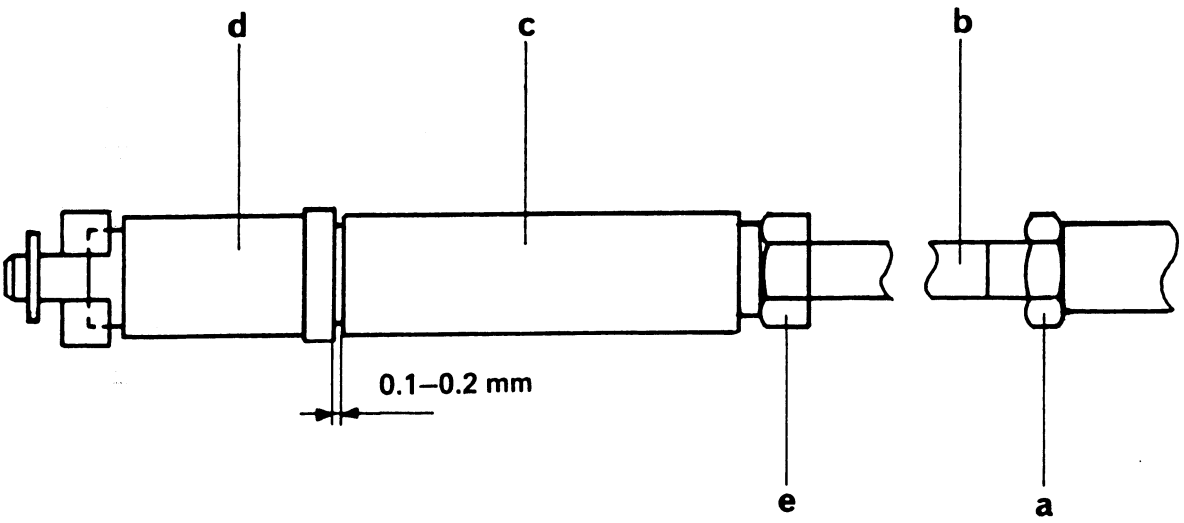
Attach a 100 g dynamometer to the tape end and pull it slowly. The reading should be 65 g ±15 g.

Select LOADING and repeat this measurement with the reel of tape on the right reel-holder.

Select PARK.

Repeat the above measurement with a 1.5 kg dynamometer. The value should be higher than 200 g.

Adjustment



LOADING Braking ⟷

NOTE: If only PARK braking values have to be adjusted, see "PARK braking adjustment, which has no influence on LOADING braking values (on the other hand the "LOADING" adjustment modifies the "PARK" values).

Open the tape deck and select LOADING ⟷

Loosen nut (a) and turn the brake control arm (b): unscrewing increases the braking force and vice-versa.

NOTE: For this adjustment the existing gap between aluminium sleeve (c) and plastic sleeve (d) must be maintained between 0.1 to 0.2 mm.

Lock nut (a) once the adjustment is completed.

PARK Braking

Open the tape deck and select PARK.

Check that the gap between sleeves (c) and (d) in LOADING position disappears.

Turn nut (e) to adjust the braking force: unscrew to decrease and vice-versa.

2.4 TENSIOMETERS

Short-circuit C314/A02-A15 or install jumper ST305 if fitted (inhibition of "Tape Take Up" signal).

H.F. SIGNAL

Do not use the extension board, as the H.F. tuning would be disturbed by its interfering capacitance.

Connect an oscilloscope to Q201/A03-A11 collector using a x10 probe and measure HF signal: 256 kHz, about 15 V peak to peak.

Adjustment

This adjustment consists of maximising an HF voltage by tuning an LC circuit. It should be carried out only after a head block replacement or replacement of the coil of a tensiometer position sensor

Find the optimum value of capacitor C202/A03-A11 (between Q201 collector and ground)

Value between 270 and 680 pF (Typical value: 470 pF)

NOTE: The LC circuit consits of capacitor C202 and the inductance of both coils for detection of the tensiometers position and the inductance of the sensor coil for the inter-head tape tension. The capacitor value is factory-selected to obtain a maximum voltage on Q201 Collector

5°POSITION

Remove jumper ST305 or short circuit on C314 if fitted as explained above.

Equipment

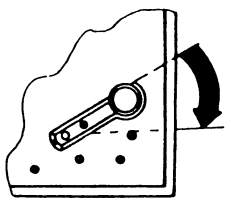
Template for adjustment of tensiometers (order no. 01 90901 042)

Select STOP.

Fit the template on one tensiometer.

Check that the relevant reel holder motor stops.

Repeat this check on the other tensiometer.



Adjustment

CAUTION: This adjustment is critical and may influence other functions

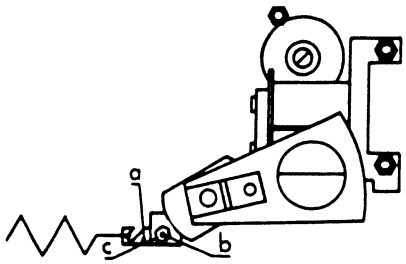
Turn RP1/A03-A12 (left tens. pos.) or RP51/A03-A12 (Right tens. pos.).

NOTE: This adjustment can possibly be carried out without the 5° template by alignment of the inner tensiometer edge to the screw, as indicated on the above drawing.

10° POSITION

Equipment

Template for adjustment of tensiometers (order no. 01 90901 042)



Select STOP

Fit the template on one tensiometer.

Open the tape-deck.

Make sure that hook (a) of tensiometer release spring just rests on eccentric screw (b).

Repeat this test for the other tensiometer.

Adjustment

Loosen locking nut (c).

Turn eccentric screw (b) so that hook (a) rests on it.

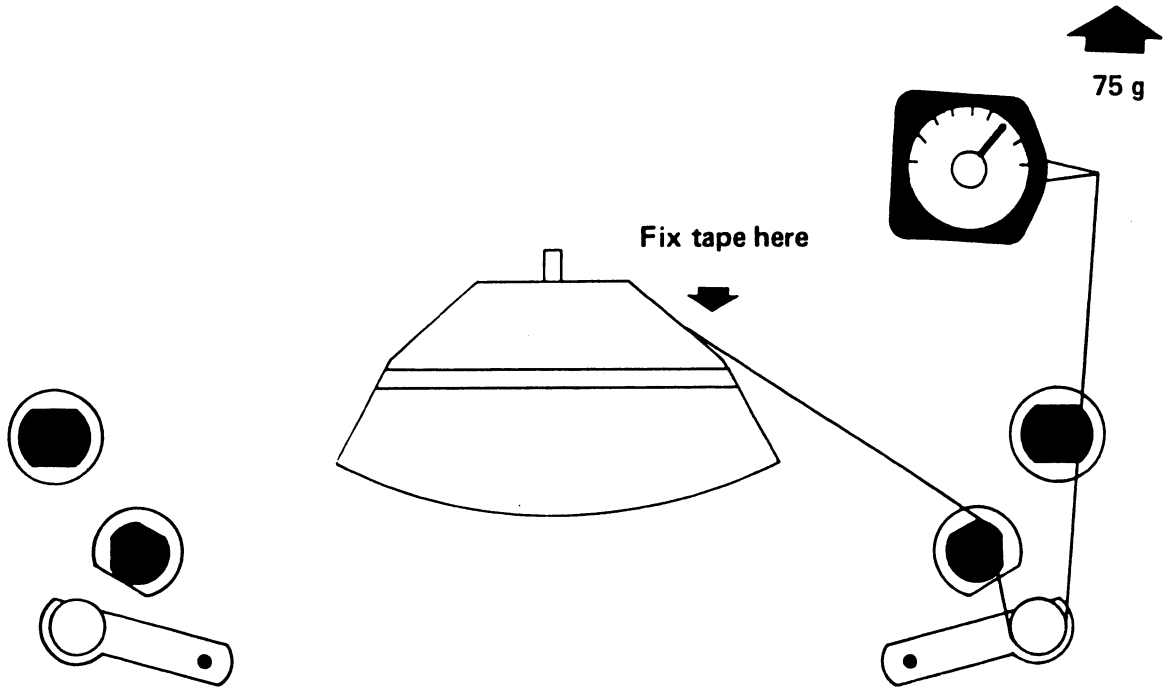
Retighten locking nut (c).

2.5 TAPE TENSION AND TAPE TRANSPORT SPEED

Inter-reel

Equipment

Correx KM dynamometer 250 g (code no. 20 99903 000) or "Pesola" type dynamometer 100 g (code no. 20 99902 000)



Short-circuit C314/A02-A15 of fit jumper ST305 (inhibition of "Tape Take Up" signal).

Select STOP.

Take a 30-40 cm length of tape and fix one end to the side of the head block as shown above then using a "Correx" or "Pessola" type dynamometer.

Pull the dynamometer till the take-up reel motor comes to a stop; it should indicate 75 g ±5 g.

NOTE: This value is a standard inter-reel tension for most T-Audio's. Yet it may be increased up to 100 g to improve winding of tapes with uncoated backs (e.g. AMPEX 456, 406, 3M 206 etc.)

Adjustment

Open the tape-deck.

Adjust the tensiometers coupling screw between both tension springs under the tape-deck (clockwise to increase tension).

NOTE: Unhook the spring at one end to prevent it from twisting.

Inter-Capstan

Remove the short-circuit on C314/A02-A15 of jumper ST305 if fitted.

Load a tape (of the type indicated in position A on "Speed/Standard & Tape" display).

Right capstan servo-control

Connect an oscilloscope to TP204/A03-A11 (output of phase comparator ensuring synchronization between the crystal reference frequency and the right tachometric frequency).

Play a tape and check at all speeds the phase lock centering; the voltage on TP204 is 0 V ±10 mV.

NOTE: Do not use the extension board which could affect this through its interfering capacitance, the H.F. level supplied to the tape tension sensor and the tensiometers.

Adjustment

Adjust the "Right Capstan Speed" potentiometer on A03-A11:

RP104 for 3 3/4 ips speed
RP103 for 7 1/2 ips speed
RP102 for 15 ips speed
RP101 for 30 ips speed

Inter-Capstan Tape Tension

The HF signal must be adjusted first as on page III.2.4-1.

Servo-control of inter-capstan tape tension is carried out by comparison between the reel-holders tape tension (outside both capstans) and the inter-capstan tape tension measured through the sensor.

Press SKIP ⟶ (left pinch-wheel disengaged) at 7 1/2 ips.

Connect an oscilloscope to TP203/A03-A11. The measured voltage depends on the ratio between the desired inter-reel and inter-capstan tensions.

Reel-holder Tension	Inter-capstan Tension	TP 203
75 g	75 g	0 V ± 10 mV
100 g	100 g	0 V ± 10 mV
75 g	100 g	0.8 V ± 20 mV
100 g	75 g	- 1 V ± 20 mV

NOTE: Other values may be calculated.

Adjustment

Press SKIP ⟶ at 7 1/2 ips.

Turn potentiometer RP201/A03-A11 (Tape Tension Ref. Adjust) until the required value is obtained on TP203 (see table above).

Select PARK (the tape is clear of the tape tension sensor).

Turn RP202/A03-A11 (Tape Tension Gain Adjust) to obtain 4 V ± 10 mV on TP203.

Recheck the voltage in SKIP ⟷ at 7 1/2 ips.

Left capstan servo-control

Select PLAY.

Make sure that the voltage on TP203/A03-A11 at all speeds is 0 V ± 10 mV.

On an oscilloscope make sure that this voltage does not vary in steps, which would indicate that the hub of the tape tension sensor rubs (possibly replace the sensor).

Adjustment

Adjust the "Left Capstan Speed" potentiometers on A03-A11:

RP4 for 3 3/4 ips speed
RP3 for 7 1/2 ips speed
RP2 for 15 ips speed
RP1 for 30 ips speed

Once these adjustments have been performed, check at all speeds that the "Phase Lock" and "Tape Tension" warning LED's do not light up.

Tape transport speeds

Equipment

Speed test tape BVQ-1 (order no. 91730) or BVQ-3.15 (order no. 91731).

No short-circuit on C314/A02-A15 ("Tape Take Up" signal not inhibited) or jumper ST305 is removed.

Load a speed test tape

Connect a frequency meter to the line output

Play the tape at all speeds and check that reproduced frequency lies within the ± 0.1% tolerance

2.6 PINCH-WHEEL & ROTARY GUIDE ALIGNMENT

CAUTION: The heights and pressures are factory-set. Do not attempt to readjust them without making sure that such an adjustment is absolutely necessary.

Equipment

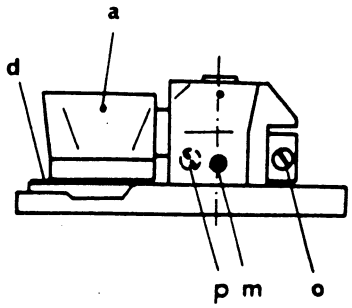
One dynamometer 1.5 kg (order no. 20 99901 000)

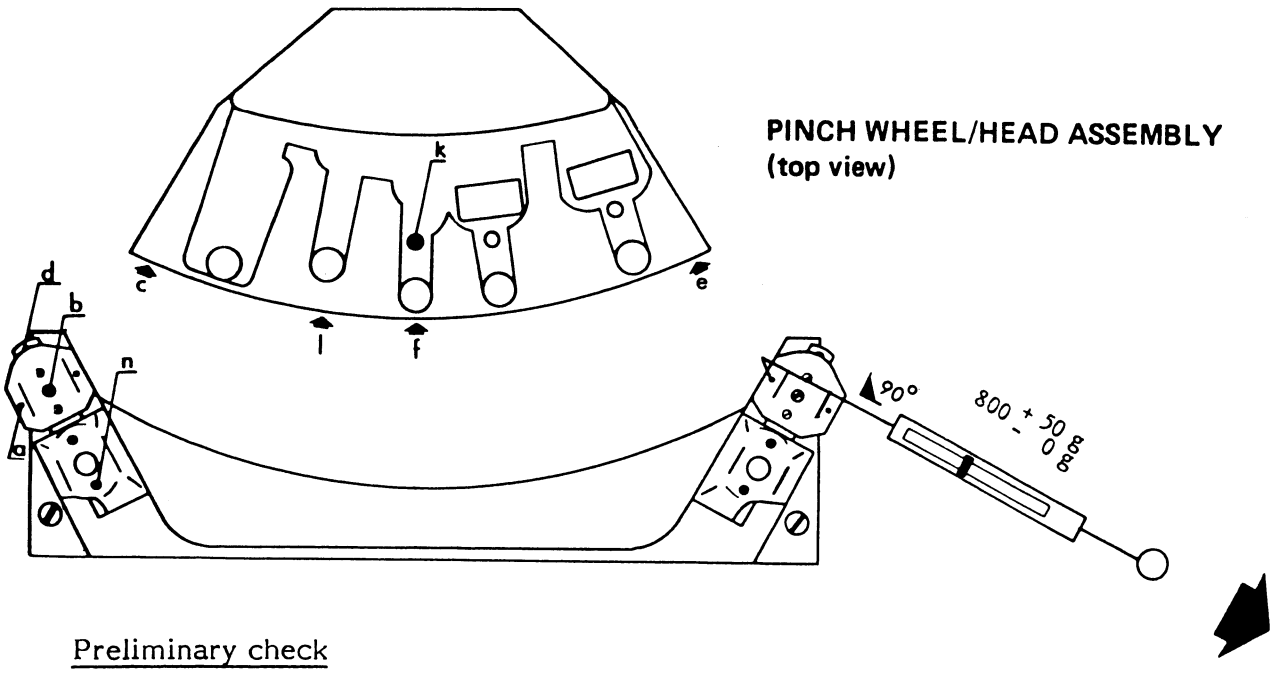
One square gauge for height check of guide rollers (code no. 01 90901 021)

One magnifying glass

One light source (swivelling lamp)

One tape of type indicated on "Speed/Standard & Tape" display in position A





PINCH WHEEL/HEAD ASSEMBLY (top view)

Preliminary check

First clean all tape guides with a brush.

No short-circuit on C314/A02-A15 (or jumper ST305) ("Tape Take Up" signal not inhibited).

Select STOP and check that the pinch-wheels are not in contact with the capstans

and there is a sufficient gap (0.2-0.65 mm) so that tape is not transported (this gap is not necessarily identical for both pinch-wheels).

Select PLAY and check that both pinch-wheels press on the capstans.

Select STOP and make sure that the square gauge for checking guide height does not touch the fixed guides (d) at the end of the pinch-wheels) (0.02 to 0.12 mm clearance).

With the square gauge, make sure that the height of the tension rollers and of all guides is correct (8.3 ± 0.02 mm).

Left pinch-wheel parallelism

Select PLAY at 30 ips.

Loosen locking screw (a) and lightly retighten it.

Turn azimuth adjustment screw (b) ± 30° while observing with the magnifying glass the section of tape at left guide (c). The tape should just touch the lower edge of the guide without folding.

Then check that the tape does not rub against fixed guide (d) on the left pinch-wheel.

Right pinch-wheel parallelism

Select GO TO LEADER at 30 ips.

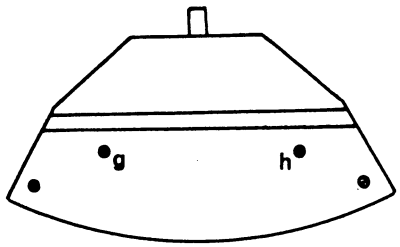
Proceed as above.

Select PLAY and make sure that the tape still touches the lower edge of guide (e) without folding. Check that the tape is not weaving accross the heads.

Check that the tape does not rub against fixed guide (d) of the right pinch-wheel.

Perpendicularity of the central rotary guide (f)

HEAD ASSEMBLY UPPER PLATE



Remove the head assembly upper plate (screws g and h).

Select PLAY.

Turn "Allen" screw (k) of central rotary guide (f) and observe the right guide of the "Tape Tension" sensor (l): the tape should just touch the guides lower edge without folding.

If not, repeat the above adjustments.

NOTE: Not valid for TA TC because adjustment is not possible.

Final check

Fully tighten locking screw (a).

Then make sure that the tape is not weaving across the heads.

Clean all guides with a brush.

Select PLAY and after a few minutes make sure that there is no oxide deposit on the guides. Otherwise repeat transport adjustments.

NOTE: If after these adjustments the tape path is not correct, then the pinch-wheel height may require adjustment.

Loosen locking screw (m) and adjust by turning screw (n). Remove the head assembly, fit the template for checking of the tape transport height (order no. 01 90901 044) and adjust the height (8.3 mm $\pm$ 0.02 mm).

PINCH-WHEEL PRESSURE

Equipment

One dynamometer 1,5 kg (order no. 20 99901 000)

CAUTION: The heights and pressures are factory-set. Do not attempt to readjust them without making sure that it is absolutely necessary.

Check right pinch-wheel parallelism. See page III.2.6-2.

Right pinch-wheel pressure

Select GO TO LEADER.

Attach the 1.5 kg dynamometer to the black protection cover (see drawing).

Pull at a right angle between the dynamometer and the pinch-wheel: the tape should stop at a reading of $800 \begin{smallmatrix} +50 \\ -0 \end{smallmatrix}$ g

Left pinch-wheel pressure

Select PLAY.

Disengage right pinch-wheel and repeat the above measurement on the left pinch-wheel.

Adjustment

a. Fine adjustment

Turn screw (o) until a reading of $800 \begin{smallmatrix} +50 \\ -0 \end{smallmatrix}$ g on the dynamometer is achieved.

NOTE: If the modification required is greater than 50 g, reset to the initial value and carry out the complete adjustment described under b. below). As a matter of fact, the pinch-wheel applies only a light pressure to its shaft thanks to the springs coupled to screws (o) and (p) and an excessive adjustment by means of (o) only would cancel their compensating effect.

b. Complete adjustment

Remove screw (o) (See page III.2.6-1).

Select GO TO LEADER or PLAY described on page II.2.6-3.

Attach the dynamometer to the black protection cover (see drawing).

Pull at a right angle between the dynamometer and the pinch-wheel; the tape should stop at reading of 430-450 g; adjust by means of screw (p).

Secure (p) with a drop of Loctite.

Refit (o) and carry out the adjustments described under (a) above.

2.7 TACHOMETRIC SIGNALS AND WOW & FLUTTER

No short-circuit on C314/A02-A15 (or jumper ST305) ("Tape Take Up" signal not inhibited).

Load a tape as indicated on position A of the "Speed/Standard & Tape" display.

Levels

Connect an AC voltmeter to TP1/A03-A11 and TP2/A03-A11.

Select PLAY at 3 3/4 ips: the voltage should be greater than 250 mV RMS.

Change speed to 30 ips. The voltage should be less than 4.5 V RMS.

NOTE: At all other speeds, the voltage will have intermediate values.

Make sure that the difference between voltage measured on TP1 and TP2 remains within 50 % limits at all speeds (if not suspect a maladjustment of tacho head height).

Repeat the above procedure for right capstan by measuring voltages on TP101/A01-A11 and TP102/A03-A11.

NOTE: Unlike other recorders in the NAGRA range, each capstan motor on the T-Audio has two tacho heads which produce tacho signals 90° out of phase with each other. The output of the tacho heads is integrated over the whole circumference of the tacho wheel, therefore it is not possible to set the tacho signal level by adjusting the tacho head gap. This gap is adjusted in the factory to be between 150 to 200 um,. The phase relationship between the two tacho outputs (lead or lag) gives the direction of rotation of the capstan.

Tachometric phase shift

Select PLAY.

Connect a dual trace oscilloscope to TP3/A03-A11 and TP4/A03-A11.

Check that the phase shift is within tolerances of 90° ±20°.

Repeat this procedure for the right capstan motor by measuring the phase shift on TP103/A03-A11 and TP104/A03-A11.

Tachometric wow and flutter

Check

Select PARK.

Pass the tape behind the head block.

Remove resistor R234/A03-A11 from its contact-pins (so the correction given by the sensor is suppressed, as the tape does not press on it).

Open the T-Audio and place the tape-deck in the vertical position.

Select PLAY at 7 1/2 ips.

Connect an AC voltmeter to TP7/A03-A11:

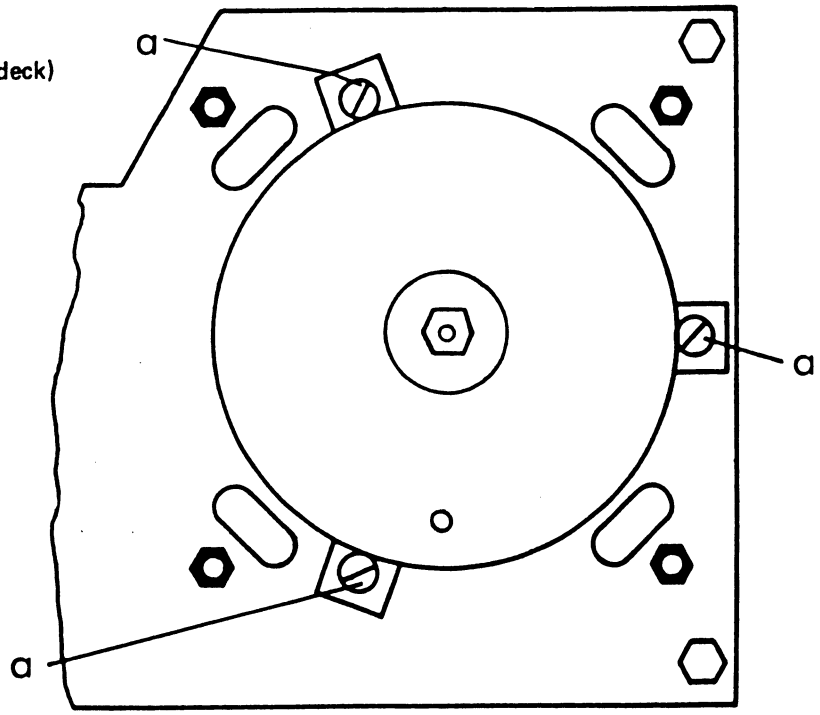
The voltage should be lower than 150 mV at 7 1/2 ips, and 60 mV at 15 ips and 30 ips (the higher the speed, the lower the voltage; if not suspect coupling between both motors)

Repeat the above procedure for the right motor on TP107/A03-A11.
Solder back R234 if no adjustment is required.

Adjustment

This adjustment should be carried out only after removal of a capstan motor.
Leave the recorder in the check configuration (R234/A03-A11 unsoldered).
Slightly loosen 3 fixing screws (a) of left capstan motor.

CAPSTAN MOTOR (under the tape-deck)



Select PLAY at 3 3/4 ips and rotate the left capstan motor to obtain a minimum voltage at TP7

Repeat this process for the right capstan motor at TP107

Repeat both adjustments several times to optimize the values

Solder back R234 into place

Check of tachometric out-of-true

Short-circuit C314/A02-A15 (or fit jumper ST305) (inhibition of the "Take Tape Up" signal).

Remove the tape.

Solder a link at ST1/A03-A11.

Select PLAY at 30 ips.

Check voltage at TP7/A03-A11 by means of an AC voltmeter and a third octave filter set to 20 Hz: voltage less than 100 mV RMS.

Move ST1 link to ST101 and repeat the measurement on TP107/A03-A11.

Unsolder the ST1 or ST101 link and remove short-circuit or jumper ST305 on C314/A02-A15 once these adjustments are completed.

WOW AND FLUTTER

Wow and flutter measurements according to DIN standards (no. 45507)

No jumper ST305 or short-circuit on C314/A02-A15 ("Tape Take Up" signal is not inhibited).

Load a tape as indicated in position A of the "Speed/Standard & Tape" display.

Move the bridge on audio board A01-A2 to position 5 (ST5) 0.775 V; so the signal from the wow and flutter meter will saturate the tape (+48 dB minimum), which lessens the error due to the wow and flutter meter.

Connect a wow and flutter meter (e.g. EMT Franz) to the recorder input: Inject a 3.150 kHz, 1 V signal.

Connect the recorder output to the meter input.

Set sensitivity to 0.1% (and "Filter" to DIN/IEC for EMT Franz meter).
At each speed:

Record the meter signal for about 30 sec

Carry out the above test several times

Disengage and release the pinch-wheels, then play back the tape portion and check that flutter remains within tolerances indicated below.

Speed		Typical value	max.
3 3/4 ips	9.5 cm/s	± 0.032 %	± 0.05 %
7 1/2 ips	19 cm/s	± 0.027 %	± 0.04 %
15 ips	38 cm/s	± 0.022 %	± 0.032 %
30 ips	76 cm/s	± 0.018 %	± 0.025 %

Values weighted according to DIN 45507 standard

Check that flutter remains within tolerances in "Variable Speed" mode with speed variator potentiometer in central position

2.8 KEYBOARD FUNCTIONS

SPOOLING function at variable speed

Select PARK.

Connect a DC voltmeter to "Remote Control Output" socket between pin 9 "POT" and pin 24" ±7.5 V ground".

Turn "Speed Variator" potentiometer to its end stop (beyond -6%): voltmeter reading should be 5 V DC ±25 mV.

Adjustment

Remove the keyboard upper plate.

Select resistor R1/A16 for 25 V DC ±5 mV (typical: 680 to 820 ohms).

Set "Speed Variator" potentiometer to central position (0%).

Check that the voltage is: 2.5 V DC ± 10 mV.

Turn "Speed Variator" potentiometer till 2.5 V DC ±10 mV is reached.

Loosen the locking screw of potentiometer knob (see III.2.12-1).

Align the 0% calibration with the pointer.

Retighten the screw and check voltage.

Motionlessness at zero

Load a tape as indicated in position A on the "Speed/Standard & Tape" display).

Spool half way through the tape.

Select SPOOLING position.

Turn "Speed Variator" potentiometer and make sure that reels stop in central position 0 ±1 division (i.e. ±0.2%).

Stability

Check the tensiometers stability in SPOOLING position.

Lightly flick the tensiometers with the finger, at various points along the tape in both directions.

In fast wind mode and in both directions switch off the power supply and check that tensiometers quickly become stable and that tape stops smoothly without falling off the sides of the machine.

PLAY Function at variable speed

Checks and adjustments of the SPOOLING function must have been carried out before proceeding.

Load a tape (similar to the type indicated in position A on the "Speed/Standard & Tape" display).

Connect a frequency meter to TP104/A03-A11 (output of tachometric signal for right capstan).

Select "Variable Speed Play" (shift + PLAY).

Speed	+6 %	0 %	-6 %
3 3/4 ips 9.5 cm/s	1060 ± 8 Hz	1000 ± 2 Hz	940 ± 8 Hz
7 1/2 ips 19 cm/s	2120 ± 16 Hz	2000 ± 4 Hz	1880 ± 16 Hz
15 ips 38 cm/s	4240 ± 32 Hz	4000 ± 8 Hz	3760 ± 32 Hz
30 ips 76 cm/s	8480 ± 64 Hz	8000 ± 16 Hz	7520 ± 64 Hz

NOTE: If frequencies at +6% and -6%, do not comply with the above figures select R134/A03-A11, typical value 15 kOhm, min. 10 kOhm. Reducing the value of R134 increases the range of speed variation

LISTEN Function (and TASIM option)

This function allows fast and momentary playback when the recorder is in SPOOLING mode.

Select SPOOLING.

Press and release the "Listen when Spooling" button ("Pause") and make sure that winding speed decreases before pinch-wheels move.

Then while pressing the "Listen when Spooling" button, quickly reverse the winding direction. Check that the tensiometers remain stable.

Adjustment

Select SPOOLING and press the "Listen when Spooling" button ("Pause").

Check that the tape touches the relevant head just enough to make monitoring possible.

Adjust RP103/A03-A12 "Listen Cam Position" to optimize tape/head contact.

Optional TASIM Board (Playback via record head)

As a general rule monitoring is achieved via the playback head. However on T-Audio TC's fitted with optional TASIM "Sync Playback" Board, which allows monitoring via the record head, the pinch-wheel assembly movement can be reduced so that head wear is minimised whilst allowing high speed tape-searching. Refer also to Section IV (Calibration manual and audio electronics) in this manual.

Move Link ST101/A02-A13 "Repro" to ST102/A02-A13 "Sync".

Dil switch S201/8 is ON, select SKIP three arrows and turn RP103/A03-A12 ("Listen Cam Position" potentiometer).

2.9 COUNTER AND CLEAR TAPE DETECTOR

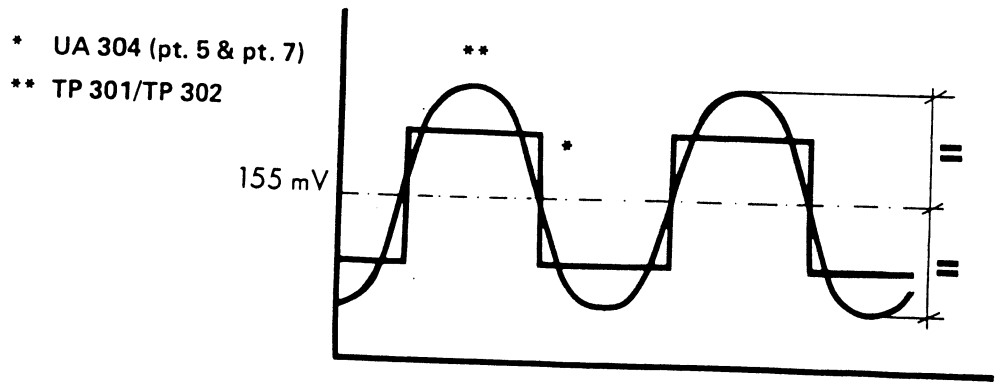
Load a tape as indicated in position A on the "Speed/Standard & Tape" display).

Connect the inputs of a dual trace oscilloscope to TP301/A02-A15 and to pin 5 of UA 304/A02-A15.

NOTE: On TP301 and TP302 there are sine waves coming from the counter roller photo-transistors. These signals are shaped (square wave) via the comparators of UA304 wired as schmitt Trigger.

Select PLAY.

Check the symmetry between signals coming from TP301 and the comparators triggering level (155 mV) on pin 5 of UA304.



Repeat this procedure with signals coming from TP302/A02-A15 and pin 7 of UA304/A02-A15.

Adjustment

Turn "Counter Encoder Sensitivity" potentiometers RP301/A02-A15 and RP302/A02-A15 to adjust the duty cycle and the symmetry of signals coming from TP301 and TP302.

If correct adjustment cannot be achieved with RP301 or RP302, select the value of R1/B3 (motors Interconnection Board). The value should lie between 0 Ohms and 1 kOhm.

NOTE: R1 sets the current of counter roller LED's CR1/A5a and CR2/A5a.

Accuracy

Play at 7 1/2 ips a tape (as indicated in position A on the "Speed/Standard & Tape display).

Connect a frequency meter, set to measure period, to pin 5 of the REMOTE CONTROL OUTPUT socket ("T.Fw" signal). Ideally this should be 6.666 msec (150 Hz).

Calculate the error in the signal between the ideal and actual, taking into account the accuracy of the tape speed. This should be less than 0.2%

$E[\%]=[(F_{measured} - F_{nominal})/F_{nominal}]x100.$

"CLEAR TAPE" DETECTOR

Equipment

Tape with 2 m (6 ft) of white translucent leader tape.

Switch "Clear Tape Function" on Logic Board A02 to OFF.

Load a tape with a white translucent leader tape.

Select STOP.

Connect an oscilloscope to TP303/A02-A15: the measured voltage should be 300 mV peak-peak.

If necessary adjust with RP303/A02-A15 "Clear Tape Sensitivity".

Select PLAY.

Recheck the voltage on TP303.

Check the operation of the three settings of the "Clear Tape Function" switch S302/A02-A15 in PLAY: OFF, STOP and REWIND.

Check also that the tape stops immediately when in GO TO LEADER function.

NOTE: This adjustment can be carried out with translucent coloured leader tape.

2.10 START TIME

Equipment

Twin beam storage oscilloscope.

Record at required speed on a section of tape as indicated in position A on the "Speed/Standard & Tape" display) a 3.15 kHz frequency delivered by the wow and flutter meter (e.g. EMT Franz, DIN 45507).

Connect a storage oscilloscope via x10 probe to the CLOCK signal on the rear REMOTE CONTROL INPUT/OUTPUT socket.

Synchronize the oscilloscope with the CLOCK signal.

Connect the second oscilloscope trace to the wow and flutter meter output (e.g. "TO EXT. FILTER for a EMT Franz meter).

Playback the recorded section of tape; adjust wow and flutter meter to eliminate the DC component of wow signal (wow meter Sensitivity set to 0.3%).

By switching from STOP to PLAY, observe on the storage oscilloscope the start time: the measurement starts as soon as the PLAY push-button is pressed.

Speed	Typ. start time	Max
3 3/4 ips 9.5 cm/s	200 ms	250 ms
7 1/2 ips 19 cm/s	250 ms	300 ms
15 ips 38 cm/s	300 ms	350 ms
30 ips 76 cm/s	500 ms	600 ms

WINDING TIME

Equipment

12" rolls of tape (2400 ft)

Load roll of tape.

Check that the time taken to completely rewind tape is less than 100 s for a tape 2400 ft long.

Check the quality of the winding.

NOTE: Quality depends on the tape backing texture: a matt back will give the best result. Use the "slow down" enable function for tapes such as Ampex 406/456 or 3 M 206. This function is activated by the Dil switch S201/7 on A02 circuit.

Having selected fast spooling mode quickly turn the "Speed Variator" potentiometer to central position: the tape should stop without slipping.

Repeat the same test when in LISTEN mode.

Select fast wind mode.

With an equal amount of tape on both reels, select PARK: tape should stop smoothly.

Repeat the same test in fast rewind (from right to left).

2.11 WARNING INDICATORS

Power

Equipment

220 V variable transformer (variac)

Connect the recorder to the mains supply via the variable transformer.

Reduce the supply voltage until the LED "Close to limits" lights up: the voltage should be lower than 195 V AC.

If not, recheck voltages (See III.1.5 "supply voltages").

Tape Tension

Load a tape as indicated in position A on the "Speed/Standard & Tape" display) and lace it behind the head assembly.

Select PLAY: both LED's "Tape Tension" are illuminated.

Lightly press with the finger on the tape tension sensor: the LED's go out in succession.

Progressively increase the pressure and make sure that the LED's light up in succession (first "Close to limits", then "out of limits").

Phase Lock

Lace the tape in front of the heads.

Select PLAY at 30 ips.

Check that the LED "Close to Limits" goes out as soon as the tape transport speed is stabilized.

2.12 SERVO-EDITING BOARD TASC

TASC: order no. 21 09353 001

Fitting

Preparation

Remove the recorder front panel (two quick-release screws one in each upper corner).

TASC Board mounting

Make sure that the mains supply is disconnected.

Remove the Counter Board (fifth from the top).

Remove the lower screening plate (two screws at the front).

Unscrew the four fixing screws for Servo Board.

Plug the Servo Board into the Counter or Time Code Board.

Turn over the Counter or Time Code Board and secure the Servo Board by means of the four fixing screws.

Replace screening plate and refit the counter or Time code board in its original position, fifth from the top.

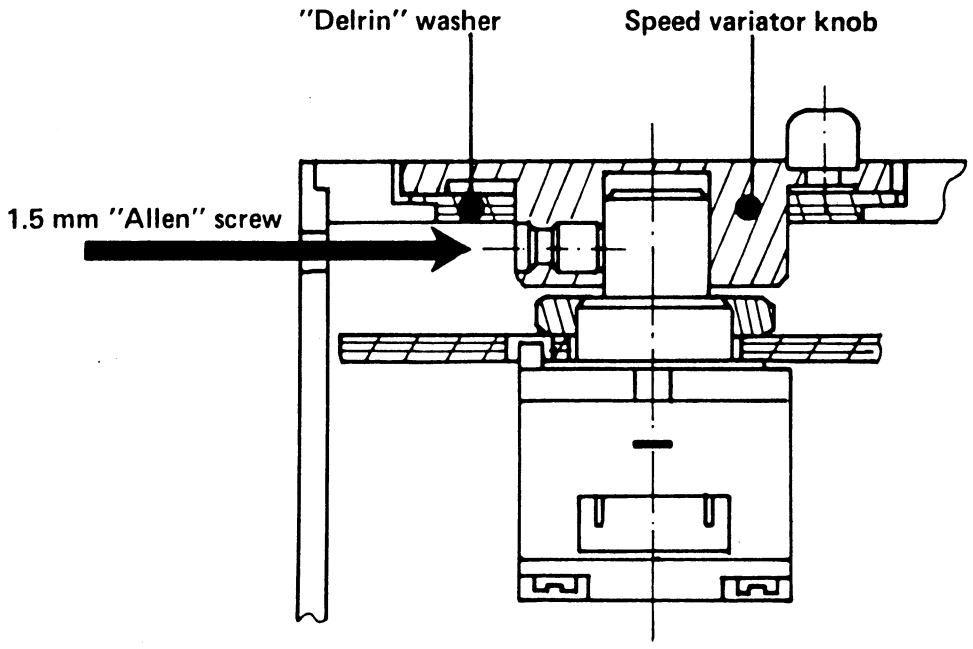
Switch on the recorder and check the CUT function.

Mounting of the encoding roller on keyboard

Disconnect the keyboard.

Loosen the fixing screw of "SPEED VARIATOR" knob (in 0% position, 1.5 mm Allen screw).

Remove the "SPEED VARIATOR" knob and its "Delrin" washer.



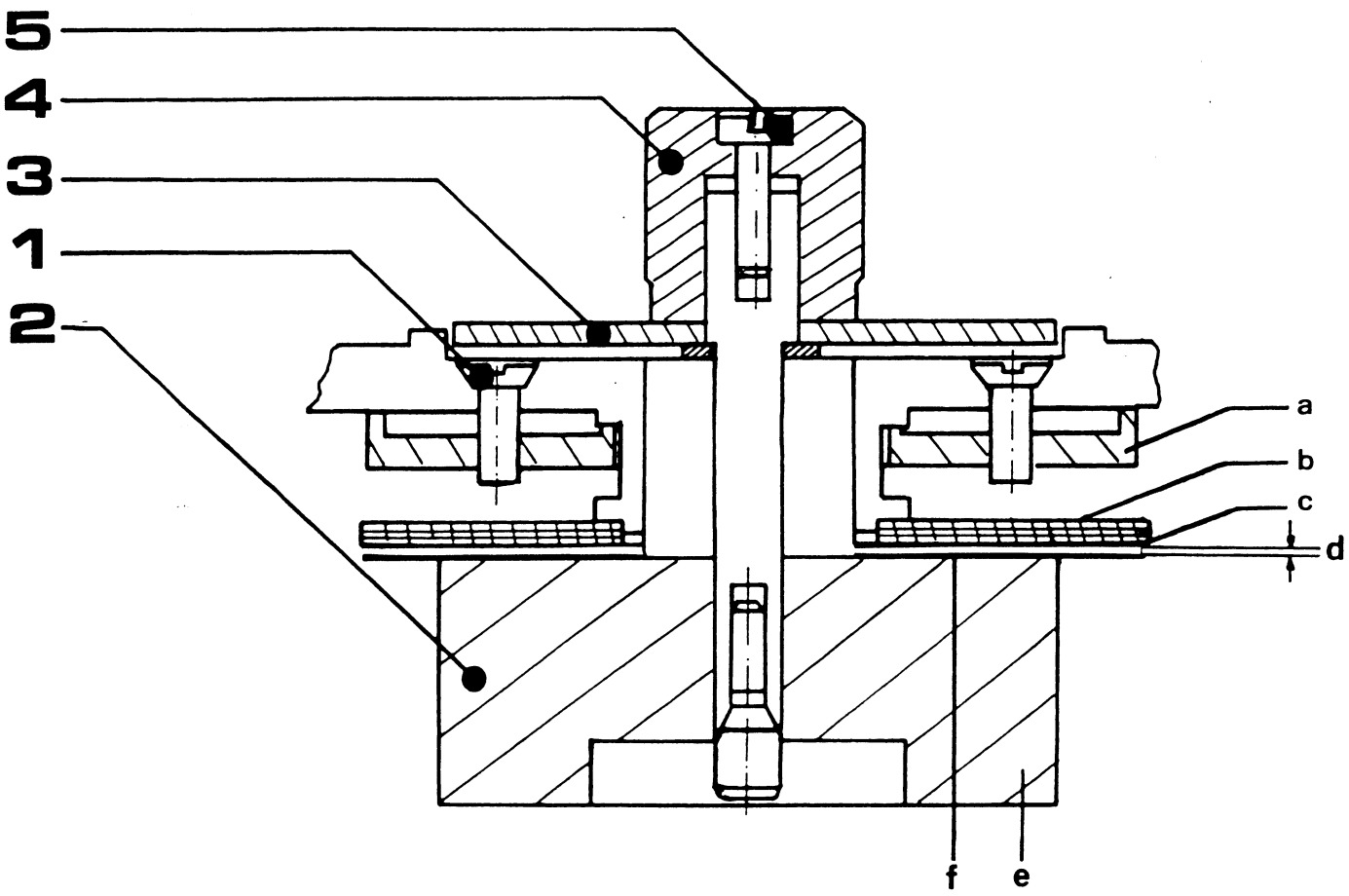
Remove the keyboard top panel (six screws).

Remove the plastic clamp fixing the 4-pole connector on the front right-hand side of the P.C board.

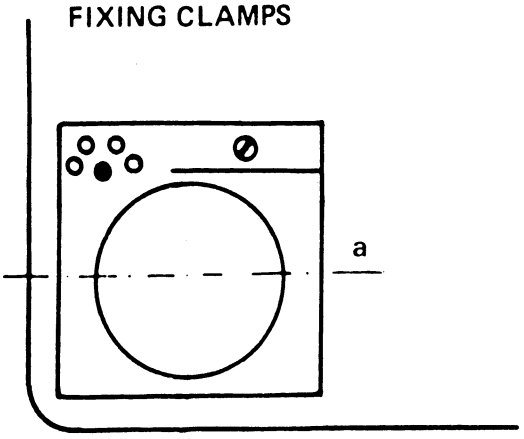
Take the keyboard panel and remove the metallic seal fitted in place of encoding roller.

Mount the Encoding Board as indicated on the drawing and fit parts (1,2,3,4,5) in sequence.

FITTING OF THE ENCODING ROLLER



FIXING CLAMPS



a Fixing clamp

b Servo-encoder board A16b

c Fixed film washer (on the board)

d Minimum play

e Fly-wheel

f Mobile film washer (on the fly-wheel)

NOTE: The two fixing clamps must be fitted in the position shown in the drawing. Handle the Servo-Encoder board with care to avoid damage to the film washers between the board and the fly wheel.

Refit the keyboard panel without tightening the fixing screws.

Refit the "SPEED VARIATOR" knob without tightening the "Allen" screw (the knob must be flush with the keyboard panel).

Connect a DC voltmeter to pins 9 (Pot) and 11 (Ground) of the REMOTE connector (rear panel of the recorder).

Switch on the recorder and connect the keyboard.

Adjust the "zero" position of the "Speed Variator" knob so that it corresponds to a 2.5 V DC voltage.

Tighten the "Allen" screw.

Switch off the recorder.

Position the keyboard panel so that the "Speed Variator" knob freely rotates.

Tighten the 6 fixing screws.

Turn over the keyboard and connect the Encoding Board.

Switch on the recorder.

Connect a dual trace oscilloscope (preferably storage) to TP11 and TP10.

Check the phase angle between signals (90°) while rotating the encoding roller to the right and to the left.

Turn over the keyboard, load a tape, press the servo button and check that the tape moves in the same direction as the encoding roller.

Refit the keyboard bottom cover.

CUT Function

Visual Check.

Make a mark transversely on the tape.

Position the tape so that the mark comes in front of the playback head gap.

Press the CUT button.

Operate the cutter (without cutting) and check that the cutting would coincide with the mark.

SERVO-CONTROL Function

Check

Select SERVO mode.

Rotate by hand, as fast as possible, the encoding roller in both directions: the measured tacho frequency on TP104/A03-A11 should be approximately 4 kHz, which corresponds to a speed of 15 ips.

Adjustment

If values obtained for the two tape directions are substantially different they can be equalised by changing the value of R62/A04-A19 (typ.22 kOhms, min. 10 kOhms). Decreasing this value increases the reverse winding speed.

SERVO-CONTROL sensitivity

Sensitivity of the SERVO-CONTROL function to the encoding roller rotation can be increased by moving link ST3/A04-A19 to ST4. This doubles capstan rotation for a same rotation of the encoding roller.

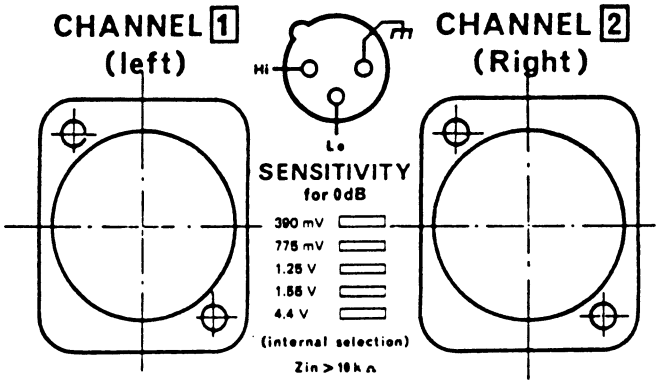
NOTE: On request the max. speed can be limited to 7 1/2 ips to facilitate editing of tapes recorded at this speed.

3.0 INPUTS/OUTPUTS

3.1 AUDIO CHAIN

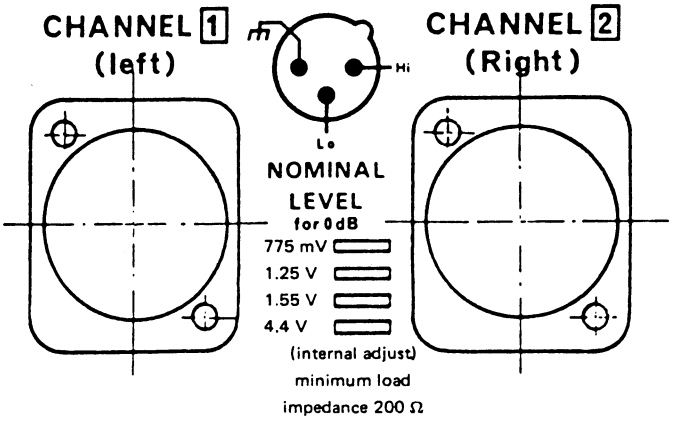
3.1.1 Balanced Lines

Input



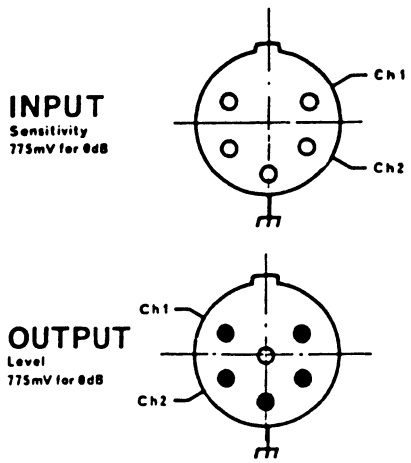
For modification of input sensitivity see section IV of this manual.

Output



For modification of nominal output level see section IV of this manual.

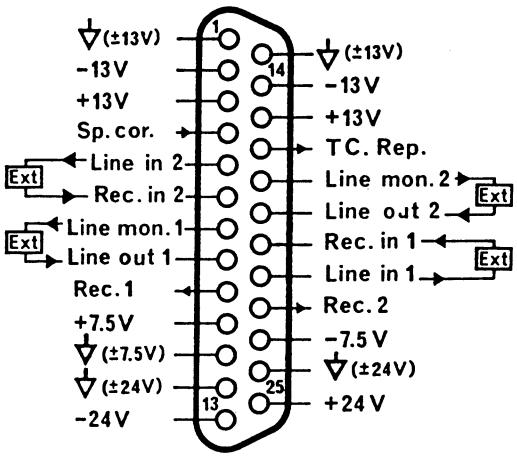
3.1.2 **High speed copy** (Option TA-PCR)



See also page I.1.7-2.
These sockets allow high speed copying (2 or 4 times nominal speed) between two NAGRA T-Audio machines fitted with 30 ips AES/COPY preset recording calibration circuit

The input sensitivity and output level are fixed at 775 mV for 0 dB. The frequency response is 50 Hz - 60 kHz ±2 dB

3.1.3 **Audio monitoring output**



This socket allows for the connection of external monitoring console and external time code devices. The following connections are available:

In 1 / In 2 Pins 21/5
Provide monitoring of the input signal present on the balanced line inputs after the input preamplifier

Rec 1 / Rec 2 Pins 6/20
Provide monitoring of the input signal just before it is recorded on tape

Rep 1 / Rep 2 Pins 8/19
Provide monitoring of signals recorded on the tape

Li 1 / Li 2 Pins 7/18

Provide monitoring of the output signal before the output balancing transformer

NOTE: The signals present at the above outputs are analogue, the nominal level is 775 mV for 0 dB.

TC In Pin 4

External reference signal input

TC Rep Pin 17

Monitoring of the reference signal recorded on the tape

Au Rec (Audio Record) Pin 22

The information present at this output can be used to switch on an external indicator to show that the NAGRA T-Audio is in Record mode.
Logic levels: 0 V / 7.5 V

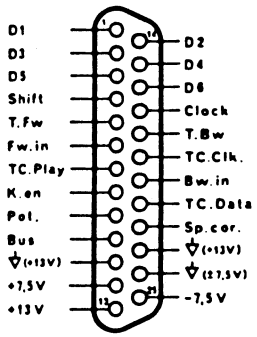
Bus Pin 9

Digital serial bus input and output. Identical to the one used by the keyboards (see under 3.2.1 REMOTE CONTROL).

Pin 10 to 13 and 23 to 25

Stabilized supply outputs to feed the monitoring console.

3.2 REMOTE CONTROL



This socket permits full remote control of the NAGRA T-Audio with an external control device via an appropriate interface (HPIB, IEEE 488 type) or a with a supplementary standard keyboard.

TC Play Pin 7

Playback or monitoring of the reference signal recorded on the tape.

TC data Pin 21

Output of the internal reference generator signals.
TC Clk Pin 19

Output of the internal reference generator signals
Pin 11 to 13 and 23 to 25

Stabilized supply outputs except pin 13(+13 V) which is unstabilized
Pot Pin 9

Speed variator pot wiper. Speed correction value corresponding to the setting of the speed variator control (0 V ±5 V).

Other special remote facilities are also provided. They are:

Bus Pin 10

Serial bus
D1 to D6 / Clock/Shift Pins 1,14,2,15,3,16/17/4

Parallel bus
T. Fw. / T. Bw (Tape forward, backward) Pins 5/18

Counter pulses
K. en Pin 8

Keyboard enable
Sp. cor. Pin 22

Speed correction
Fw in / Bw in Pins 6/20

Tape Transport Control (forward, backward) in servo

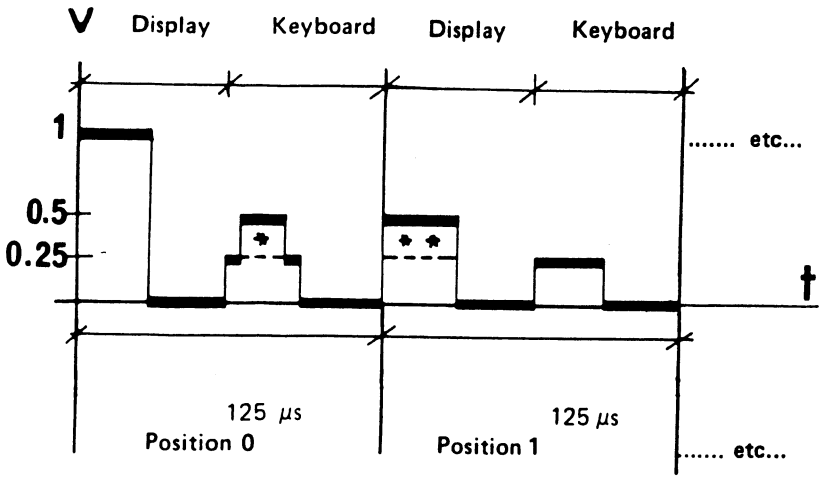
Serial Bus Pin 10

Serial digital bus input and output, identical to the one used by the keyboard.

The serial bus allows bi-directional transferring of information (keyboard functions

and display) with only one conductor between keyboard, Logic Board and Counter Board. Information to be transmitted from T-Audio to the keyboard (and vice-versa) are gathered, managed and multiplexed by "Serial Bus Multiplexer" Board A02-A14 which also generates "Sync" and "Clock" signals. The Counter Board sends counter information via the serial bus, the keyboard A16 sends to the Logic Board the status of the function keys and decodes the display signals coming from the T-Audio recorder.

To check this, connect the oscilloscope to the "Bus" output on REMOTE socket and observe that the serial information has the following features.



1 V	=	RESET
0.5 V	=	DATA
0.25 V	=	CLOCK

* "Keyboard" Data narrower than "Clock" width . In this example: STOP button is pressed

** Display Data : width similar to the "Clock" width

Note: 1 position = 125 µs / 128 positions x 125 µs = 16 ms

RESET : One 1 V pulse every 16 ms

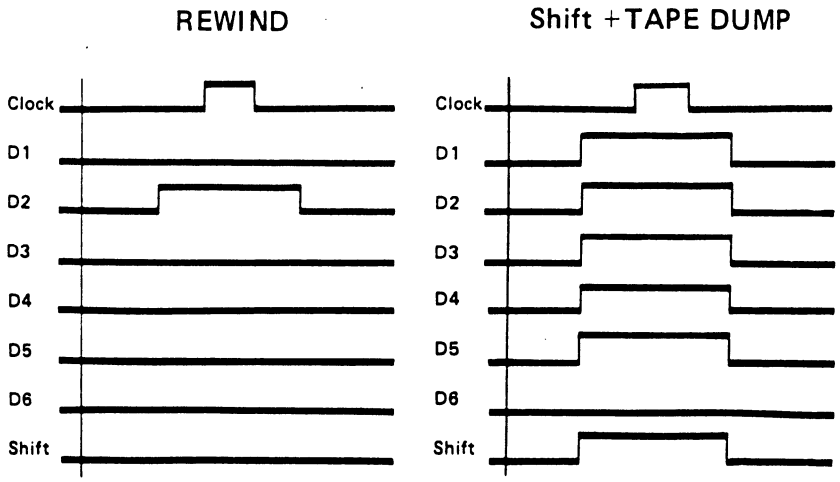
Parallel Bus

to D6 /Shift /Clock: pins 1,14,2,15,3,16/17/4

Remote control input and output using a standard parallel bus, enables the use of a control device with standard remote output (IEEE 488, HPIB) via an appropriate interface

Signals coming from the keyboard are decoded by A02-A14 and transmitted to the parallel bus in a binary 6-bit code (64 separate functions). The information is validated by a "Clock" pulse. The "Shift" signal gives a second group of 64 functions

Check with a logic probe the presence of the codes corresponding to functions given in the list of various functions and their binary code converted from decimal form given in Chapter VI.



Oscillogram shown by an Logic Analyser (e.g. Dolch, Lam 4850)

NOTE: The use of a logic probe is advised as the binary code present at parallel outputs comes in very short pulses (shorter than us range). If you wish to view the pulses on an oscilloscope proceed as follows:

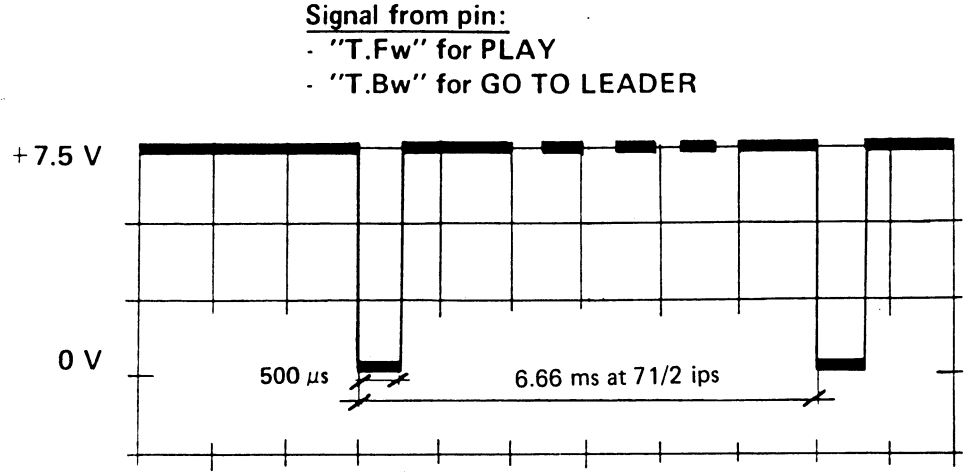
Set the oscilloscope to MANUAL triggering (external) mode.

Synchronize the oscilloscope with the CLOCK signal (triggering level 1 V).

Counter Pulses

T Fw (tape forward; pin 5) and T Bw (tape backward; pin 18) indicate the tape direction.

Check the counter pulses in PLAY mode on "T. Fw" and in GO TO LEADER mode on "T. Bw" by viewing 500 us negative pulses.



Note: 75 periods/sec. at 3 3/4 ips (300 periods/sec. at 15 ips)

Keyboard Inhibition

"K. en." (keyboard enable, pin 8) inhibits the use of the keyboards connected to the recorder when grounded.

Connect pin 8 "K. en." to ground and check that the keyboard is inhibited.

Speed Correction

Sp. cor. (speed correction, pin 22): input of a playback or spooling speed correction signal from an external unit (speed variator or synchronizer).

Set "Synchronizer/Timing Variator" switch on S1/A03-A11 to "Synchronizer".

Load a test tape BVQ-1 (code no. 91730).

Connect a frequency meter to the line output.

Connect a stabilized power supply to pin 22 "Speed Correction".

Select PLAY "Variable Speed".

Supply "Speed Correction" with 0 V, + 7.5 V and -7.5 V and check the frequencies indicated on the frequency meter.

Voltage	Frequency
0 V	1000 Hz ± 1 Hz
+7.5 V	926 Hz ± 2 Hz
-7.5 V	1081 Hz ± 2 Hz

Reset the switch (on A03) to "Timing Variator" position

Tape Transport Control

Fw in (forward; pin 6)/Bw. in (backward; pin 20)

When the NAGRA T-Audio is fitted with an optional Board TASC (servo-controlled editing), these inputs allow accurate location of a portion of tape for instance by means of a microprocessor controlled unit (gives the same functions as the servo editing control knob; see Section I.1.2.

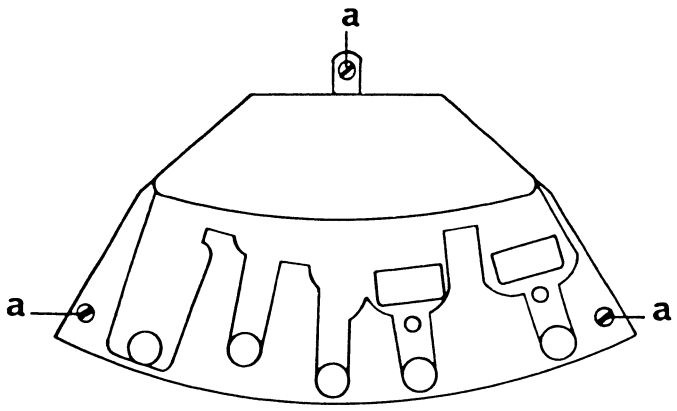
Select SERVO.

Inject via a 4,7 nF capacitor a 15 V peak-peak square wave into pin "Fw.in.", then into "Bw.in."

Frequency	Speed	
1 kHz	3 3/4 ips	9.5 cm/s
2 kHz	7 1/2 ips	19 cm/s
4 kHz	15 ips	38 cm/s

NOTE: Maximum frequency (consequently speed) is limited to 4 kHz.

4.0 HEAD ASSEMBLY REPLACEMENT



Squaring and adjustment of head height have been carried out ex-works.

Unscrew screws (a) and remove the head assembly.

Fix the new assembly with (a).

Check the "Clear Tape" detector as described under Section III.2.9.

Carry out checks, and if necessary adjustments, described under Sections III.2.9 ("Inter-capstan tension", "Capstan Servo-Control") and under Section III.2.5 ("Tape Alignement").

Carry out the whole calibration of Playback and Record Chains, as described in Section IV of this manual.

4.1 HEAD REPLACEMENT

Equipment

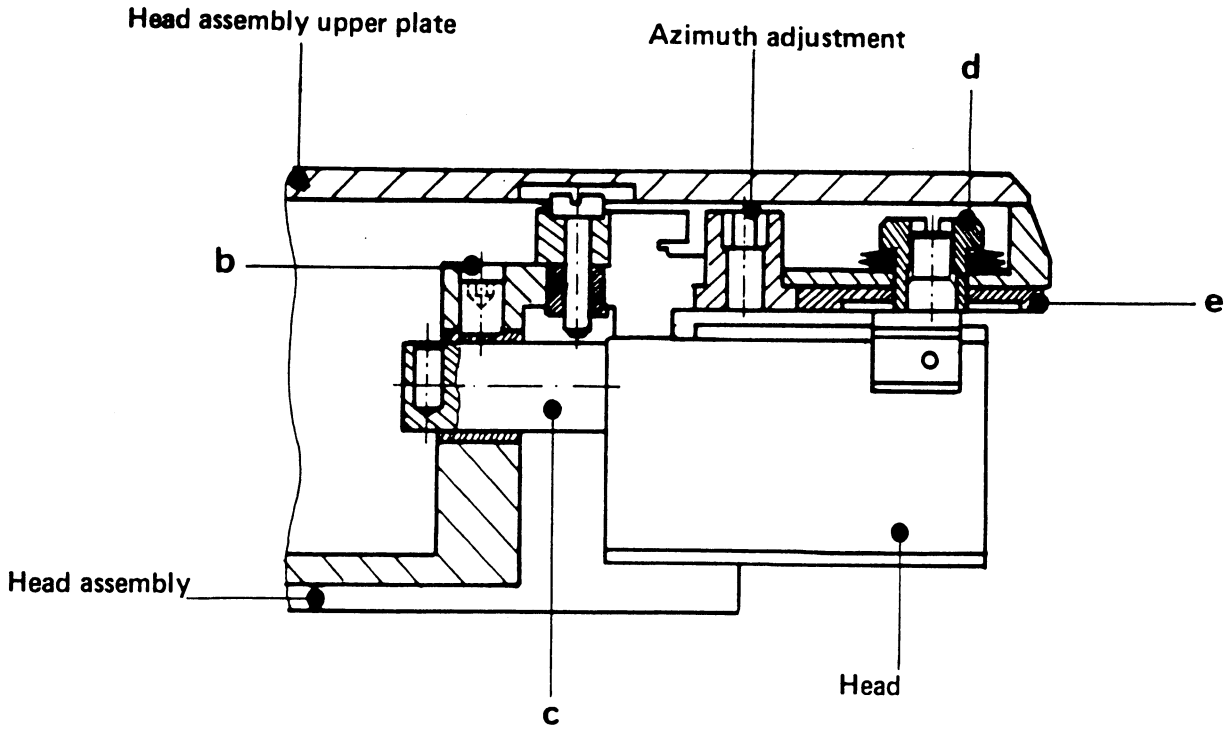
Template for head assembly adjustment (including a squaring gauge); (order no. 01 90901 043)

Replacement

Remove head assembly cover

Unscrew screws (a) and remove the head assembly (drawing under 4.2).

Record head/Playback head (stereo, two-track)



Pull out the connection wires

Unscrew screw (b)

Slide out cylinder (c)

Disengage the head by unscrewing nut M3 (d)

Fix the new head

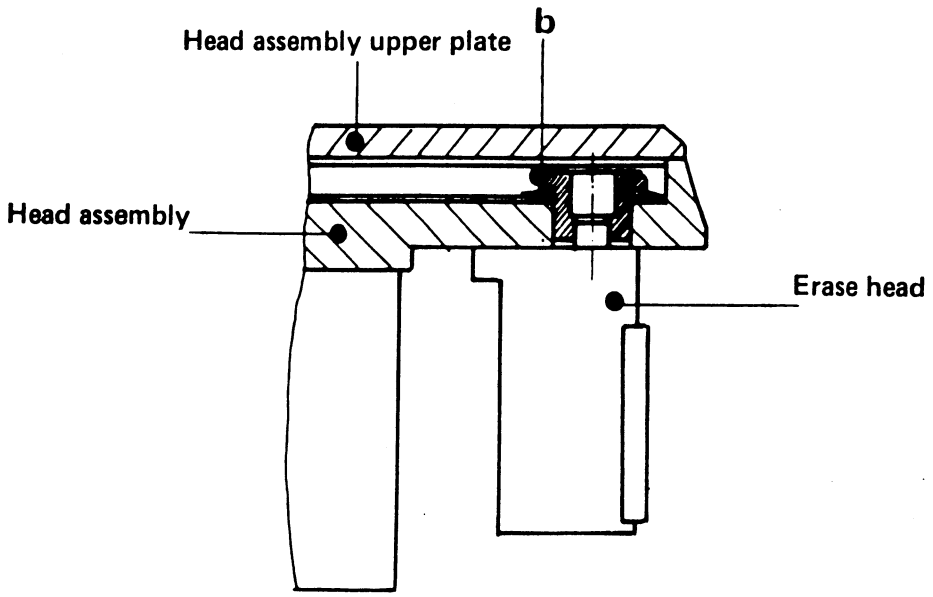
Carry out adjustments described in Section IV of this manual.

Erase head

Erase head is available in two versions:

Stereo: Full track erasing; order no 71 09174 000

Two-track : Erasing of each track separately; order no. 71 09175 000



Unsolder connection wires

Disengage the head by unscrewing nut M3 (b)

Fix the new head

Carry out adjustments described in Section IV (erase head).

Adjustments

Unscrew and remove the 3 knurled rods of the adjustment template.

Place the head assembly onto the template and fix it with knurled rods.

Then carry out adjustments.

4.2 MECHANICAL ADJUSTMENTS

Record heads/Playback heads

Squaring

Place the squaring gauge order No 01 90 901 043 onto the adjustment template and against the head (in the middle of head gap).

Shine a light on this assembly and make sure that the head-squaring gauge contact does not let the light through.

Otherwise turn cylinder (c) (drawing under III.4.3-1, record and playback heads) at the rear of the head with a 4 mm wrench.

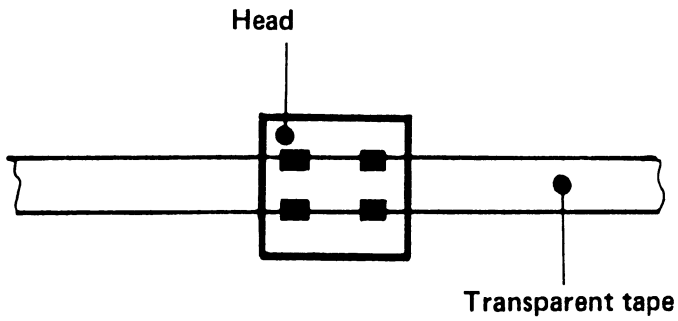
Height

Drawing 4.3.1 (Record head/Playback head).

Remove the head assembly from the adjustment template and fix it onto the tape-deck with screws (a) (drawing 4.2).

Load a tape with a transparent portion (about 1 m).

Select PLAY at 3 3/4 ips and check that the tape overlaps symmetrically the head gap.



Otherwise replace azimuth discs (e) (drawing 4.3.1, record or reproduce heads) by other thickness values until the height is correct (order no. 01 09155 020 to 01 09155 029) and repeat the adjustment for the "squaring".

ELECTRONIC ADJUSTMENTS

Record head/Playback head

Refer to the "Calibration Manual" (Section IV):

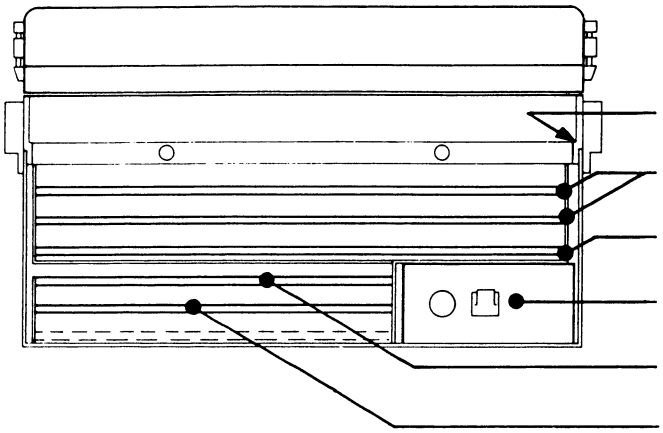
Playback head, chapter 2: azimuth, level, frequency response

Record head, chapter 3: azimuth, bias, treble and bass preemphasis, level, predistortion.

5.0 ADJUSTMENTS LAY-OUT

5.1 P.C Boards location

Front View



A20 TAHP Option

A01 Audio

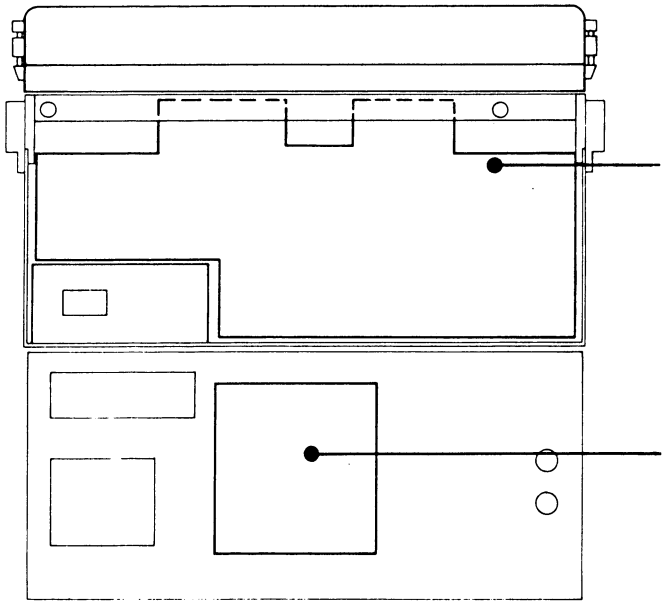
A02 Control Logic

A30 Power Supply

A03 Speed Stabilizer / Transport Control

A04 Counter / Servo Encoder

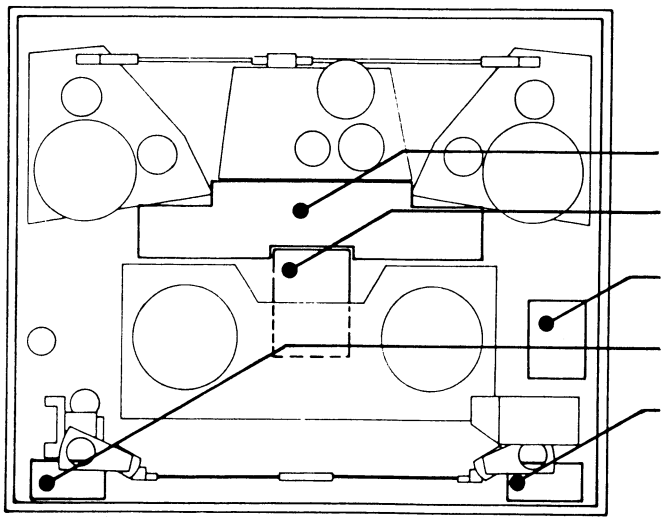
Rear View



B5 Interconnection

A9a Line In/Out Transformers

Tape Deck
Bottom View



B3 Interconnection

B1 Interconnection

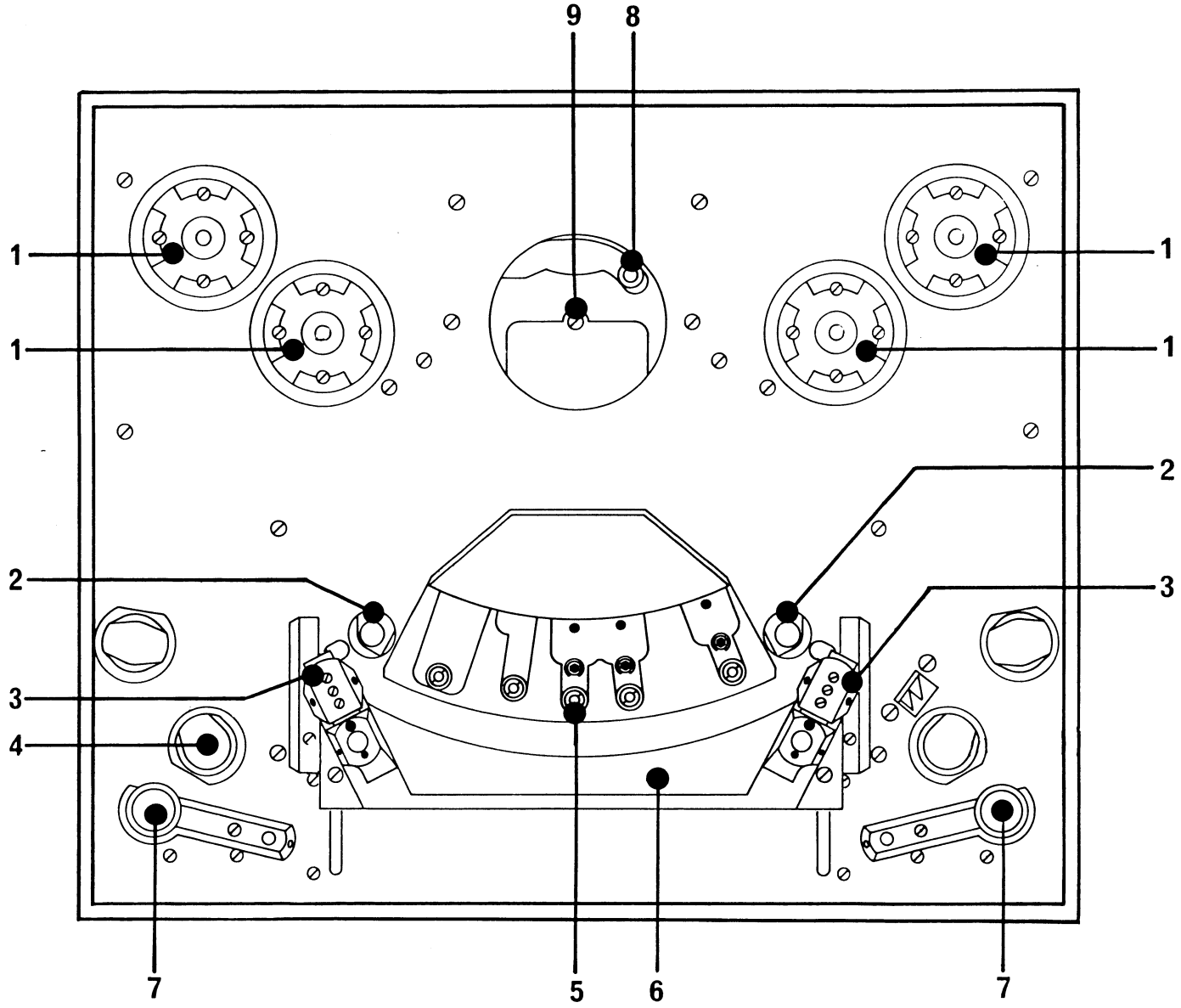
B2 Interconnection

A12b Right Tensiometer

A12a Left Tensiometer

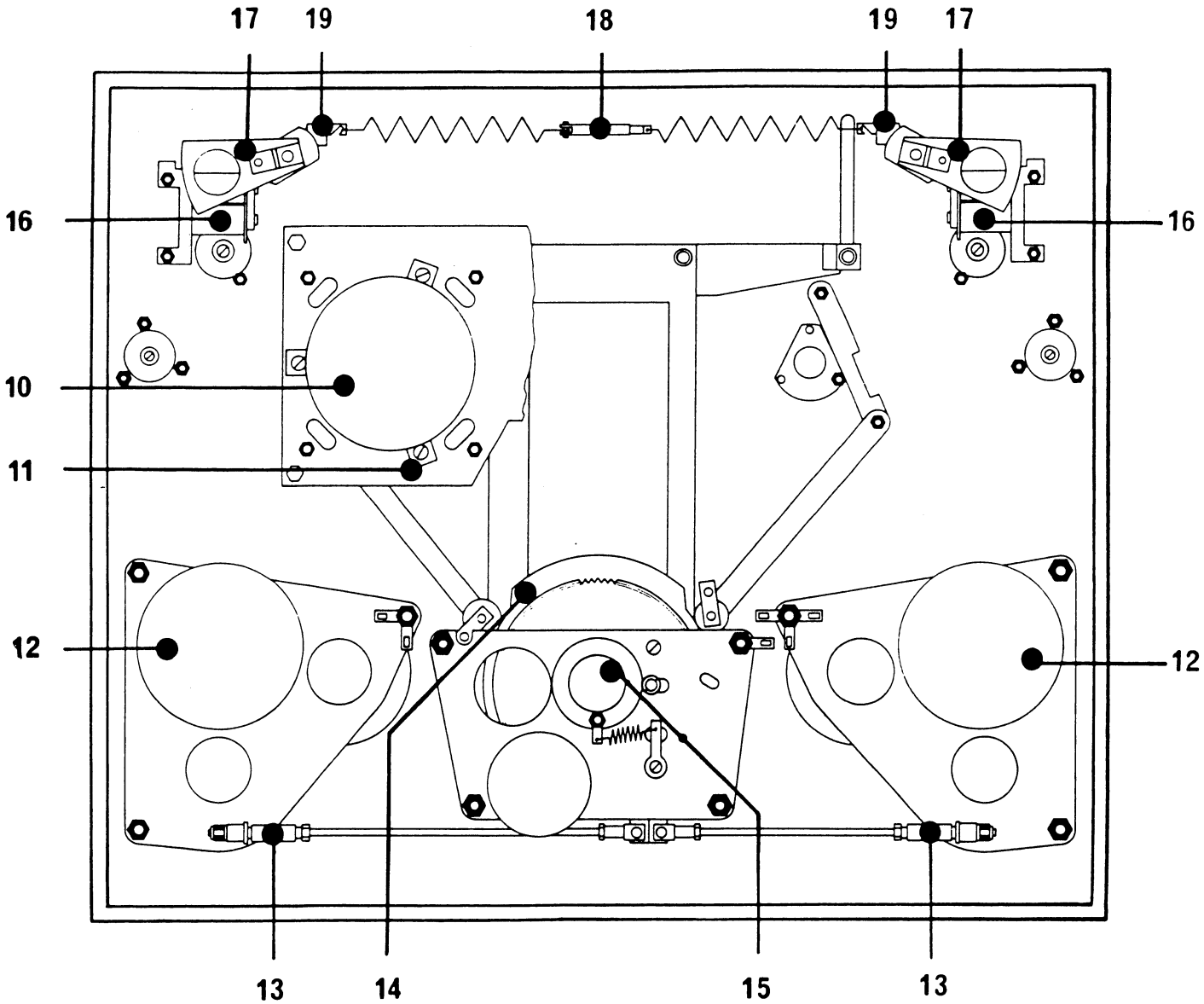
5.2 MECHANICAL ADJUSTMENTS

Tape-Deck (Top View)



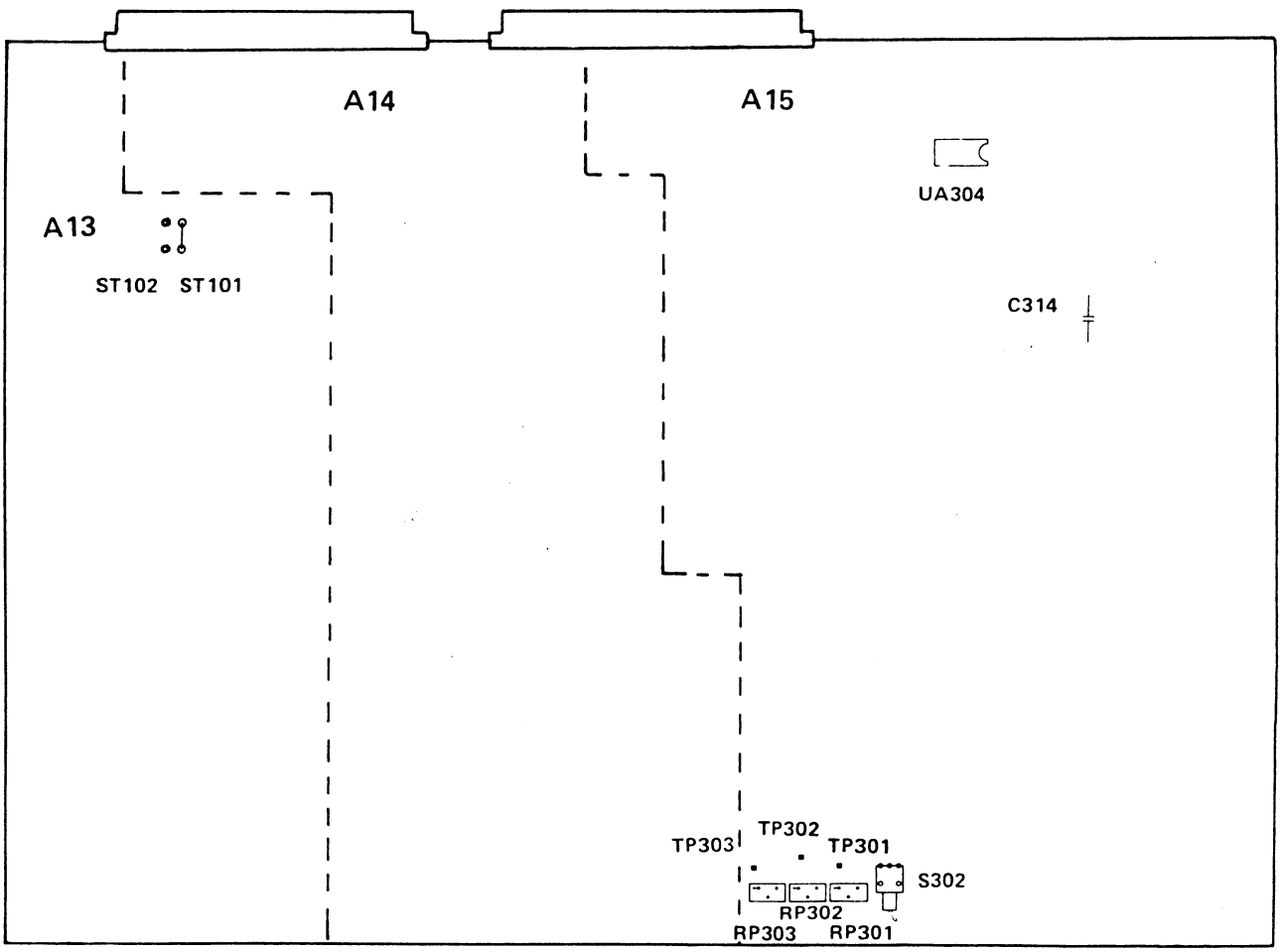
1 Reel-holder (2.3)
2 Capstan (2.1)
3 Pinch-wheel (2.6, 2.7))
4 Counter-Roller (2.12)
5 Central Rotary Guide (2.6)
6 Pinch-wheel Assembly (2.6, 2.7)
7 Tensiometer Arm (2.4, 2.5.1)
8 Cam Guiding Roller (2.2)
9 Cam Potentiometer Shaft (2.2)

Tape-Deck (viewed from underneath)



10 Capstan Motor (2.1)
11 Motor fixing screw (2.1.3)
12 Reel-Holder Motor (2.3)
13 Reel-Holder Braking Torque Control (2.3)
14 Cam Disc (2.2)
15 Cam Potentiometer (2.2)
16 Tensiometer locking coil (2.4)
17 Toothed arc for tensiometers locking (2.4)
18 Tensiometer Coupling Screw (2.5.1)
19 Tensiometer Spring Hook (2.4.3)

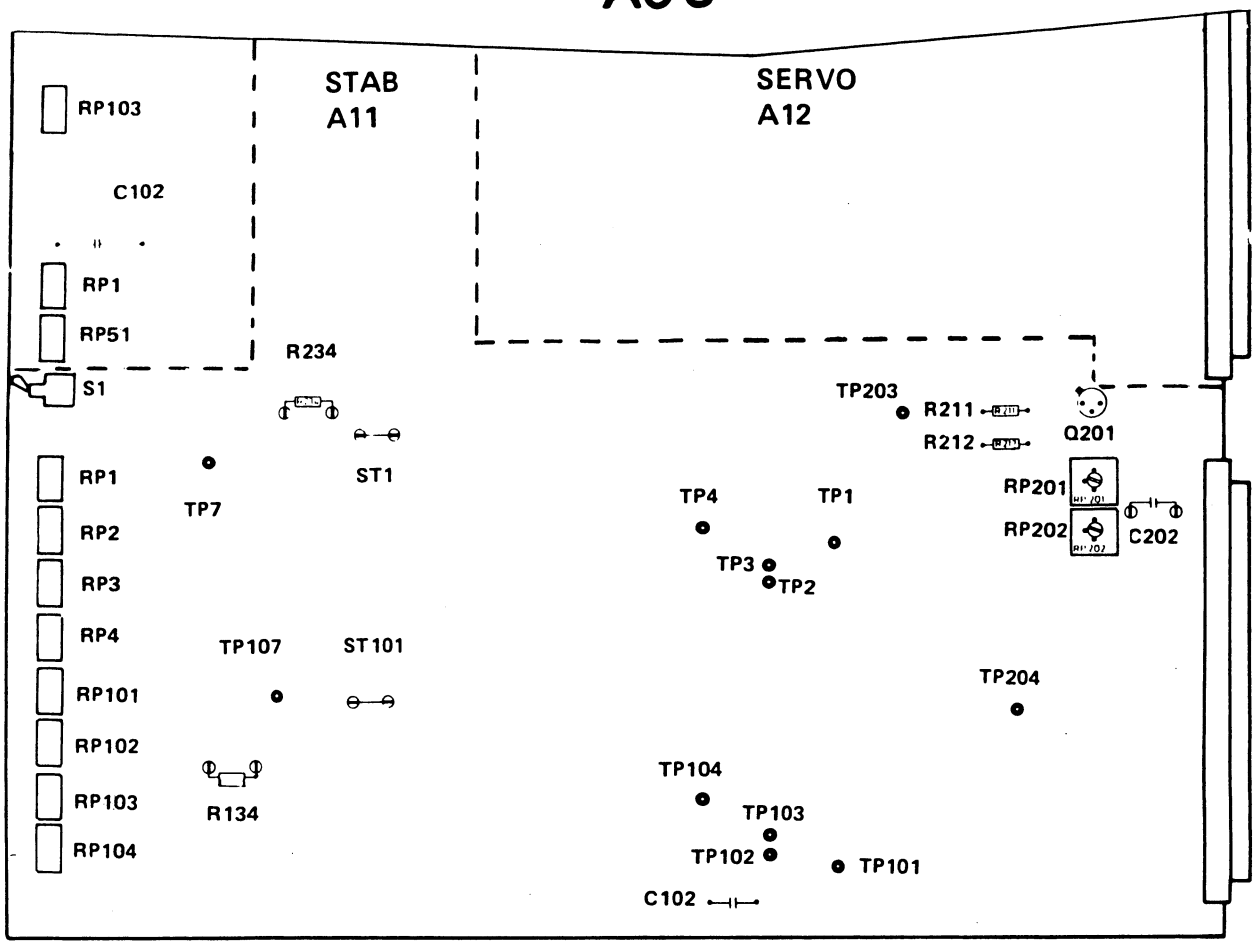
A02



A02 Control Logic

2.2	Cam positioning	A15	C314/TP311
2.11	LISTEN	A13	ST101/ST102
2.12.1	Counter encoder	A15	RP301/TP301/UA304 (contact 5) RP302/TP302/UA304 (contact 7)
2.13	CLEAR TAPE	A15	RP303/TP303/S302

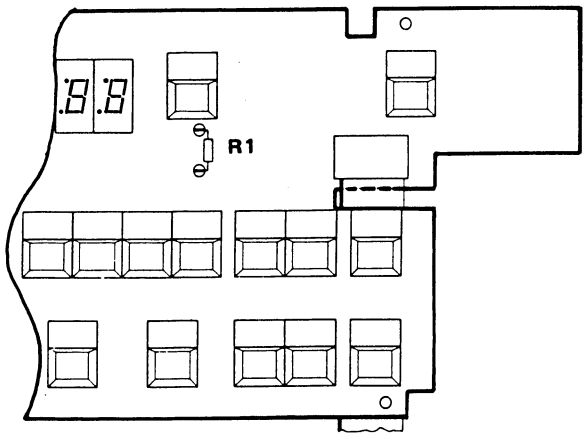
A03



A03 Speed stab. & Tape transport Servo-control

2.2	Cam positioning	A11	RP102/RP104
2.2	Cam potentiometer	A12	C102/TP102
2.4.1	Tensiometers H.F. signals	A11	C202/Q201
2.4.2	Tensiometers, 5^0 position	A12	RP1/RP51
2.5.2	Right capstan speed	A11	TP204/RP101 to RP104
2.5.2	Inter-capstan tension	A11	TP203/RP201/RP202
2.5.2	Left capstan speed	A11	TP203/RP1 to RP4
2.8.1	Tachometric levels	A11	TP1/TP2/TP101/TP102
2.8.2	Tacho signals phase angle	A11	TP3/TP4/TP103/TP104
2.8.3	Tacho wow & flutter	A11	ST1/TP7/ST101/TP107/R234
2.10.1	SPOOLING Speed variator	A11	R211/R212
2.10.2	PLAY Speed variator	A11	R134/TP104
2.11	LISTEN	A12	RP103
2.17.2	CUT	A11	TP104
2.17.3	Servo-controlled editing	A11	TP104
3.2.5	Speed correction	A11	S1

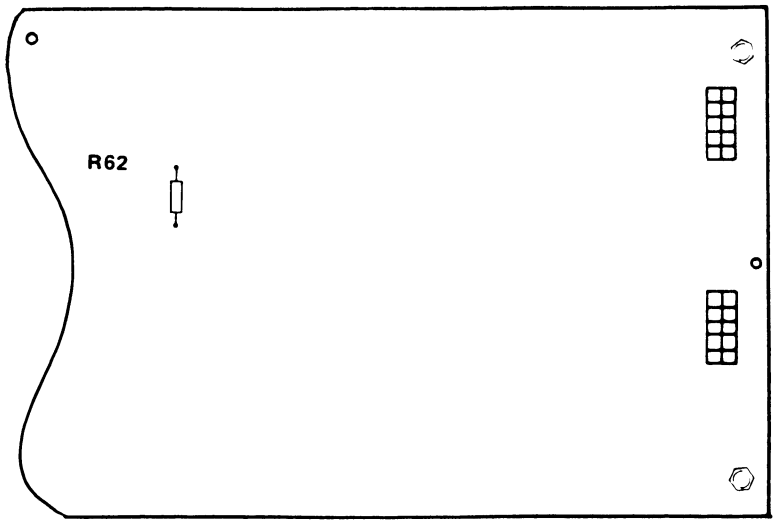
A16 a



A16a Keyboard encoder

-	R1
2.10.1	SPOOLING speed variator

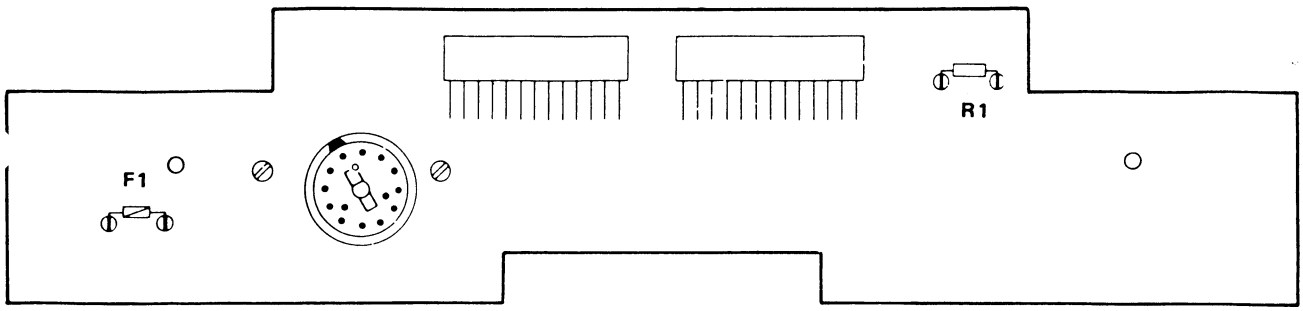
A04 - A19



A04–A19 TASC servo-editing

	R62
2.17.3	Servo-controlled editing

B3



B3 Tape deck interconnection

	R1
2.12.1	Counter encoder

6.1 Internal switchings

Board	Reference	Switch or bridge	Initialization facilities (bold-faced type: ex-factory	Description
A01-A02	ST1 ST2 ST3 ST5 No bridge	U-Link (only one)	4.4 V/ = dB 3.1 V/ 0 dB 1.55 V/ O dB 1.25 V / 0 dB 0.390 V / 0 dB	Selection of line input level. To obtain accurate values, a fine adjustment by means of RP1/AO1-A02 is required
A01-A4	S1	2-position switch	Norm / Copy	Copy: switches the input of line board to "30 ips Copy" recording
AO1-A6	ST4	Bridge / Pont		Erasing oscillator power supply. Bridge on channel 1 only for mono and stereo version; on channels 1 & 2 for 2-track models
A01-A8	S1	2-position switch	Norm / Copy	Copy: suppression of phase compensation
A01-A9	ST1 ST9 ST2 ST9 ST3 ST9 ST1 ST9 ST1 ST4 ST1 ST5	U-link U-link to the left U-link U-link to the left U-link U-link to the left Don't care U-link to the right U-link U-link to the right U-link U-link to the right	0.7 75 V / 0dB 1,25 V / 0 dB 1.55 V / 0 dB 4.4 V / 0 dB **No console** / console	Selection of line output level. To obtain accurate values, a fine adjustment with RP1 / A01-A09 is required Links to be removed when installing TACO-M1 audio monitoring console
A01-A10	S1	2-position switch	Input / Repro	Input: level monitoring. Repro: tape level monitoring
A01-XA3		U-links between 2-3 & 5-6		
		1. -- 2. "Repro Out" from A8 3. "Repro monit.IN" A9 4. -- 5. Input monitoring" output on A2 6. "Record input" on A4 7. -- 8. -		Link between line input and record board when no noise reduction board A3 is fitted Link between playback and line output boards when no noise reduction board A3 is fitted
A02-A13	S101	3-position switch	Mono-2-Track-Stereo	Audio boards switching.Mono : mixing of both channels. 2-Track : separation of channel controls on audio matrix
A02-A13	S102	2-position switch	Tape length/speed stab.	The recording starts as soon as the speed is stabilized or, the speed being stabilizied, as soon as a tape length equal to the distance beetween erase and record heads has been transported
A02-A13	S103-1 S103-2 S103-3 S103-4	2-position switch	Sync switch ofer: input/off	one switch for each channel. Automatic switching over to playback sync head when recording

A02-A13	ST101	Bridge	ST101 or ST102 /*ST101 ou 102* Ex-factory : ST 101	In "Listen" playback via the playback
	ST102			In "Listen", playback via sync head (if the TASIM board is fitted
A02-A14		2-position switches	Model : NTA-M NTA-S NTA-2	Type of initialization when the TA is switched on
	S201-1	Ready	1 1 0	Ready to record
	S201-2	Safe	0 0 1	Recording inhibited.
	S201-3	Repro	1 1 1	Output: off tape signal
	S201-4	Input	0 0 0	Output: input signal
	S201-5	Off	0 0 0	Output disconnected.
	S201-6	Sync. Inhibited	0 0 0	Sync playback via record head inhibited/
	S201-7	—	0 0 0	
	S201-8	—	0 0 0	
A02-A14	S202 S203 S204 S205	8-position switches	C:CCIR/ N:NAB/ M:Nagramaster 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 3 3/4 | 7 1/2 | 15 | 30 | 7 1/2 | 15 | 15 | 30 C/N | C | C | C | N | N | M | AES	Selection for each "Speed & Standard Modify" position on keyboard (A,B,C,D)
A02-A14		Bridge	A–B–C–D/A–B	"Speed & Standard Modify": facility for direct selection from A to B, then B to A, without switching through C and D
A02-A15	S301	2-position switch	Record Inhibit: **Off**/Inh	inh.: Record inhibition
A02-A15	S302	3-position switch	Clear tape: Stop/**Off**/Rewind	Choice of the automatical function selected when a transparent leader tape in Play or Record is detected
A02-A15	ST301	Bridge	ST301 or ST302/*ST301 ou 302* Ex - factory : ST 302	"Load" function with brakes disengaged
	ST302			"Load" with a light brake applied
A02-A15	ST303	Bridge	ST303 or ST304/*ST303 ou 304* Ex - factory : ST 304	"Edit" function with pinch wheel assembly in "Listen" position.
	ST304			"Edit" with pinch wheel in "Stop" pos.
A03-A11	S1	2-position switch	**Timing variator**/Synchronizer	"Timing var.": speed variation ("Play var.") by means of the keyboard pot. or by the synchronizer
A04-A19	ST3	Bridge	ST3 or ST4/*ST3 ou ST4* Ex -factory : ST 3	Standard sensitivity of the servo control wheel on keyboard
	ST4			Twofold increased sensitivity of "servo" control
A04-A19	ST5	Bridge	Ex - factory : with ST 5	Limits the effect of the servo wheel rotation speed
A20	S1a/b	2-position switch	**Stereo**/Mixed	External switch "Channel" allows to select "stereo or mixed" according to the setting of S1a/b
A16	ST1	Bridge	NTA–S/NTA–M: with bridge NTA–2: no bridge	

6.2 Location of keyboard information in the serial bus

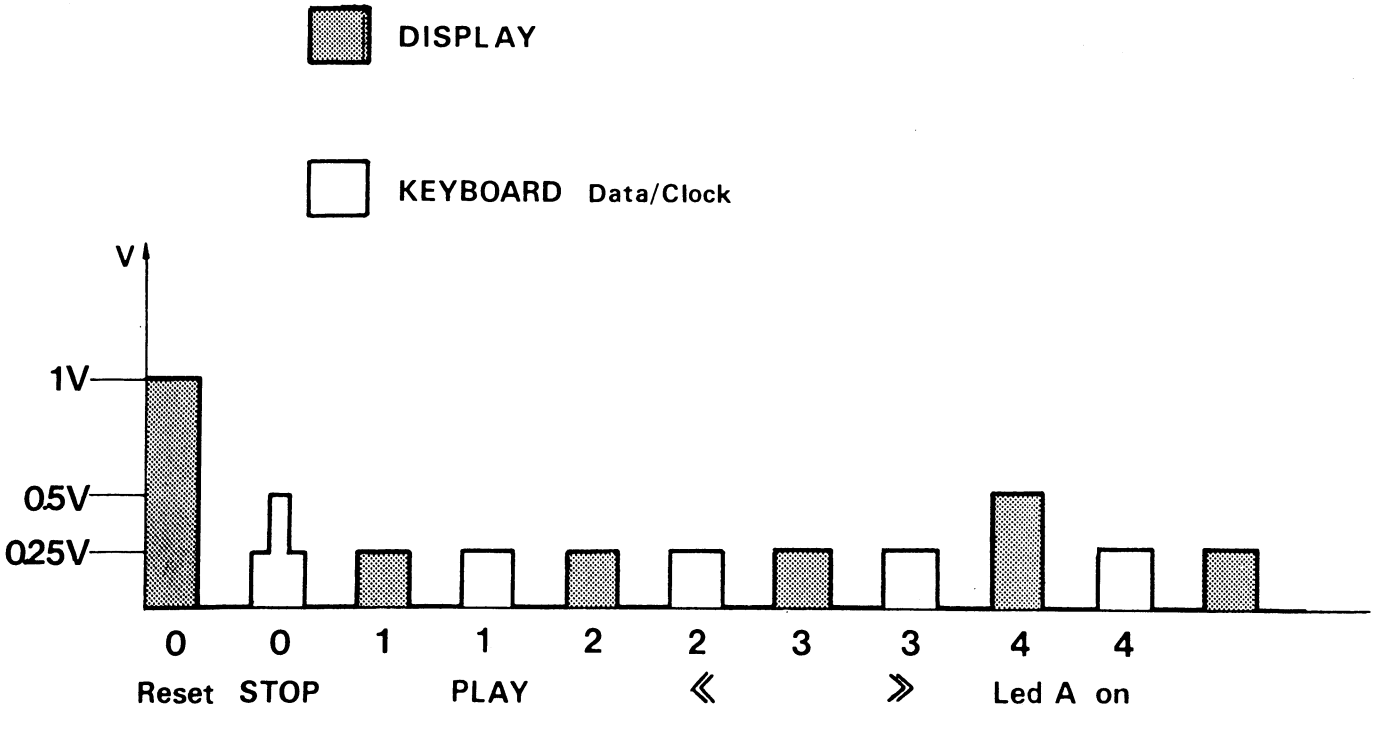
Refer also to 3.2.1.

See explanations given under section 3.2

Pos.	Function	Pos.	Function	Pos.	Function	Pos.	Function
0	stop	16	Pause	32	Ready 1	48	Ready 3
1	play	17	Go to Ø	33	Safe 1	49	Safe 3
2	«	18	Modify	34	Sync 1	50	Sync 3
3	»	19	Reset counter	35	Repro 1	51	Repro 3
4	Record	20	Shift	36	Input 1	52	Input 3
5		21	–	37	Off 1	53	Off 3
6	Listen TC	22	–	38	–	54	–
7		23	–	39	–	55	–
8	Edit free	24	–	40	Ready 2	56	Ready 4
9	Edit servo	25	Skip	41	Safe 2	57	Safe 4
10	Edit	26	Skip	42	Sync 2	58	Sync 4
11	Edit	27	Skip	43	Repro 2	59	Repro 4
12	Load	28	Skip	44	Input 2	60	Input 4
13	Load	29	Skip	45	Off 2	61	Off 4
14	Load	30	Skip	46	–	62	–
15	Cut	31	Dump	47	–	63	–

NOTE: – Positions no. 48 to 63 are provided for a future 4_track machine
– Positions from no. 64 to 127 are not yet used.

Drawing refered to 6.1 and 6.2:



Location of display information in the serial bus

Position of "Display" indications in the serial bus information.

0	–		16	Rec 4		32	Safe 4		48	Repro 4		64	Power close	80	Sp.2	96	–		112	–	
1	–		17	Ready 4		33	Sync 4		49	Input 4		65	Power out	81	TC present	97	–		113	–	
2	–		18	Rec 1		34	Rec 2		50	Rec 3		66	I lock close	82	Mono	98	–		114	–	
3	–		19	Ready 1		35	Ready 2		51	Ready 3		67	I lock out	83	Stop	99	–		115	–	
4	A		20	Safe 1		36	Safe 2		52	Safe 3		68	TT close	84	Play	100	–		116	–	
5	B		21	Sync 1		37	Sync 2		53	Sync 3		69	TT out	85		101	–		117	–	
6	C		22	Repro 1		38	Repro 2		54	Repro 3		70	(sp. 1 close)	86		102	–		118	–	
7	D		23	Input 1		39	Input 2		55	Input 3		71	(sp. 1 out)	87	Record	103	–		119	–	
8	a		24	a		40	a		56	a		72	a	88	a	104	a		120	a	
9	b		25	b		41	b		57	b		73	b	89	b	105	b		121	b	
10	c		26	c		42	c		58	c		74	c	90	c	106	c		122	c	
11	d	FRAMES	27	d	FRAMES	43	d	SECONDS	59	d	SECONDS	75	d	91	d	107	d	HOURS	123	d	HOURS
12	e		28	e		44	e		60	e		76	e	92	e	108	e		124	e	
13	f		29	f		45	f		61	f		77	f	93	f	109	f		125	f	
14	g		30	g		46	g		62	g		78	g	94	g	110	g		126	g	
15	DP		31	DP		47	DP		63	DP		79	DP	95	DP	111	DP		127	DP	

NOTE: – a, b, c, e, f, g and DP correspond to the segments and decimal point actived on the "HH MM SS FF" display.
– functions followed by number 3 or 4 are provided for a future 4– track machine.

6.3 Binary code on REMOTE CONTROL socket

Remote control parallel binary Code (pins D1 to D6 and shift on REMOTE CONTROL socket)

See explanations given under chapter 3.2

	Binary Code D6 D5 D4 D3 D2 D1	Direct Functions		Binary Code D6 D5 D4 D3 D2 D1	Audio Functions		Binary Code D6 D5 D4 D3 D2 D1	Shift Functions
0	0 0 0 0 0 0	Stop	32	1 0 0 0 0 0	Ready 1	0	0 0 0 0 0 0	Park
1	0 0 0 0 0 1	Play	33	1 0 0 0 0 1	Safe 1	1	0 0 0 0 0 1	Play variable
2	0 0 0 0 1 0	≪	34	1 0 0 0 1 0	Sync. 1	2	0 0 0 0 1 0	Go to leader
3	0 0 0 0 1 1	≫	35	1 0 0 0 1 1	Repro 1	3	0 0 0 0 1 1	Spooling
4	0 0 0 1 0 0	Record	36	1 0 0 1 0 0	Input 1	4	0 0 0 1 0 0	(Record)
5	0 0 0 1 0 1	---	37	1 0 0 1 0 1	Off 1	5	0 0 0 1 0 1	---
6	0 0 0 1 1 0	Listen TC	38	1 0 0 1 1 0	---	6	0 0 0 1 1 0	---
7	0 0 0 1 1 1	---	39	1 0 0 1 1 1	---	7	0 0 0 1 1 1	---
		Permanent Editing function			Audio Functions			Shift Functions
8	0 0 1 0 0 0	Edit free	40	1 0 1 0 0 0	Ready 2	8	0 0 1 0 0 0	Lock slow
9	0 0 1 0 0 1	Edit servo	41	1 0 1 0 0 1	Safe 2	9	0 0 1 0 0 1	Lock fast
10	0 0 1 0 1 0	Edit←	42	1 0 1 0 1 0	Sync. 2	10	0 0 1 0 1 0	Cue 2
11	0 0 1 0 1 1	Edit →	43	1 0 1 0 1 1	Repro 2	11	0 0 1 0 1 1	Cue 1
12	0 0 1 1 0 0	Load↔	44	1 0 1 1 0 0	Input 2	12	0 0 1 1 0 0	Disp to/ub
13	0 0 1 1 0 1	Load ←	45	1 0 1 1 0 1	Off 2	13	0 0 1 1 0 1	Disp offset
14	0 0 1 1 1 0	Load →	46	1 0 1 1 1 0	---	14	0 0 1 1 1 0	Disp delta
15	0 0 1 1 1 1	Cut	47	1 0 1 1 1 1	---	15	0 0 1 1 1 1	Lock incr.
		Counter function			Audio Functions			Shift Functions
16	0 1 0 0 0 0	Pause	48	1 1 0 0 0 0	Ready 3	16	0 1 0 0 0 0	Lock time fast
17	0 1 0 0 0 1	Go to ⊘	49	1 1 0 0 0 1	Safe 3	17	0 1 0 0 0 1	Locator
18	0 1 0 0 1 0	Modify	50	1 1 0 0 1 0	Sync 3	18	0 1 0 0 1 0	Num / execute
19	0 1 0 0 1 1	Reset counter	51	1 1 0 0 1 1	Repro 3	19	0 1 0 0 1 1	Reset display
20	0 1 0 1 0 0	Schift	52	1 1 0 1 0 0	Input 3	20	0 1 0 1 0 0	---
21	0 1 0 1 0 1	---	53	1 1 0 1 0 1	Off 3	21	0 1 0 1 0 1	---
22	0 1 0 1 1 0	---	54	1 1 0 1 1 0	---	22	0 1 0 1 1 0	---
23	0 1 0 1 1 1	---	55	1 1 0 1 1 1	---	23	0 1 0 1 1 1	---
		Momentary functions			Audio Functions			Shift Functions
24	0 1 1 0 0 0	(*)	56	1 1 1 0 0 0	Ready 4	24	0 1 1 0 0 0	---
25	0 1 1 0 0 1	Skip ⇉	57	1 1 1 0 0 1	Safe 4	25	0 1 1 0 0 1	Store or set
26	0 1 1 0 1 0	Skip ⇇	58	1 1 1 0 1 0	Sync 4	26	0 1 1 0 1 0	Recall
27	0 1 1 0 1 1	Skip ←	59	1 1 1 0 1 1	Repro 4	27	0 1 1 0 1 1	Left
28	0 1 1 1 0 0	Skip →	60	1 1 1 1 0 0	Input 4	28	0 1 1 1 0 0	Right
29	0 1 1 1 0 1	Skip ⇆	61	1 1 1 1 0 1	Off 4	29	0 1 1 1 0 1	Up
30	0 1 1 1 1 0	Skip ⇶	62	1 1 1 1 1 0	---	30	0 1 1 1 1 0	Down
31	0 1 1 1 1 1	Dump	63	1 1 1 1 1 1	---	31	0 1 1 1 1 1	Time offset

*Disable mom. function used with remote control to disable a momentary function (same effect as when relaeasing a button on the keyboard.).

6.4 Spare parts list

Article No	DESCRIPTION
	BOX & TAPE DECK
71 08450 000	Lid , plexi window, complete, with metallic frame
71 08416 000	Hinge, tape-deck hinge on box side
	Box
71 09212 000	Coupler for Nagra TA on the TMU moving carriage
30 01054 136	Screw, slotted cheese head, M5 x 6
07 08422 000	Nut, M5 headed nut
01 15200 155	Circuit board guide
01 09200 162	Circuit board guide for logic control board
01 09200 006	Support, left, for circuit board guides
01 09200 007	Support, right, for circuit board guides
01 09200 008	Panel, front quick-release panel
01 09200 063	Shock absorber for front panel
01 09200 042	Window for front panel
30 01022 436	Screw, slotted cheese head
38 40026 104	Fastener Camlock, receptacle , L212-12N
38 40026 102	Fastener Camlock, touth holding ring, 2600-LW
38 40026 007	Fastener Camlock, locking shaft with slotted head No 7,26S38-7
30 03022 636	Screw, slotted countersunk head M2 x 6
32 01002 036	Nut hex M2 x 0.8 D
23 09305 002	Potentiometer , 2 x 25 kOhms logarithmic for loudspeakers option
01 21100 006	Washer, Mylar, 3.25/9.5 x 0.25
22 09200 046	Printed panel for monitoring speakers option
30 21039 814	Set screw, Allen with flat end, M3 x 3
01 15200 047	Knob, flat D = 3.20
40 45515 011	Rotary switch 2 x 6 Jeanrenaud RBP12F, no shorting
01 09050 034	Washer, Mylar, 3.15/5.00 x 0.25
01 09200 049	Stop ring, D = 3.10
01 09200 047	Switch shaft for monitoring speakers option
01 06510 009	Bearing for switch shaft
40 45720 220	Switch Nikkai E-2022 /S
01 04510 026	Nut, hex, M12 x 1 for Nikkai switch
01 06510 029	Support, left, for Nikkai switch
40 22502 000	Jack socket, stereo headphones 1/4"

Article No.	DESCRIPTION
01 06510 007	Nut for headhpones jack socket
71 08416 000	Hinge, tape-deck hinge on box side
01 09200 010	Panel, rear quick-release panel
38 40026 012	Fastener Camlock, locking shaft with slotted head No 12, 26F38-12
40 24301 000	Socket, Tuchel female 5-pole
01 04500 012	Nut M18 x 0.75
01 06510 033	Soldering tag, D = 18.1, 3 legs
40 24302 000	Socket, Tuchel male, 5-pole
40 26603 100	Socket, Neutrik female, 3-pole, NC3FD-V
40 26603 110	Socket, Neutrik male, 3-pole, NC3MD-V
40 25025 400	Connector female, 25-pole, DBSP-B25S Cannon
40 25009 400	Connector female, 9-pole,DESP-B9S Cannon
	Tape deck
71 09815 000	Tape cutter
71 08112 000	Catch assembly for tape-desk
71 08114 000	Ring for tape-deck catch assembly
01 08100 070	Screw, locking screw
01 09050 008	Shielding
01 08400 008	Stop bar for tape-deck
01 09050 033	Sprindle for the chassis stop bar
	Head Assembly
71 09140 000	Guide , fixed
01 09155 004	Screw, M3 x 5 special cheese head
30 01033 236	Screw, slotted cheese head M2 5 x 8
01 09155 006	Nut, M2.5 headed nut of rotating guide
30 01022 436	Screw, slotted cheese head M2 x 4
01 09155 009	Nut, M3 special fixing nur for erase head and tape tension transducer
33 11008 800	Spring washer for M5, 5.2/10 x 0.25 , DIN 2093-C
01 09155 007	Guide sleeve for head adjustment drum
30 21039 927	Set screw, Allen with flat end M3 x 4
01 09155 002	Ground plate
01 08100 073	Bung in head-block
01 09155 005	Head adjustment hex drive pinion
33 55005 044	Ring, "Seeger" holding ring for shaft D = 5
01 09155 008	Nut M3 special head nut for playback, record and time code heads
30 01022 736	Screw, slotted cheese head M2 x 8
01 08310 006	Nut M2 (to stick) for head-block bracket
01 04260 025	Contact , female

Article No.	DESCRIPTION
01 08100 072	Insulator for female contacts
01 08360 013	Insulator, half insulator for tape tension transducer contacts
01 08310 007	Insulator plate 0.3 x 11.5/14.0
30 01022 436	Screw, slotted cheese head M2 x 4
30 01022 936	Screw slotted cheese head M2 x 12
32 01002 036	Nut, hex M2 x 0.8 D
33 10002 000	Washer, Schnorr safety for M2
71 08235 000	Rotating guide, central
81 08831 100	Photo-transistor with connection wires
71 09135 000	Rotating guide-Dummy head
71 09180 000	Tape tension transducer, complete
01 08100 074	Drum for head adjustement
01 08310 004	Braket of head harness
01 09310 005	Bracket of tape tension transducer harness
01 09155 018	Base plate for erase head
01 08360 013	Insulator , half insulator for tape tension transducer contacts
01 09155 030	Insulator plate 0.3 x 7.50/14.0
01 09155 020	Azimuth disc, thickness 1.24 mm
01 09155 021	Azimuth disc, thickness 1.27 mm
01 09155 022	Azimuth disc, thickness 1.30 mm
01 09155 023	Azimuth disc, thickness 1.33 mm
01 09155 024	Azimuth disc, thickness 1.36 mm
01 09155 025	Azimuth disc, thickness 1.39 mm
01 09155 026	Azimuth disc, thickness 1.42 mm
01 09155 027	Azimuth disc, thickness 1.45 mm
01 09155 028	Azimuth disc, thickness 1.48 mm
01 09155 029	Azimuth disc, thickness 1.50 mm
01 09156 007	Time code head height adjustment cam, thickness 0.90 mm
01 09156 008	Time code head height adjustment cam, thickness 0.95 mm
01 09156 009	Time code head height adjustment cam, thickness 1.00 mm
0 25025 000	Socket, male 25-pole DB-25P, Cannon
	Stereo Head
1 09155 000	Head-block stereo (2.75 mm) TAT-S; full track erasing
1 06211 000	Recording head, large tracks
1 06216 100	Playback head, large tracks
1 09174 000	Full track erase head
	Two Track Head
1 09157 000	Two track head-block (2 mm) TAT-B; separate erasing
1 06210 000	Recording head, small tracks
1 06215 100	Playback head, small tracks
1 09175 000	Two track erase head (separate erasing)

Article No.	DESCRIPTION
	Two Track and Time Code Head
71 09156 000	Two track head block (2 mm) + Time Code TAT-BTC, separate erasing
71 09170 000	Time Code recording/playback head
71 09176 100	Two-track audio "ON LINE" erase head
71 09177 000	Time code track erase head
	Pinch-wheel assembly
71 09112 100	Pinch-wheel assembly, complete
01 09112 022	Schaft, pinch-wheel eccentric shaft
30 01022 436	Screw, slotted cheese head M2 x 4
01 09112 021	Cap, pinch-wheel cap
33 13072 020	Spring washer K624
30 20022 114	Set screw, slotted with camfered end M2 x 2
30 21139 827	Set screw, Allen with cone end, M3 x 3
25 14650 110	Compression spring 1.6/2.2 x 6
01 09112 003	Screw , pinch-wheel adjustment M7 x 0.75
25 14007 007	Compression spring 4.2/5.4 x 15
25 09112 017	Compression spring 3.9/5.4 x 13.0
71 09108 100	Shielding assembly for magnetic heads
07 09115 100	Pinch-wheel pulley, complete
	Capstan
71 09066 000	Shaft, capstan motor shaft
71 09150 000	Tachometric head
71 08145 000	Capstan motor
37 70401 301	Ball bearing 4/13 x 5, 624 ZZ, high precision
	Reel-holders
71 09105 000	Brake rod, short
71 09106 000	Brake-rod, long
71 08165 000	Reel motor
37 70481 271	Ball bearing 0.187 / 0.5 x 0.196"
37 70601 901	Ball bearing 6/19 x 6 , 626-ZZ
	Reel-holder plate
01 08160 004	Wheel, toothed wheel of outer reel-holder
38 01061 500	Drive bels, cogged (150 cogs), 0.08" - 1/4"
33 51003 044	Clip, elastic Benzing for unsplined shaft D1 = 3.0
30 01032 936	Screw, slotted cheese head, M2.5 x 4

Article No.	DESCRIPTION
01 08160 027	Mylar washer
01 22150 024	Mylar washer 4.20/6.00 x 0.12
01 08160 020	Brake actuator fork
37 70601 901	Ball bearing 6/19 x 6, 626-ZZ
01 08160 010	Spacer 6.10/8.50 x 11.0
30 21039 827	Set screw, Allen with flat end M3 x 3
01 08160 009	Spacer 16.5/18.8 x 9.0
33 53019 044	Clip, Benzing (boring D1 = 19)
30 01033 236	Screw slotted cheese head M 2.5 x 8
01 08401 001	Screw cheese head camfered 3 x 8
33 11003 200	Spring washer for M3
01 08160 005	Wheel, toothed wheel of inner reel-holder
33 13102 025	Spring washer, inside indented for 607 bearing
25 08160 007	Shaft, reel-holder shaft
	Cam
71 09113 000	Cam assembly for tape deck
71 09117 000	Lever, cam left lever
71 09118 000	Lever, cam right lever
25 05110 005	Tension spring 4.0/5.0 x 19
33 10003 000	Washer, Schnorr safety for M3
33 11008 400	Spring washer for M3, Schnorr
33 51003 044	Clip, elastic Benzing (for unsplined shaft D1 = 3.0)
56 27200 310	Potentiometer, endless 10 kΩ, 20 % , 1W
25 08100 061	Tension spring 2.0/2.5 x 20.0
32 01004 036	Nut, hex M4 x 0.8 D
33 10004 000	Washer, Schnorr safety for M4
30 01040 136	Screw, slotted cheese head M3 x 6
01 08125 011	Shaft, eccentric adjustment shaft
33 51005 044	Clip, elastic Benzing (for unsplined shaft D1 = 5.0)
01 08100 090	Washer 5.20/12.0 x 0.20
01 09050 028	Guide, tape-deck complete guide
42 67302 000	Soldering tag, D = 5.1, thickness = 0.5, one leg
	Tensiometers
71 09120 000	Bearing, left tension roller
71 09121 000	Bearing, right tension roller
71 09125 000	Clamping system for tension arm assembly

Article No.	DESCRIPTION
25 08205 013	Shaft, tension arm shaft
25 08210 006	Bushing, tension arm shaft bushing
30 21046 927	Set screw, Allen with flat end M4 x 4
30 01022 636	Screw, slotted cheese head M2 x 6
30 01033 036	Screw, slotted cheese head M2.5 x 5
30 21247 127	Set screw, Alen with cup M4 x 6
01 08210 001	Arm, left tension arm
01 08210 005	Contact of left tension arm
01 08215 002	Arm, right tension arm
01 08215 001	Contact of right tension arm
25 08100 054	Tension spring 2.8/3.8 x 46.3
71 08220 000	Tension roller spring, tension adjust
30 01033 136	Screw slotted cheese head M2.5 x 6
57 00112 000	Tube, ferrite 4C1, 4.15/2.00 x 12.2
25 07110 016	Compression spring 3.6/4 x 16
30 01033 036	Screw, slotted cheese head M2.5 x 5
33 10002 500	Washer, Schnorr safety for M2.5
	Rotating guides
71 09142 000	Guide, left outer rotating guides
71 09143 000	Guide, right outer rotating guides
71 09145 000	Guide, right inner rotating guides
07 09137 000	Bearing housing , upper , of rotating guides
07 09138 000	Bearing housing , lower , of rotating guides
01 08225 005	Washer 15.0/22.5 x 1.2
30 01022 436	Screw, slotted cheese head M2 x 4
30 01022 736	Screw, slotted cheese Head M2 x 8
30 20032 814	Set screw, slotted with camfered end M2.5 x 3
	Counter rotating guide
71 09133 000	Guide, counter rotating guide
07 09137 000	Upper bearing housing
07 09138 000	Lower bearing housing
01 09145 002	Cup
37 50002 036	Steel ball, D = 2 mm
30 01022 436	Screw M2 x 4, cup fixing
50 61709 201	Infrared phototransitor, MRD 701
51 66809 291	Infrared LED,MLED 71
	Fitting the guides (to the tape-deck)
30 01022 736	Screw, slotted cheese head M2 x 8
32 01102 036	Nut, hex M2 x 0.5 D
33 10002 000	Washer, Schnorr safety for M2

Article No.	DESCRIPTION
	P.C. boards
91 09250 000	Interconnection circuit for heads
91 09255 000	Interconnection circuit for high frequency encoder
	Head assembly
91 09266 000	Circuit for two track Head Assembly
91 09267 000	Circuit for two track and time code Head Assembly
	Tensiometers
91 09285 000	Tension arm circuit, left
91 09286 000	Tension arm circuit, right
92 07951 000	Coil for differential transformer
01 08520 002	Bracket , differential transformer bracket on tension arm circuit
30 01032 936	Screw, slotted cheese head M2.5 x 4
	Box
91 09305 000	Loudspeaker amplifier circuit for TAHP
91 09321 000	Interconnection circuit in box
	Line input & output
91 09326 000	Line input/output circuit and transformers
58 82035 550	Microphone transformer TR/BV 352-200-025
	Speed stab. & servo-motor
91 09340 000	Tape speed stabilizer and servo-motors circuit
40 45781 235	Switch Nikkai A-12JH, horizontal adjustment
41 43121 353	Relay NF4-12 V National
56 36420 320	Resistor, trimmer 20 KOhms, 10 % , 1/2W , horizontal adjustment
56 36420 150	Resistor, trimmer 500 Ohms, 10 % , 1/2W , horizontal adjustment
	Control logic
91 09345 000	Control logic circuit
56 36420 210	Resistor , trimmer 1 kOhms, 10 % , 1/2 W, horizontal adjustment
56 36420 310	Resistor , trimmer 10 kOhms, 10 % , 1/2 W, horizontal adjustment
40 35501 000	Side switch, miniature SPDT slide switch INCA2
40 35504 010	Dual-in-line (DIL) switches , 4-station assembly
40 35508 010	Dual-in-line (DIL) switches, 8-station assembly
40 45781 335	Switch Nikkai A-13JH, horizontal,
40 45520 002	Coding switch micro-DIP (BCD 1-2-4-8; 10 positions)
	Tape counter
91 09350 000	Tape counter circuit

Article No.	DESCRIPTION
40 35510 000	Switch, rotary SP type MD
58 43032 458	Crystal, frequency = 2.4576 MHz ± 50 ppm
56 36360 110	Resistor, trimmer 100E, 10 % , 1/2 W, vertical adjustment
	Editing servo-control TASC
91 09353 000	Servo-editing circuit for TASC
	Audio recording & playback
91 09365 000	Audio record and reproduce circuit
56 36420 310	Resistor, trimmer 10 KOhms, 10 %, 1/2 W , horizontal adjustment
56 36420 220	Resistor, trimmer 2 KOhms, 10 %, 1/2 W , horizontal adjustment
56 36360 310	Resistor, trimmer 10 KOhms, 10 %, 1/2 W , vertical adjustment
92 09452 000	Erase transformer
92 09453 000	Bias transformer
56 36420 410	Resistor, trimmer 100 KOhms, 10 %, 1/2 W , horizontal adjustment
	Modulometer
91 09368 000	Modulometer circuit
40 45781 245	Switch, Nikkai A-12JV, vertical
56 36420 250	Resistor, trimmer 5 KOhms, 10 % , 1/2 W, horizontal adjustment
	Record precalibration TACAL
70 09370 000	Recording calibration circuit TACAL, factory-adjusted for any specified combination of speed and equalization standard
56 36420 350	Resistor, trimmer 50 kOhms, 10 %, 1/2 W, horizontal adjustment
56 36420 310	Resistor, trimmer 10 KOhms, 10 %, 1/2 W, horizontal adjustment
56 36420 320	Resistor, trimmer 20 KOhms, 10 %, 1/2 W, horizontal adjustment
56 36420 410	Resistor, trimmer 100 KOhms, 10 %, 1/2 W, horizontal adjustment
	Playback via record head, TASIM
70 09372 000	Circuit TASIM for playback via record head (one TASIM per channel)
56 36420 410	Resistor, trimmer 100KOhms, 10 %, 1/2 W, horizontal adjustment
	Keyboard TACA and TACO
	A) Lower Board
91 09425 000	Lower circuit
56 36360 220	Resistor, trimmer 2 kOhms, 10 %, 1/2 W, vertical adjustment
	B) Upper Board
91 09430 000	Upper circuit for non time code keyboard (TACA-SM and TACA-BM)
91 09431 000	Upper circuit for time code keyboard (TACA-TC and TACO-P)
23 09430 010	Potentiometer, linear 10 kOhms, modified
40 40040 740	Switch without LED SRU
40 40040 752	Push button, black, without LED, SRK

Article No.	DESCRIPTION
40 40040 753	Push button, grey, without LED, SRK
40 40040 754	Push button, green, without LED, SRK
40 40040 887	Push button, red, without LED, SRK
	C) Editing servo-control TASC
71 09225 000	Servo-control unit
01 08430 003	Special screw for connector cup
01 08435 002	Connector cup
01 09230 031	Support plate
01 09230 032	Ring
01 09230 033	Knob
01 09230 039	Half-ring
30 01033 236	Screw M2.5 x 8 for knob
30 03080 236	Screw M3 x 8 for half-rings
	Simplified Keyboard TADESK
91 09715 000	Central processing unit circuit
91 09716 000	Keyboard circuit
58 43031 992	Crystal, frequency = 1.9920 MHz
41 10112 060	Lamp 12V, 60 mA, Bi-pin
41 25455 837	Key
41 29011.906	Lamp extractor
	Miniature simplified Keyboard TASKR
91 09725 000	Central processing unit circuit
91 09726 000	Keyboard Circuit
40 35508 010	Dual-in-line (DIL) switches, 8-station assembly
40 40040 756	Switch with red LED, SRUL
40 45782 267	Slide switch DP DT, ON-ON , horizontal slide
	Tape - deck interconnection
91 09260 100	Tape-deck interconnection circuit
40 45516 011	Rotary switch 3 x 4 Jeanrenaud RBP12F non-shorting
	Mains power supply TAPS
91 09300 000	Power supply circuit for TAPS
92 09460 000	Transformer, power supply for TAPS
40 24505 000	Socket, power supply 2-pole + ground, plastic
40 35414 622	Switch, toggle APR 4146 A-22
41 21501 000	Lamp holder LS9
41 31502 000	Lens, red for control light LS9
41 61303 010	Voltage selector SWP
41 71304 000	Fuse holder "FEU" without cup , 5 x 20 or 6 x 32
41 71528 000	Lamp 28 V 40 mA

Article No.	DESCRIPTION
41 71304 061	Cup FEK 6 x 32 for fuse holder "FEU"
52 50288 339	Capacitor, Aluminium 3300 µF , -10 + 50 % , 25 V
52 56288 689	Capacitor, Aluminium 6800 µF , -10 + 30 % , 25 V
52 56348 479	Capacitor, Aluminium 4700 µF , -10 + 30 % , 40 V
52 60348 227	Capacitor, Aluminium 2200 µF , -10 + 50 % , 40 V
55 10201 820	Resistor NTC 82 Ohms, 20 %
40 20422 052	Connector, female, right angle, 2 x 5 poles
01 09300 003	Bracket of internal mains power supply circuit
41 89620 000	Temperature sensing switch UCHYA UP62
58 30221 000	Insulator, mica , for transistor 199-04/TO-220
58 44732 048	Crystal : frequency = 2.0480 MHz
	Special tools and service materials
70 91550 000	TA-PC1, extender circuit board for audio circuit
70 91552 000	TA-PC3,extender circuit board for logic, speed stabilizer and counter circuits
70 91554 000	TA-PTC, extender circuit board for time code circuit
40 20420.080	Isolated jumper 2.54 mm
01 90901 044	Gauge with base plate fortape transport height adjustment
01 90901 043	Gauge with base plate for Nagra TI/TA head adjustment
01 90901 041	Gauge (5 degrees), adjustment of tension arm assembly
01 90901 042	Gauge (10 degrees), adjustement of tension arm assembly
39 15550 100	Force gauge Correx 0-100G
01 90901 023	Pin for capstan motor shaft locking
01 90901 050	Arm for Capstan motor shaft torque adjustment
-- ----- ---	Modified 8 mm spanner for capstan motor shaft torque adjustment
39 15560 030	Dynamometer 0.3 kg
01 90901 004	Wrench for the spreader inside motors
01 90901 072	Tool, for location of motor magnets
01 90950 009	Ring for magnetic shorting of motor rotor
01 90901 040	Wrench for potentiometer nut for TACAand TACO keyboards
71 09540 000	Gauge for tachometric head centering, set of 4
01 90901 069	Gauge, positining gauge for time code erase head, for Nagra TA-TC
01 90901 068	Gauge, positining gauge for neopilot playback head (TA-ONP), for Nagra TA-TC
3915371 010	Pliers for large circlips Benzing SP220
39 15512 130	Feeler gauge set (13 blades)
39 15150 100	Watchmaker screwdriver 1.0 mm black
39 15150 140	Watchmaker screwdriver 1.4 mm, grey
39 15150 250	Watchmaker screwdriver 2.5 mm, blue
39 15186 020	Screwdriver for adjustment potentiometers
25 90900 079	Allen wrenches, right angle, set of 4
-- ----- ---	Long screwdriwer for potentiometers adjustment
-- ----- ---	Industrial alcohol (ethyl alcohol)
71 04056 000	Grease tube,FGP, for Nagra machines

Article No.	DESCRIPTION
71 04058 000	Oil Isoflex PDP38, 50 ccm
39 80210 222	Loctite 222, weak glue for threaded parts (50 ccm)
39 80210 601	Loctite 601, strong glue for adjusted parts (50 ccm)
39 80221 106	Glue, epoxy resin with hardener, Araldite AW 106 (2 tubes of 20 ccm)
	Fuses/Lamps
41 81321 100	Fuse, 1 A, 6 x 32 , FST slow-blow
41 81321 200	Fuse, 2 A, 6 x 32 , FST slow-blow
41 11528 000	Lamp 28 V, 40 mA, MIDGET TI 3/4
41 81551 250	Fuse 2.5 A, 2.4 X 7, with connection wires, fast-blow
41 81551 100	Fuse 1A, 2.4 x 7, with connection wires , fast blow
41 81550 250	Fuse 250 mA, 2.4 X 7, with connection wires, fast-blow
41 81550 125	Fuse 125 mA, 2.4 x 7, with connection wires, fast-blow
41 81611 250	Fuse 2.5 A, TR5-T, with connection wires , slow blow

CALIBRATION MANUAL
AUDIO ELECTRONICS 4

NAGRA T-AUDIO

RECORD / PLAYBACK CHAIN CALIBRATION

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June 1988

MEASURING INSTRUMENTS REQUIRED

- Low frequency, low distortion, stabilized output generator 30 Hz-60 kHz
- Frequency meter
- Electronic voltmeter
- Analyzer with a third octave filters set (e.g. Brüel & Kjaer 2606/2608 and 1614/1615 types)
- Dual trace oscilloscope
- Extension boards:
  Audio A01: 91 91 550 000

  Logic A02: 91 91 552 000
- Test tapes:
  - azimuth tape BA-19, code no 91735
  - set of 3 multifrequency tapes:
    BM-IEC, code no 91700 (CCIR standard)/BM-NAB,
    code no 91701 (NAB Standard)

AUDIO CALIBRATION

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GENERAL INFORMATION

In order to avoid damage to any of the circuits, be sure to switch off the recorder before removing or replacing any of the printed circuit boards.
To get access to the main circuit boards of the T-Audio time code remove the front panel of the machine by turning the two screws 90°.

The circuit boards are located in the machine as follows:

A01	Audio channel 1
A01	Audio channel 2
A02	Main control logic
A03	Tape transport speed stabilizer
A05	Time code and servo control circuits

DIRECT CHAIN CALIBRATION.

INPUT SENSITIVITY.

The input sensitivity of the T-Audio is changed by moving a bridge located on each of the two A 01 audio circuits. They are located on A 01 A2 in the centre of the rear of the card to the right of the two transformers. These jumpers have 6 possible positions.

Bridge pos.	corresponding input sensitivity	
1	4.4V for 0 dB (+15 dBm)	
2	3.1V for 0 dB (+12 dBm)	
3	1.55V for 0 dB (+15 dBm)	Diagram
4	1.25V for 0 dB (+15 dBm)	
5	0.775V for 0 dB (+15 dBm)	
without	0.390V for 0 dB (+15 dBm)	

Feed the line inputs with a 1 kHz signal at the desired input level. Connect an oscilloscope to TP3 of A01-A2 (or the audio output monitoring connector BJ-4 pins 5 and 21, on the rear panel of the machine). Position the jumper in the desired position and then check the level on TP2 of A01-A9. Check the frequency response is within ±0.5 dB from 30 Hz to 20 kHz. Repeat this for the other channel.

NOTE: If it is not otherwise specified when ordering the machine, the input sensitivity will be factory set to 1.55V (jumper in position 3)

OUTPUT LEVEL

Unless otherwise specified when ordering the machine the output level will be factory set at 4.4V for 0 dB at 1 kHz. This can be changed in the same way as the input sensitivity by altering the position of the jumper on the output amplifier.
There are two small jumpers the first may be in one of three positions (ST 1, 2 or 3) the other, ST 9 can be in one of two positions.
Connect a 0 dB signal to the line input and select the desired output voltage bridge position.

Jumper position	Output level	
1	0.775 V	
2	1.25 V	DIAGRAM HERE !
3	1.55 V	

Changing the position of ST 9 gives 4.4 V

NOTE: A solder bridge is used for this selection on machines carrying serial numbers up 0900190.

FINE LEVEL ADJUSTMENT

This must be done if the above mentioned jumper has been moved. Select INPUT on the channel status matrix of the keyboard for both audio channels. Load the line outputs with a 5 kOhm load and inject a signal of 0 dB at the line inputs. Monitor the line outputs and adjust RP 1 on A01-A9 for the desired level.

OUTPUT LEVEL ON BJ 4 (AUDIO MONITORING)

Connect an AC voltmeter onto pin 7 (channel 1) or pin 18 (channel 2) Select INPUT on the keyboard and check that the output is present, and that when switching the keyboard to the REPRO position the signal disappears.

MAXIMUM OUTPUT LEVEL

Connect to the line inputs a low distortion sinal generator at 30 Hz to give a line output of 12.3V. Load the line output with 200 Ohms and using RP 2 on A01-A9 adjust for minimum distortion.(MAX 0.1%).
Increase the input level so as to have 1% distortion on the line output and check that the line output is >13V.

Change the line input to 1 kHz at 1.55V and loaded with 5 kOhms. Increase this level so as to give 1% distortion on the line output and then check the line output is >18V.

FREQUENCY RESPONSE

Inject a 1 kHz signal to the line inputs to obtain 775mv on the monitoring output connector BJ4 (pin 21 for channel 1 and 5 for channel 2). Sweep the frequency between 30 Hz and 20 kHz and check the output is 775 mV $\pm$ 0.3 dB. Repeat this measuring on the line output loaded with 5 kOhms and that the output is 4.4V $\pm$ 0.5 dB. Finally load the output with a 200 Ohm load and repeat the sweep and verify that the output remains 4.4V with tolerance between +0.5 dB -1.5 dB.

SIGNAL TO NOISE RATIO

Using 0dB=4.4V at the line output as a reference short circuit the line inputs. Measure the noise ASA A weighted to be => 91 dB and linear => 84 dB.

PEAK METER

ADJUSTMENT OF THE MODULOMETER DISPLAY.

Apply a 1 kHz 1.55V + 0.2 dB (1.59 V) signal to the line inputs of the machine and then adjust RP2 on A01-A10 so that the 8th LED in the display just starts to turn OFF. Now check that the corresponding LED is alight in the following positions: -12 dB, -6 dB and +6 dB (± 1dB). Finally check the frequency response of the display from 30 Hz to 20 kHz is ± 1dB.

CROSSTALK

Take 0 dB on the line output loaded with 5 kOhms as reference. With a signal on channel 1 only and channel 2 connected to ground, measure with a third octave filter the residue of signal on channel 2 at 1 kHz is => 90 dB and at 10 kHz is =>73 dB. Swap the channels over and repeat the test.

NOTE: There is a difference of about 10 dB when measuring channel 1 to 2 as opposed to channel 2 to 1 due to the line "MONO REPRODUCE".

COMMON MODE REJECTION

This measurement controls the symmetry of the line inputs. Firstly short circuit the HI and LOW line inputs, and inject a signal at 10 kHz between the ground and the short circuit HI/LOW and adjust C1 on A01-A9a to obtain a minimum line output signal using a 1/3 octave filter.

10 kHz rejection => 55 dB
1 kHz rejection => 65 dB
60 Hz rejection => 75 dB

PLAYBACK CHAIN

Configuration of the T-Audio:

INPUT	REPRO	SYNC	SAFE	READY	PLAY	RECORD
	X		X		X	

Firstly check the squaring and height of the playback head, and carefully demagnetize the headblock.

AZIMUTH

Place an azimuth test tape on the machine containing 1 kHz and 10 kHz at 19 cm/s (7 1/2 ips) (BA-19), and connect a dual trace oscilloscope to the line outputs triggered by one channel and switched to the position "CHOP".
Remove the cover of the headblock and then adjust the azimuth of the playback head (furthest right) for the maximum output on both channels. Then adjust finely for accurate phase relationship between the two channels. Check that the maximum difference in level between the two channels at 10 kHz is $\pm$ 1 dB, and that the maximum phase difference between the two channels is $\pm$ 10°

NOTE: Select depending on the desired speed/standard norm the following switches on the main logic circuit A02 for the positions A, B, C and D S 205, S 204, S 203 and S 202 respectively.

PLAYBACK LEVEL

The adjustment of the playback level depends, above all, upon which tape for which each position is to be calibrated. The tables below give all the possibilities, assuming that only one test tape is to be used.

A. Table relating level to a 320 nWb/m tape

RECORDING LEVEL DESIRED	nWb/m	200	250	320	405	510
PLAYBACK LEVEL	Db	+4	+2	0	-2	-4
CORRESPONDING OUTPUT	V	6.97	5.54	4.4	3.5	2.78

B. Table of switch positions, speeds and standards

POSITION	SPEED cm/s	STANDARD	FREQUENCY REFERENCE Hz	LEVEL POT TO ADJUST
0	9.5	NAB/CCIR	250	RP 6
1	19	CCIR	500	RP 7
2	38	CCIR	1000	RP 8
3	76	CCIR	2000	RP 9
4	19	NAB	500	RP 10
5	38	NAB	1000	RP 11
6	38	MASTER	1000	RP 12
7	76	AES	2000	RP 13

Adjust successively the level of each of the required positions for each channel using the following procedure:

lace a 320 nWb/m test tape onto the machine, connect an AC voltmeter to the line output, and adjust the playback level according to table B to the corresponding output listed in table A.

EXAMPLE: For a tape having 405 nWb/m in the 19 cm/s CCIR position, adjust RP 7 to give 3.5 V on the line output.

NOTE: In the event that two tapes containing two different levels need to be set for the same speed and standard, it is the level of the first that must be chosen.

FREQUENCY RESPONSE CURVES

The compensation of head loss is only dependant upon the speed of the tape. Therefore there is only one adjustment for each of the four speeds. To be the most accurate, the adjustment must be done at the most frequently used speed of the machine, with a corresponding multi frequency test tape.

NOTE: In the event that two standards at the same speed are to be adjusted it is the first that must be used for the adjustment. If there is not however enough for the second, then a compromise must be taken between the two.

C. Table of adjustments and tolerances of the response curves.

POS	SPEED CM/S	STANDARD	CONST HF	TIME LF µS	FREQ REF Hz	FREQ ADJ Hz	LEVEL ADJ dB	FREQUENCY RESPONSE Hz	SPEC dB
0	9.5	NAB/CCIR	90	3180	400	10	-0.5	31.5 TO 10 kHz	±1.5
	19	CCIR	70	--	500	16	-0.5	31.5 TO 16 kHz	± 1
2	38	CCIR	35	--	1000	20	-0.5	31.5 TO 20 kHz	± 1
3	76*	CCIR	35	--	2000	20	+5.2	50 TO 20 kHz	± 1*
4	19	NAB	50	3180	500	16	-0.5	31.5 TO 16 kHz	± 1
5	38	NAB	50	3180	1000	20	-0.5	31.5 TO 20 kHz	± 1
6	38	MASTER	13.5	3180	1000	20	-0.5	31.5 TO 20 kHz	± 1
7	76**	AES	17.5	--	2000	20	0	50 TO 20 kHz	± 2
7	76	AES/COPY	17.5	--	2000	60	-1	50 TO 20 kHz	± 2

* The 35u test tape for 76 cm/s does not exist, so use the 38 cm/s tape, in which case the following differences must be taken into account:

FREQ.	1 kHz	2 kHz	8 kHz	16 kHz	20 kHz	24 kHz	
DELTA	0 dB	+0.4 dB	+3.47dB	+ 5dB	+5.26 dB	+5.44 dB	± 1 dB

** For the position AES/COPY be sure that the correct components are fitted to the calibration circuit. Also that the switches are correctly set. For the response adjustments use the 38 cm/s tape and the following procedure:

Place the multifrequency test tape onto the machine, and connect a third octave filter to the line output. Take the reference level following table C, and adjust the third octave filter accordingly. Verify in turn all the frequencies recorded on the tape and adjust the response curve according to the tolerances.

NOTES:

FRINGING EFFECT: During playback of a full track test tape (6.3 mm) using narrower heads (2.0 mm or 2.75 mm), at very low frequencies it picks up the neighboring magnetic field. This causes a gentle lift at frequencies lower that 100 Hz. An acceptable maximum level at 30 Hz is:

+0.5 dB for 2.75 mm heads
+1.0 dB for 2.00 mm heads.

These values must be subtracted from the results in order to see the correct curve.

CONTOUR EFFECT: The profile of the playback heads, as well as their construction, influences the low frequency response. In this case there is a fluctuation in the response curve depending on the speed of the tape. This effect is most significant at 76 cm/s. To improve this, the replay circuitry is fitted with a"T" filter for each speed, to compensate the effect.

3180μs CONSTANT: For the NAB and NAGRAMASTER standards, there is bass attenuation, during replay. This is adjusted during the manufacturing of the circuits, however if necessary it can be adjusted by means of the resistance R 36 on A01-A8.

SIGNAL TO NOISE RATIO.

Firstly, to avoid mains "hum" pickup, be sure to fit the shields to the audio circuits, as well as the headshield in front of the replay head. Put the machine in STOP mode, and connect a voltmeter to the line output, and inject a signal to the line input so as to give 4.4 V on the voltmeter. Then remove the input signal and measure the residual noise according to the following table.

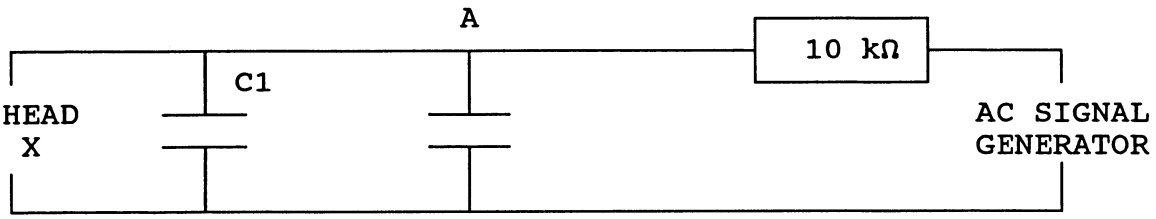
D. PLAYBACK CHAIN NOISE TOLERANCES.

SPEED (CM/S)	ASA A			LINEAR 22 HZ ... KHZ		
	CCIR	NAB	AES/COPY	CCIR(22)	NAB (22)	AES/COPY(80)
76	≥ 82	-	≥ 78	≥ 71	-	≥ 62
38	≥ 81	≥ 79	-	≥ 68	≥ 68	-
19	≥ 75	≥ 75	-	≥ 65	≥ 65	-
9.5	-	≥ 71	-	-	≥ 63.5	-
38 MAST	-		-	-		-

RECORDING CHAIN CALIBRATION

HEAD TUNING

Before the recording calibration can be started, the erase and recording heads must be tuned to their resonant frequency. This only needs to be altered if the heads have been replaced. Switch off the machine, and remove both of the audio circuits. Then for each of the heads to be tuned, connect as follows:



LAYOUT OF HEADBLOCK INTERCONNECTION CIRCUIT.

Connect an oscilloscope via a 10 KΩ resistor to the point A.
While tuning one of the audio erase heads, it is important to short circuit the other head. Connect as shown above the generator via a 10 KΩ resistor onto the capacitor of the head to be tuned. Adjust the value of the capacitor (C1 or C2 for the audio heads and C3 for the time code head) in such a way that the maximum signal level corresponds to the resonant frequency:

f audio = 256 kHz ± 1 kHz
f T.C. = 160 kHz ± 1 kHz

ERASE HEAD TUNING

Configuration of the T-Audio:

INPUT	REPRO	SYNC	SAFE	READY	PLAY	RECORD
				X		X

For each audio channel connect the circuit on an extender card. Place the probe of the oscilloscope on the respective erase head and put the T-Audio into RECORD mode. Correct the tuning of the head by adjusting the core of the coil L1 on A6 and with the capacitor C6 on A6. The signal must be as sinusoidal as possible, with the minimum of switching points according to the figure below. Then adjust RP 1 on A6 so as to have 120 Vpp on the contacts of the erase head.

SINEWAVE FIGURE

NOTE: The erase voltage depends upon the magnetic characteristics of the particular tape being used. For example 3M 256 needs 140 Vpp.

Check that there is no phase difference between the two channels, by means of two probes placed across the headgap of each of the erase heads. The fine tuning of the recording head is done in the same manner, but adjusting the core of the coil L2 on A6 and the probes on the recording head.

FIGURE SHOWING CIRCUIT A6

RECORDING HEAD AZIMUTH

Configuration of the T-Audio:

INPUT	REPRO	SYNC	SAFE	READY	PLAY	RECORD
	X			X		X

Put the desired tape for calibration onto the machine and connect the signal generator to the line inputs, and a dual trace oscilloscope onto the line outputs (in the chop position) and trigger it from one of the audio channels. Adjust the line inputs so as to have 10 kHz at a reference level of -20 dB on the line output.
Put the machine into RECORD and then adjust the azimuth of the recording head to give a maximum level on both channels on the line output. When this is done carefully adjust the azimuth in order to put the two channels in phase with each other. Check that the difference in output level between the two channels is no greater then $\pm$ 1 dB, and that the phase difference is $\leq 15°$.

BIAS ADJUSTMENT.

On the NAGRA T-Audio the bias level is found by the method of "overbiasing". This means that the working point is determined, by adjusting at high frequency, the biasing voltage such that the level recorded on the tape begins to fall off by a certain amount. The table on the following page gives all the necessary information as well as the necessary fall off depending on the speed of the tape.

TABLE OF BIASING FREQUENCIES.

SPEED	FREQUENCY
9.5 cm	3 kHz
19 cm	5 kHz
38 cm	10 kHz
76 cm	20 kHz

TABLE OF TAPES AND THEIR OVERBIAS AND LEVEL
(the overbias values are related to the size of the head gap of the recording head)

TAPE TYPE	THICKNESS µm	OVERBIAS dB	RECORDING LEVEL FOR 0 dB (nwb/m)		
			38 cm/s	19 cm/s	9.5 cm/s
PEM 369	35	-1.5	405	320	250
PEM 468	50	-2	510	405	320
PEM 469	50	-1.5	510	405	320
PER 525					
PER 528	50	-2.5	405	320	250
LGR 50	50	-3	510	405	320
BASF 910	50	-2	510	405	320
BASF 911	50	-2	510	405	320
3M 256	50	-2.5	510	405	320
3M 808	50	-2	510	405	320
AMP 406	50	-1	320	320	320
3M 226	50	-2	510	405	320

The bias adjustment must be done for each of the positions A,B,C and D and also for each channel. There is a general adjustment for the logic circuit A 02 for each of the four positions. It is a bias voltage that is automatically selected when choosing one of the positions. One each audio circuit there is a fine adjustment, to compensate for the difference between the two heads. The potentiometers on the logic circuit "bias ref level" are as follows:

Position A : RP 201 on A02-A14
Position B : RP 202 on A02-A14
Position C : RP 203 on A02-A14
Position D : RP 204 on A02-A14

Connect an AC voltmeter to the line output of channel1 and adjust the line input to give 0 dB -20 dB on the lie output. Lace the required tape and select the desired position. Set the potentiometer RP2 on A6 to its mid position, and put the machine into record. Adjust by means of the "bias ref level" on the logic circuit, for the maximum line output in the "REPRO" position. Take this value as a reference and then increase the bias voltage slowly so as the output level falls off according to the "overbias" value given on the table. Measure the overbias voltage (peak to peak) on the contacts of the head and note this value. Repeat the above for the other channel then adjust finally the bias reference level potentiometer and also both the RP 2 potentiometers so that the heads have the same voltage.
For the positions B, C and D the potentiometers RP2 on A6 MUST NOT be re-adjusted Their difference is solely due to the head.

RECORD REPLAY FREQUENCY RESPONSE

In order to use the maximum of common standard components the T-Audio was designed with separate pre-magnetization cards for specific calibration. These circuits (TACAL) allow the adjustment of head loss compensation and for minimum distortion. They also correct the phase at high frequencies and allow the response curve to be manipulated to the best working position, depending on the particular type of tape being used.
The TACAL-S circuits only allow the compensation of the head loss and to alter the response curve.

TACAL TACAL-S

DRAWING OF EACH

TABLE OF TOLERANCES FOR FREQUENCY RESPONSE CURVES

SPEED cm/s	REF. FREQ. Hz	FREQ. RESPONSE Hz	TOLERANCE dB
38	1000	30 to 20 K	± 1.5
19	500	30 to 15 K	± 2
9.5	250	30 to 8 K	± 2
76	2000	50 to 20 K	± 2
76copy	2000	50 to 60 K	

NOTE: The adjustment of the position 76 cm/s AES COPY is only possible in the position "D". It must be done using the inputs and outputs "COPY" and put the switches "norm/copy" on A6 and A8 are in the "copy" position.

NOTE: Foe TACAL and TACAL-S circuits calibrated to the NAB or NAGRAMASTER standards, it is also possible to adjust the low frequency part of the frequency response curve at 30 Hz by means of R9 on A5.

It is important to carefully clean the heads before each frequency response curve is adjusted, as certain tapes tend to deposit a lot of oxide, which will rapidly affect the HF response.
For each of the positions to be set up, check that the correct TACAL or TACAL-S is in the correct position. This is done in the following manner:
Select the position to be adjusted and place the calibration tape onto the machine and select the relevant audio channel to RECORD. Adjust the input level to -20 dB. Take the reference according to the table "BIASING FREQUENCIES". Adjust on the appropriate TACAL the potentiometer RP 2 on A05 such that the response curve is within the tolerances.

RECORDING LEVEL

For each of the positions to be calibrated the reference must be taken according to the table "BIASING FREQUENCIES". Select INPUT for the corresponding audio channel and then pass into the position REPRO. Adjust the potentiometer RP1 on A5 to get 0 dB on the line output ± 0.5 dB. If the level adjustment is not possible, ie the difference between INPUT and REPRO is too large then the potentiometer RP2 on A4 allows will give more swing for the adjustments.

For the 76 cm/s COPY position the high speed copy inputs and outputs must be used, and the level must be 775 mV IN/OUT.

ANTIDISTORTION ADJUSTMENT (TACAL circuits only)

The signal to noise ratio is essentially dependant upon the characteristics of the tape itself. In saying this it is possible to improve this ratio by influencing the shape of the signal to be recorded in the saturation zone. The idea of the TACAL circuit is to deform the signal to be recorded in such a way as to compensate the beginning of the saturation of the tape. It is also possible to "gain" several dB before saturation. The figure below clearly shows the difference ratio of level and distortion when recording with and without antidistortion.

FIGURE

Carefully demagnetize the heads, and adjust the line input level from 0 to +6 dB. Adjust first of all the level of the second harmonic, by means of RP 5 on A5 at the reference frequency according to the tables "OVERBIAS FREQUENCY" and "TABLE OF TAPES"
The second harmonic must be $\leq 0.5\%$ Now adjust the 3rd harmonic at 160 Hz by means of RP 4 on A5 such that H3 $\leq 1.3\%$ Finally adjust the 3 rd harmonic at 1600 Hz by means of RP 3 on A5 such that H3 $\leq 1.2\%$
Recheck the level at 0 dB and adjust if necessary by means or RP 1 on A5. Recheck in turn the 2 nd and 3 rd harmonic adjustments in turn as they are interdependent. Then proceed in the same manner for all the other positions to be calibrated.

TABLE OF 1/3 OCTAVE FILTERS FOR HARMONIC MEASUREMENTS

FUNDAMENTAL FREQUENCY Hz	160	250	500	1K	1.6K	2K
FILTER FOR H2 Hz	315	500	1K	2K	3.15K	4K
FILTER FOR H3	500	800	1.6K	3.15K	5K	6.3K

NOTE: For machines equipped with the TACAL-S circuits these measurements are not possible. the only possibility is to make the distortion measurements of the tape at 0 dB +4 dB at 1 kHz for all speeds.

$H2 \leq 0.5\%$
$H3 \leq 3\%$

CROSSTALK

Switch the machine to position A (38 or 19 cm/s) and connect the signal generator to the line input of channel 1 only, and connect the input of channel 2 to earth. Adjust the input level to give 0db - 20 dB at 1 kHz. Adjust R 36 on A01-A4 CH1 and CH2 for a minimum crosstalk at 1 kHz. Control the residue of the 1 kHz on the output of channel 2 using a 3 rd octave filter.

FREQUENCY	TRACK WIDTH	
	2 mm	2.75 mm
125 Hz	≥ 40 dB	≥ 37 dB
1 kHz	≥ 50 dB	≥ 50 dB
10 kHz	≥ 40 dB	≥ 40 dB

The same results should be obtained when swapping the channels over.

ERASING

Set the machine to 38 cm/s and connect a signal generator to the line input f= 1.25 kHz. Adjust the input level to MPL (+6 dB) and record a length of tape. Rewind the recorded section and then remove the line input signals and connect the inputs to ground. Set the machine to record again. Then measure the residue of the signal using a 1/3 octave filter referenced to MPL. The residue must be ≥ -82 dB.

SIGNAL TO NOISE RATIO

Connect an AC voltmeter to the line output, and remove the line input signal. measure the noise level in record, being sure that the head and circuit shields are in place.

RECORD REPLAY				
TAPE SPEED	ASA A		LIN 20Hz-20 kHz (LIN 20Hz-80 kHz COPY)	
(CM/S)	CCIR	NAB	CCIR	NAB
76cm/s ref 510 nWb/m	≥ 70	-	≥ 60.5	-
76 AES COPY 510 nWb/m	≥ 69	-	≥ 55	-
38 MASTER				
38 cm/s ref 405 nWb/m	≥ 65.5	≥ 66	≥ 62	≥ 62
19 cm/s ref 320 nWb/m	≥ 61.5	≥ 66	≥ 57	≥ 57.5
9.5 cm/s ref 320 nWb/m	-	≥ 59	-	≥ 57

TACHOMETRIC RESIDUE

Select the machine to PLAY, and following the table below check at all speeds using a third octave filter that the residue on the line output is $\leq$ 150 μV.

SPEED (cm/s)	TACHOMETRIC FREQUENCY (kHz)
76	8 kHz
38	4 kHz
19	2 kHz
9.5	1 kHz

INSERT TIMING ADJUSTMENT

By means of the time code system, the T-Audio allows electronic editing. That is to say, to insert and replace a portion into a pre-recorded tape a section of audio in perfect synchronization and without audible clicks being recorded onto the tape.

Set the machine to 19 cm/s and connect a 1 kHz signal at -20 dB to the line inputs. Record a section of tape. Rewind this recorded section and then change the frequency of the signal generator to 300 Hz. Connect a storage oscilloscope to both the line outputs with the time base set to 50 ms, on the CHOP mode and trigger it externally positive on TP 108 on A 02-A13.

Press PLAY and while playing back the 1kHz signal on tape press RECORD. Adjust RP 105 (ch 1) and RP 102 (ch 2) on A 02-A13 to give the overlap as shown in the diagram below:

DIAGRAM OF CROSSOVER showing 10 mS timing

NOTE: This adjustment will need to be done several times to get the correct 10 ms timing.

Once this adjustment is correct then the "Drop Out" point can be adjusted.

this is done in the same manner as above, except the machine is switched from RECORD to PLAY. Adjust RP 104 (ch 1) and RP 101 (ch 2) on A 02-A13 to get the correct overlap across the drop out point.
Now set the machine to 38 cm/s and do the drop IN adjustment again, as above using RP 106 (ch 1) and RP 103 (ch 2) on A02-A13.

Finally erase a length of tape, then playback this length and switch to record in the middle and adjust RP1 on A01-A4 to give minimum switching noise on each channel $\approx$ 150 mV pp.

PREPARATION

In order to avoid possible damage to the circuits, switch off the recorder before removing or replacing any PC board.

The PC boards are located as follows: from top to bottom

A01	Audio channel 1
A01	Audio channel 2
A02	Main control logic
A03	Tape transport speed stabilizer
A05	Counter and servo control circuit, or:
A05	Time code and servo control circuit

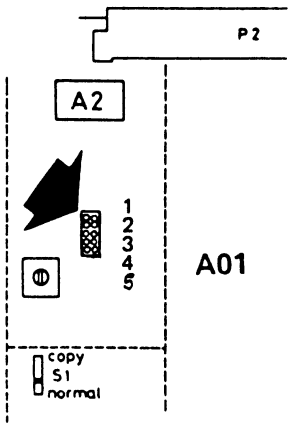
Both Audio boards are identical, however on stereo machines do not interchange Audio 1 and Audio board 2 as only Audio board 1 has an active erase circuitry. Do not interchange Audio boards after calibration.

1.0 DIRECT CHAIN CALIBRATION

1.1 INPUT SENSITIVITY

The input sensitivity is modified by moving a bridge located on A01 on the right of the two transformers.

Bridge in position 1	4.4 V for 0 dB (+15 dBm)
Bridge in position 2	3.1 V for 0 dB (+ 12 dBm)
Bridge in position 3	1.55 V for 0 dB (+ 6 dBm)
Bridge in position 4	1.25 V for 0 dB (+ 4 dBm)
Bridge in position 5	0.775 V for 0 dB (0 dBm)
Without bridge	0.390 V for 0 dB (- 6 dBm)



Adjustment

Feed the line inputs with a 1 kHz signal of the selected level.
Attach an oscilloscope to TP3 of A01-A2 (or the Audio monitoring output connector BJ-4 (pins 5 and 21)) and check this level again on TP2 of A01-A9. Check frequency response 30 Hz - 20 kHz ± 0.5 dB.

Repeat for the other channel.

Adjustment of modulometer display

Apply a 1 kHz 0 dB signal to the line inputs of the machine then increase this level by 0.2 dB and check that the 8 LED on the display just starts to be switched on.

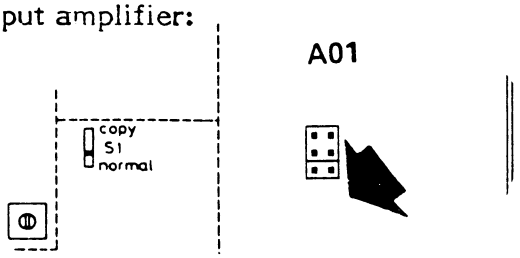
To adjust this, use RP1 (A01-A10). Then reduce the input level to 0 dB and check that the 8th LED goes out.

Check linearity of the display at + 6dB, - 6dB and -12 dB. Check frequency response of meter from 30 Hz to 20 kHz (tolerance ± 1 dB).

1.2 OUTPUT LEVEL

The output level is factory set to 4.4 V for 0 dB/1 kHz. It can be modified by altering the position of the jumper on the output amplifier:

ST-1	0.775 V
ST-2	1.25 V
ST3	1.55 V
ST-9 (change over)	4.4 V



(NOTE: A soldering bridge is used for this selection in machines with serial numbers up to 0900190).

Adjustment

(Necessary after any modification of the above).

Select "Input" on the keyboard. Load the line output with 5 kOhm load. Solder the bridge according to the required level. Inject a signal of 0 dB to the line inputs and monitor the line outputs and adjust RP1 (A01-A9) for the correct level.

Check the output level	Max. output 1% total harmonic distortion
0.775 V	3.17 V
1.5 V	6.34 V
4.4 V	18 V

Check these values at 1 kHz and 30 Hz.

Minimize the 30 Hz distortion using RP2 on A01-A9.

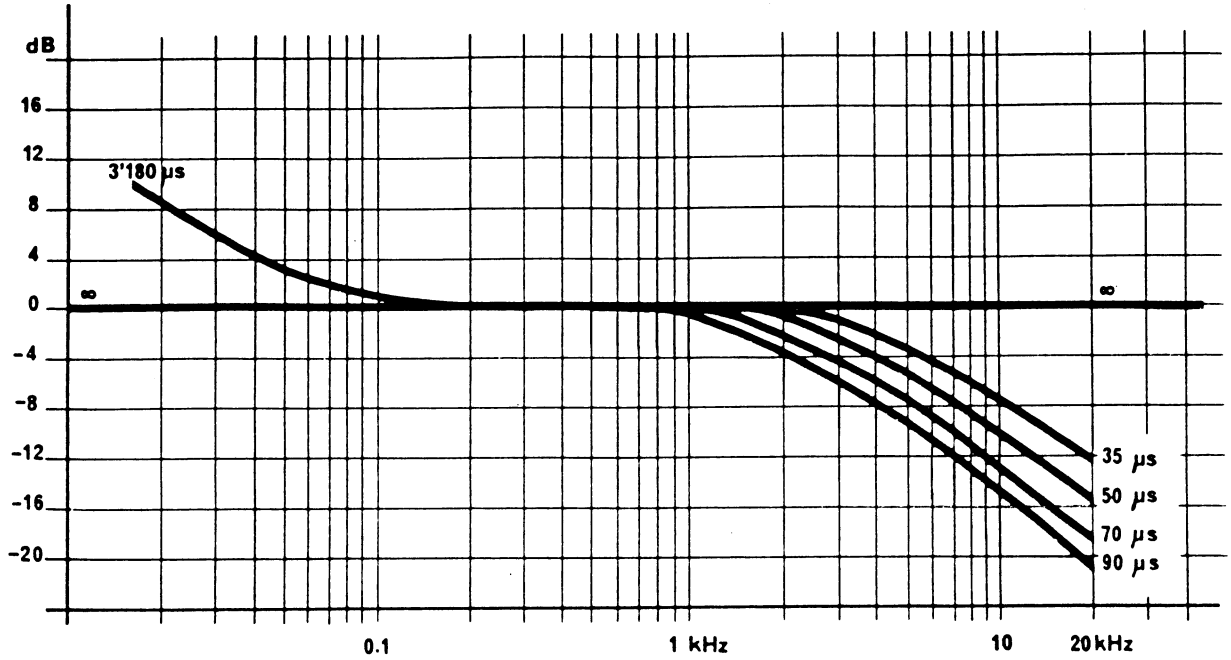
Repeat for the second channel.

FREQUENCY RESPONSE

Inject a 1 kHz signal to obtain 0 dB at the line output loaded with 5 kOhm. Take this value as reference. Sweep from 30 Hz to 20 kHz: tolerance 0 dB $\pm$ 0.5 dB. Check on Monitoring Output (pin 21 and 5): 0 dB $\pm$ 0.5 dB.

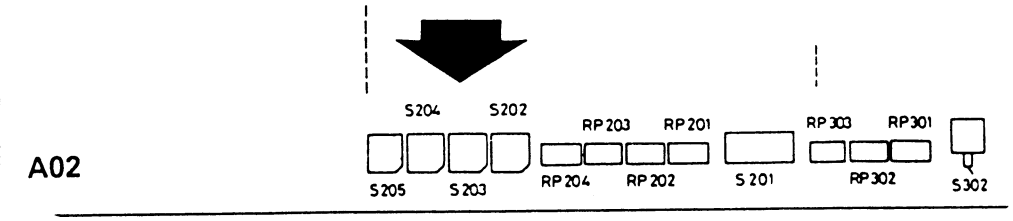
1.3 SPEEDS

The recording and/or playback speeds are selected on the main Logic Control Board A02-A14 using the four "Repro Speed-Std Select" switches (S205, S204, S203, S202). These switches determine the tape speed in accordance with the standard for the ABCD positions of the keyboard. Particularly they permit the selection of playback speeds and standards differing from those preset for recording.



The first eight positions correspond to:

Position	Speed cm/s ips	Standard	IEC designation	Time constant (us) HF	LF
0	9.5 (3.75)	NAB/CCIR	IEC 1	90	3180
1	19 (7.5)	CCIR	IEC 1	70	°°
2	38 (15)	CCIR	IEC 1	35	°°
3	76 (30)	CCIR	IEC 1	35	°°
4	19 (7.5)	NAB	IEC 2	50	3180
5	38 (15)	NAB	IEC 2	50	3180
6	38 (15)	Nagramaster	-	13.5	3180
7	76 (30)	AES-COPY	-	17.5	°°



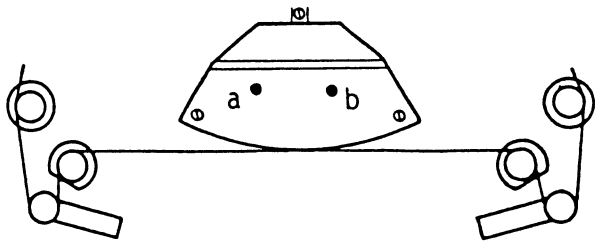
NOTE: As the tape speed is governed by a crystal there is no adjustment for tape speed on the NAGRA T-Audio.

2. PLAYBACK CHAIN CALIBRATION

Carefully clean and demagnetize the heads before carrying out any adjustment.

2.1 AZIMUTH ADJUSTMENT

Remove the upper plate of the head block by unscrewing **a** and **b**.



Connect one trace of a dual trace oscilloscope to each line output.

Thread an azimuth test tape (BA-19, code no 91735) and select the 19cm/s (7.5 ips) playback speed.

Start playback.

Rotate the playback head adjusting screw to the left or to the right to bring both 1 kHz signals into phase.

Proceed likewise using the 10 kHz signals in order to optimize the adjustment.

NOTE: Tolerance of phase shift between the two signals at 10 kHz is ± 15° maximum.

2.2 LEVEL ADJUSTMENT

This adjustment is carried out with a multifrequency test tape BM-IEC (code no. 91700) for CCIR standard or BM-NAB (code no. 91701) for NAB standard.

The general level adjustment for all speeds and standards is made by means of "Repro Level" RP14/A01-A8 (see page IV.4.1-1).
This gives a swing of ± 3 dB.

If necessary, you can optimize the adjustment for each speed and standards with:

Trimmer (A01-A8)	Speed cm/s (ips)	Standard	Position (cf.1.3)	f reference
RP 6	9.5 (3.75)	NAB/CCIR	0	375 Hz
RP 7	19 (7.5)	CCIR	1	500 Hz
RP 8	38 (15)	CCIR	2	1 KHz
RP 9	76 (30)	CCIR	3	2 KHz
RP 10	19 (7.5)	NAB	4	500 Hz
RP 11	38 (15)	NAB	5	1 KHz
RP 12	38 (15)	Nagramaster	6	1 KHz
Rp 13	76* (30)	AES	7	2 KHz

* Use the 38 cm/s CCIR test tape for level and bandwidth adjustment

NOTE: These potentiometers give a swing of +3 dB to -3 dB.

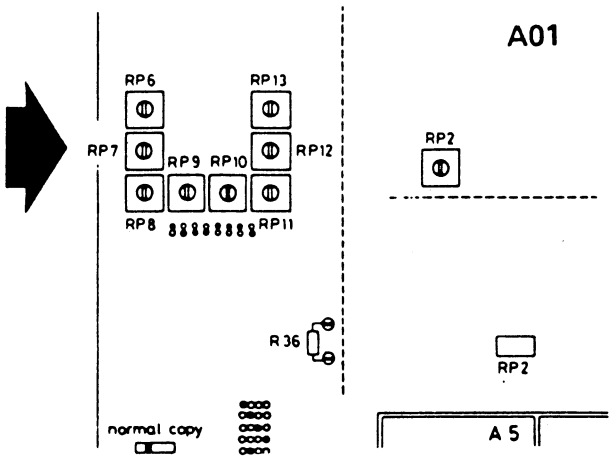
Unless specifically requested the recorders are adjusted ex-works for a magnetic flux corresponding to a nominal level of:

510 nWb/m for 38 cm/s (15 ips) and 76 cm/s (30 ips)

405 nWb/m for 19 cm/s (7.5 ips) or -2 dB with respect to 510 nWb/m

320 nWb/m for 9,5 cm/s (3.75 ips) or -4 dB with respect to 510 nWb/m

A 2 dB level reduction permits running a tape at half speed with approximately the same saturation level. (Particularly in the high frequencies. Therefore, with such an adjustment, the modulometer (or Vu-meter) will read the same whatever the speed selected. For the T-Audio, for example, up to + 6dB with less than 1,2% distortion, when fitted with TACAL circuits. When fitted with TACAL-s (no predistortion) up to + 4 dB with less than 3% distortion.



2.3 PLAYBACK FREQUENCY RESPONSE

This adjustment compensates at the high frequency end of the spectrum the losses due to the ratio between the head gap width and the wave-length of the signal recorded on the tape.

Thread a multifrequency test tape corresponding to the speed and standard to be adjusted.

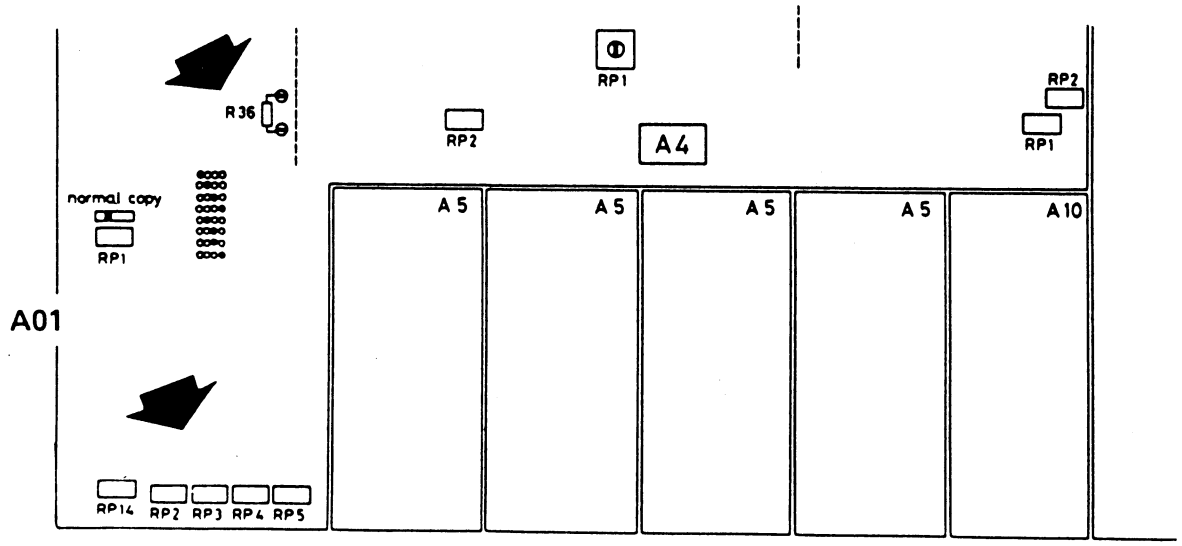
Adjust the "Head loss compensation" potentiometers of A01 PC board in order to obtain a bandwidth within tolerances up to the mentioned frequency.

Potentiometer (on A01-A8	Speed cm/s (ips)	Frequency and tolerance	
RP 5	9.5 (3.75)	10 KHz	± 1.5 dB
RP 4	19 (7.5)	16 KHz	± 1 dB
RP 3	38 (15)	20 KHz	± 1 dB
RP 2	76 (30)	20 KHz	± 1 dB
RP 2	76 (30) COPY	60 KHz	± 2 dB

NOTE: For the last position (AES-COPY) also some component modifications are required. See Section 8, schematics, page 8.3-8.

Check the whole bandwidth.

For NAB and NAGRAMASTER standards as well as for the CCIR standard at a 9.5 cm/s (3 3/4 ips) speed only, if necessary adjust the R36/A01-A8 value to optimize the response at low frequencies.



3. RECORDING CHAIN CALIBRATION

This calibration can only be carried out when the playback chain is fully calibrated. Do not forget to clean and demagnetize the heads.

3.1 HEAD AZIMUTH ADJUSTMENT

Thread a reel of tape for which the machine is to be calibrated.

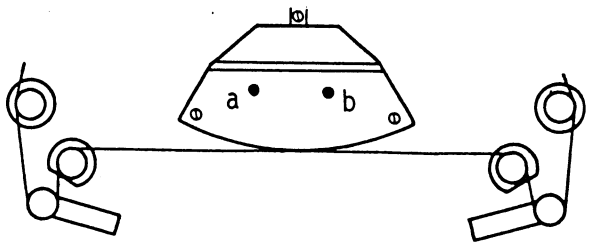
Connect the oscilloscope to the outputs, inject a 10 kHz signal into both line inputs (right and left).

Select a 7 1/2 ips recording speed (or 15 ips if the recorder is not fitted with such a calibration).

Select Shift+Record to start the recording.

Rotate the record head azimuth adjuster to the left or to the right to bring both signals into phase at max. output level as explained on page IV.2.1-1.

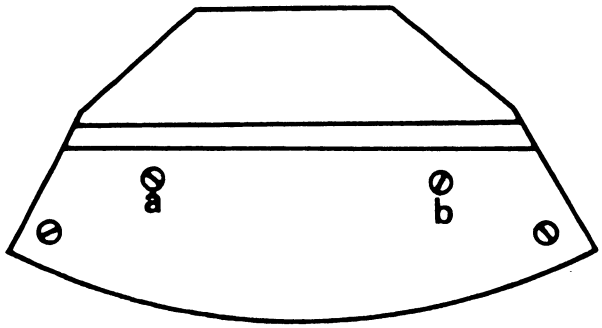
NOTE: All playback chain calibrations must be done before adjusting the record chain.



3.2 ERASE HEAD TUNING

NOTE: Generally this calibration is only necessary after the erase head has been changed.

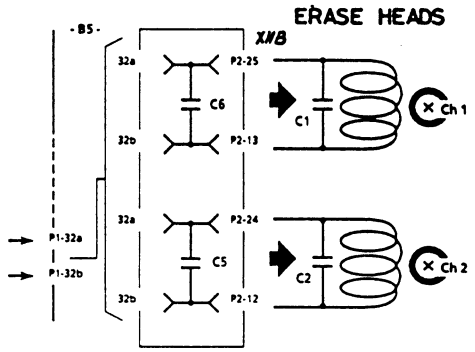
Remove the upper plate of the head block by unscrewing **a** and **b**.



Remove Audio boards A01.

Feed approximately 3 Vpp 256 kHz sine wave signal through a 10 kOhm resistor onto the rear end of erase head. This can be applied on the capacitor C1 or C2 on the head block interconnection board. Short circuit which ever is not used (other channel).

Then tune the head by changing capacitor values to get the resonant frequency at 256 kHz ± 2 kHz.



When this is done, remove signal and replace audio boards.
Now while monitoring at point A adjust L1 on A01-A6 for minimum switching distortion of the wave.

Check finally without extender board - the switching distortion should be in the center of the wave.

Finally measure the voltage fed to the erase head - it should be 120 V peak to peak. If necessary adjust RP1 (A01-A6).

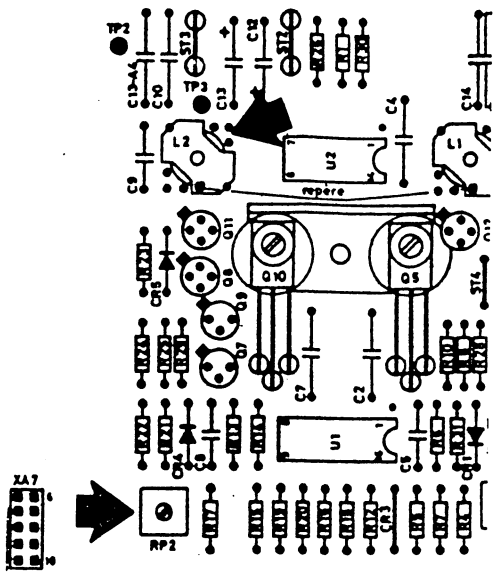
NOTE: Some tapes might require 140 V or less than 120 Vpp.

3.3 BIAS ADJUSTMENT

Thread a reel of the tape of the type to be used.

Start RECORD". Monitor the left-hand side of the record head with an oscilloscope and adjust the core of coil L2 (A6) to get the distortion equal on both halves of the cycle and as close to the zero point as possible.

A6



Turn the bias reference potentiometer RP2 A6 to its central position.

Select on the keyboard the A, B, C or D position to be adjusted.

Record at -20 dB a signal of:

3 KHz for a 9.5 cm/s (3.75 ips) speed

5 KHz for a 19 cm/s (7.5 ips) speed

10 KHz for a 38 cm/s (15 ips) speed

20 KHz for a 76 cm/s (30 ips) speed

Then using the "Bias level" potentiometers on the logic control board A02 adjust the bias according to tape type.

Potentiometer at min., increase the bias level while measuring the playback level from the tape until the maximum is reached.

RP 201/A02-A14 for position A

RP 202/A02-A14 for position B

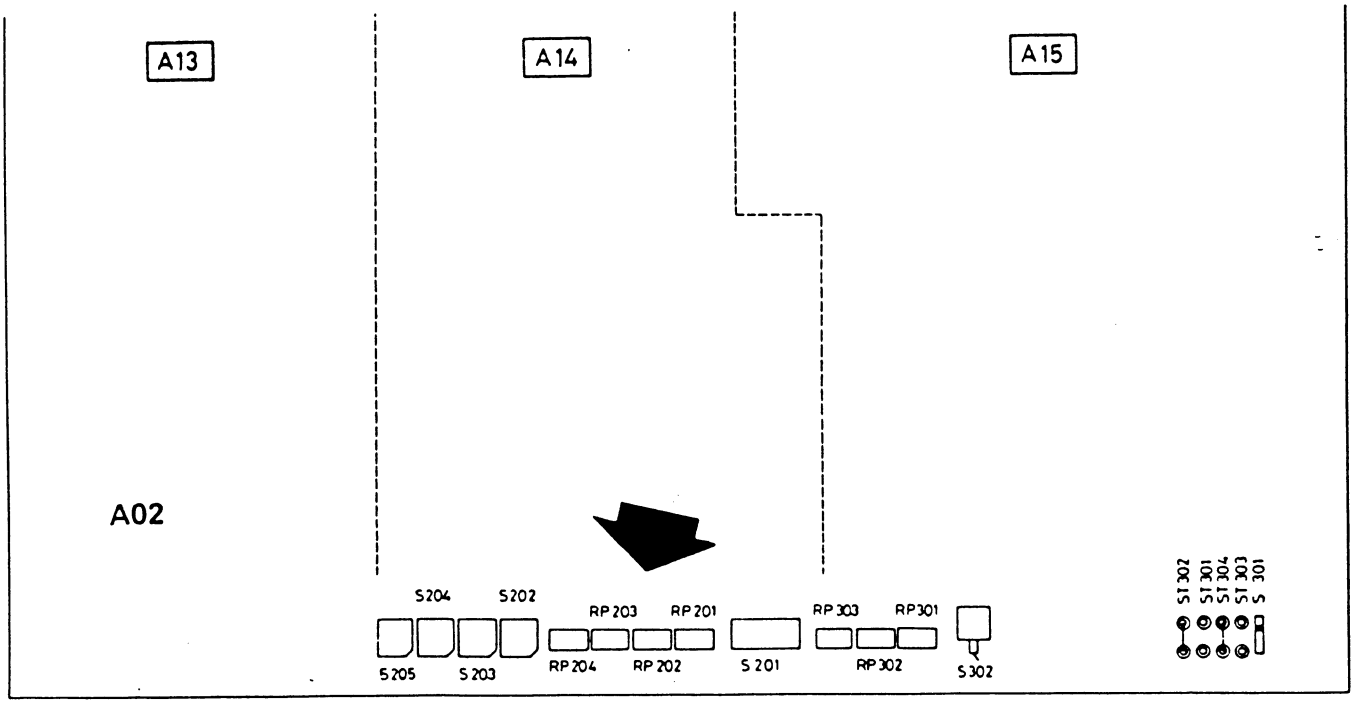
RP 203/A02-A14 for position C

RP 204/A02-A14 for position D

NOTE: Do not use the extension board to carry out the adjustment as it will add stray capacitance.

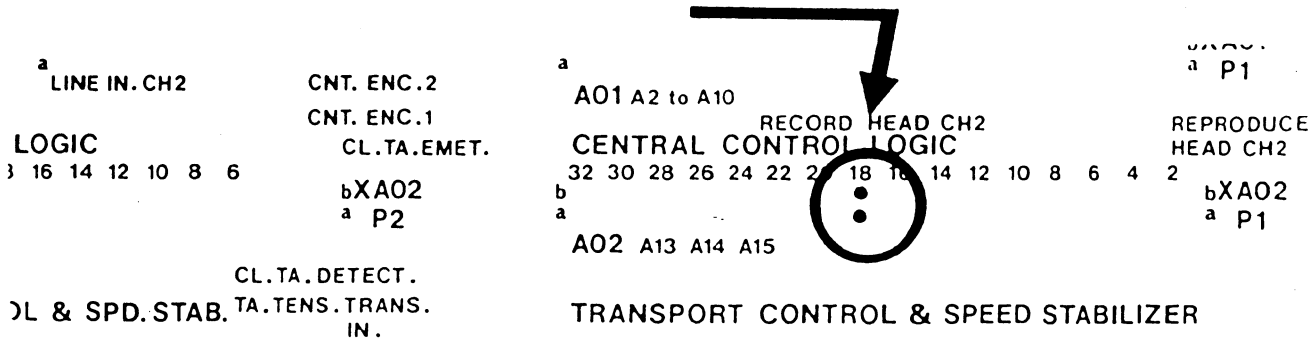
Keep increasing until the bias level drops by the overbias value given by the tape manufacturer. For example:

Type of tape	Thickness um	Overbias	Recording level for 0 dB (nWb/m)		
			15 ips	7.5 ips	3 3/4 ips
3M 808	50	- 1.5 sB	320	250	200
3M 806	50	- 0.5 dB	405	320	250
3M 226	50	- 1.5 dB	510	405	320
3M 250	50	- 1 dB	510	405	320
3M 256	50	- 2 dB	510	405	320
BASF SPR 50 LHL	50	- 2 dB	510	405	320
AGFA PEM 468	50	- 2.5 dB	510	405	320
AGFA PER 528	50	- 1.5 dB	405	320	250
AMPEX 456	50	- 2.5 dB	510	405	320
PYRAL CJ 87	50	- 2.5 dB	510	405	320

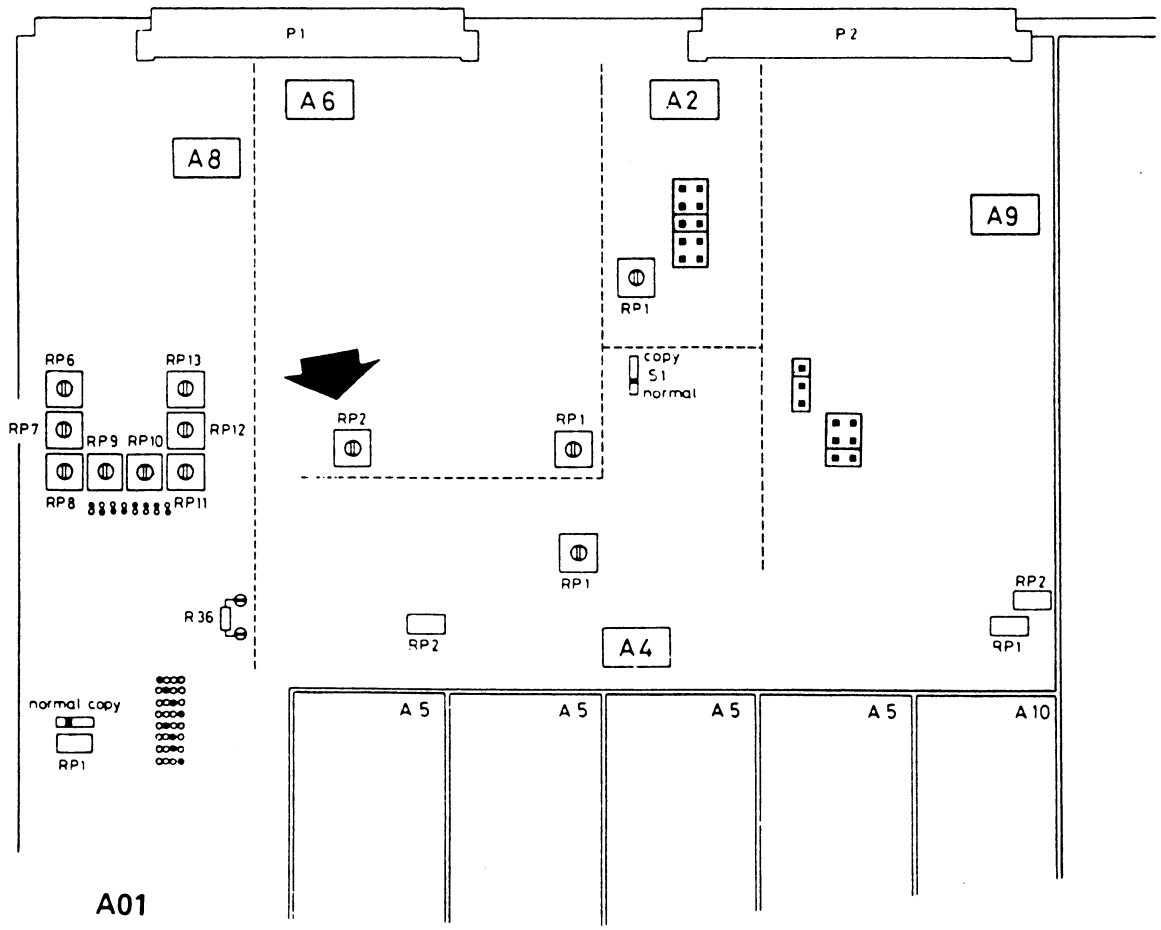


When adjusting the bias level for different types of tape (consequently a different TACAL) on the same ABCD position, it is possible to measure the bias DC reference voltage for each type of tape. As a result it will be much easier to find again the bias level used to calibrate the TACAL. This measurement is made on the rear PC Board (B-5, interconnection) between XAO2-P1.18 **a** or **b** and the ground.

NOTE: When adjusting the bias reference level on the logic control board, the bias level for the time code head will be changed.



The bias voltage is the same for both channels. When changing the head block, carry out the bias adjustment as explained above and readjust channel 2 using RP2/A01-A6. (Compensation of the differences between the two half recording heads).



3.4 TACAL ADJUSTMENT

The adjustments explained below are the same for all TACAL boards of the recorder. However the TACAL's delivered with the machine are factory preadjusted for a specified speed and standard and are fitted with different components according to these parameters. For this reason when readjusting a TACAL for an other speed and/or standard, it will be necessary either to order a new TACAL from the factory specifying speed and standard or to replace the components as mentioned under IV.3.4-3 before attempting any adjustment.

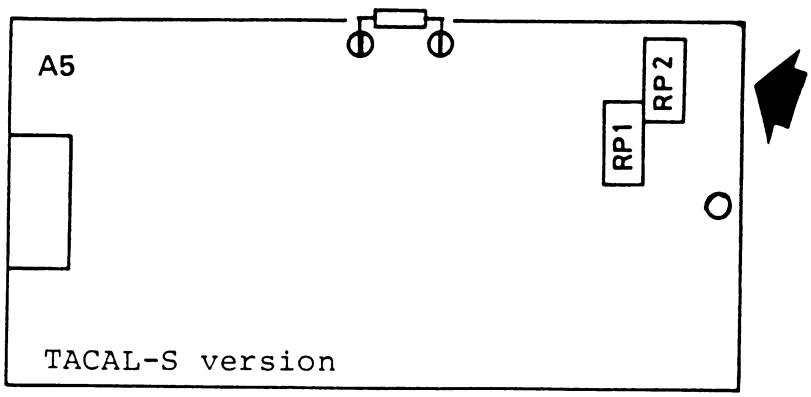
High Frequency Preemphasis Adjustment

Level: -20 dB with respect to nominal level

- Connect a voltmeter to the output. Take a reference level of:

Reference frequency	Speed cm/s (ips)	Frequency Limit	Tolerance A	Tolerance B
250 Hz	9.5 (3.75)	10 KHz	1.5 dB	±2 dB
500 Hz	19 (7.5)	15 KHz	1 dB	±1.5 dB
1 kHz	38 (15)	20 KHz	1 dB	±1.5 dB
2 kHz	76 (30)	20 KHz	1 dB	±1.5 dB
2 kHz	76 (30) COPY	60 KHz	1.5 dB	±2 dB

and adjust "Equaliz." RP2/A01-A5 to obtain the nominal level less Tolerance A at the limit frequency.



Check that the frequency response is within Tolerance B.

Speed	9.5 cm/s	19 cm/s	38 cm/s	76 cm/s	76 cm/s COPY
Bandwidth	30 Hz- 8 KHz	30 Hz- 15 KHz	30 Hz- 20 KHz	50 Hz- 20 KHz	50 Hz- 60 KHz

Low Frequency Pre-emphasis Adjustment

This adjustment is to be carried out only for the NAB and NAGRAMASTER standards as well as the CCIR standard but at 9.5 cm/s (3 3/4 ips) only.

On the TACAL PC Boards preadjusted for these parameters, condenser C4 and resistor R9 are fitted.
Check the whole record/playback response curve and if necessary adjust the R9 value (typical 180 k).

Level adjustment

Nominal level 0 dB

Adjust the record level with "Level" RP1/A01-A5 by selecting alternately "Repro" and "Input" on the keyboard to obtain at the reference frequency 0 dB at the output.

Predistortion adjustment (not available on TACAL-S)

The predistortion optimization will be carried out at a +6 dB level (e.g. 1020 nWb/m at 38 cm/s) using a 1/3 octave filter. First demagnetize the heads.

H_2 adjustment, F_{ref} = 160 Hz *
1/3 octave filter set on F_{ref} x 2 = 315 Hz *
Adjust RP5 to obtain a minimum distortion

H_3 adjustment, F_{ref} = 160 Hz
1/3 octave filter set on F_{ref} x 3 = 500 Hz
Adjust RP4 to obtain a minimum distortion

H_3 adjustment, F_{ref} = 1600 Hz
1/3 octave filter set on F_{ref} x 3 = 5 KHz
Adjust RP3 to obtain a minimum distortion

* **NOTE:** These frequencies are speed-dependent.

Check again level and predistortion adjustment, but this time with a different reference frequency F_{ref}, dependent on the nominal speed: 250 Hz at 3 3/4 ips /500 Hz at 7 1/2 ips / 1 KHz at 15 ips / 2 KHz at 30 ips.

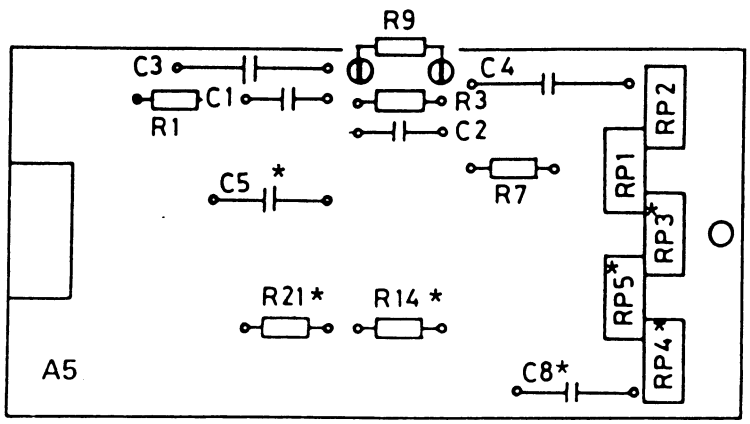
TACAL Modification

The diagrams below gives the approximate values of the components to be used for each speed and standard.

SPEED cm/s (ips)		9.5 3.75	19 (7.5)	19 (7.5)	38 (15)	38 (15)	38 (15)	76 (30)	76 (30)
STANDARD		NAB/ CCIR	NAB	CCIR	NAB	CCIR	Nagra master	AES Copy	AES/
R1	2%	-	-	22k	-	-	22k	27k	18k
C1	cert cog	-	-	150pF	-	-	82pF	68pF	47pF
R3	2%	(R4 27k)	-*	-	56k	-	-	-	-
C2	cert cog	-	-	-*	470pF	-	-	-*	-
C4	per 10%	47nF	47nF	bridge	47nF	bridge	47nF	bridge	bridge
R7	2%	1k	1.5k	1.5k	2.2k	2.2k	1.5k	3.3k	820ohm
C3	per 10%	15nF	6.8nF	6.8nF	3.3nF	3.3nF	3.3nF	3.3nF	820pF
R9	typique	180k	180k	nothing	180k	nothing	180k	nothing	nothing
C5 *	cert cog	2,2nF	1,5nF	1,5nF	1nF	1nF	1nF	1nF	1nF
R14 *	2%	18k	18k	18k	18k	27k	27k	27k	18k
C8 *	cert cog	1,5	1nF	1nF	1nF	1nF	1nF	1nF	1nF
R21 *	2%	8,2k	6.8kk	6.8k	6.8k	4.7k	4.7k	4.7k	6.8k

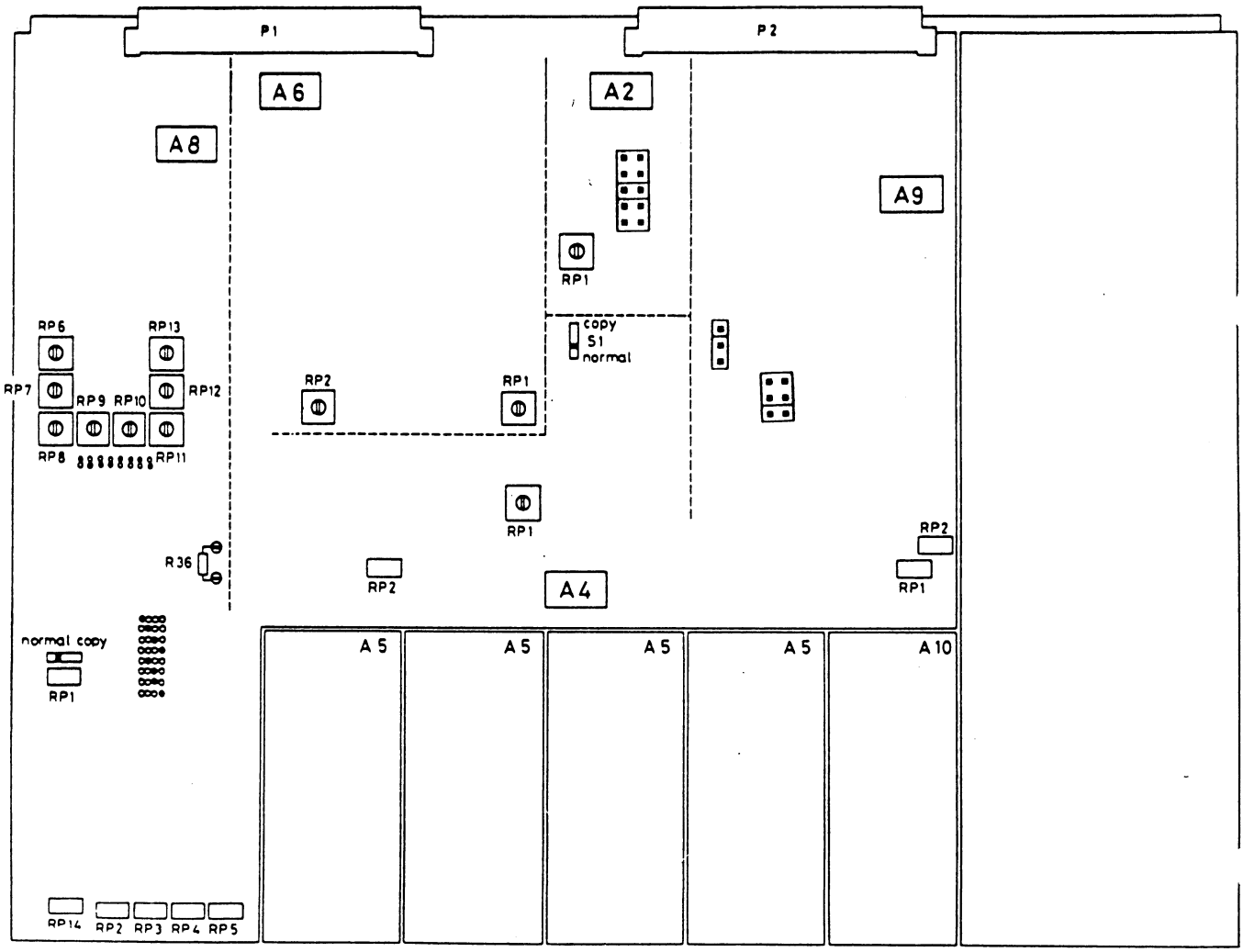
- value depending on tape type (usually not fitted)

* not fitted on TACAL-S



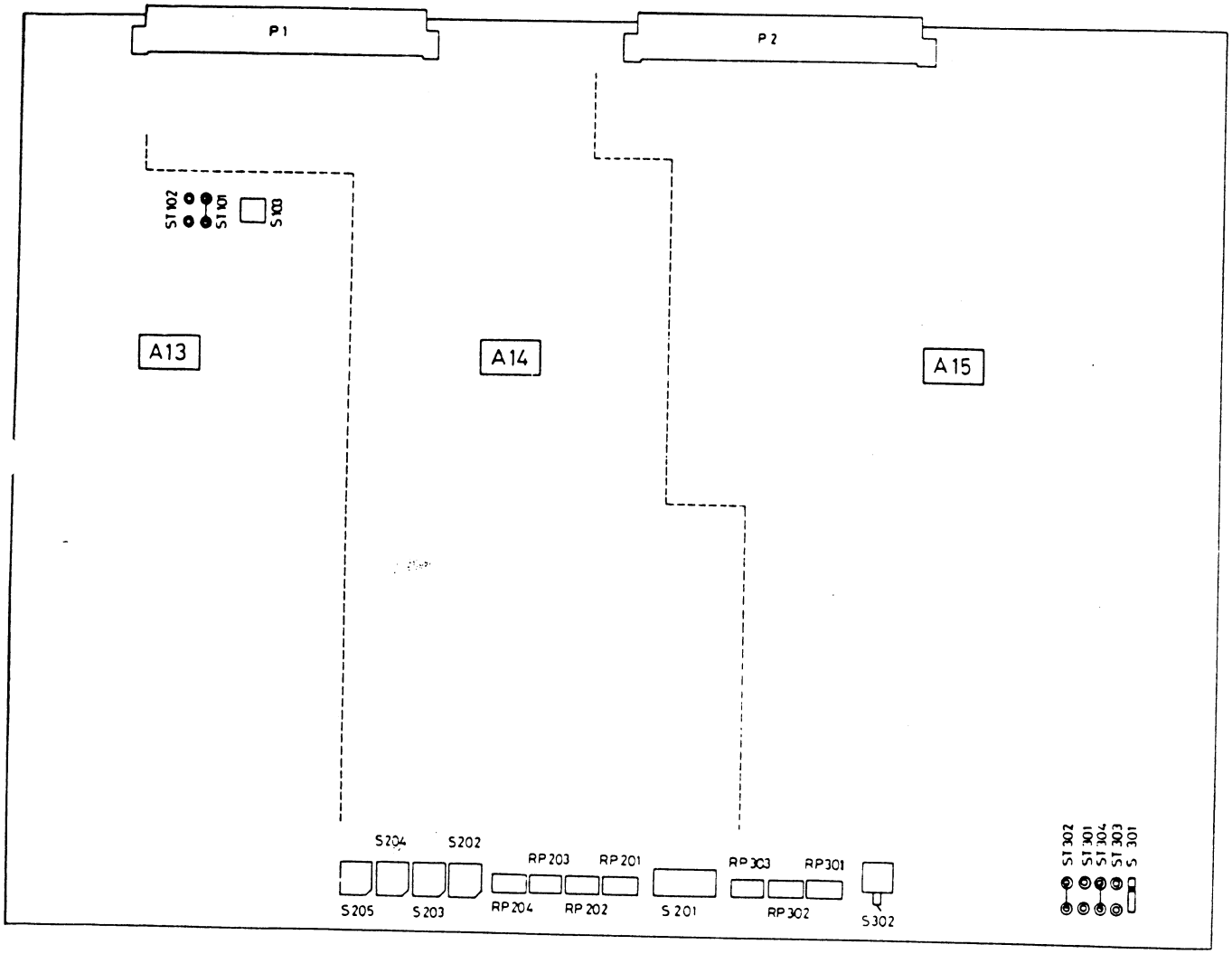
4. ADJUSTMENT POINTS LAY-OUT

4.1 AUDIO BOARD A01



ref	for adjusting	board/component
		A2 bridges
1.1	Input sensitivity	A2 RP1
1.2	Output Level	A9 bridge
		A9 RP1
2.2	Playback Level	A8 RP6 to RP13
2.3	Response Curve	A8 RP2 to RP5
		A8 R36

4.2 LOGIC BOARD A02



ref	for adjusting	board/component	
1.3	Speed/Standard	A14	S202 (D)
			S203 (C)
			S204 (B)
			S205 (A)
3.2	Bias	A14	RP201 (A)
			RP202 (B)
			RP203 (C)
			RP204 (D)

5.0 SELF-SYNC CHAIN CALIBRATION

Before starting any self-sync calibration whether with the TASIM option or the improved TASIM-2 board make sure that the playback and the recording chain have been calibrated. Check in particular that the record head azimuth has been adjusted (see page IV 3.1-1).

5.1 LEVEL ADJUSTMENT

This adjustment is carried out with a multifrequency test tape BM-IEC (code no. 91 700) for CCIR standard or BM-NAB (code 91701) for NAB standard.

The following procedure is valid both for the TASIM circuit and the improved TASIM-2 version of this circuit.

Thread a multifrequency test tape corresponding to the speed and standard to be adjusted (normally for the most used position A calibration).

NOTE: Unless specifically requested the T-Audio is usually adjusted for the following magnetic flux corresponding to a nominal level of:

510 nWb/m for 38 cm/s (15 ips) and 76 cm/s (30 ips)

405 nWb/m for 19 cm/s (7.5 ips) or -2 dB with respect to 510 nWb/m

320 nWb/m for 9.5 cm/s (3.75 ips) or -4 dB with respect to 510 nWb/m

As a consequence of that, matching the level of the playback chain and the self-sync chain can only be done for a specific playback speed. It is advised therefore to perform this matching at the most frequently used playback speed (ex-factory position A).

The level adjustment for all speeds and standards is made by means of the "Level" potentiometer RP1/AO1-A7 which gives a swing of ±3 dB.
Adjust the "Level" potentiometer to achieve the same output level on the line output with the matrix in "REPRO" and in "SYNC".

5.2 TASIM-2 FREQUENCY RESPONSE

Make sure that the bandwidth selection switch or bridge S1 is in the "Flat" position (see page I.3.3-1 for proper location).

Check also that the CCIR/NAB standard selection switch or bridge S2 is set according to the desired standard (see page I.3.3-1 for proper location).

Before starting the frequency response adjustment of the TASIM-2 circuit it is important to check the characteristics of the record head in order to select the right set of component values. Two versions of the record head exist:

standard head: 20 microns gap
amorphous metal head: 10 microns gap.

In case of doubt to which type of record head is installed on your T-Audio, the following measurement gives a rapid check:

Thread a multifrequency test tape for the 38 cm/s (15 ips) speed. Play it back at 19 cm/s (7.5 ips). Measure the "SYNC" output level at 6.3 kHz, at 8 kHz and at 10 kHz with a third octave analyzer. If there is notch in the frequency response at 8 kHz (less than -15 dB with respect to the adjacent frequencies) then the gap of the head is 20 microns.

Optimized component values for the LC bandpass head gap compensation center frequency on A01-A7:

Speed	Component	10 microns gap (ex-factory)	20 microns gap
9.5 cm/s	C12	5.6 nF	10 nF
19 cm/s	C13	2.7 nF	6.8 nF
38 cm/s	C14	1.2 nF	2.7 nF
76 cm/s	C15	820 pF	820 pF (no change)

Once the correct values of components is installed on the TASIM-2, the adjustment of the frequency response is made by means of the "Gap compens." potentiometer RP2/A01-A7 for both head types. Of course the bandwidth obtainable at each speed is almost double with the 10 microns head gap with respect to the 20 microns head gap.

Thread a multifrequency test tape for the 38 cm/s (15 ips) speed.

Adjust RP2 for 0 dB response at 20 kHz with 10 microns head gap and at 10 kHz with 20 microns head gap.

Check the following frequency responses at ±3 dB with respect to the reference frequency level:

Speed	Ref.frequency	10 microns gap	20 microns gap
76 cm/s	2 kHz	60 - 20.000 Hz	60 - 20.000 Hz
38 cm/s	1 kHz	50 - 20.000 Hz	50 - 12.000 Hz
19 cm/s	500 Hz	50 - 10.000 Hz	50 - 6.300 Hz
9.5 cm/s	400 Hz	50 - 5.000 Hz	50 - 2.000 Hz

CALIBRATION MANUAL
TIME CODE AND PILOT OPTIONS 5

TABLE OF CONTENTS

1.0 TIME CODE ERASE HEAD TUNING

This calibration is only necessary when the time code erase head has been replaced. This should also be checked if the complete headblock has been replaced.

Remove the cover of the headblock by removing the two screws as explained on page III.4.2-1.

Remove the time code circuit completely and do not insert the extender card.

PROCEDURE

Feed via a 10 kOhm resistor a 10 V sine wave of 160 kHz across capacitor C3 on circuit A42 located inside the headblock. See section VIII.11-2 (Set of schematics).

Adjust the value of capacitor so that the resonant frequency is 160 kHz ± 1 kHz. (Typical value for C3 = 5.6 nF).

NOTE: Capacitor must be of the polystyrene type rated at 100 V min.

NOTE: For actual mechanical head replacement see section III of this manual.

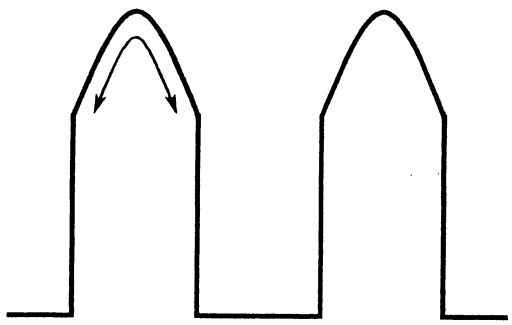
TIME CODE ERASING

Re-install the time code circuit on the extender card (TA-PTC).

Load a reel of tape of the type for which the T-Audio is calibrated (usually tape type of position A).

Record some time code and monitor TP 14 on A05-A22 with an oscilloscope. (If necessary remove the TA-PFM option to obtain better access).

Adjust the core of transformer T2 to obtain a balance and an even curve.



T2 CW ⟶ signal CCW

Finally test the bias on C35 using an oscilloscope. It should be 27 Vpp.
Connect a DC voltmeter to TP 15 (A05-A22) and measure:

Typical Vdc = 4.2 ± 0.5 V

2.0 TIME CODE HEAD HEIGHT ADJUSTMENT

Fit extender card to time code circuit and install into the T-Audio TC.

Remove headblock cover.

Thread a time code test tape (BHNTC, code no 91737) and replay the center track erased head height adjustment section at 19 cm/s ($7\frac{1}{2}$ ips).

Rotate the time code head height adjustment washer using azimuth tool (01 90 900 042) while monitoring the "TC play" output on pin 15 of the THIRD TRACK INPUT/OUTPUT connector via a voltmeter and then into an oscilloscope.

Adjust this for minimum output.

NOTE: This adjustment will alter the time code head squaring so it is now necessary to resquare the head as explained in section III.4.2-1.

Then repeat the above adjustments to check that minimum has been achieved. Typically under 5 mV RMS on the TC play output.

2.1 TIME CODE PLAYBACK LEVEL

Reproduce the time code test tape level section at 38 cm/s (15 ips).

Monitor the "TC Play" output (pin 15 of the THIRD TRACK IN/OUT connector) on an oscilloscope via an AC voltmeter to obtain 1.2 Vpp which should correspond to approx. 240 mV RMS on the voltmeter.

Level on "TC Play" at 38 cm/s: 1.2 Vpp ≈ 240 mV RMS

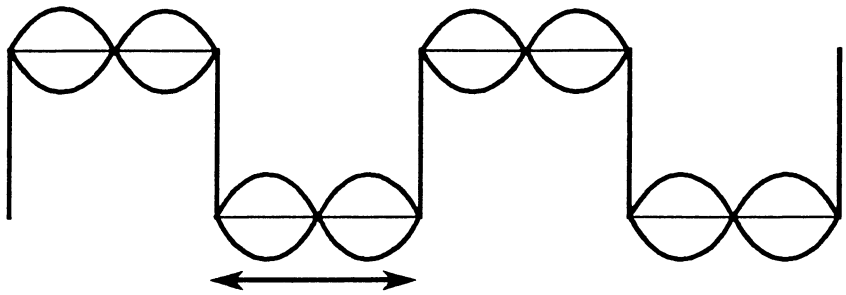
Adjust the playback level, if necessary, using RP1 on A05-A22.

2.2 TIME CODE RECORD BIAS

2nd harmonic phase tuning

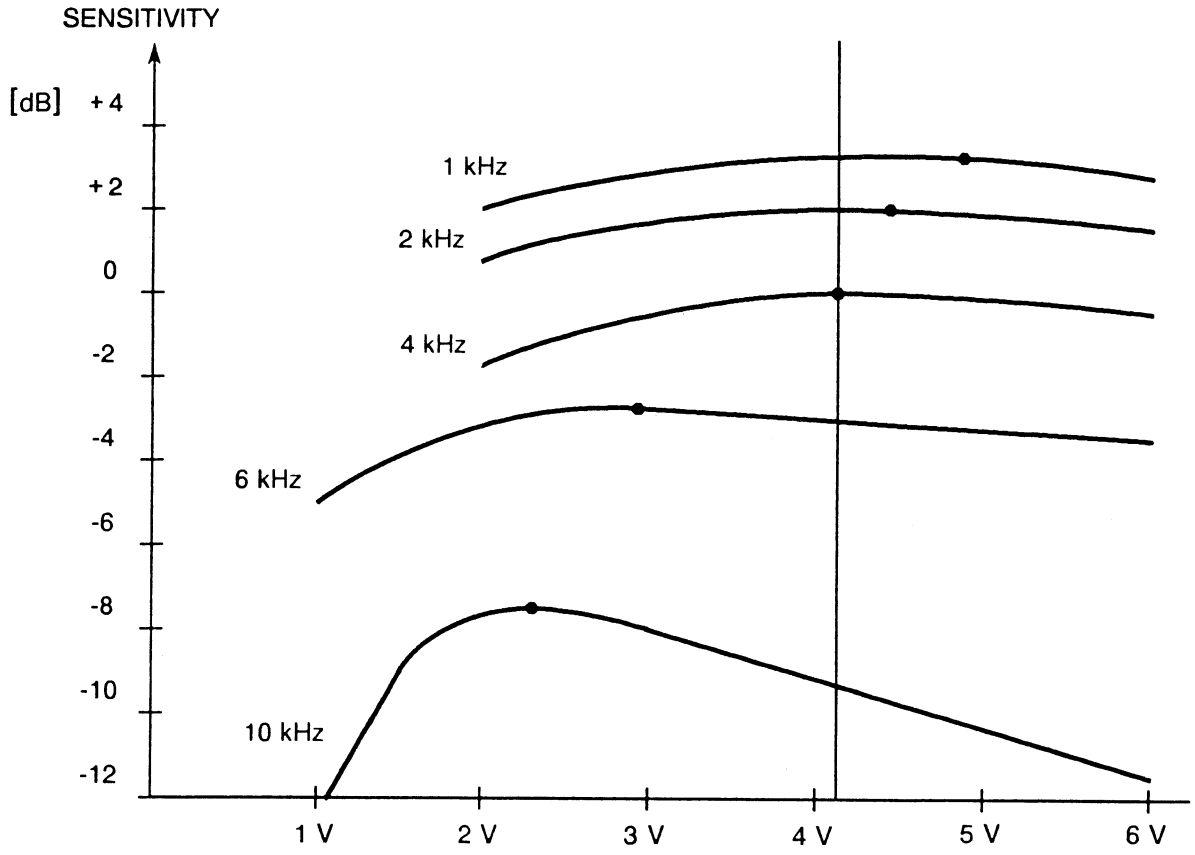
To make this adjustment, first turn the "TC rec. level" potentiometer RP3 to maximum (fully clockwise).

Monitor TP5 with an oscilloscope and adjust the core of transformer T1 to obtain a symmetrical signal as shown below.



Bias voltage adjustments

The special method applied in the T-Audio to record the time code signal by phase modulating the second harmonic of the bias is inherently showing little sensitivity of the recorded level with regard to the bias level. The sensitivity curves below show that the amount of bias has very little influence on the level of the recorded time code over quite a large range. Nevertheless care should be taken to apply a correct amount of bias as too little would increase the amount of drop-outs and too much would damp the high frequency content of the time code signal with the result to decrease the slew rate of the replayed TC square wave.



As may be seen from the previous sensitivity curves, the optimal bias level corresponds to the maximum of the 4 kHz sensitivity curve. As the TC generator of the time code board cannot produce a 4 kHz signal, it is necessary to use an external AC generator.

If the strap ST10/ST11 is in ST10 position, connect the generator to the "EXT. DIRECT TC IN" input (pin 8 of the THIRD TRACK IN / OUT connector) otherwise if in ST11 position connect the generator to the standard TC INPUT XLR-3 connector. Set the switch "TC RECORD SOURCE" S2 to "EXT. UNPROCESSED".

Set the external generator to 4 kHz sinus 1 V RMS.
Connect a DC voltmeter to the pin 1 of UJ1 in order to have a visual check of the bias level voltage.
Set the "Bias level adjust" potentiometer RP4 to the maximum (fully clockwise).

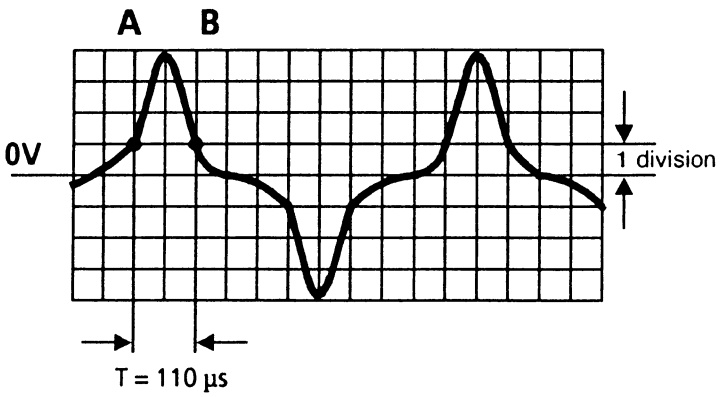
Record the 4 kHz signal at 38 cm/s (15 ips) on the tape type for which the T-Audio is calibrated (usually tape type of position A).
While recording this signal, slowly turn RP4 to the fully counterclockwise position. Now rewind the tape and replay this recorded section while observing the amplitude on the AC voltmeter connected to the "TC Play" output (check with the oscilloscope).

Watch for maximum during this operation and note it, and then try to adjust the potentiometer RP4 to a value that corresponds to the maximum previously seen. Repeat the recording and reproducing to check that the maximum has been set.

Switch the "TC RECORD SOURCE" selector back to "NORMAL".

2.3 TIME CODE RECORD RISE TIME

Record a section of time code at 38 cm/s (15 ips). Replay this section monitoring on an oscilloscope connected to the "TC Play" output.
Time base should be set to 50 µs per division. Gain should be set such that pp amplitude covers 8 divisions as shown below.



Now measure the time interval between the points A and B which should be 110 µs ± 5 µs. Generally this tolerance can be set to correspond to the time observed with the time code test tape BHNTC. Adjust if necessary the rise time by changing the "TC record rise time adjust" resistor R67.

Typical value 27 kOhm - 33 kOhm

NOTE: Decreasing the resistor value will decrease the rise time (sharper time code edges) and will increase the recorded time code level.

2.4 TIME CODE RECORD LEVEL

Record a section of time code at 38 cm/s (15 ips), then play it back and monitor "TC Play" output on the AC voltmeter so that in playback the level is the same as the time code test tape (approx. 240 mV RMS). If necessary, adjust RP3 and re-record the signal. It may be necessary to repeat this several times to get an accurate result.

It is advised to check again the time code rise time (see section V.2.3) as the rise time is also slightly affected by the time code record level adjustment.

NOTE: This is a RECORD ADJUSTMENT and therefore it is necessary just to monitor the level during each replay and make adjustments before each recording.

After that calibration, check the recording level at 19 cm/s ($7\frac{1}{2}$ ips) which usually shows a slightly lower level with respect to 38 cm/s:

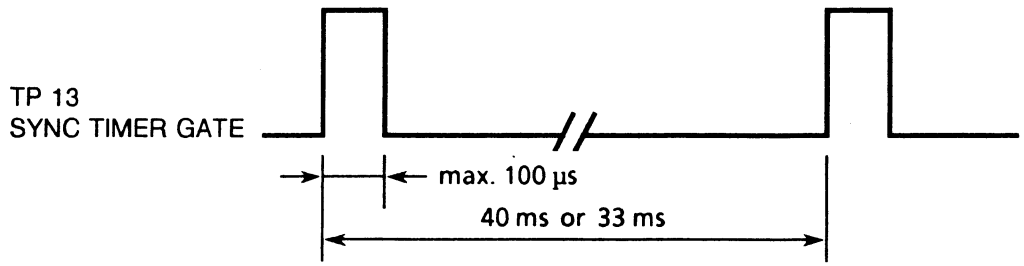
Level on "TC Play" at 19 cm/s: 950 mVpp ≈ 210 mV RMS.

3.0 TIME CODE SYNCHRONIZER OFFSET

Check that switch S1 in front of the speed stabilizer board A03 is in its synchronizer position.
Record at 38 cm/s (15 ips) a portion of time code. Connect an external time code generator to the T-Audio (TCGR) and press "SYNC INCREMENTAL".

Select display "Delta" in "Bits".

Monitor the control pulses on TP13 (A05-A23) and check that the pulse width is less than 100 µs.



Also check that the delta display only shows zeroes (without "-"). Press "pause key" a couple of times. The machine should resynchronize and check display each time as above.

NOTE: The pulse width is adjustable via the "synchronizer offset adjust" potentiometer RP5 but should only be adjusted after having checked that the SPEED VARIATOR potentiometer on the keyboard (TACA-TC) is in the center position.
Also make sure before adjusting RP5 that the "Syncronizer range adjust" potentiometer RP6 is set to its normal position, i.e. to its fully clockwise position (maximum synchronizer range).

3.1 LISTEN TIME CODE ADJUSTMENT

Load a tape containing audio and time code. Set a time code on the display using the blinking mode approximately 10 minutes ahead of the time code on the tape. Then select locator and adjust listen T.C. potentiometer RP101 on Servo card A03 as follows:
If TASIM is fitted, then adjust for T.C. replay and Audio output (tape touching T.C. head & rec head).
If no TASIM is fitted, then adjust for T.C. output (i.e. tape only touching T.C. head).

NOTE: T.C. output can be observed by the LED on the keyboard.

4.0 PILOT CALIBRATION

NOTE: These calibrations only apply to machines fitted with PFM circuit.

Preparation

Fit extender circuit to T.C. board. Switch S1 on the speed stabilizer board A03 to synchronizer position. Using two dil switches on A05 select 25 frames/sec. Press CPU reset. Set switch S1 on T.C. circuit to external (towards the front of the circuit).

Remove the TA-PFM and connect it to the time code circuit using the extender harness.

LEVEL ADJUSTMENTS

Monitor R60 on TAPFM with an A.C. voltmeter.

FM Pilot (NAGRA SYNC)

Switch 5 to OFF and switch 6 to ON (right-hand block of 8 dil switches) on the TC board.

Switch S1 on TAPFM to FM position as indicated on the TAPFM circuit.

Reproduce Pilot test tape 50 Hz FM center track (7 1/2 ips 19 Cms).

Check that T.C. led on the keyboard is alight without interruption.

Adjust RP4 so that the output on R60 is VFM 1.7 ± 0.1 VRMS.

Stella pilot

Slide switch S1 to position ST as indicated on the PFM circuit.

Reproduce Stella pilot test tape at 7 1/2 19 cms and adjust RP1 to obtain level of 1.7 V ± 0.1 VRMS on R60.

Neo pilot

(Only applicable if TA-OPN is fitted). Set switch 6 (right-hand block of 8 on T.C. board) to the OFF position (Neopilot operation).

Reproduce Neopilot section of test tape at 7 1/2 (19 cms) and adjust RP2 on TAPFM for 1.7 V ± 0.1 VRMS on R60.

5.0 RESOLVER CHECKS

Set dil switches 5 and 6 to ON (right-hand block of 8).

Set S1 on TAPFM to FM position.

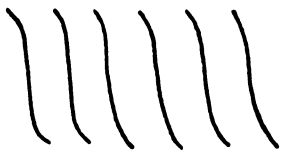
Put the T.C. channel of the channel status matrix to "READY" & "SYNC".

To protect the test tape, set the record inhibit switch on the main logic card to inhibit.

RESOLVING AGAINST INTERNAL 50 HZ REFERENCE

Set S1 on T.C. board to internal reference position (towards rear of machine).

Replay in variable speed play the FM pilot 50 Hz test tape. Monitor R65 using an oscilloscope and look for a constant display as shown below.



stable

Press "Pause" key and check that the machine starts to resolve again within 2 seconds as shown above.

Adjust variable speed potentiometer to both extreems and check that the signal above is still constant and stable.

RESOLVING AGAINST EXTERNAL 50 HZ REFERENCE

Set switch S1 on T.C. board to external reference position (towards front of machine).

Feed on external reference of 48 Hz 1 Vpp signal wave and with the speed variation pot in the central position (0 position) and replay 50 Hz FM pilot test tape in variable speed play and monitor using an oscilloscope on R65. Signal should stabilize within 2 seconds. Repeat as above using 52 Hz external reference.

EXTERNAL ACCESSORIES 6

TABLE OF CONTENTS

1.0 INTRODUCTION

This condensed information is aimed at all our agents and clients who, for the first time, have to set up a system including a NAGRA T-AUDIO TC in a RS 422 or RS 232 environment. It describes both the method of operation to follow, and also the fitting of the TAIRS option into a T-Audio T.C., not previously fitted with this option or the necessary EPROM version. This section also covers other accessories and their uses in conjunction with the NAGRA TA-TC.

January 1987

2.0 INSTALLATION OF THE TAIRS OPTION

The TAIRS option consists of two main elements. The UART (Universal Synchronous Receiver Transmitter) circuit NSC-858 which has to be installed into the socket UK4 on the circuit A05-A23 (machine interface and synchronizer) and an Eprom containing the software and dialog for the external interface TAERS.

This EPROM can be identified by the letters ..RS written on the sticker on top of the chip itself or by the last line of the status display menu (page II.1.4-1).

NOTE: If after fitting the ..RS eprom and the display still does not show ..RS on the menu, then contact a NAGRA agent for information on how to activate this function.

2.1 VERIFICATION OF CABLING AND OPERATION OF TAERS/TAESV

Open the TAERS and remove the TAESV option by unscrewing the two screws found on either side of the BNC connectors, NOT the two screws between the board and bracket when viewed from above.

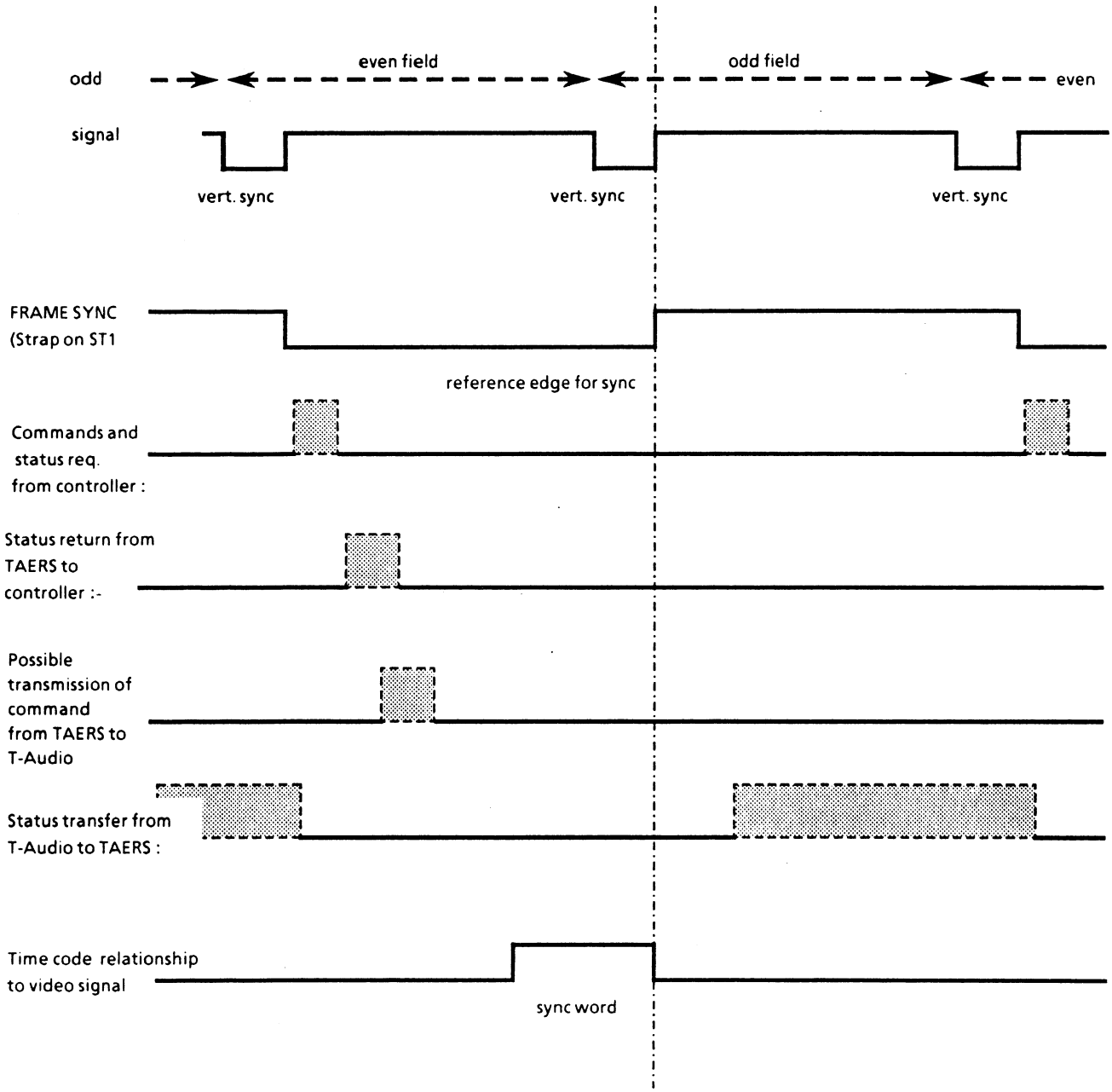
Note the position of the bridge ST1/ST2 which determines the phase of the reference signal extracted from the video signal. The position of this strap ex-factory is in ST1 position. This strap has to be in the ST1 position if the T-Audio is not equipped with the TAPFM option. (Pilot circuit) and position ST2 if the TAPFM option is installed. (The TAPFM effectively inverts the phase of the reference signal).

The drawing on the following page indicates the principle timings of the different sync signals with respect to the video signal.

Refit the TAESV option and check the position of the PAL/NTSC switch with respect to the inscription on the rear pannel of the TAERS (the inscription on the circuit board with indication ⬡ or A is inverted).

TAERS

Check the position of the switch S2 which has to be pushed towards the NSC 858 circuit (U11).
This switch assures the selection between the 5.12 MHz and the 4.91 MHz crystals which act as baud rate references for the serial communication with the "Controlled device".
The indication 5.12 is only correct on boards marked Ⓐ (the earlier circuits without any mark have indication 5.12 and 4.91 inverted).
In the case of the T-Audio the baud rate obtained by the UART using the 5.12 MHz crystal is slightly higher than normal (4%).
Check that the EPROM version corresponds to the desired protocol (Ampex & Sony format). Protocols for Studer and SMPTE/EBU bus are under development.
Check the settings of the "DIL" switches S1 and in particular S1-7 which must be in the "ON" position.


odd
even field
odd field
even
signal
vert. sync
vert. sync
vert. sync
FRAME SYNC
(Strap on ST1
reference edge for sync
Commands and
status req.
from controller :
Status return from
TAERS to
controller :-
Possible
transmission of
command
from TAERS to
T-Audio
Status transfer from
T-Audio to TAERS :
Time code relationship
to video signal
sync word

2.2 CHECKING AND SETTING OF THE "FRAME PULSE" REFERENCE SENT BY THE VIDEO SIGNAL

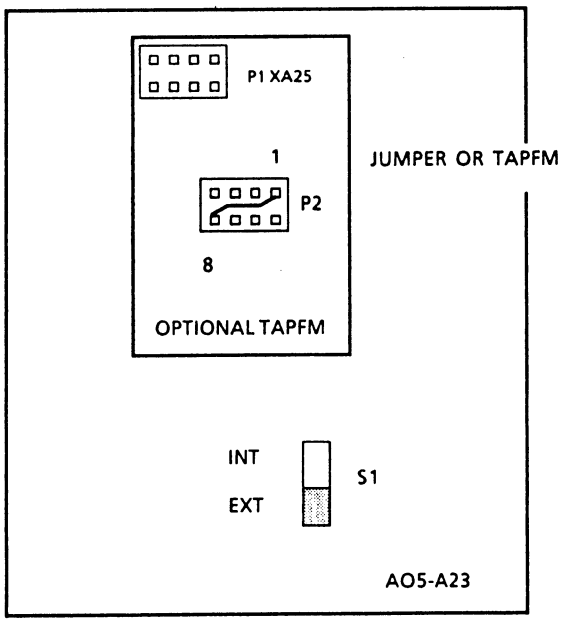
Control "hardware"

The external (Frame sync) reference is sent directly from the TAERS to the T-Audio via pin 5 on the RS 422 connector. Wire No. 5 is not used in most of the RS 422 cables, therefore ensure that this wire is present between the TAERS and the T-Audio, to transmit the signal to pin 5 (by experience we have discovered that the majority of RS 422 cables supplied by Ampex and Sony allow this connection with a NAGRA) T-Audio TC.

Check that your T-Audio TC has a 1 kOhm resistor soldered between pin 5 of the RS 422 connector and pin 2 of the third track IN/OUT connector on the interconnection circuit numbered (2109 200 172).

Check that the time code circuit is either equipped with the TAPFM option or fitted with a bridge between the pins P2-1 and P2-8 on connector XA25 (connector in the center of pilot circuit).

Check that the switch S1 on the time code circuit A05-A23 is in the postion "EXT REF" (switch towards the front of the circuit).



If the T-Audio TC is used in conjunction with the pilot signal monitoring module TACO-D2, then also check that the switch INT/EXT REF on the TACO-D2 itself is also in the position "EXT REF" and that no other pilot reference signal is fed to the TACO-D2.

NOTE: If TACO-R is fitted to TACO-D2, then set the INT/EXT reference switch to "OFF" on the TACO-D2R.

2.3 CONTROL "SOFTWARE"

The synchronizer of the T-Audio T.C. is able to use either an external reference time code signal (which obviously has to be locked to the studio reference) or directly the "FRAME PULSE" reference extracted by the TAESV from a composite video signal, generally the second solution is used.

It is not possible for the T-Audio to synchronize itself at the same time, on a time code signal and on an external "FRAME PULSE" reference. It is therefore possible to program the time code circuit of the T-Audio for the selection of a chosen reference.
Numerical code 004 = Reference frame pulse "rEF.Fr.P" in EPROM version 1.6 ("rEF.PIL" EPROM 1.4 - 1.5).
Numerical code 005 = reference time code "rEF tc"
Once this selection has been made the T-Audio will stay in the same chosen mode even after power has been turned off. The Ampex (and SMPTE/EBU) protocol allocates an address number (tributary address) to all machines in the system, which may be displayed and programmed on the T-Audio by means of the numerical code 200. The address number is factory set at "001". This number may be modified within the following limits by means of "blinking" and "store" functions (see II.2.5-1).

Machine Number	RS 422 Select address
001	80A2H (Hexadecimal)
002	80FEH (Max. value for control by Ampex VRC-2)
048	80FEH
082	81E6H
099	82A6H (Max. value for the Ampex Ace editor)

The SONY Protocol does not use this number identification.

Check the reception of the "FRAME PULSE" reference signal supplied by the composite video signal to TAESV and through to the T-Audio T.C. by putting the time code channel matrix in "INPUT". The "TIME CODE" Led must light without interruption. The condition of the reference signal received is critical for the correct operation of the RS 422 communication between the TAERS and the T-Audio as the T-Audio depends on it to return its status to the TAERS.

In the EPROM version 1.3 inside the TAERS it is possible to check separately the presence of the FRAME PULSE signal on the output of the TAERS. In the absence of communication between the TAERS and the T-Audio the "CONTROLLED DEVICE" led will stay illuminated permanently if the TAESV does not generate the "FRAME PULSE" signal or it will blink if it is present.

2.4 POSSIBLE PROBLEMS

If the Time Code Led does not light up when the time code channel status matrix is in INPUT, recheck all the points mentioned above, then make sure that the standard selection on the T-Audio corresponds to the video signal.

PAL video signal: frame pulse = 25 Hz Frame rate of 24 or 25 F.P.S.

NTSC video signal: frame pulse = 29.97 Hz Frame rate of 29.97 or 30 F.P.S.

Check that the technical level of the T-Audio includes the modifications described in the technical information sheet 09-7 (June 1986).
If the led goes out occasionally then the "FRAME PULSE" signal is disturbed, the possible causes may be found in the quality of the video signal sent to the TAESV, or due to a poor cable or one that is too long between the TAERS and the T-Audio.
Any disturbance of the "FRAME PULSE" signal will cause a synchronizing error in the T-Audio as this signal is used to increment the value of the "TIME LINE" on each frame (a time code signal purely contained in software used to synchronize to the external reference during replay in the Ampex protocol).

3.0 SELECTION OF RS 422 AND CHECKING OF OPERATION

3.1 PROGRAMMING THE T-AUDIO T.C. FOR RS 422 OPERATION

Two numerical codes allow the selection of the T-Audio machine identification which is sent to the Ampex or ACE VRC-2 systems.

Numerical code 204: Code ID (Hex) identification as "NTA-TC"
(Valid in version 3.0 of the ACE, the older versions announce the message "Unknown transport")

Numerical code 205: Code 09 - identification as a "VPR-3".

This code does not directly affect the way that the ACE system controls the T-Audio T.C.
The ex-factory setting corresponds to code 204 (NTA-TC).
Two numerical codes allow the reading of signal from the record head or from the replay head in the event of "Rehearse".

Numerical code 008: Simulation of "Rehearse" in "REPRO" (Audio and time code signal from the replay head).

Numerical code 009: Simulation of "Rehearse" in "SYNC" (Audio and time code signals from the recording head).

The numerical code 008 is advised for the systems with the Ampex protocol in as much as it offers a better sound quality. The numerical code 009 is to the contrary obliged for system using the Sony protocol in as much as the Edit mode (Rehearse, Insert or Assemble) are not sent to the T-Audio until the last moment (at the point of entry) thus this does not allow the T-Audio to differenciate sufficiently soon if the time code has to be referenced on the replay head (Rehearse) or on the record head (Edit).
The ex-factory setting is code 008 (Rehearse in Repro).

3.2 CHECKING OF THE COMMUNICATION

Check the operation of the RS 422 communication between the editor and the TAERS.
The "CONTROLLER ERROR" led must be off and the "SELECT" led must light up as soon as the "Polling" of the addresses by the Ampex protocol recognizes the address selected on the T-Audio.
Check the operation of the RS 422 communication between the TAERS and the T-audio the led "CONTROLLED DEVICE" error must be out.

Then check the status (Stop, time code etc.) returned by the TAERS on the editor's display.

Finally check the correct reception by the T-Audio of the simple commands (TAPE/EE) then the transport commands (Play, etc).

3.3 SWITCH: REMOTE/LOCAL ON THE T-AUDIO T.C.'S KEYBOARD

This switch does not permit the inhibition of the communication between the T-Audio and the edit system in the "Local" position which does not affect the serial RS 232 or RS 422 communication.

3.4 POSSIBLE PROBLEMS

The speed control in "Shuttle" depends on the voltage (+ 5 Volts) of the Time code circuit of the T-Audio. If the "joystick" is in the central position in "Shuttle" and the transport is at rest, check the voltage polarity which has to be + 5 Volts (+ 0.05 - 0.04 V) on ST4 on A05-A23 (the first T-Audio TC's are at + 5.3 Volts and should be adjusted to + 5 Volts). This operation requires a recalibration of the offset voltage of the synchronizer (potentiometer RP5 on the circuit A05-A23) and a regulation of the centering of the P.L.L. of the clock resynthesizer (adjustable capacitor C24 on A05-A24).

The control of speed in "Slow motion" may equally develop a problem when the "Joystick" is at end stop (Speed corresponding to 15 ips (38 cm/s). If jerks in the transport are detected the maximum speed limitation of the circuit A04-A19 (Servo-editing) must be increased by replacement of the resistance R70 (220 kOhm) with a resistance of 270 kOhm in parallel with a 3.3 MOhm resistor.

4.0 TAERS PROTOCOL FOR ACE & MOSAIC

The signaling rate is 38.4 KBaud.
Each character consists of a START bit, eight DATA bits and a STOP bit. The parity bit is such that the sum of ONES in the data and the parity bit itself is an ODD number.

The connectors, voltage levels, source impedances, etc., described in the documents are similar to RS 422.
Further information may be found in the following document: "CONTROLLING AMPEX EQUIPMENT VIA THE SMPTE PORT" issued 14.6.84.

4.1 MACHINE NUMBER PROGRAMMING

Select the ADDRESS to which the T-Audio will respond through the TAERS and enter in the SELECT state (communication state). This depends directly on the number of the T-Audio TC according the following table:

Machine number	RS 422 select address
001	80A2
002	80A4
003	80A6
004	etc

Use Numerical code 200 to check or modify the machine number.

4.2 USER DEFINED COMMUNICATION

To enter the "user defined communication" allowed by the SMPTE/EBU standard the controller sends, after the TAERS has entered the SELECT state, an "ESC" (ESCape = Hex 03). Upon this transmission the slave responds by transmitting "ACK" (ACKnowledge = Hex 04) and communication is established.

4.3 MESSAGE STRUCTURE

From controller to TAERS interface:

STX (Hex 02):	at the head of every message
Byte count of the message:	does not include the STX, itself or the
The message:	checksum variable length, 250 bytes max.
The checksum:	the two's complement of the one-byte sum, without carry, of the message and the byte count

Several commands may be combined into one message, as follows:

STX
Byte count of all the commands
Command 1
Command 2

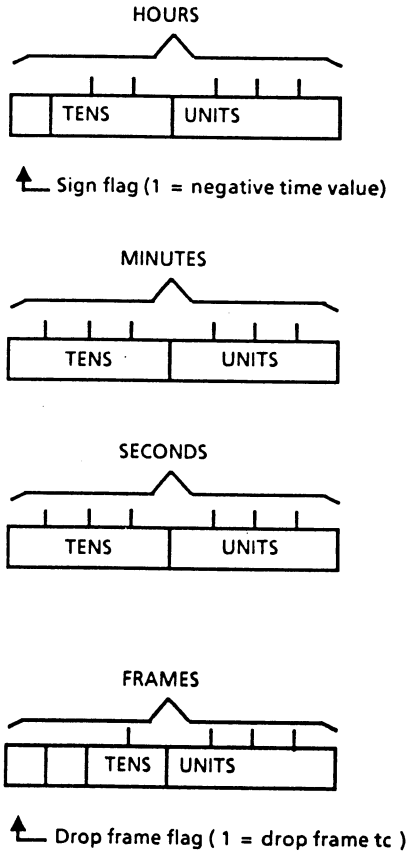
Command N
Last command
Checksum

From TAERS interface to controller, only when requested:

STX
Byte count of command echo and data
Echo of the command which requested the data
The requested data
The checksum which includes the byte count, echo and data

4.4 TIME CODE FORMAT

Time code values are transmitted as fields of 4 bytes in packed BCD, hours byte first. Most significant nibble (4 bits) is tens, least is units.



4.5 COMMANDS

Following are all the commands decoded in the TAERS interface. Numbers are Hex.

01	**SEND STATUS** For reply refer to chapter 4.8	1 byte
02	**SEND EXTENDED STATUS** For reply refer to chapter 4.8	1 byte
03	**DEFER THE FOLLOWING COMMANDS**	N bytes
+	4 bytes of time code which corresponds to the time of execution	
+	1 byte which is the byte count of the command(s) to be deferred	
+	N bytes of command(s) to be deferred	
04	**CUE** Cue to the earliest event on the time line. The T-Audio TC automatically subtracts the previously programmed preroll time	1 byte
05	**STOP THE TIME LINE** Stop incrementing the software counter	1 byte
06	**CLEAR THE TIME LINE** All events associated with the time line are cleared.	1 byte
07	**LOAD AND START THE TIME LINE**	5 bytes
+	4 bytes of time code. This number must be earlier than the first deferred command	
26	**TREAT THE FOLLOWING AS A TAPE TRANSPORT SUB-COMMAND**	1 byte

4.6 SUB-COMMANDS

The following are all the tape transport specific sub-commands decoded in the TAERS interface. Sub-commands have the following format:

Hex 26:	the sub-command identifier
Byte count:	the sub-command count
Sub-command	

01	**READY SWITCH**	2 bytes
+	0=off (sets the T-Audio in PARK), 1=on (sets the T-Audio in STOP)	
02	**EE/TAPE SWITCH**	2 bytes
+	0=Tape (REPRO), 1=EE (INPUT)	
03	**COLOR FRAMER**	2 bytes
	Not relevant to audio tape transport	
04	**LONGITUDINAL TIME CODE**	2 bytes
+	0=off (TC channel in OFF), 1=on (TC channel in REPRO)	
05	**VERTICAL TIME CODE**	2 bytes
	Not relevant to audio tape transport	
06	**EDIT MODE**	2 bytes
+	0=off, 1=insert, 2=assemble, 3=rehearse, 4=crash record	
07	**RECORD ENABLE**	2 bytes
+	One other byte, whose bits enable the following channels, when set to one Bit 1=Audio channel 1 READY Bit 2=Audio channel 2 READY Bit 7=Tc channel READY	

NOTE: For any channel to be recorded, it must be both enabled beforehand and called in the ENTRY command (17 below).

08	**TIME CODE MODE**	2 bytes
+	0=hold, 1=run now, 2=jam slave	
09	**SET SPEED**	3 bytes
+	Not remote controllable in the T-Audio	
0A	**SET THE TIME CODE GENERATOR**	5 bytes
+	Four bytes of time code	
0B	**SET THE USER BITS**	5 bytes
+	Four bytes of binary, most significant first	
0C	**STOP**	1 byte

NOTE: Depending on the ready status this command is interpreted as STOP if on, and as PARK if off.

0D **PLAY** 1 byte

0E **ROLL** 1 byte
This command should be deferred and sets the T-Audio in the SYNC INCREMENTAL mode. The external reference may be time code, a 25/30 Hz signal applied to the "EXT. REF." input of the 3rd TRACK CONNECTOR, or the "FRAME PULSE" signal originaled by the TAESV.

0F **TAPE SPEED OVERRIDE** 3 bytes
\+ Two bytes of magnitude (± 511 correspond approx to ± 14% speed change). The T-Audio automatically sets itself to the VARIABLE SPEED PLAY mode upon receiving this command.

10 **SLOW PLAY** 3 bytes
\+ Two bytes of magnitude (+ 511 correspond to 38 cm/s forward, 0 to stop and - 511 to 38 cm/s backward). The T-Audio automatically sets itself to the SERVO mode upon receiving this command.

11 **SHUTTLE** 3 bytes
\+ Two bytes of magnitude (+ 510 corresponds to maximum speed forward and - 510 to maximum reverse). The T-Audio TC automatically sets itself to the LISTEN TC mode. Maximum values + 511 and - 511 produce respectively FAST FORWARD and FAST REWIND mode where the tape is no longer in contact with any head.

12 **SET PREROLL DURATION** 5 bytes
\+ Four bytes of time code. (Suggested minimum for T-Audio is 3 seconds).

13 **SET SYNC POINT** 5 bytes
\+ Four bytes of time code. This sets a point of synchronism for the cue command.

14 **SET CONTROL POINT** 7 bytes
No action on the T-Audio

15 **CUE** 1 byte
No action on the T-Audio

16 **SEARCH** 5 bytes
\+ Four bytes of the time code. Causes the T-Audio to move to the specified time code location, ignoring preroll.

17 **RECORD ENTRY** 2 bytes
\+ One other byte with same format as in 07 above.
Causes the T-Audio to start recording on the specified channels.

18 **RECORD EXIT** 2 bytes
\+ One other byte with same format as in 07 above.
Recording is stopped on the specified channels. For a clean audio record exit (during an insert for example) the RECORD EXIT command must be applied to all recording channels. A partial exit of one channel only will produce audible clicks on the track concerned.

19 **CHASE** 1 byte
Causes the T-Audio to enter one of the SYNC mode (SYNC SLOW, SYNC FAST or SYNC INCREMENTAL) depending on the previously transmitted value of SYNCHRONIZE SELECT 54.

Commands 1A through 24 ask the transport to send the status of certain parts of itself. For the replies made by the TAERS interface see chapter 5.8.

1A **SEND THE READY STATUS** 1 byte

1B **SEND EE/TAPE STATUS** 1 byte

1C **SEND COLOR FRAMER STATUS** 1 byte
Not relevant to audio tape transport

1D **SEND LONGITUDINAL TC STATUS** 1 byte

1E **SEND VERT. INTERVAL TC STATUS** 1 byte
Not relevant to audio tape transport

1F **SEND EDIT MODE** 1 byte

20 **SEND RECORD ENABLE STATUS** 1 byte

21 **SEND TC GENERATOR MODE** 1 byte

22 **SEND TRANSPORT SPEED SETTING** 1 byte

23 **SEND TIME CODE FROM READER** 1 byte
Depending on the "TIME SOURCE SELECT" the reply will hold tape timer or TC reader values

24 **SEND USER BITS FROM READER** 1 byte

25 **JOG FORWARD** 1 byte
Causes the T-Audio TC to advance one frame. The T-Audio TC automatically sets itself to SERVO mode.

26 **JOG BACKWARD** 1 byte
Causes the T-Audio TC to go back one frame. The T-Audio TC automatically sets itself to SERVO mode.

27 **SET ACCURACY WINDOW** 2 bytes
\+ One byte, 0 thru 0A. Normally set to zero. No action on the T-Audio.

28 **SET TAPE TIMER** 5 bytes
\+ Four bytes of time code. "Hours 80" bit set to one is considered as minus sign for tape timer.

2C	**TIME SOURCE SELECT**	2 bytes
+	0 = time code reader 1 = tape timer 2 = tape timer	
2D	**SEND TIME SOURCE SELECT**	1 byte
53	**SET SYNCHRONIZATION OFFSET**	5 bytes
+	Four bytes of time code. "Hours 80" bit set to one, indicates a negative or lagging offset relative to external time code.	
54	**SYNCHRONIZE SELECT**	2 bytes
	One other byte as follows:	
	00 External time code (data dependent) = SYNC SLOW 01 External time code (data independent) = SYNC INCREMENTAL 02 External video reference = SYNC INCREMENTAL 03 SYNC FAST	
55	**SEND SYNC SELECT**	1 byte

4.7 TAERS RESPONSES TO INFORMATION REQUEST

If the command is garbled, the TAERS will send NAK (NotAcKnowledge = Hex 05) and exit to IDLE mode, otherwise STX plus byte count, plus one or more of the following replies, and terminated by a checksum

SEND STATUS **Reply** 7 bytes

01 (command echo)
4 bytes of time code
1 byte as follows:

Bit	0:	1=NTSC, 0=PAL
	1:	1=Drop frame, 0=non drop frame
	2:	1=Time line running, 0=stopped
	3:	1=Deferred command buffer is full, 0=not full
	4-7	Reserved

Another byte as follows:

00	Stopped
01	Stopping
02	Playing
03	Tape speed override on
04	Shuttle mode
05	Fast forward
06	Rewind
07	Synchronizing
08	Synchronized, and is a source
09	Synchronized and is the master recorder (set only if one audio channel at least is in READY and if in editor mode during assembly or insert)
0A	Master edit period (not yet implemented)
0B	Record
0C	Cueing
0D	Cued (parked)
0E	Searching (not the same as cueing)
0F	Search completed
10-12	Reserved
13	Slow play
14	Power not on
15	Not in remote control mode (not yet implemented)
16	Unthreaded

SEND EXTENDED STATUS Reply 5 bytes

02	(command echo)
03	(deviced type = transport)
00	(first byte of device identify always 00)
1D	(second byte of device identify attributed to T-Audio TC)
	1 byte of extended status:
0	No error
1-3	Reserved
4	Command unknown
5	Bad command arguements
6	Command currently impossible
7	Machine not configured to execute command

8	Machine not (ever) capable to execute command
9	Time line entry data bad
10	Time line command missed or badly executed

In the following, note that tape transport sub-command identifier and the sub-command are echoed.

SEND READY STATUS

Reply 3 bytes
26
1A
one byte as follows: 0=not ready, 1=ready

SEND EE/TAPE STATUS

Reply 3 bytes
26
1B
one byte as follows: 0=tape (REPRO), 1=EE (INPUT)

SEND COLOR FRAMER STATUS

Reply 3 bytes
26
1C
one byte as follows: 0=off, 1=on (transparent to T-Audio TC)

SEND LONGITUDINAL TC STATUS

Reply 3 bytes
26
1D
one byte as follows: 0=off, 1=on

SEND VERT. INTERVAL TC STATUS

Reply 3 bytes
26
1E
one byte as follows: 0=off,
1=on (transparent to T-Audio TC)

SEND EDIT MODE

Reply 3 bytes
26
1F
one byte as follows: 0 = off,
1=insert, 2=assembled,
3=rehearse, 4=crash record

SEND RECORD ENABLE STATUS

Reply 3 bytes
26
20
one byte in same format as in 07

SEND TC GENERATOR MODE

Reply 3 bytes
26
21
one byte as follows: 0=holding,
1=running, 2=jam slave

SEND TRANSPORT SPEED SETTING

Reply 4 bytes
26
22
one byte of magnitude with following value:
0 = 9.5 cm/s
1 = 19 cm/s
2 = 38 cm/s
3 = 76 cm/s

SEND TIME CODE FROM READER

Reply 6 bytes
26
23
four bytes of time code or tape timer

SEND USER BITS FROM READER

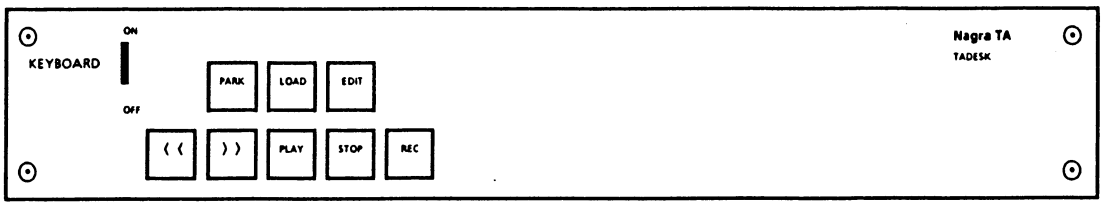
Reply 6 bytes
26
24
four bytes of time code

SEND SYNC SELECT

Reply 3 bytes
26
55
One byte with values as in command 54 (Synchronize select)

5.0 TADESK (simplified keyboard)

The TADESK is a simplified keyboard for the NAGRA T-Audio. It is connected to the T-Audio through a serial bus to the socket on the left (if TA-PPA option is fitted) or otherwise on the right hand-side of the recorder.



5.1 KEYBOARD FUNCTIONS

Eight keys allow the user to select the main transport functions of the T-Audio. Lamps in each key are controlled by the central logic of the recorder thus ensuring that the selected function has been correctly received and decoded.

PLAY Same function as on the T-Audio

STOP Same function as on the T-Audio

≫ Same function as on the T-Audio

≪ Same function as on the T-Audio

RECORD The recording is started when both PLAY and RECORD keys are pressed simultaneously but only the RECORD lamp is switched on. Selecting RECORD with all channels set to SAFE will put T-Audio in the PARK position. In this case the RECORD lamp on the TADESK will blink thus indicating that RECORD has been selected but not executed.

PARK Same effect as on the T-Audio but with only one key instead of SHIFT and STOP.

LOAD Same function as the LOAD key of the T-Audio.

EDIT The user selects the function corresponding to the EDIT key by the means of dil switches on the rear side of the TADESK. The command assigned to the EDIT key is to choose between the functions FREE SPOOL, SERVO, 0 and 0 on the T-Audio.

KEYBOARD This switch, when set to OFF, inhibits the keys on the TADESK. However the lamp display still reflects the state of the T-Audio.
A switch on the rear side of the TADESK allows the STOP key to remain active when the KEYBOARD switch is set to OFF for emergency stops.

5.2 TADESK CUSTOMIZING SELECTORS

The simplified keyboard can be programmed according to the needs of the user by means of dil switches on the rear of the TADESK.

EDIT

Four different commands can be sent to the T-Audio -FREE SPOOL, SERVO, 0↦ , ↤0 - when the key EDIT is pressed according to the position of switches S1 and S2.

	S1	S2
FREE SPOOL	ON	ON
SERVO	ON	OFF
0↦	OFF	ON
↤0	OFF	OFF

SPEED INITIALIZATION

On power up the T-Audio is automatically set to speed A. Switches S5 and S6 allow the choice of another speed on power up B, C or D.

	S5	S6
Speed B	ON	ON
Speed C	ON	OFF
Speed D	OFF	ON
Free	OFF	OFF

When more than one keyboard with this feature is connected to a T-Audio, it is important to note that all except one must be set in the "Free" position to ensure a correct initialization.

KEYBOARD

Switches S7 and KEYBOARD on the front of the TADESK define the action of the keys. The lamp display works normally.

	S7	KEYBOARD
Stop only	ON	OFF
Enable	ON	ON
Disable	OFF	OFF
Enable	OFF	ON

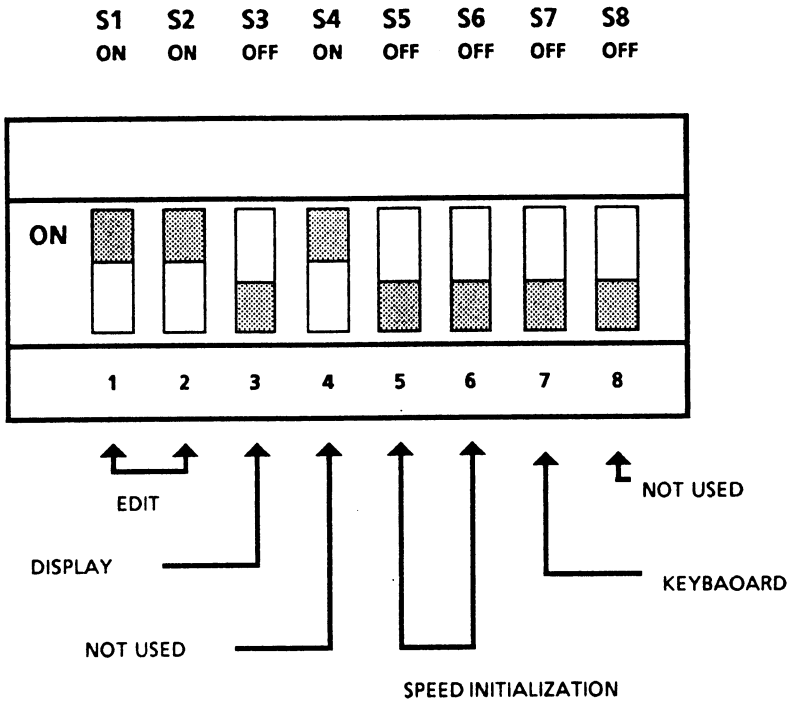
When switches S7 and keyboard switch are set to "Enable" position, the keyboard operates normally with all keys active on the TADESK.
When the "Disable" position is selected, no key is active on the TADESK. In the "Stop only" position, all the keys are inactive except STOP for emergency stops.

DISPLAY

The switch S3 is to set imperatively to OFF for use of TADESK.

TADESK customizing selectors

EX FACTORY CONFIGURATION



NOTE: Selectors with blue color have the "ON" position inverted (ON is downwards).

5.3 POWER UP

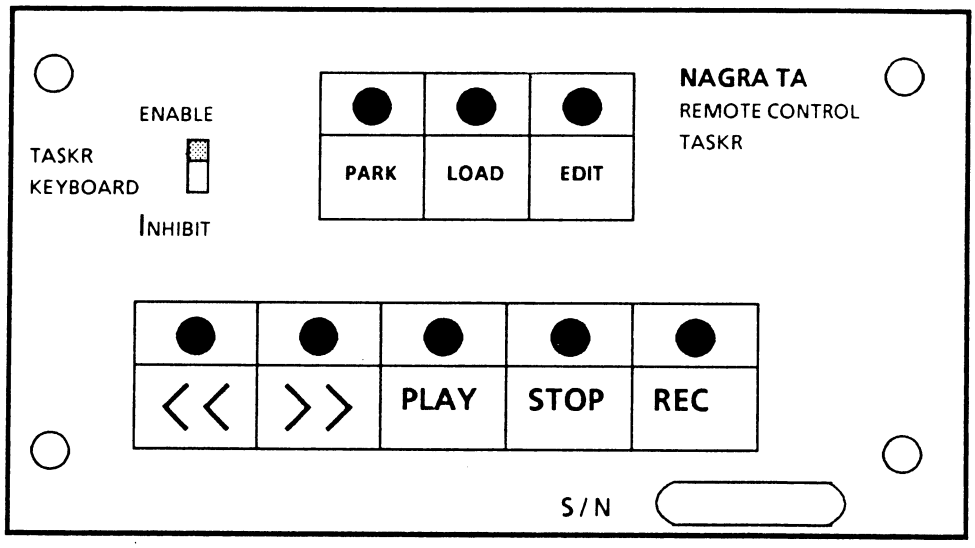
On power up, all the lamps in the keys of the TADESK are switched on one by one for a period of about half a second before the remote control is ready to accept commands.

5.4 CONNECTIONS

The remote control keyboard TADESK is connected to one of the side socket of the T-Audio. (Left-hand side is only possible if TA-PPA option is installed in the machine).

6.0 TASKR (remote keyboard)

The TASKR is a remote keyboard for the NAGRA T-Audio which is connected to the T-Audio through a serial bus with the connector REMOTE CONTROL INPUT/OUTPUT on the rear side of the recorder.



6.1 KEYBOARD FUNCTIONS

Eight keys allow the user to select the main transport functions of the T-Audio. Leds on each key are controlled by the central logic of the recorder thus ensuring that the selected function has been correctly received and decoded.

PLAY Same function as on the T-Audio

STOP Same function as on the T-Audio

≫ Same function as on the T-Audio

≪ Same function as on the T-Audio

RECORD The recording is started when both PLAY and RECORD keys are pressed simultaneously but only the RECORD led is switched on. Selecting RECORD with all channels set to SAFE will put T-Audio in the PARK position. In this case the RECORD led on the TASKR will blink thus indicating that RECORD has been selected but not executed.

PARK Same effect as on the T-Audio but with only one key instead of SHIFT and STOP.

LOAD Same function as the LOAD key of the T-Audio.

EDIT The user can select the function corresponding to the EDIT key by means of dil switches on the rear side of the TASKR. The function assigned to the EDIT key is to choose between the function FREE SPOOL, SERVO, 0 and 0 of the T-Audio.

KEYBOARD This switch, when set to "Disable", inhibits the keys on the TASKR. However the led display still reflects the state of the T-Audio.

A switch on the rear side of the TASKR allows the STOP key to remain active when the KEYBOARD SWITCH is set to "Disable" for emergency stops.

NOTE: When the LOCAL/REMOTE switch of the main keyboard of the T-Audio is set to LOCAL, the keys on the TASKR are always inhibited.

6.2 TASKR CUSTOMIZING SELECTORS

The remote control keyboard can be programmed according to the needs of the user by means of dil switches on the rear of the TASKR.

EDIT

Four different commands can be sent to the T-Audio - FREE SPOOL, SERVO, 0→ , ←0 - when the key EDIT is pressed according to the position of switches S1 and S2.

	S1	S2
FREE SPOOL	0	0
SERVO	0	1
0→	1	0
←0	1	1

SPEED INITIALIZATION

At power up the T-Audio is automatically set to speed A. Switches S5 and S6 allow choose of another speed at power up B, C or D.

	S5	S6
Speed B	0	0
Speed C	0	1
Speed D	1	0
Free	1	1

When more than one keyboard with this feature is connected to a T-Audio it is important to note that all except one must be set in the "Free" position to ensure a correct initialization.

KEYBOARD

Switches S7 and the keyboard switch on the front side define the action of the keys of the remote control. In any case the led display works normally.

	S7	Keyboard
Stop only	0	←Disable
Enable	0	Enable
Disable	1	←Disable
Enable	1	Enable

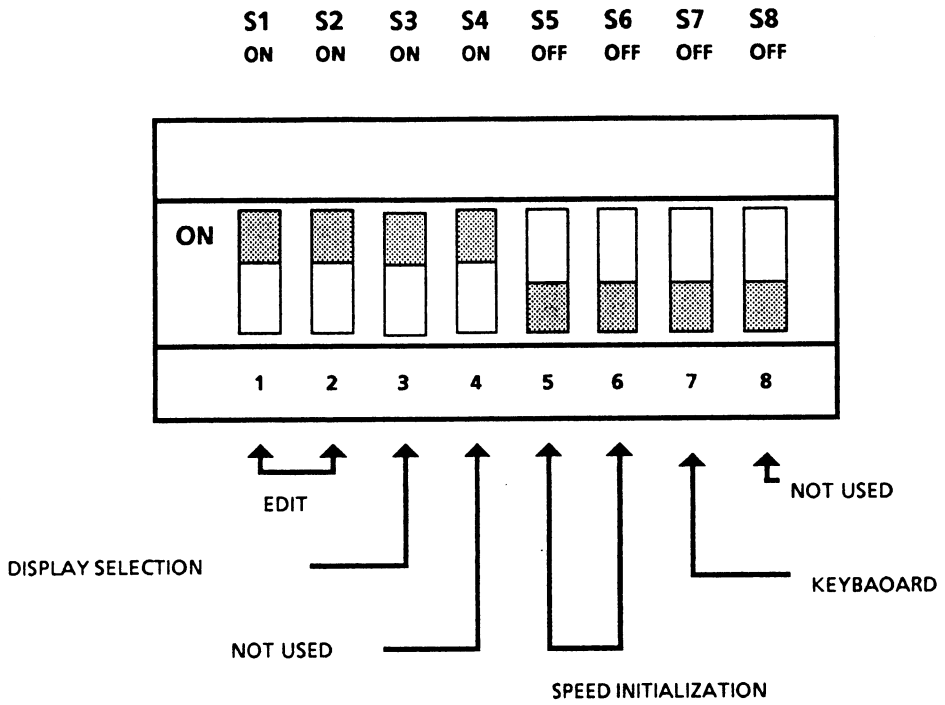
When switches S7 and keyboard switch are set to "Enable" position, the keyboard works normally with all keys active.
When the "Disable" position is selected, no key of the TASKR is active. In the "Stop only" mode, all the keys are inactive except STOP for emergency stops.

DISPLAY

The switch S3 is to set imperatively to 0 for a correct use of TASKR.

TASKR customizing selectors

EX FACTORY CONFIGURATION

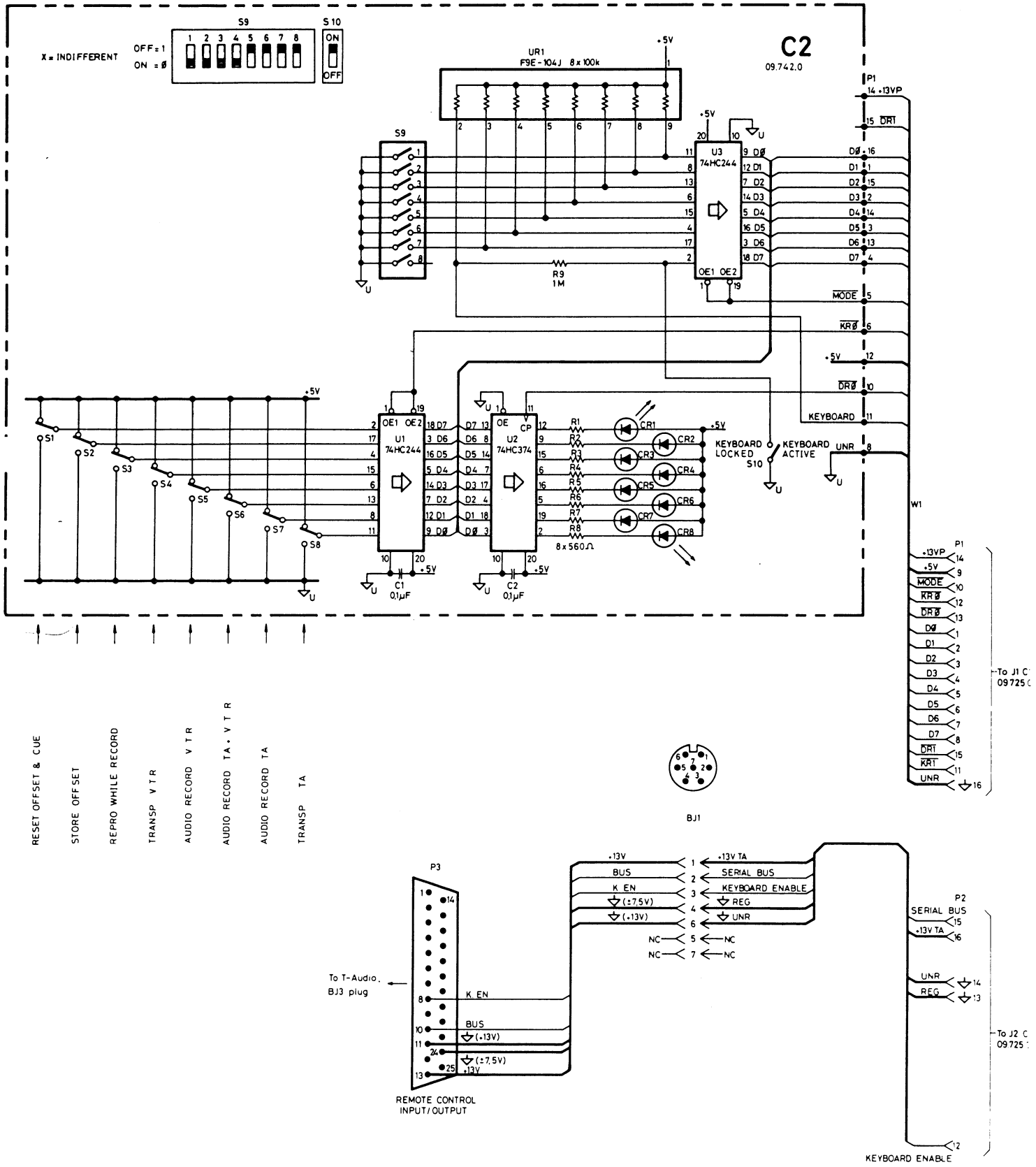


WARNING: ON represents Logic state 0 (0 V)
OFF represents Logic state 1 (+ 5 V)

NOTE: Selectors with blue color have the "ON" position inverted (ON is downwards).

6.3 POWER UP

On power up, all the leds in the keys of the TASKR are switched on one by one for a period of about half a second before the remote control is ready to accept commands.



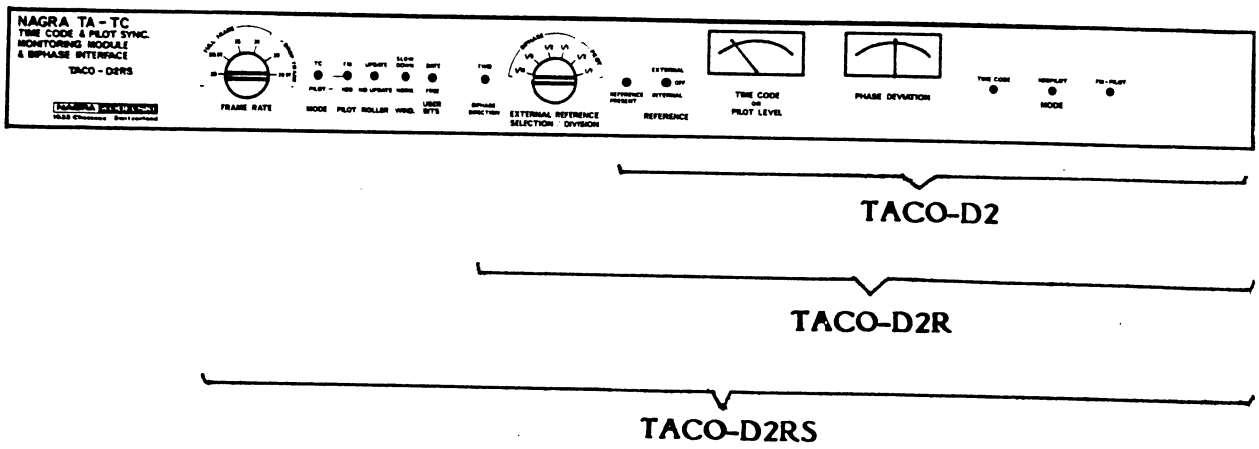
DATE	MODIFICATIONS

KUDELSKI SA Dept NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 19 West 44 th Street	C2 Ⓐ
TA-BOX	09.09.742.0.00	4.10.89
REMOTE CONTROL KEYBOARD		

6.4 CONNECTIONS

The remote control keyboard TASKR is connected to the T-Audio via the REMOTE CONTROL INPUT/OUTPUT connector on the rear side of the recorder.

7.0 TACO-D2, TACO-D2R AND TACO-D2RS (time code and pilot monitoring module, bi-phase interface and mode selectors)



The TACO-D2 is an external 19" rack mount accessory for use with Nagra T-Audio TC which are equipped with the Neopilot and FM pilot playback facilities (TAONP and TAPFM). It is equipped with a voltmeter as found on the QSLS to indicate phase deviation during synchronization.

There is a second meter on the TACO-D2 to measure the signal level (NEO-pilot, FM-pilot and T.C.). The switching between the different signals is automatically made within the TACO-D2 in conjunction with the time code circuit inside the T-Audio T.C. Three leds are fitted to the TACO-D2 to indicate the type of signal being used and a switch for INT/EXT reference is also fitted onto the TACO-D2.

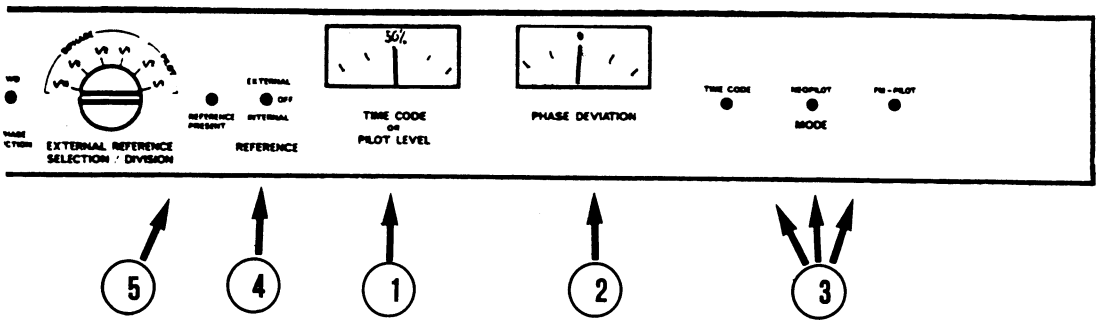
The TACO-D2 can be istalled in any of the TACO overbridge units and connects to the T-Audio whether directly or via the TACO-M1.

The TACO-R option allows the T-Audio TC to synchronize itself to a bi-phase signal such as that sent by Telecine machines or any other perfo-tape machines that deliver 2 bi-phase signals 90 degrees out of phase.

The TACO-R option fits inside the TACO-D. However in order to make the retrofit it is necessary to make some new holes in the front pannel of the TACO-D and some modifications to the existing wiring.

The TACO-S can be installed into the TACO-D2R to form the TACO-D2RS. This unit enables the switching of the time code system mode presently located on the time code circuit (switch S4) to be done more conveniently.

7.1 TACO-D2 OPERATING INSTRUCTIONS



1. Time code or pilot level meter

This meter indicates the level of time code or pilot signals depending on the time code system mode selectors position. The needle should show the middle position when tapes with a nominal level on the third track are played back. Time code level is adjusted with trimmer RP2 (refer to schematics for adjustment). Pilot level is adjusted with trimmer RP3 (refer to schematics for adjustment).

2. Phase deviation meter

This meter indicates the amount of speed correction applied to the capstan motor via the "speed correction" signal. This speed correction signal is originated by the time code synchronizer (TASYN) when in time code mode and by the pilot resolver (TAPFM) when in pilot mode. This meter is particularily useful in pilot mode to check the functioning of the pilot resolver. It should fluctuate around the center position while the T-Audio TC is in "PLAY" and settles to the center when the T-Audio TC is put into "VARIABLE PLAY" or "SYNC INCREMENTAL". Centering of the speed correction for off speed tapes may be done to a certain extent with the help of the manual speed variator on the T-Audio T.C. keyboard.

3. Mode selection leds

These three leds indicate the mode of operation which has been selected by the system mode switches on the time code board (S4) or on the TACO-D2RS if TACO-S option is fitted.

4. Internal/external reference switch

Assuming the S1 switch on the time code circuit is in "external position", this determines the source of reference used by the T-Audio.

Upper position: internal reference.

Middle position: off (only available with the newer TACO-D2R/D2RS versions). When the desired reference source is supplied by the TAERS/TAESV combination via the RS 422 connector it should be in this position.

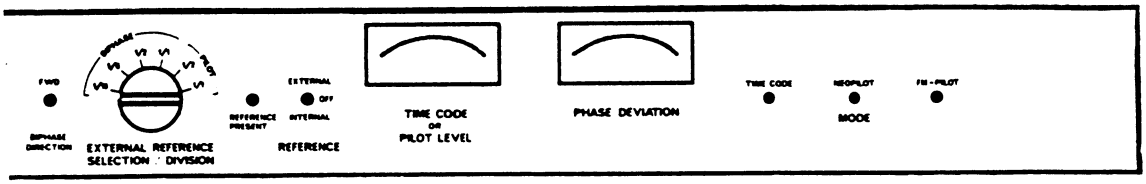
Lower position: external reference. This position selects the signal fed to pin 2 of the THIRD TRACK INPUT/OUTPUT connector as a reference source.

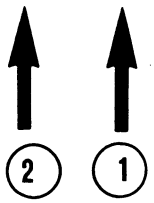
(5.) **Reference present led**

This led shows the presence of the reference as selected above.

7.2 TACO-D2R OPERATING INSTRUCTIONS

The TACO-D2R comprizes of two parts: the TACO-D2 option (time code and pilot monitoring) and the TACO-R (bi-phase interface). This section describes the use of the TACO-R part, refer to section 7.1 for information regarding the TACO-D2.





(1.) MODE & DIVISION SELECTOR: This rotary 6 position switch allows operation with a pilot reference and the operation with a bi-phase reference. For each of these modes a frequency division of the reference signal is provided.

(2.) BI-PHASE DIRECTION LED: This led indicates the direction of the machine generating the bi-phase signal.
Alight: forward
Out: reserve

Connection to the T-AUDIO

Connect the 15-pole and 25-pole connectors from the TACO-D2R to the "THIRD TRACK INPUT/OUTPUT" and the "AUDIO MONITORING OUTPUT" connectors respectively, on the back of the T-Audio.

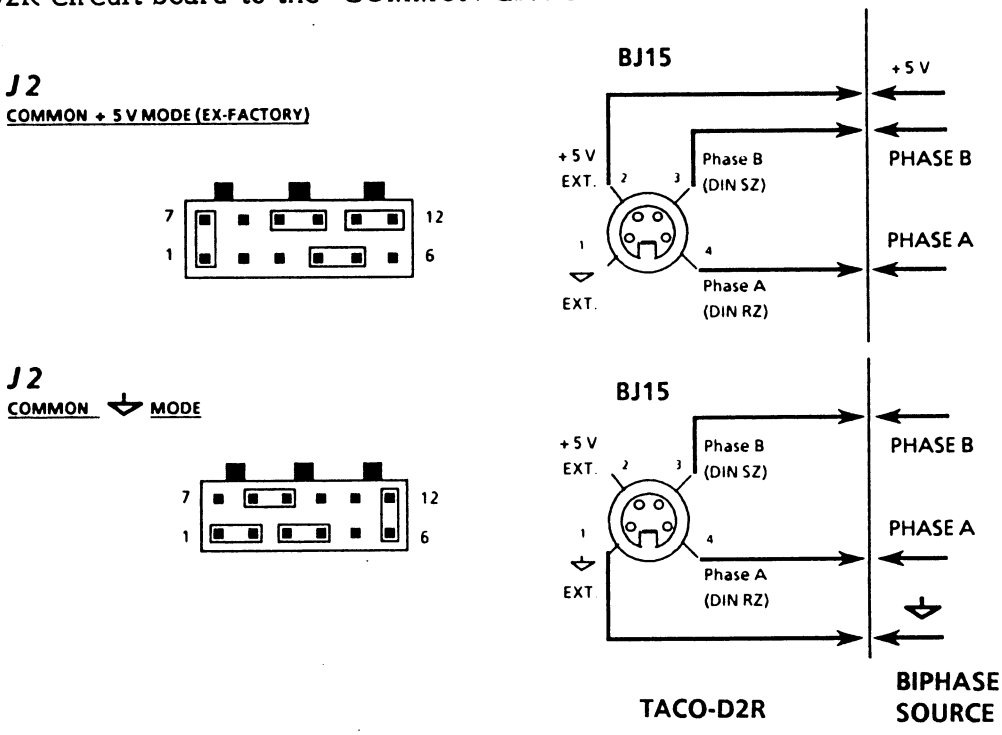
Operation in "BI-PHASE" MODE

Connect the A and B phase signals to the 4 pin tuchel input of the TACO-D2R, and also the + 5 V from the bi-phase source.

The bi-phase signal inputs on the TACO-D2R are linked via opto-couplers. The earths of the bi-phase source and the T-Audio do not have to be connected together.

NOTE: Without an easily accessible +5V supply it is possible to connect the earth of the bi-phase source to the TACO-D2R.

In this case, you must set the position of the jumpers for the connector J2 on the TACO-D2R circuit board to the "COMMON GROUND MODE".



Place the switch INT/EXT REFERENCE in the "EXT" position and the phase division selector in one of the 4 bi-phase positions depending on the nominal frequency of the bi-phase signals, according to the following table:

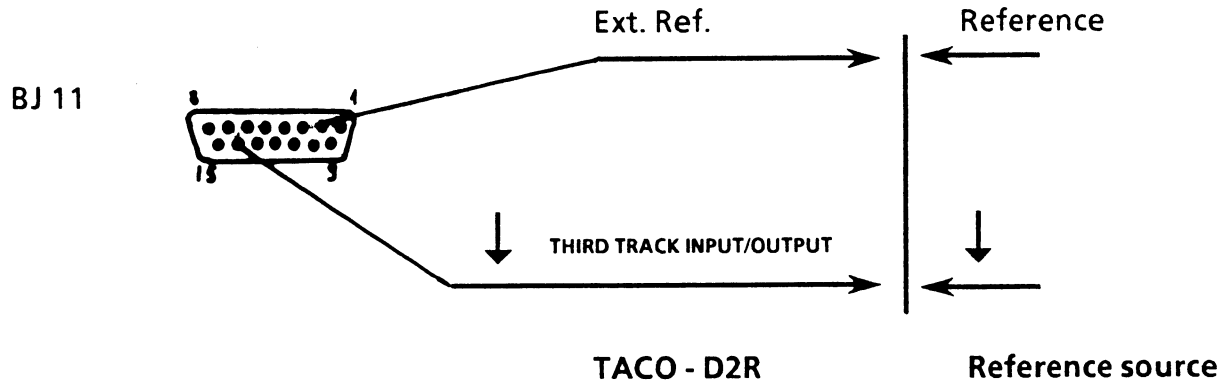
Switch	Nominal bi-phase frequency	T-Audio TC frame rate
1/1	24 impulsions	24 FPS
1/1	25	25
1/1	30 or 29.97	30 or 29.97
1/2	48 (2x24)	24
1/2	50	25 standard position (Europe)
1/2	60 or 59.94	30 or 29.97
1/8	240 or 239.76 (8x24)	30 or 29.97 standard position (USA)
1/10	240 or 239.76 (10x24)	24
1/10	250	25
1/10	300 or 299.7	30 or 29.97

Put the T-Audio in the bi-phase "reception" mode using numerical code 006. The display of the T-Audio should show "ref. biPH. Check the direction of the bi-phase signals by advancing or reversing the bi-phase source.

Check the direction indicator led (Alight = forward, out = backwards).

If the direction indicator is wrong, invert the A and B signals. Check the reception of the bi-phase signals by the T-Audio TC by putting the time code channel status matrix into "INPUT" and check the increment or decrement of the display. Synchronization is made using the "Sync + Incremental" function (possibly followed by "Sync +Slow" to avoid any ulterior modifications of the previous offset).

Operation in "PILOT" MODE



Two pilot positions are provided.

The position 1/1 allows synchronization (resolving) of "pilot" tapes (FM or Neopilot) 50 or 60 Hz against an external 50 or 60 Hz. This mode of operation uses the pilot synchronizer (resolver) located on the TAPFM.

The position 1/2 allows synchronization (resolving) of "time code" tapes of 25 or 30 frames per second against an external 50 or 60 Hz reference. In this position, the frequency of the external reference is divided by two before being fed to the "time code" synchronizer TASYN.

Installation of the TACO-D2R

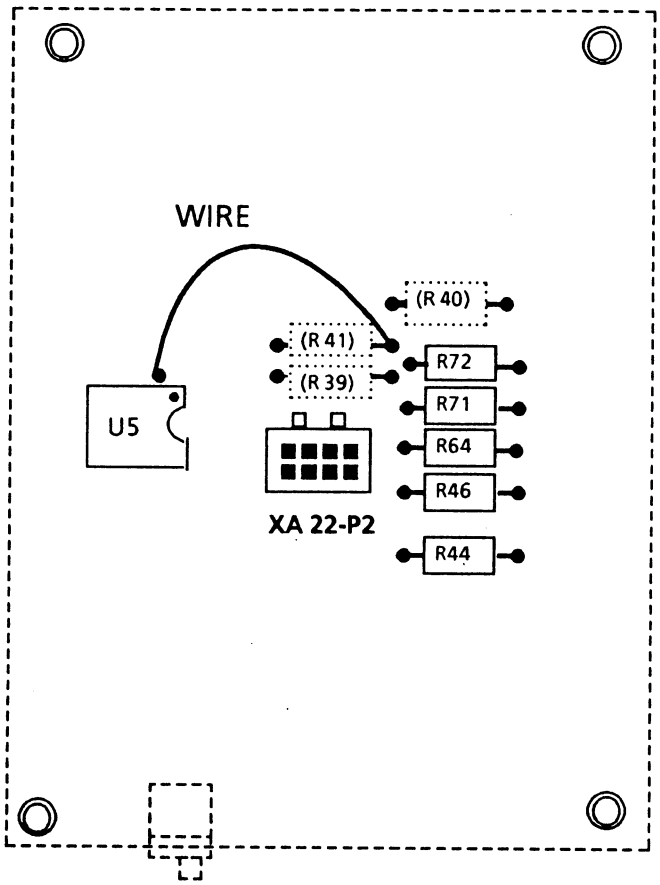
If the T-Audio TC is equipped with the pilot option (TAPFM) circuit, a modification has to be done before operating the bi-phase interface TACO-R. Indeed, the TAPFM circuit has a comparator for shaping the external reference signal which inverts the latter. This inversion is not suitable when the external reference for the T-Audio comes from the TACO-R.

Besides, the comparator for shaping of the external reference has been integrated in the TACO-R circuit, it is no longer necessary on the TAPFM. To remove the shaping comparator on the TAPFM circuit (bypass), make the following modifications:

Switch off the T-Audio and remove the time code circuit A05. Unscrew the TAPFM circuit and make the following modifications to it:

Replace capacitor C22 (2.2 uF) with a 1 K ohm resistance. Remove resistors R39, 40 & 41. Connect pin 2 of the comparator U5 (LM2903) to the point that was common to the resistances R39, 40 & 41.

NOTE: Once this change has been made, do not apply any external reference which is not a logical signal between 0 and 5 V directly on the THIRD TRACK IN/OUT connectorat the back of the T-A.



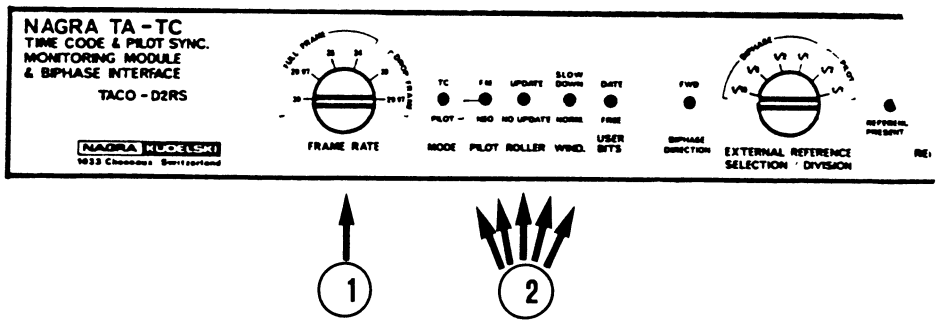
Replace the existing EPROM in the T-Audio with the new version containing the relevant software for synchronizing to a bi-phase signal.

Refit the TAPFM circuit and reinstall the time code board.

Checking of the EPROM of time code circuit

Check that the EPROM is equal or higher than the 1.6 version by looking at the last line of the status menu.

7.3 TACO-D2RS OPERATING INSTRUCTIONS



1. Frame rate selector

This rotary knob combines the action of the three left switches of selector S4 on the time code circuit (refer to page II.1.3-3)

2. System mode selector

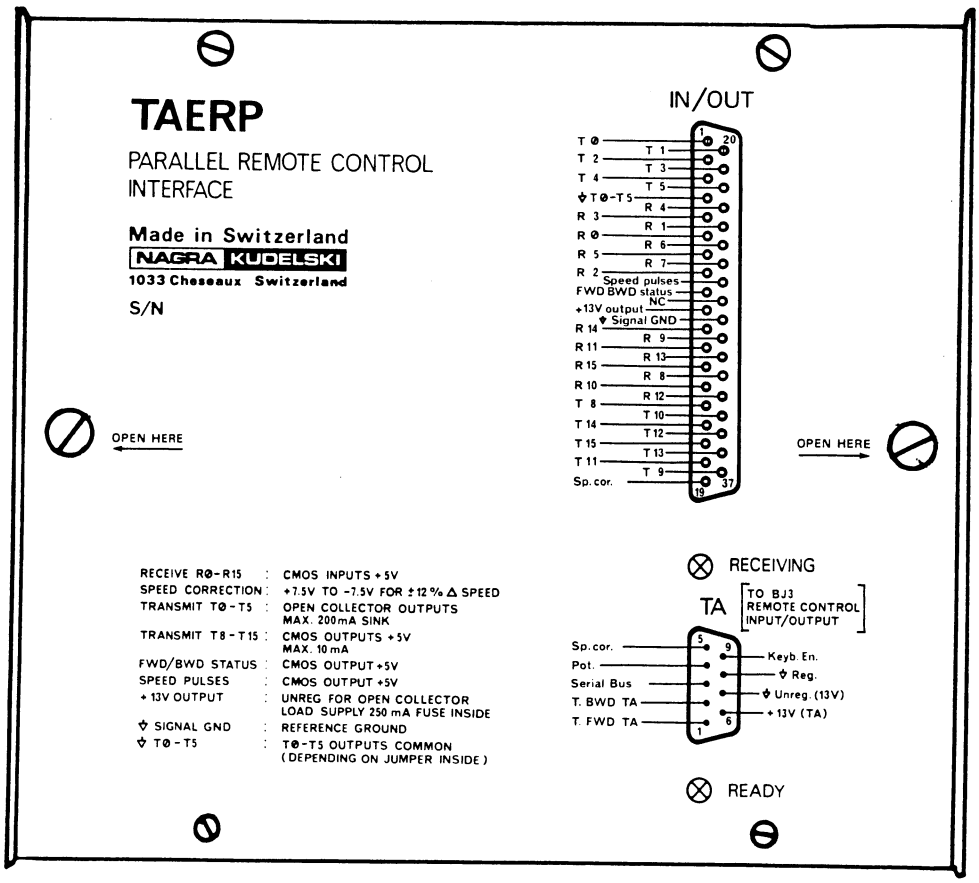
These switches are in parallel with the five right switches of selector S4 on the time code circuit (refer to pages II.1.3-3 and II.1.3-4).

NOTE: When the TACO-S option is installed in the TACO-D2RS unit, all S4 selector switches must be placed in the "OFF" position.

8.0 TAERP (parallel remote control interface)

The TAERP is a general purpose interface for the T-Audio. It transmits parallel input data to the recorder via a serial bus and sends back tallies according to the state of the T-Audio It is connected to the REMOTE CONTROL INPUT/OUTPUT connector on the rear side of the recorder. This interface is mainly used with an external synchronizer but may also be used for user customized remote keyboards.

Explanations concerning hardware. electrical characteristics relative to inputs and outputs may be found on the upper side of the interface. Paragraph 8.6 shows the relationship between the IN/OUT connector pinning and corresponding functions in the software.

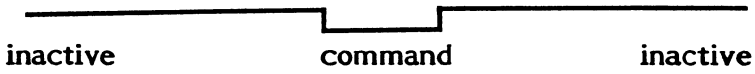


8.1 COMMAND DESCRIPTION

Two types on inputs are decoded in the software:

PULSE COMMANDS

These commands are active during a high to low transition
(high state represents 5 V, low state represents 0 V)
(high state is logic state 1, low state is logic state 0)



STATUS COMMANDS

These commands are decoded depending on their logic state, high or low.

Pulse commands decoded in the software are:

STOP Command and tally: same function as on the T-Audio

PARK Command and tally: same function as on the T-Audio

PLAY Command and tally: depending on CAPSTAN status
CAPSTAN = 1 PLAY at nominal speed
CAPSTAN = 0 PLAY at variable speed

RECORD Command and tally: depending on CAPSTAN status
CAPSTAN = 1 RECORD at nominal speed
CAPSTAN = 0 RECORD at variable speed

For PLAY and RECORD commands speed can be adjusted by means of SPEED CORRECTION input, $\pm$ 7.0 V for $\mp$ 14% speed variation.

» Command and tally: depending on TAPE LIFTER status
TAPE LIFTER = 1 without tape/head contact
TAPE LIFTER = 0 with tape/head contact

« Command and tally: depending on TAPE LIFTER status
TAPE LIFTER = 1 without tape/head contact
TAPE LIFTER = 0 with tape/head contact

Status commands decoded in the software are:

READY/SAFE 1 Command without tally
1: Sends SAFE 1 to the T-Audio
0: Sends READY1 to the T-Audio

SYNC/REPRO 1 Command without tally
1: Sends REPRO 1 to the T-Audio
0: Sends SYNC 1 to the T-Audio

READY / SAFE 2 Command without tally
1 : Sends SAFE 2 to the T-Audio
2 : Sends READY 2 to the T-Audio

SYNC / REPRO 2 Command without tally
1 : Sends REPRO 2 to the T-Audio
0 : Sends SYNC 2 to the T-Audio

READY / SAFE TC Command without tally
1 : Sends SAFE TC to the T-Audio
2 : Sends READY TC to the T-Audio

SYNC / REPRO TC Command without tally
1 : Sends REPRO TC to the T-Audio
0 : Sends SYNC TC to the T-Audio

CAPSTAN Used with PLAY or RECORD to select variable speed mode
1 : NOMINAL speed
0 : VARIABLE speed

TAPE LIFTER Used with » or « to choose whether the tape touches heads or not :
1 : NO CONTACT between tape and heads
0 : Tape TOUCHES heads

8.2 LED DESCRIPTION

The internal status of the TAERP are shown by two leds placed on the front pannel near the two connectors.

READY This led blinks on power up and is on permanently as soon as the TAERP is ready to receive commands.

RECEIVING This led is briefly switched on each time a correct command is sent to the TAERP.

8.3 OTHER TALLIES FROM TAERP

Two more tallies are generated in the TAERP: FWD/BWD STATUS and SPEED PULSES.

FWD/BWD STATUS This status (CMOS OUTPUT) indicates the tape motion direction, either forward or backward.
Ex factory, 5 V equates to backward, 0 V equates to forward.
This can be changed replacing R40 with R39.

SPEED PULSES (Tape counter pulses) negative going pulses (CMOS OUTPUT) corresponding to the speed of the T-Audio.

Ex factory setting: 150 pulses/second at 19 cm/s

8.4 CUSTOMIZING SELECTORS

Dil switches located on a board inside the interface allow the user to customize the TAERP according to his needs.

S1: MODE SELECTOR

S1-1: TAPE LIFTER UPDATE

S1-1 = OFF: TAPE LIFTER changes are not taken into account after >> or << have been sent to the T-Audio.

S1-1 = ON: TAPE LIFTER changes are taken into account even after >> or << have been sent to the T-Audio.

S1-2: CAPSTAN UPDATE

S1-2 = OFF: CAPSTAN changes are not taken into account after PLAY or RECORD have been sent to the T-Audio.

S1-2 = OFF: CAPSTAN changes are taken into account even after PLAY or RECORD have been sent to the T-Audio.

S1-3, S1-4: SPEED INITIALIZATION

On power up the T-Audio is automatically set to speed A (according to the Tape speed and standard selector). Switches S1-3 and S1-4 allow the user to choose another speed on power up (B, C or D).

	S1-3	S1-4
Speed B	ON	ON
Speed C	OFF	ON
Speed D	ON	OFF
Free	OFF	OFF

When more than one device with this feature is connected to a T-Audio, it is important to note that all except on are to set in the "Free" position to ensure a correct initialization.

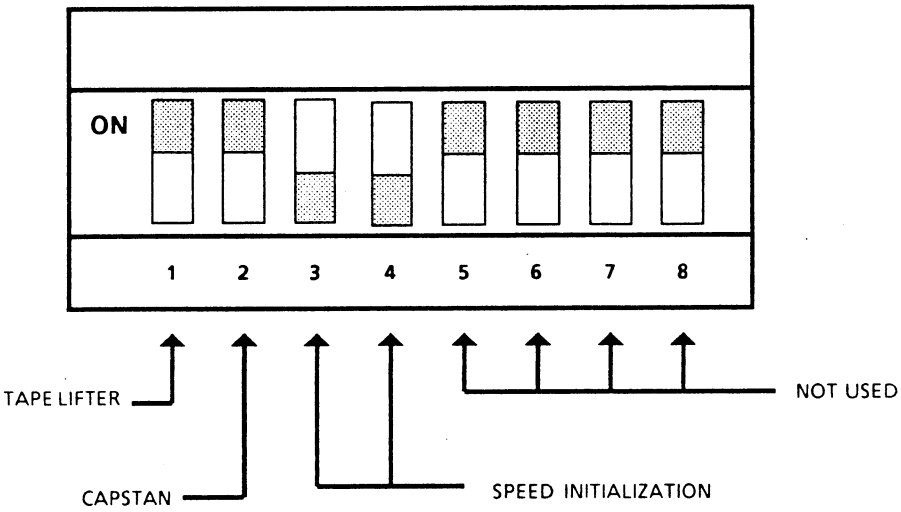
The other switches are not presently used.

TAERP customizing selectors

EX FACTORY CONFIGURATION

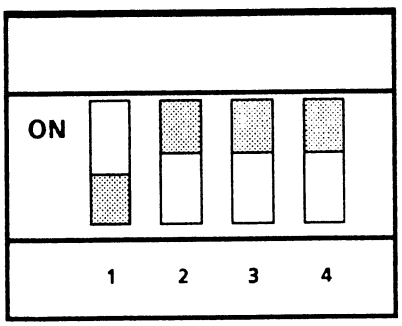
S1 MODE SELECTOR

S1.1	S1.2	S1.3	S1.4	S1.5	S1.6	S1.7	S1.8
ON	ON	OFF	OFF	ON	ON	ON	ON



S2 TAPE COUNTER DIVISION

S2.1	S2.2	S2.3	S2.4
OFF	ON	ON	ON



DIVISION = 1

ON represents logic stale 0
OFF represents logic stale 1

NOTE: Selectors with blue color have the "ON" position inverted (ON is downwards).

8.5 TA CONNECTOR PINNING

P1: to TA: Connector BJ3 of T-Audio (Remote control INPUT/OUTPUT)

1	T.Fwd TA
2	T.Bwd TA
3	Serial Bus
4	Pot
5	Sp.cor.
6	+ 13 V (TA)
7	⊥UNREG (13 V)
8	⊥REG
9	Keyb. En

8.6 IN/OUT CONNECTOR PINNING

The relationship between software and signals on the 37 pin IN/OUT connector may be found in the following table:

NOTE: RO .. R5 are pulse commands
R8 .. R15 are status commands.

Logic state 0 corresponds to 0 Volts
Logic state 1 corresponds to + 5 Volts.

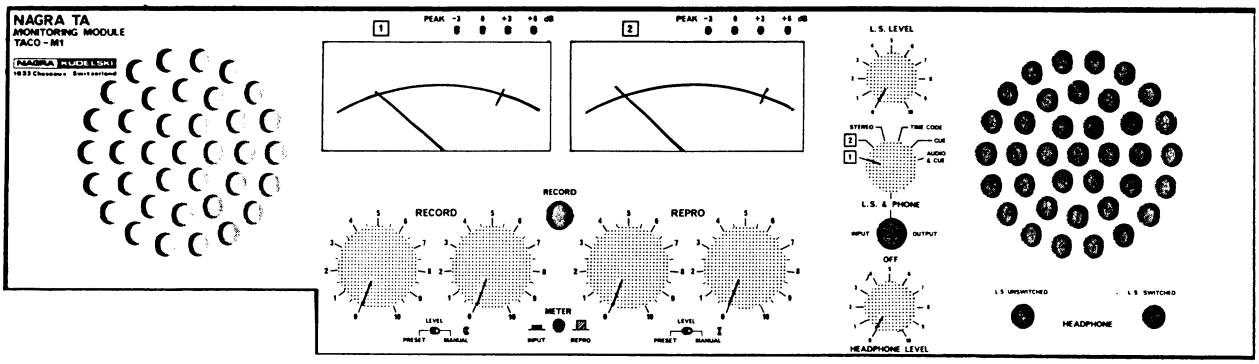
P2: Connector 37 pins

No.	Name of pin	Software function
1	TO	≪ tally
2	T2	PLAY tally
3	T4	RECORD tally
4	↓ TO-T5	
5	R3	STOP
6	RO	≪
7	R5	PARK
8	R2	PLAY
9	FWD/BWD status	
10	+ 13 V Output	
11	R14	SYNC/REPRO 1 (0=SYNC)
12	R11	READY/SAFE TC (0=READY)
13	R15	READY/SAFE 1 (0=READY)
14	R10	SYNC/REPRO TC (0=SYNC)
15	T8	Not presently used
16	T14	Not presently used
17	T15	Not presently used
18	T11	Not presently used
19	Sp. cor	
20	T1	≫ tally
21	T3	STOP tally
22	T5	PARK tally
23	R4	RECORD
24	R1	≫
25	R6	Not presently used
26	R7	Not presently used
27	Speed Pulses	
28	N.C.	
29	↓ Signal GND	
30	R9	CAPSTAN (0=VAR SPEED)
31	R13	READY/SAFE 2 (0=READY)
32	R8	TAPE LIFTER (0=CONTACT)
33	R12	SYNC/REPRO 2 (0=SYNC)

No.	Name of pin	Software function
34	T10	Not presently used
35	T12	Not presently used
36	T13	Not presently used
37	T9	Not presently used

9.0 TACO-M1 (audio monitoring module)

This option is designed to fit into the TACO-5 or TACO-7 overbridge units. It allows monitoring of the two audio channels of the T-Audio on vu meters and it incorporates two loudspeakers and two headphones sockets.



9.1 DISPLAYS

The two vu meters show the signal level found on the line output of the T-Audio. The signals displayed are switched from one mode to another by means of the channel status display matrix on the main keyboard of the "recorder". They can be switched between "INPUT", "REPRO", "SYNC" or OFF". This allows the checking of the levels at the line input, the normal replay output via the replay head and the replay output via the recording head (SYNC position providing TASIM option is fitted to the audio boards A01). Four leds per channel are fitted above the vu meter to indicate peak readings.

A red lamp marked "Record" will automatically illuminate when either of the AUDIO channels is put into record.

NOTE: This lamp will not illuminate if only the T.C. channel is selected to go into record.

9.2 CONTROLS

Two push buttons are fitted so that each channel may be temporarily switched, to monitor the input signal without having to modify the channel status matrix on the keyboard.

Two potentiometers per channel are fitted to allow adjustment of the input levels and output levels of each channel between -infinity and +6 dB.

A rotary switch is fitted to allow the operator to select between the different signals and loudspeakers or headphones. Either each channel separately or both in stereo or time code or cue track (commentary recorded on the FM track). The levels on speakers or on the headphones may be adjusted separetely using their respective potentiometers.

9.3 OUTPUTS

Two headphone sockets are fitted to the TACO-M1 one of which will automatically cut off the loudspeakers when used the other will have no effect.

The TACO-M1 is connected via the cable supplied to the rear of the T-Audio via the AUDIO MONITORING connector and the THIRD TRACK INPUT/OUTPUT connector.

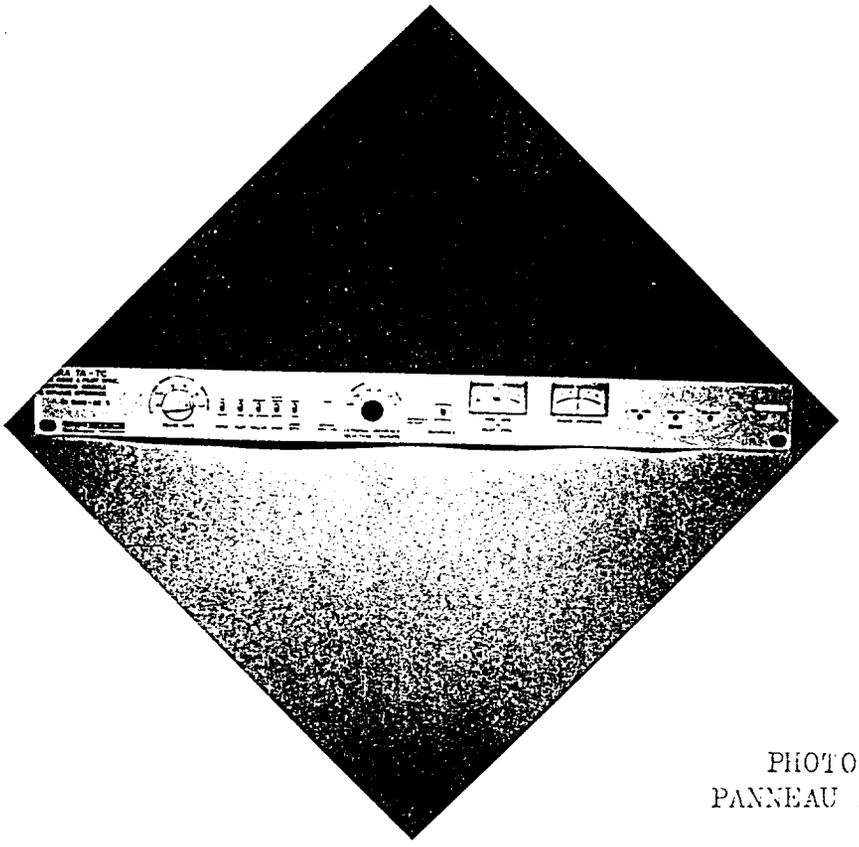


PHOTO 1
PANNEAU AVANT

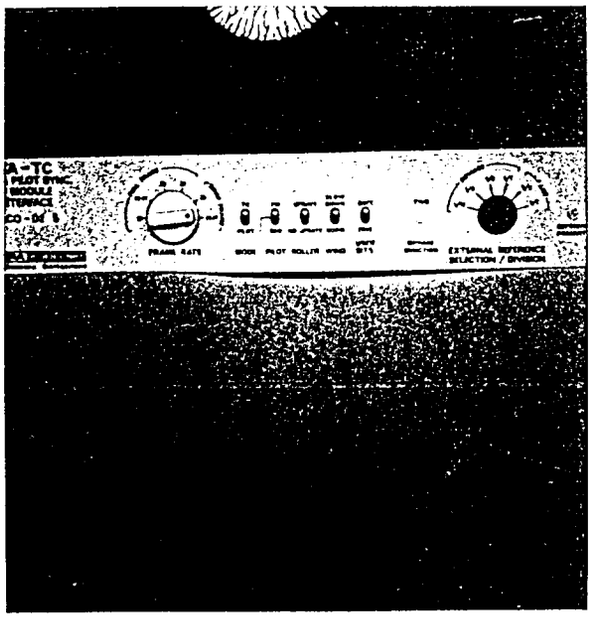


PHOTO 2
PAN.AV.PART.TACO S

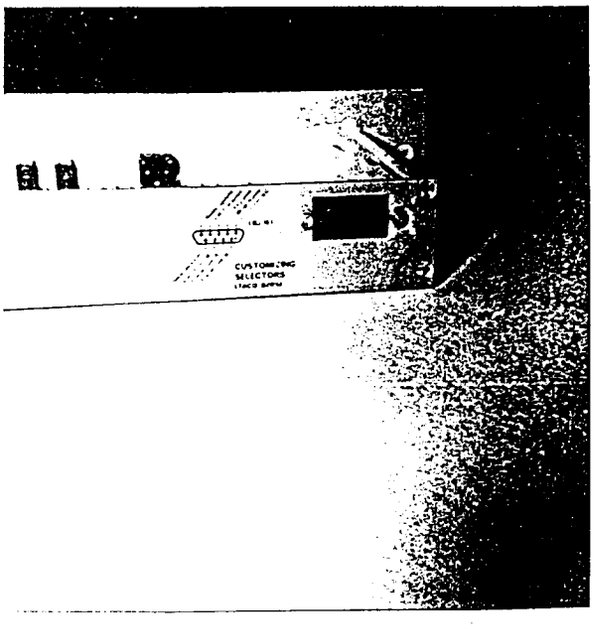


PHOTO 3
PAN.AR.PART.TACO S

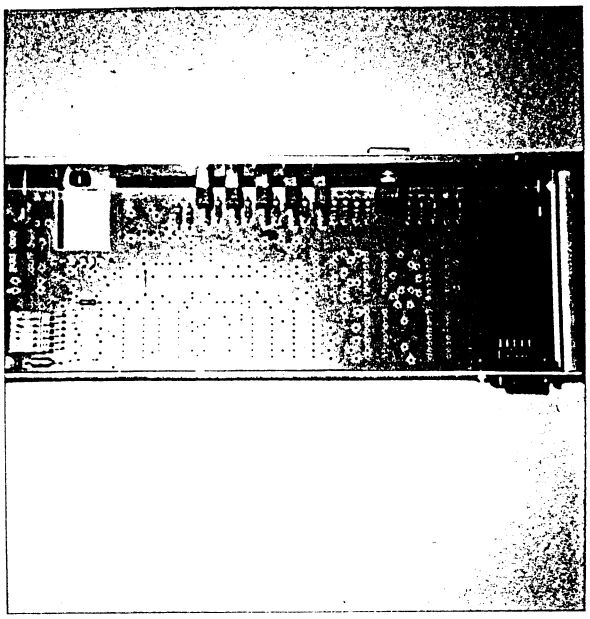


PHOTO 4
CIRCUIT TACO S

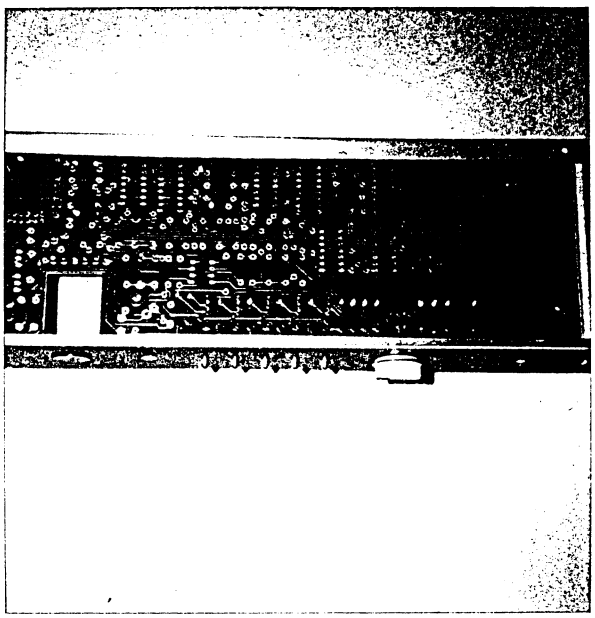


PHOTO 5
CIRCUIT TACO S

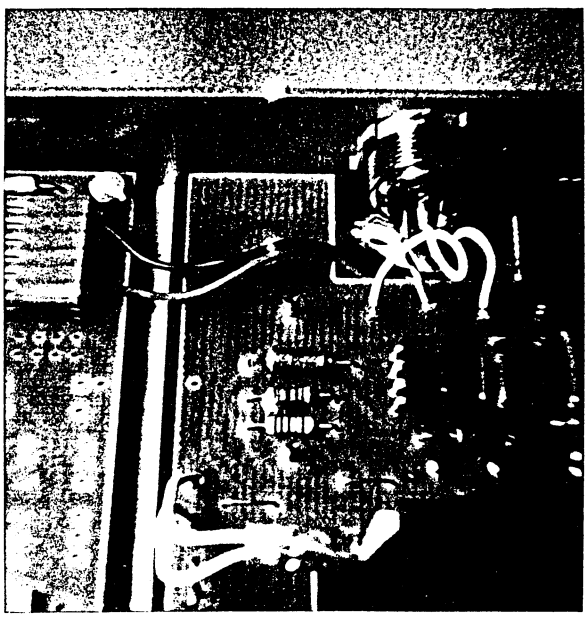


PHOTO 6
CONNEXIONS INTERNES

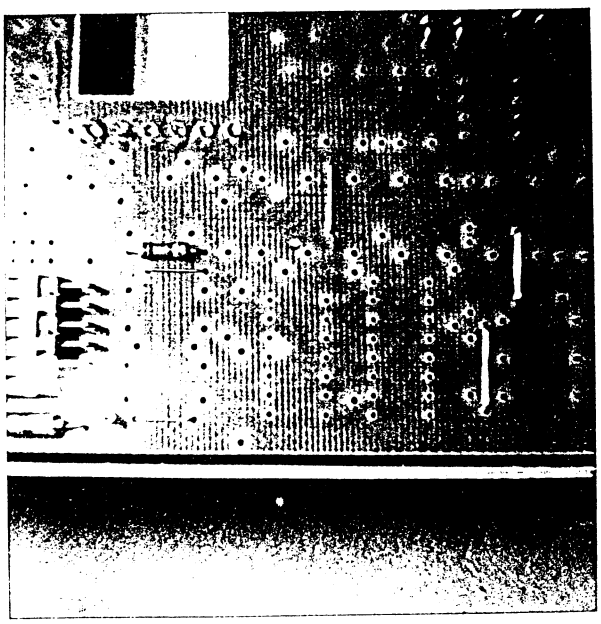


PHOTO 7
PONT LIAISON ALIM.

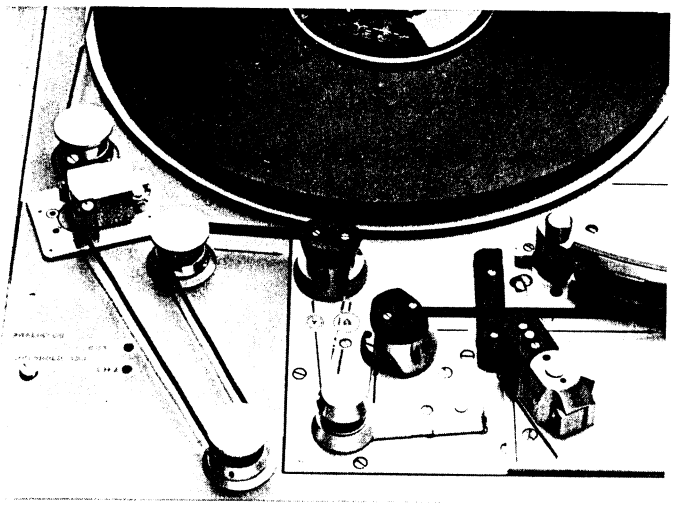
9.4 Installation TACO-M1

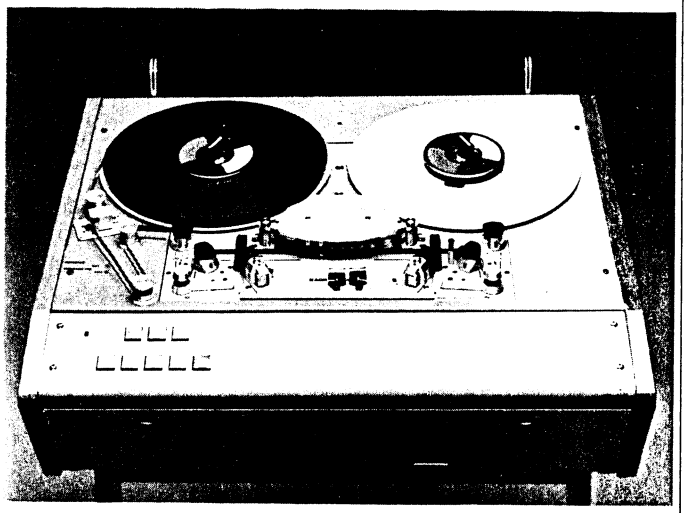
When installing a TACO-M1 in a rack to use with the T-Audio T.C. it is important to remove the two jumpers ST 4 and ST 5 on each of the audio circuits to prevent a monitoring loop.
The TACO-M1 is factory calibrated so no adjustments should be necessary.

NAGRA KUDELSKI

09 670 TAPL
PRE-LISTENING UNIT

ACCESSORY DATASHEET





The TAPL is a system for pre-listening for the NAGRA T-Audio. It consists of a surround for the deck plate of the machine, guide rollers and a two channel replay head. Connected to the head is an amplifier with an adjustable headphone output and a tuchel connector providing a relay closure for each channel.

The head is placed in such a way that a delay of 5 seconds (+ / – 0.15 s.) is achieved at a nominal tape speed of 19 cm/s. (likewise a delay of 2.5 s. at a speed of 38 cm/s.)

The way the system works is that the head detects a signal level on the tape (the level of which can be pre-set) and this in turn generates a square wave signal equivalent in length to the duration of the signal on the tape. This in turn closes the contacts of a tuchel connector (two contacts for each channel) which can be used to control a display.

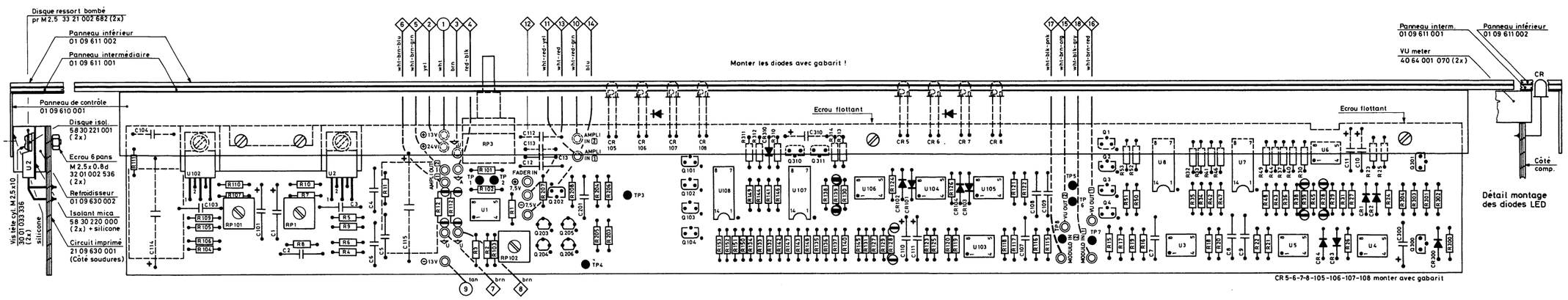
This unit may only be fitted to a machine when it is installed in the TMU-S trolley. It is connected to the machine via the third track IN/OUT connector BJ-4 on the back of the machine, which supplies power to the pre-listening unit.

Reference No.
20 09 670 141

KUDELSKI S.A.
1033 CHESEAUX/LAUSANNE
SWITZERLAND

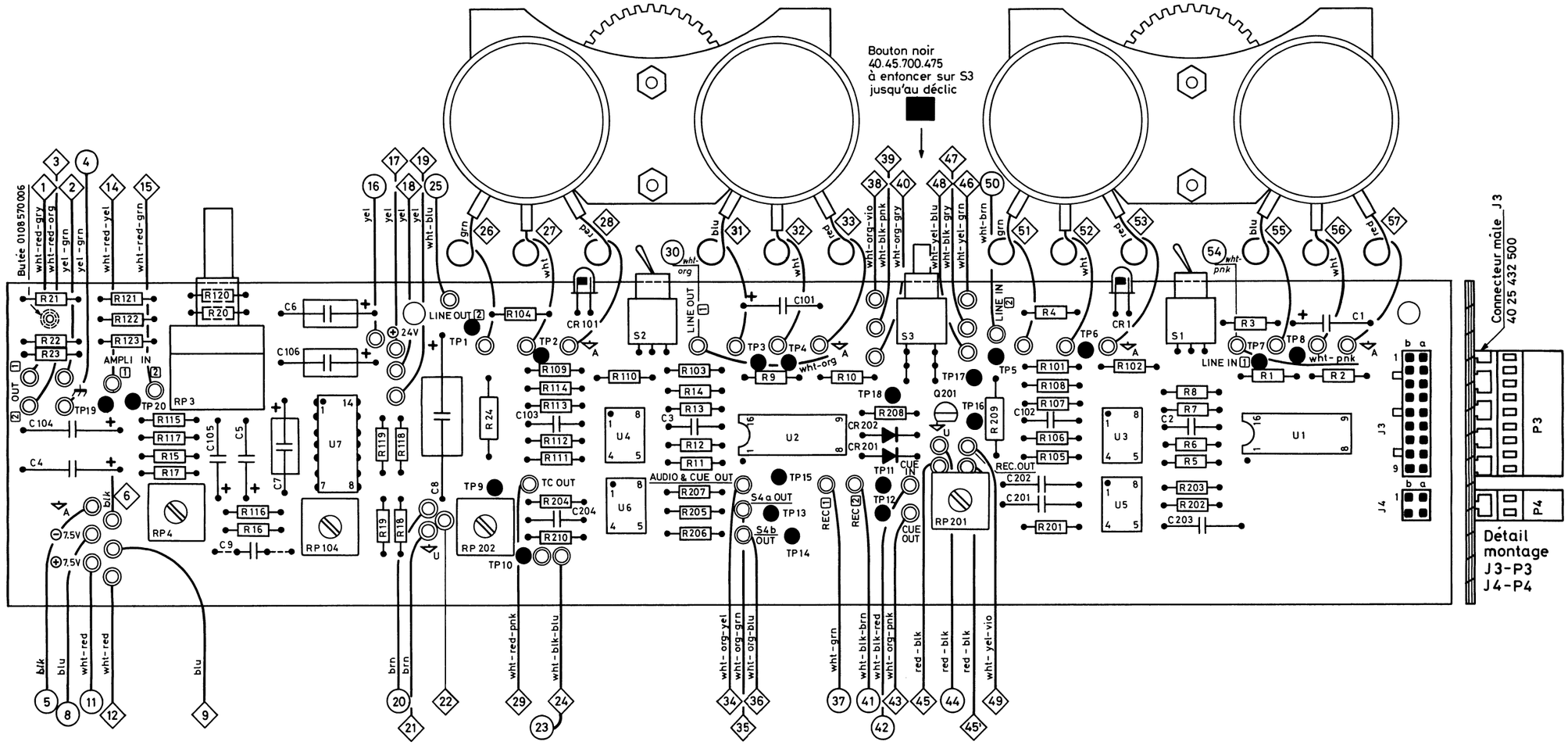
tel. (021) 731 21 21
telefax (021) 731 41 55
telex 459 302 nagr ch

January 1989



A27 AUDIO MONITORING UNIT (high frequency amplifier + VU meter)
TACO-M1

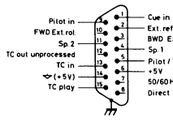
09.630.0 **index A**



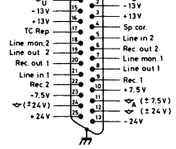
A28 AUDIO MONITORING UNIT (input amplifier + headphone)
TACO-M1
09.632.0 **index A**

A 27		
Components	VU-meter version	PEAK-meter
R17 ÷ R117	100k	68k
R23 ÷ R123	100k	2.7k
R24 ÷ R124	10k	NC
R27 ÷ R127	6.8k	82k
R29 ÷ R129	2.5k	120k
R38 ÷ R138	33k	100k
R300 ÷ R310	NC	560k
R301 ÷ R311	NC	47k
R302 ÷ R312	NC	100k
R303 ÷ R313	NC	680k
R304 ÷ R314	NC	4.7k
C10 ÷ C110	0.68µF	1µF
C300 ÷ C310	NC	3.3µF
Q300 ÷ Q310	NC	BC 214
Q301 ÷ Q311	NC	BC 184
CR300 ÷ CR310	NC	1N 4148

P2 to BJ11 THIRD TRACK INPUT / OUTPUT



P1 to BJ4 AUDIO MONITORING OUTPUT



IC LIST								
N°	Ref.design.	+7.5V	-7.5V	+13V	-13V	+24V	V_A	V_U
A27 09.630.0								
U1	34002	8	4					
U2 / U 102	TDA 2030AH			5	3			
U3 / U 103	34002	8	4					
U4 / U 104	34002	8	4					
U5 / U 105	34002	8	4					
U6 / U 106	34002		4	8				
U7 / U 107	3303	4					11	
U8 / U 108	4070	14					7	
A28 09.632.0								
U1	4053	16	7				3,4,5,6,8	
U2	4053	16	7				3,4,5,6,8	
U3	34002	8	4					
U4	34002	8	4					
U5	34002	8	4					
U6	34002	8	4					
U7	LM 378					14		10,11,12,5

SCHEMATIC DIAGRAM NOTES

- Asterisk denotes a factory adjusted value shown is typical
- Circuit assembly borderline
- Arrows indicate signal flow
- A conducting connection to a chassis or frame
- Common connections
- Male
- Female Contact
- Test Point
- Two sided adjustment
- All components viewed from the outside

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS ¼W ± 5%
ALL CAPACITORS ± 20%
ALL DIODES 1N 4148

MEASURING INSTRUMENT
Digital voltmeter Zm 3170 e.g. B&K 2112 or 2606-1615 or equivalent

COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White
PNK	Pink
TAN	Tan

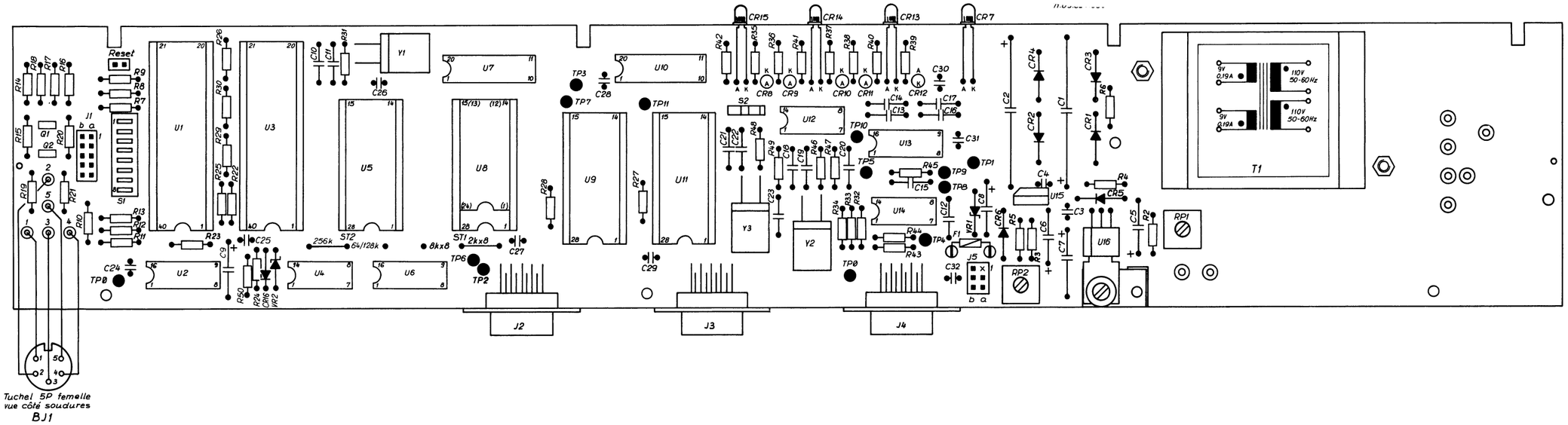
KUDELSKI SA Dept NAGRA CH-1033 CHESEAUX Switzerland

NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street

A 27 A
A 28 A

TACO-M1 | 09 09 610 000 | 9. 7. 85.

CONSOLE FOR T-AUDIO



A29 TAERS INTERFACE / RS 422
09.641.0 index A

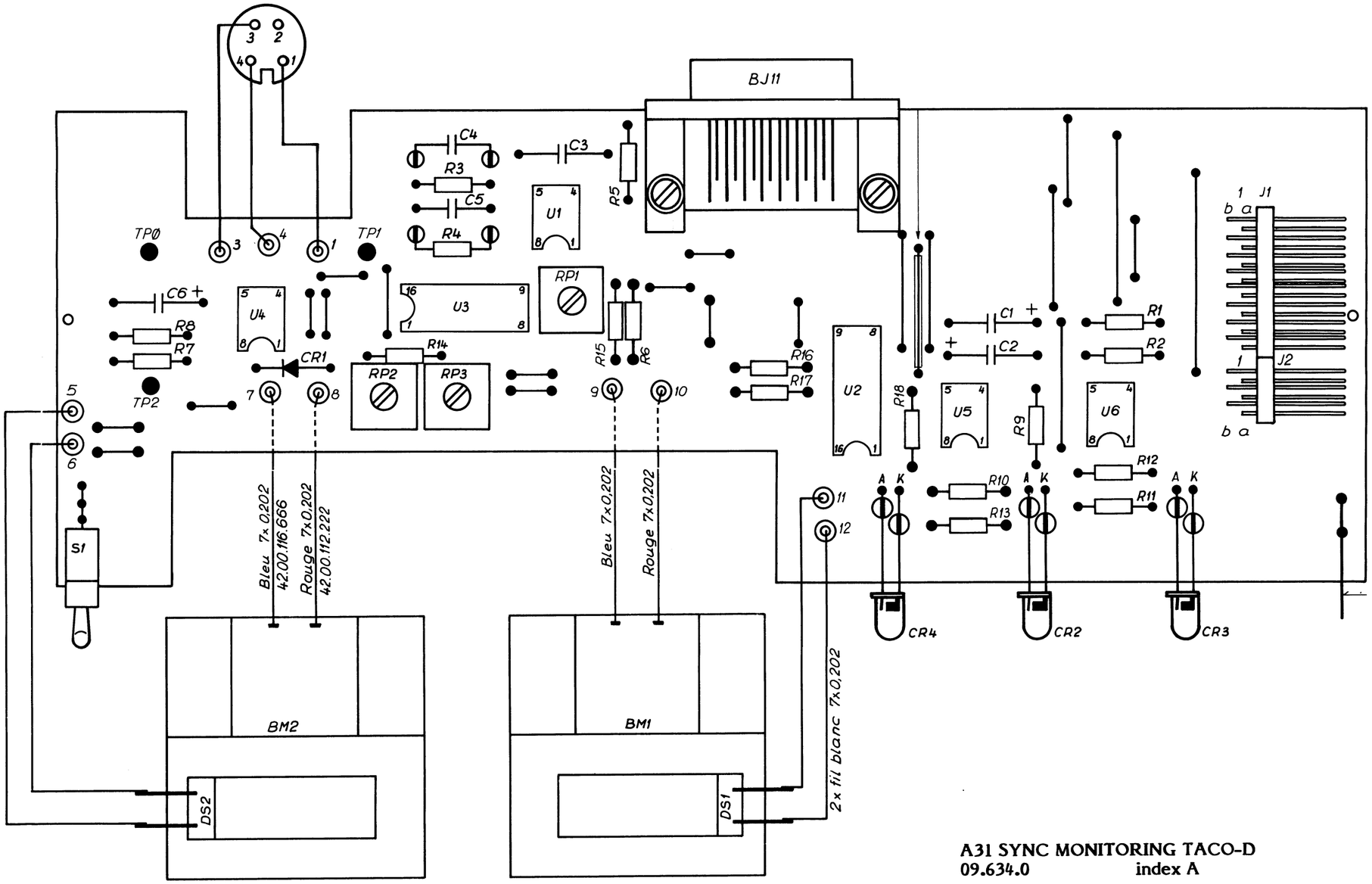
A29
09.641.0

IC LIST				
Nr	Ref. design.	+5V	⏚	
U1	NSC 810 AN-4	40	20	
U2	74HC138	16	8	
U3	NSC 800 N-4	40	20	
U4	74HC00	14	7	+5V 12-13 ⏚ 4-5
U5	EPROM 27C64	28	14	+5V 1
	EPROM 27C128	28	14	+5V 1
	EPROM 27C256	28	14	+5V 1
U6	74HC138	16	8	
U7	74HC 373	20	10	
U8	RAM 2 x 8k	24	12	
	RAM 8 x 8k	28	14	
U9	NSC 858N	28	14	
U10	74HC244	20	10	
U11	NSC 858N	28	14	
U12	74HC04	14	7	+5V 3-11
U13	DS3692N	1	5-8	
U14	DS88C20N	14	7	

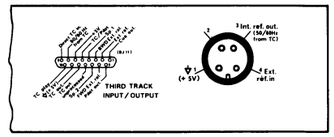
ADDRESS DECODERS
HIGH ADDRESS BUS
CONTROL BUS
RAM
EPROM
I/O + TIMERS
CENTRAL PROCESSING UNIT
SERIAL PORTS
ADDRESS
A/D BUS
TO/FROM CONTROLLER AND NEXT DEVICE
TO/FROM CONTROLLED DEVICE
CONTROLLER
CONTROLLED DEVICE
ΦCPU
ERROR CONTROLLER
ERROR CONTROLLED DEVICE
SELECT
RED, MV57640
GRN, MV5464 3
TO FROM TEST KEYBOARD J1
TO FROM SYNCHRO EXTRACTOR A32 09.642.0 (OPTION) J5
I ≤ 85mA without RS 422 connections
I ≤ 110mA both sides loaded
POWER SUPPLY REGULATION
AC POWER INPUT 115/230V ± 15% nominal 4 VA max. 6VA
POWER
LINE VOLTAGE SELECTOR
STATUS
RS-422 REMOTE CONTROL INTERFACE
NAGRA TAERS
NAGRA KUDELSKI
1033 Cheseaux Switzerland

DELETED:
R1

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A29 B
TAERS	09.09.625.0.00	5 . 1 . 86
REMOTE CONTROL EXTERNAL RS 422 INTERFACE		



A31 SYNC MONITORING TACO-D
09.634.0 index A



(BJ11)

INTERNAL S1 EXTERNAL
PILOT REFERENCE

R5 1k

TC monitoring selection factory fitted

B7
09.610.016

A31
09.634.0

U2 2x¼ 40109
U3 ⅓ 4053
U4 ½ 34002
U5 ½ 40107
U6 ½ 40107
U1 2x½ 34002

R1 10Ω
R2 10Ω
R3 22k
R4* adj. typ. 1M
R5 1k
R6 18k
R7 220k
R8 2,7k
R9 100k
R10 680Ω
R11 680Ω
R12 100k
R13 680Ω
R14 5,6k
R15 100k
R16 100k
R17 100k
R18 100k
RP1 20k
RP2 10k
RP3 10k
C1 4,7µF
C2 4,7µF
C3 0,1µF
C4* adj. typ. 680pF
C5 680pF
C6 1µF

CR1 1N4148
CR2 MV57640 RED
CR3 MV57640 RED
CR4 MV57640 RED

NEOPILOT
FM-PILOT
TIME CODE

TP1
TP2
TPØ (+5V)

DC +1,8V NOM. FOR TC
+2,2V FOR PILOT

TIME CODE level adj.
PILOT LEVEL adj.
cw

Nominal level: 4,8V P-P (1,7V RMS)

4,5V at 38 cm/s
3,8V at 19 cm/s

Nominal level 1,2V at 38 cm/s
0,85V at 19 cm/s

Sensitivity : 2% /V

PHASE DEVIATION gain adj.

PHASE DEVIATION

BM1 ±200µA
BM2 +400µA
DS1
DS2

50% at nominal level

TIME CODE OR PILOT LEVEL

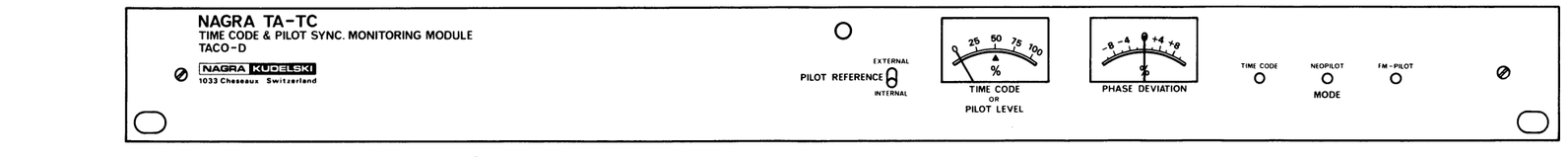
IC LIST						
Nr.	Ref. design.	+7,5V	+5V	⏚	-7,5V	
U1	34002	8	-	-	4	
U2	40109	16	1	8	-	+5V 9-10-14-15
U3	4053	16	-	8	7	⏚ 6
U4	34002	8	-	-	4	
U5	40107	8	-	4	-	
U6	40107	8	-	4	-	

P2/1 WHT-BLK-RED P3 J1 12a (W1-P3) A28 42 WHT-BLK-RED
P2/9 WHT-BLK-YEL PILOT OUT P4 8a (W1-P4)
P2/10 WHT-BRN-GRY 7a
P2/3 WHT-BRN-PNK 2b
P2/11 WHT-BLK-GRN SPARE 2 6a
P2/4 WHT-BLK-ORG SPARE 1 1b
P2/12 WHT-BRN-YEL 5a
P2/5 WHT-YEL-GRY TC/PILOT 1a
P2/13 WHT-BLK-BLU P3 J1 11a (W1-P3) A28 23 WHT-BLK-BLU WHT-BLK-VIO
P2/6 GRN +5V P4 2a (W1-P4)
P2/14 WHT-BRN-GRN 0V 4a
P2/7 WHT-RED-BLU 50/60 Hz 3b
P2/15 WHT-BLK-VIO P3 J1 10a (W1-P3) WHT-BLK-VIO TC PLAY P1 2a
P2/8 WHT-RED-VIO P4 3a (W1-P4)
P2/2 WHT-YEL-PNK EXT. REF. 5b
A28 11 WHT-RED
P1/10 WHT-RED P3 J1 10b (W1-P3) WHT-RED +7,5V P1 1b
A28 8 BLU
P1/23 BLU P3 J1 12b (W1-P3) BLU -7,5V 3b
A28 44 RED-BLK
P1/13 WHT-YEL-VIO-GRY -24V P4 6b (W1-P4)
P1/24 RED-BLK P3 J1 11b (W1-P3) RED-BLK P1 3a (W2-P1)
P1/4 WHT-BLK SPEED COR. P4 4b (W1-P4)

J2 (W2-P1) J1 (W1-P4)

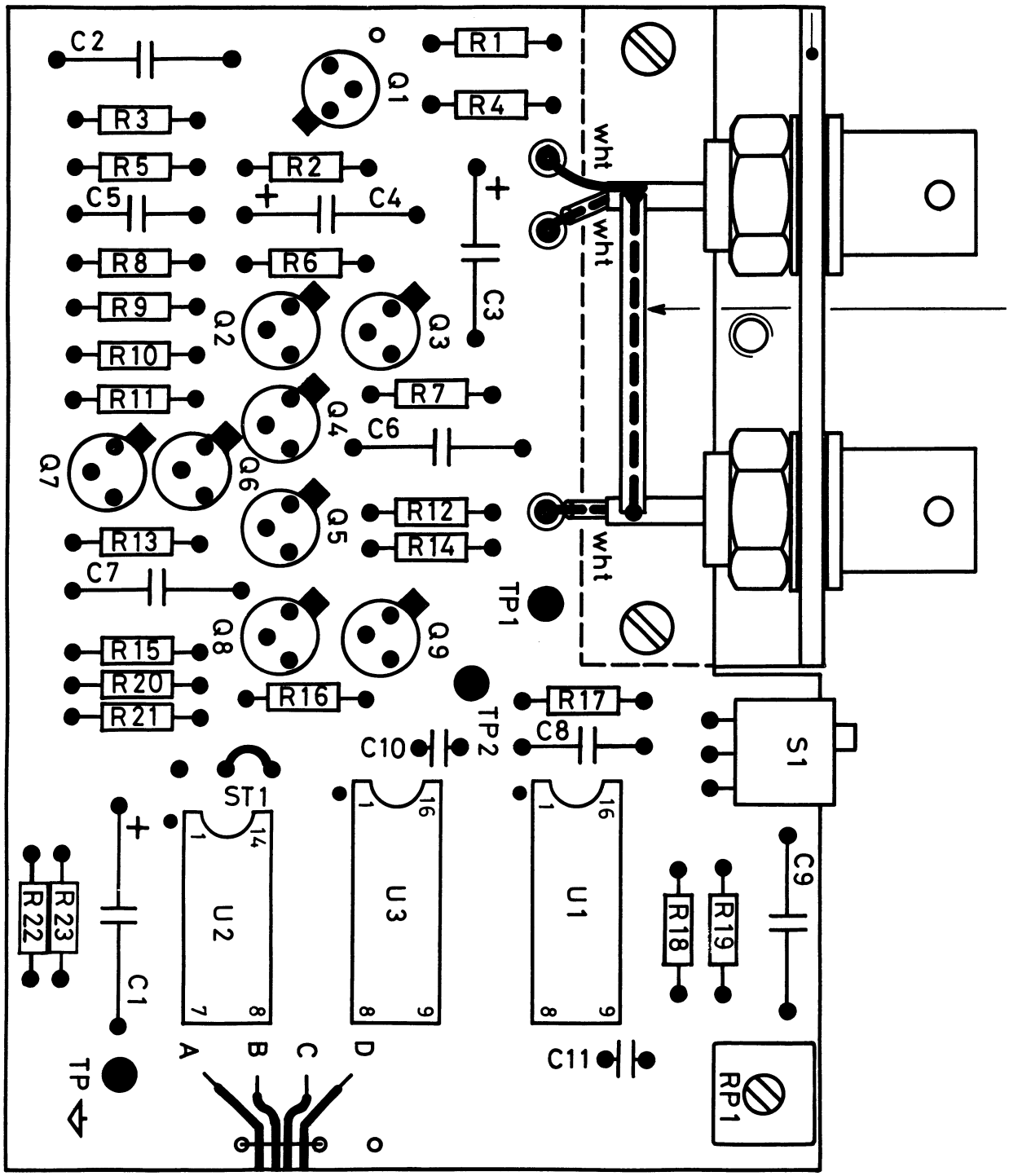
+5V +7,5V -7,5V -24V ±24V

PHASE DEVIATION
-24V



6-7

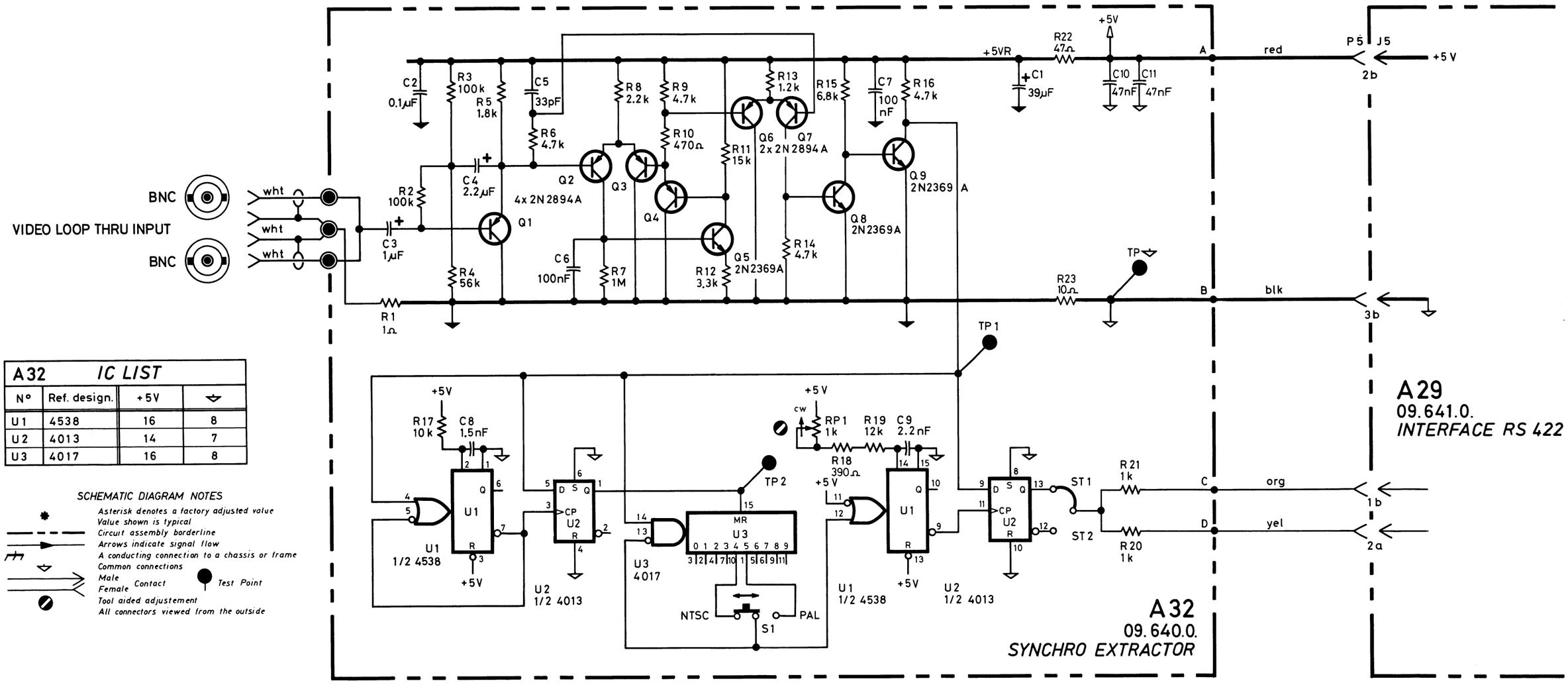
KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	**A31** A
TACO-D	**09.09.615.0.00**	**8 . 1 . 86**
PILOT/TC DISPLAY MODULE		



A32 SYNC EXTRATOR TAESV

(Option of TAERS)

09.640.0 index A



A32 IC LIST			
N°	Ref. design.	+5V	⏚
U1	4538	16	8
U2	4013	14	7
U3	4017	16	8

SCHEMATIC DIAGRAM NOTES

Asterisk denotes a factory adjusted value
Value shown is typical
Circuit assembly borderline
Arrows indicate signal flow
A conducting connection to a chassis or frame
Common connections
Male / Female Contact — *Test Point*
Tool aided adjustement
All connectors viewed from the outside

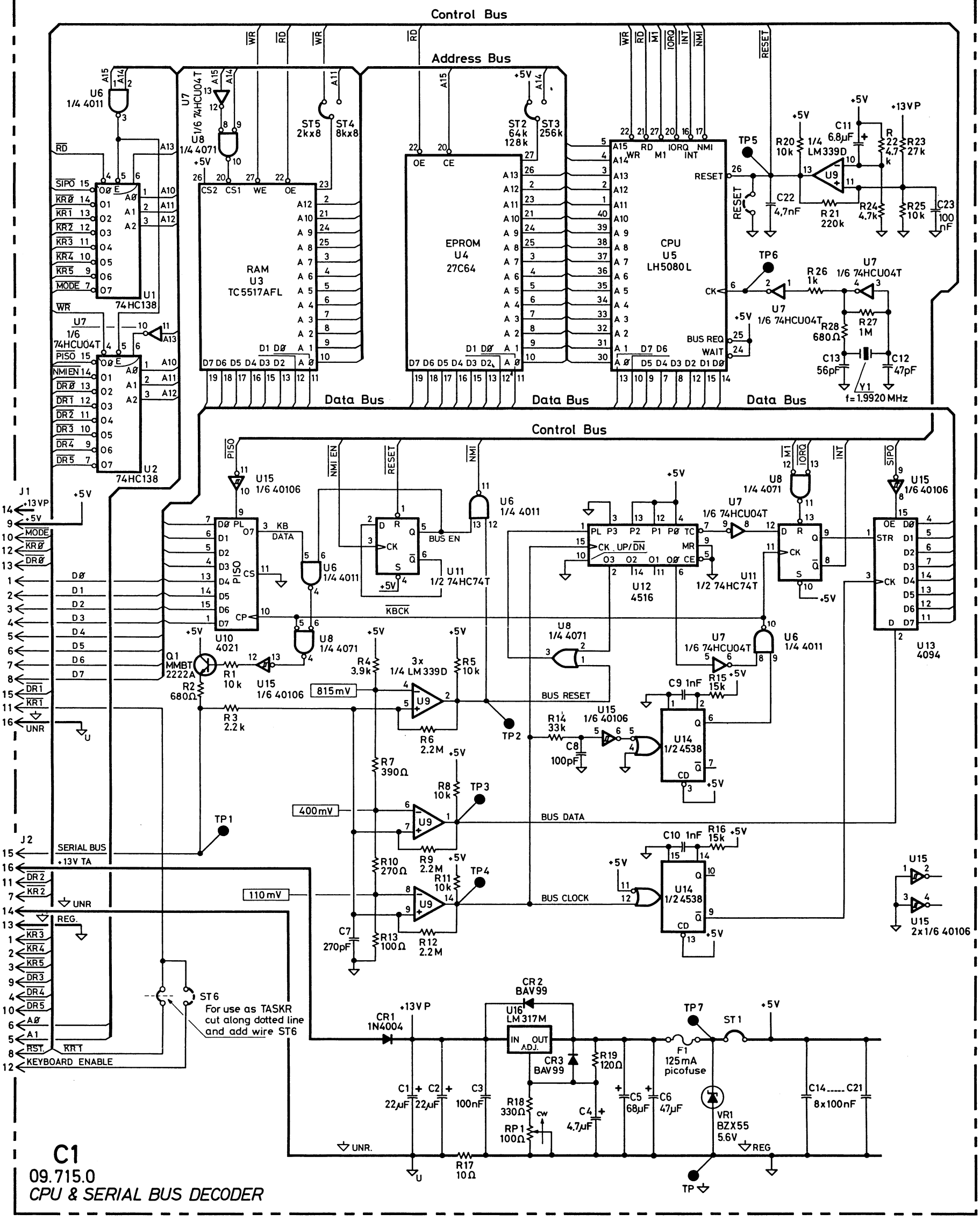
KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A32 Ⓐ
TAESV	09 09 640 000	13.02.86
SYNCHRO EXTRACTOR		

IC LIST			
N°	Ref.design.	+5V	▽
U1	74HC138	16	8
U2	74HC138	16	8
U3	TC5517AFL	28	14
U4	27C64	28	14

IC LIST			
N°	Ref.design.	+5V	▽
U5	LH5080L	11	29
U6	4011	14	7
U7	74HCU04T	14	7
U8	4071	14	7

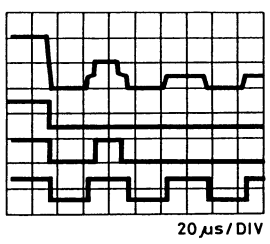
IC LIST			
N°	Ref.design	+5V	▽
U9	LM339D	3	12
U10	4021	16	8
U11	74HC74T	14	7
U12	4516	16	8

IC LIST			
N°	Ref.design	+5V	▽
U13	4094	16	8
U14	4538	16	8
U15	40106	14	7



With STOP key pressed

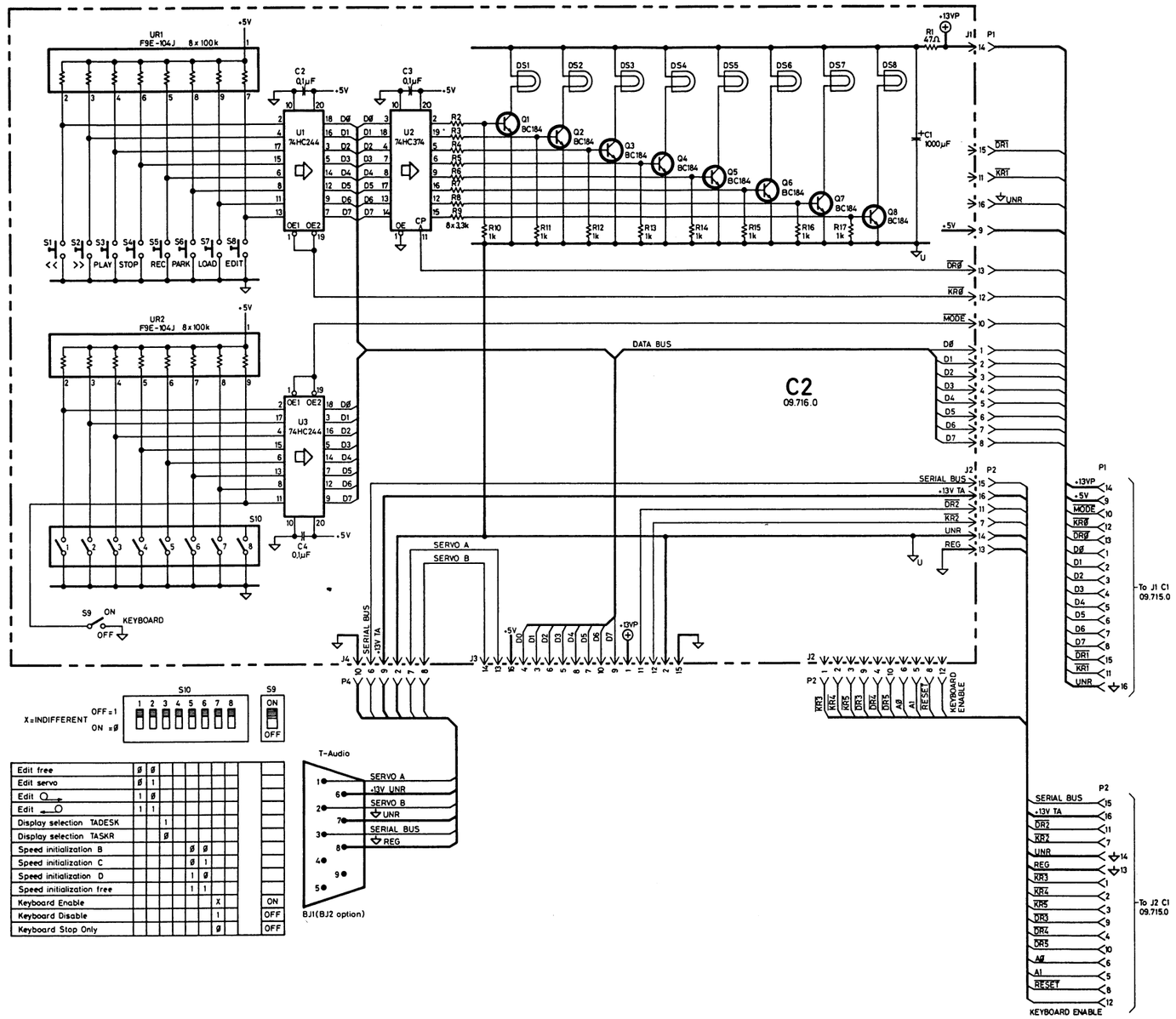
TP1	Serial bus	0.5 V/DIV
TP2	Bus Reset	5.0 V/DIV
TP3	Bus Data	5.0 V/DIV
TP4	Bus Clock	5.0 V/DIV



DATE	MODIFICATIONS

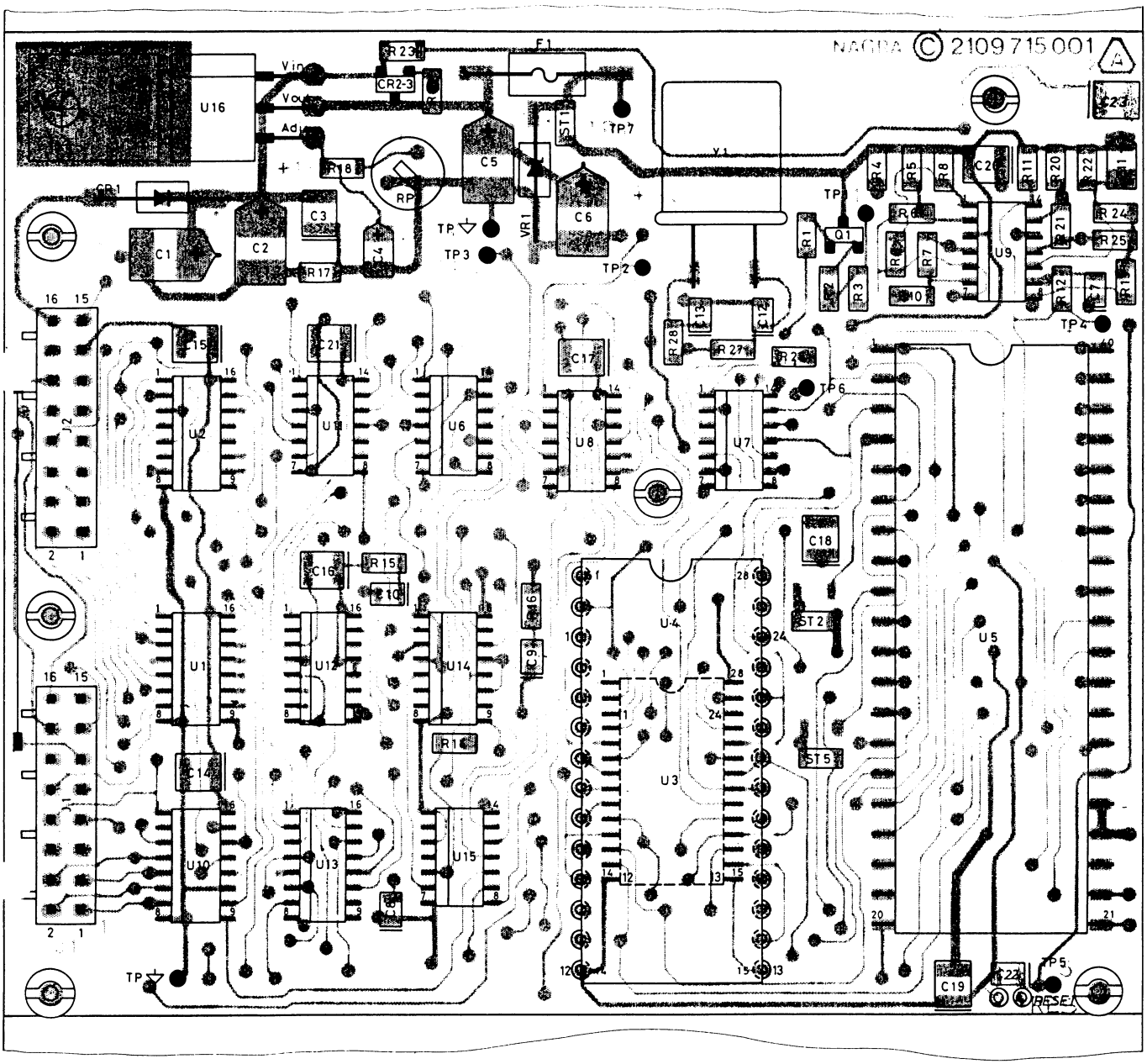
CPU for TADESK-TAERP, Number 09.715.0
CPU for TASKR , Number 09.725.0

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	C1 A
CPU	09 09 715 000	20 8 86
CPU & SERIAL BUS DECODER for TADESK-TAERP-TASKR		

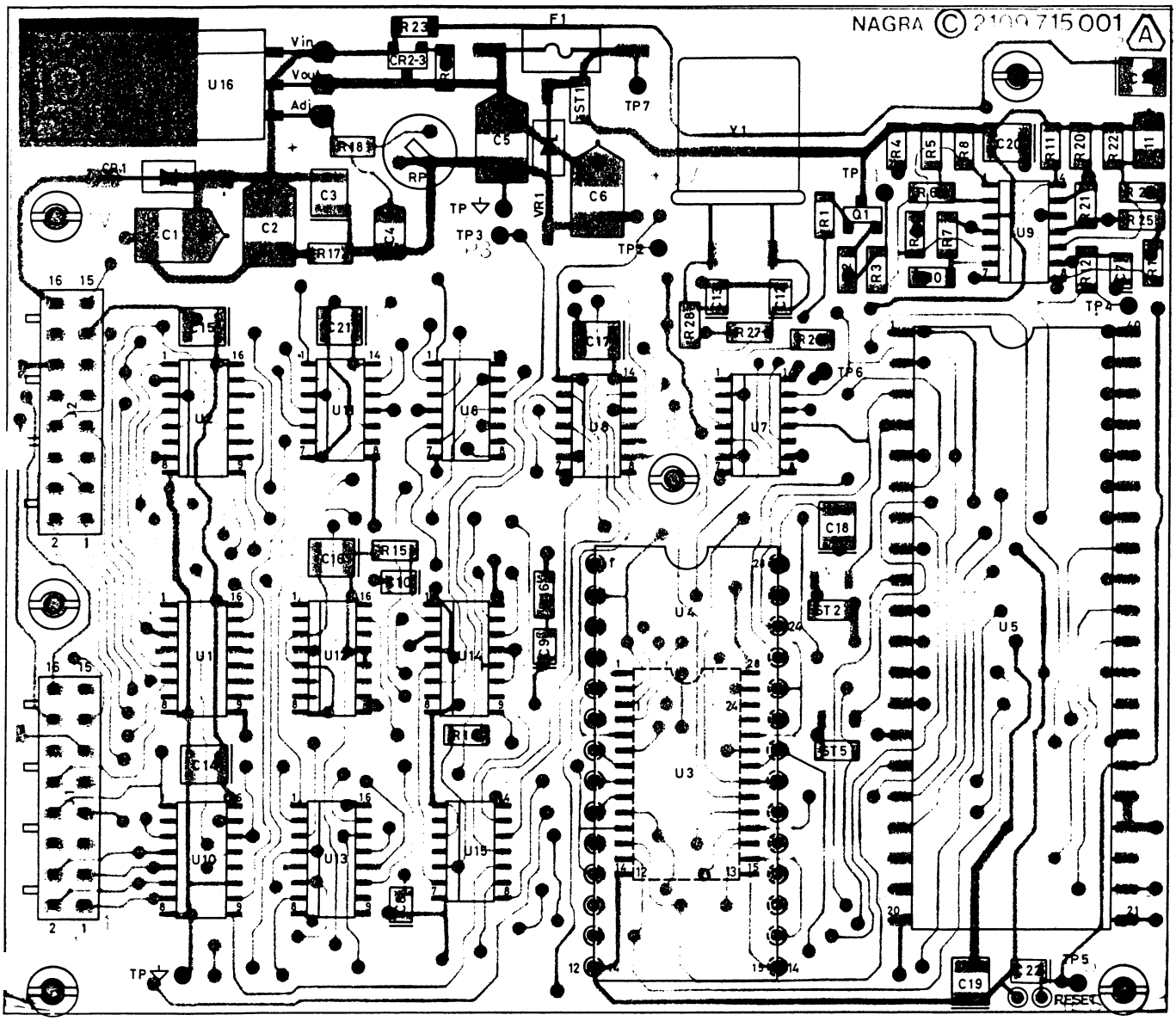


Edit free	0	0								
Edit servo	0	1								
Edit ○→	1	0								
Edit ←○	1	1								
Display selection TADESK			1							
Display selection TASKR			0							
Speed initialization B				0	0					
Speed initialization C				0	1					
Speed initialization D				1	0					
Speed initialization free				1	1					
Keyboard Enable						X		ON		
Keyboard Disable						1		OFF		
Keyboard Stop Only						0		OFF		

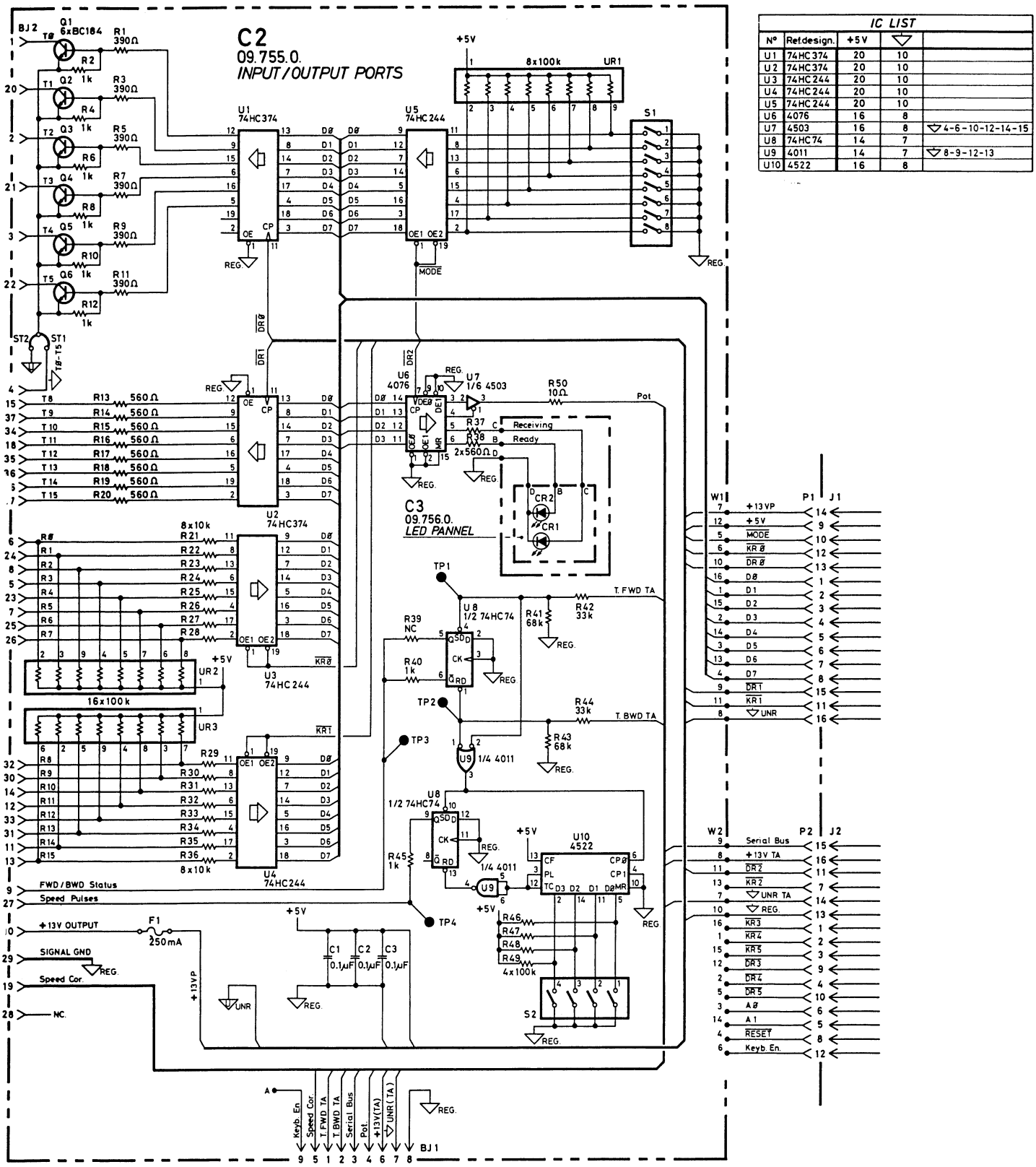
KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	C2 △
TADESK	09.09.716.0.00	3 . 9 . 86
SIMPLIFIED KEYBOARD		



CPU & SERIAL BUS DECODER
TABOX C1 Index A
91 09 742 000



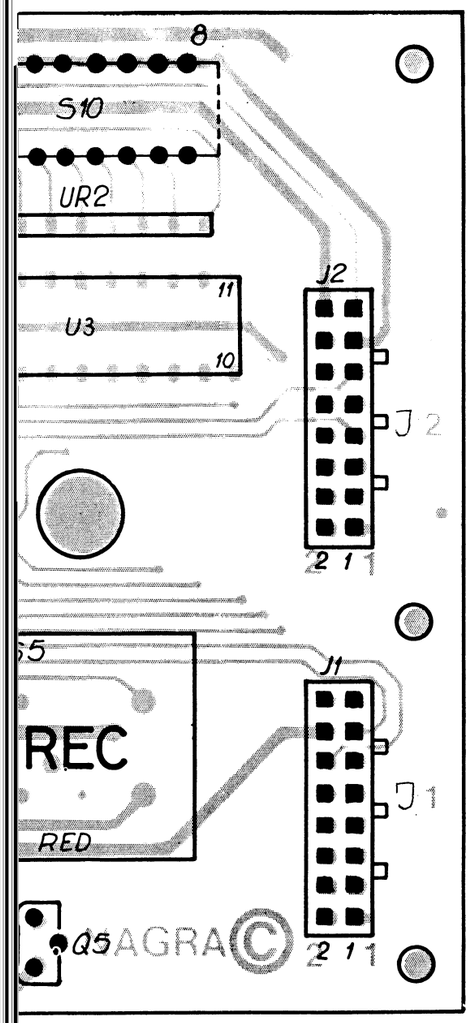
CPU & SERIAL BUS DECODER
TADESK, TAERP C1 Index A
91 09 715 000

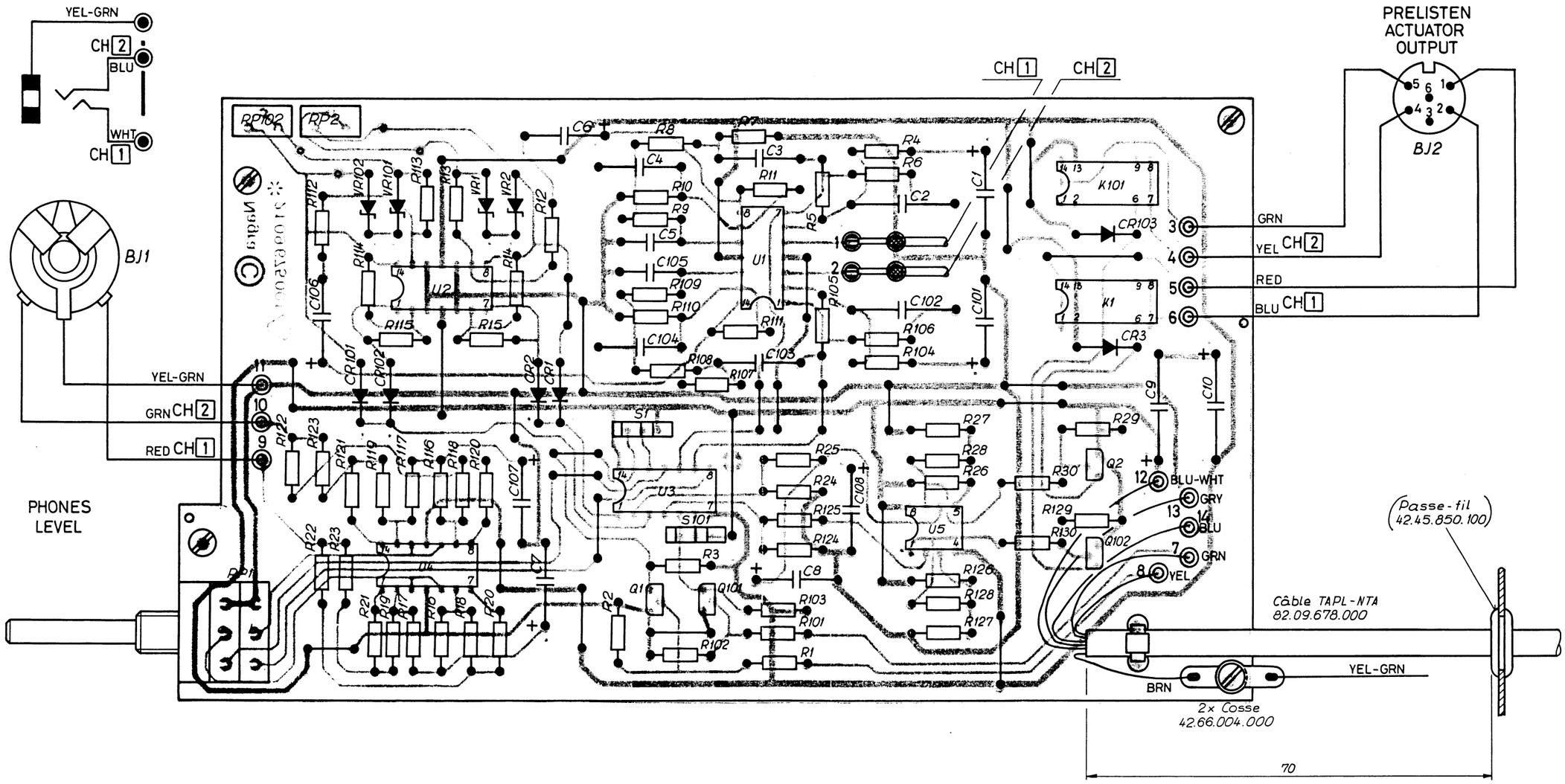


IC LIST				
N°	Ref.design.	+5V	▽	
U1	74HC374	20	10	
U2	74HC374	20	10	
U3	74HC244	20	10	
U4	74HC244	20	10	
U5	74HC244	20	10	
U6	4076	16	8	
U7	4503	16	8	▽ 4-6-10-12-14-15
U8	74HC74	14	7	
U9	4011	14	7	▽ 8-9-12-13
U10	4522	16	8	

DATE	MODIFICATIONS

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 19 West 44 th Street	C2 △
TAERP	09 09755 000	4.9.86.
INPUT/OUTPUT PORTS		


8
S10
UR2
11
U3
10
J2
J2
2 1
J1
J1
2 1
REC
RED
Q5
AGRA



PRELISTEN FOR NTA
TAPL 91 09 675 000

CH 1 — 09.675.0

INPUT STAGE AND DE-EMPHASIS ($T_1 \approx 50\mu s$, $T_2 \approx 3180\mu s$) | H.P. FILTER | L.P. FILTER | AMPLIFIER | H.P. FILTER | AMPLIFIER, LIMITER AND FULL-WAVE RECTIFIER

PLAYBACK HEAD 1

¼ 4156 U1 — C3 0,1µF — R8 22k — R9 22k — C4 2,2nF — C5 1nF — R7 33k — R5 330k — C2 10nF — R6 4,7k — R4 1k — C1 6,8µF

DC 0,05V / AC 150mV

DC 0V / AC 9mV for 1kHz and 510nWb/m on tape

¼ 4156 U1 — C6 0,68µF — R13 10k — R12 2,2k — R11 10k — R10 3,3k

DC +0,125V / AC 605mV

RP2 200k Switching sensitivity — VR1 2x 1N5520B 3,9V — VR2

DC 0V

¼ 3303 U2 — CR1 1N4148 — R14 15k — R15 15k — U2 ¼ 3303 — CR2 1N4148

DC 0V / AC Depending of RP2 position

U3 ¼ 4066 — S1 — Position for permanent headphone signal

REC 1 — From BP4-9 — YEL — R1 330k — R2 68k — Q1 BC214 — R3 33k

0V Switching enabled / +7,5V Switching disabled

PHONES LEVEL

HEADPHONE AMPLIFIER

RP1a 10k — R16 3,3k — R17 3,3k — R18 68k — R19 68k — 2x ¼ 3303 U4 — R20 100Ω — R21 100Ω — R22 180Ω — R23 180Ω — C7 6,8µF

DC 0V

SWITCHING AMPLIFIER

U3 ¼ 4066 — R25 33k — R24 3,3k — R26 33k — R29 15k — R30 100k — ½ LM358 U5 — Q2 BC214 — CR3 1N4148 — K1 — C8 0,33µF — R27 4,7k — R28 390k

DC +1V

HEADPHONE OUTPUT 1 — 9 RED — BJ1

HEADPHONE OUTPUT 2 — 10 GRN — 11 YEL-GRN

5ms — 0,15V — 2,5V

Measurement conditions:
a) 8Vp-p at 7-U_2
b) f = 100Hz
c) Input 8 grounded
d) RP2 = 200kΩ

From PRELISTEN HEAD ground — YEL-GRN — BRN

To REC 1 — YEL

To REC 2 — GRN

+7,5V 12 BLU-WHT — C9 22µF — 13 GRY — C10 22µF — -7,5V 14 BLU

PRELISTEN ACTUATOR OUTPUT

1 2

5 RED — 6 BLU — BJ2

4 YEL — 3 GRN

BJ4 To Console (External)

BP4 From NAGRA TA AUDIO MONITORING OUTPUT

IC LIST

Nr	Ref. design.	+7,5V	-7,5V
U1	4156	4	11
U2	3303	4	11
U3	4066	14	7
U4	3303	4	11
U5	LM358	8	4

CH 2

REC 2 — From BP4-22 — GRN — R101 330k — S101 — RP1b 10k — U3 ¼ 4066 — 2x ¼ 3303 U4

PLAYBACK HEAD 2 — ¼ 4156 U1

½ LM 358 U5 — U3 ¼ 4066 — K101

¼ 4156 U1 — ¼ 3303 U2 — ¼ 3303 U2 — RP102 200k

CH 2 IDENTICAL CH 1 :
COMPONENT NUMBERS ARE ALSO IDENTICAL
BUT CH 2 ALWAYS PLUS 100 (EXCEPT. IC_S)
E.G. R15(CH 1) R115 (CH 2)

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

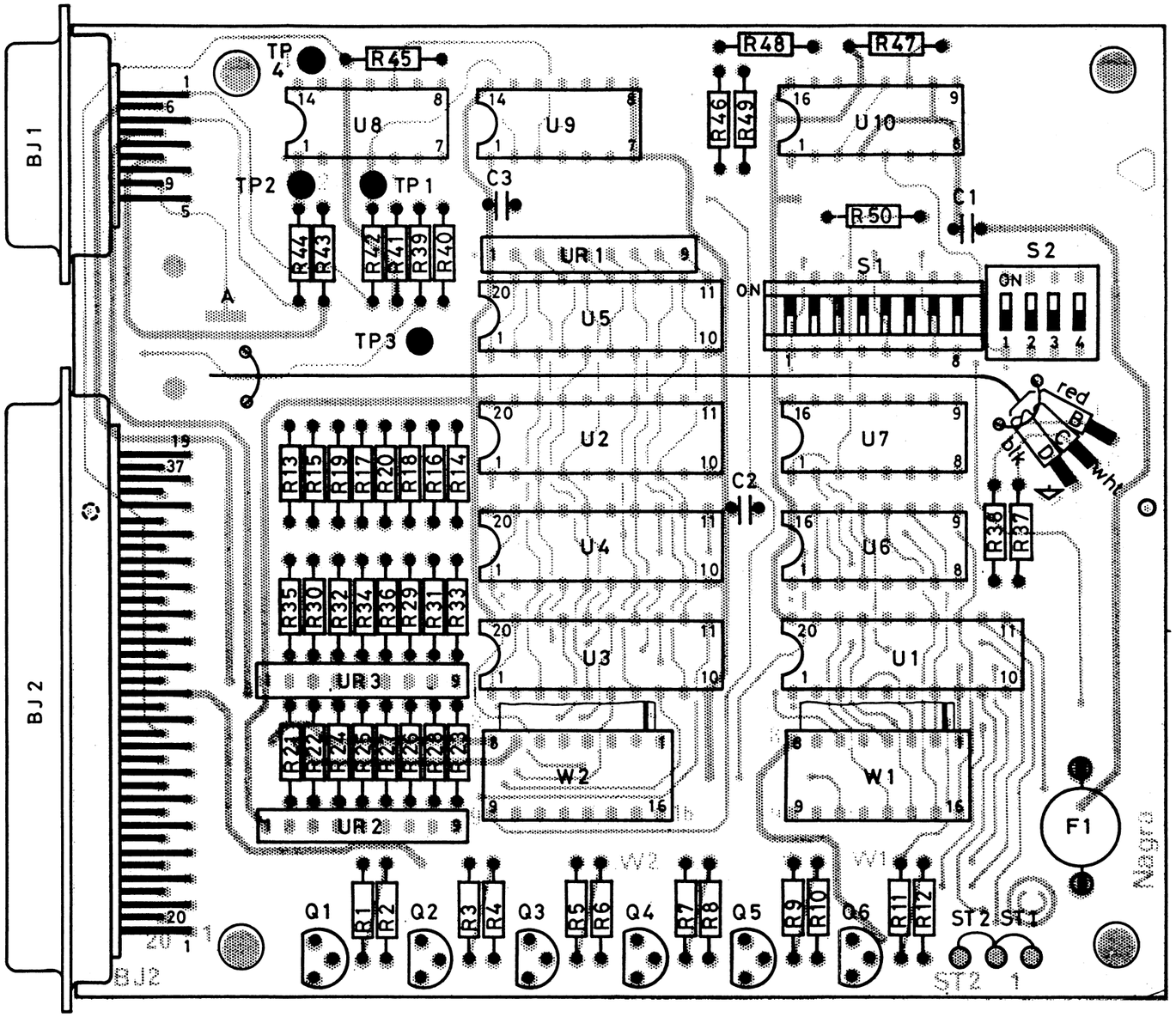
UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %

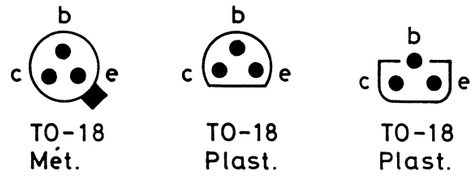
ALL RESISTORS ¼W ± 2 %
ALL CAPACITORS ± 20 %

EYELET

ALL CONNECTORS VIEWED FROM THE OUTSIDE

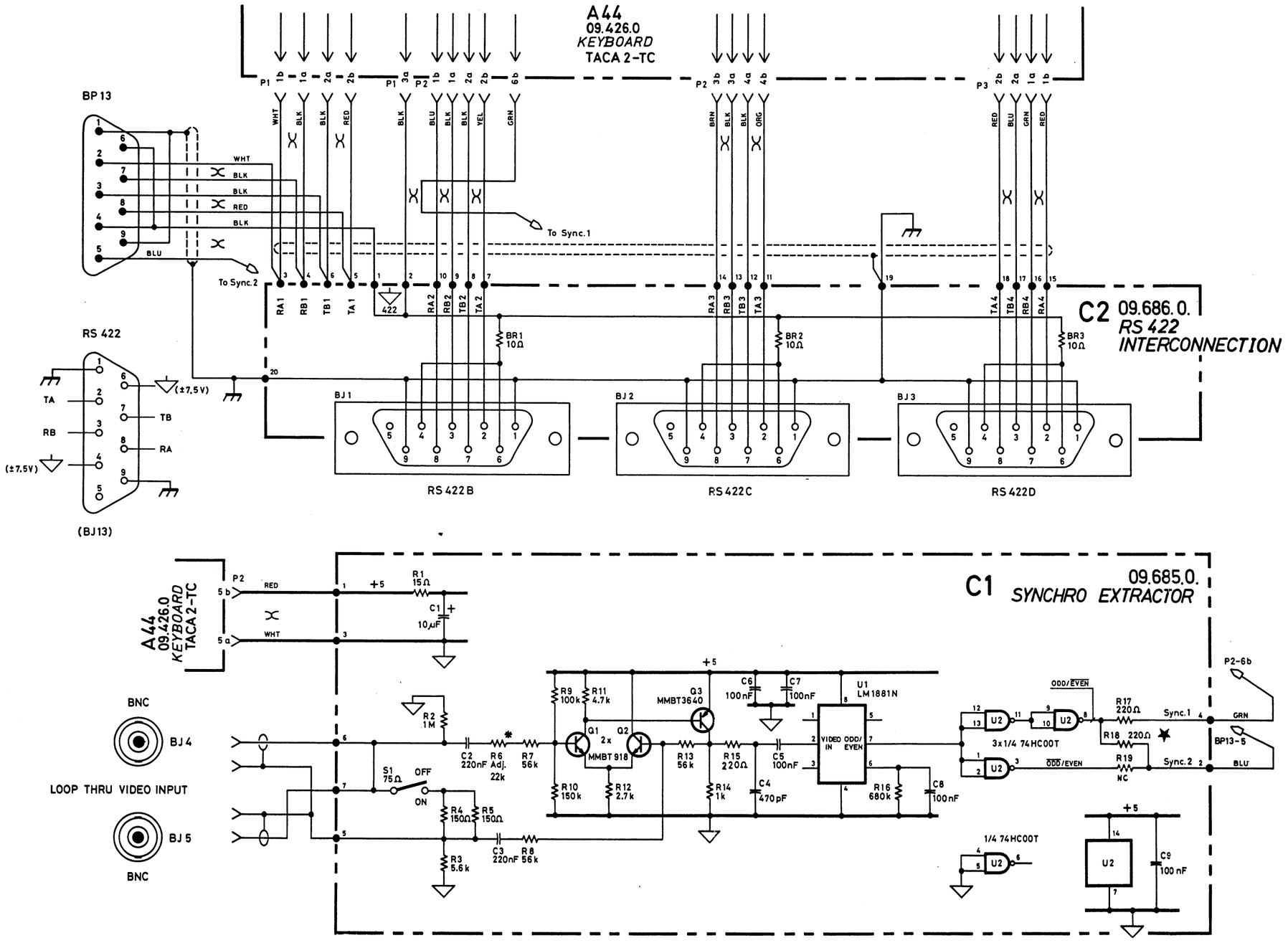
KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	
TAPL	09.09.675.0.00	9 . 3 . 87
PRELISTEN FOR NTA		





Valable pour circuit indice ○

Copie à : ○	Plan d'implantation Interface parallèle TAERP	Echelle	Dessine	3.9.86	Király
			Contrôle		
			Alpha numerique	C2	
NAGRA KUDELSKI		91 09 755 0 00			



UNLESS SPECIFIED

Voltages may vary ±10%
All resistors 1/8W ± 2%
All capacitors ±10%

MEASURING INSTRUMENT

DC Voltmeter 40000 Ω/V

* Optimum value to be selected typical value shown

Male contact

Female contact

Common

Frame

COLOR CODE

WHT	= White
BLK	= Black
RED	= Red
YEL	= Yellow
GRY	= Grey
BLU	= Blue
ORG	= Orange
BRN	= Brown
GRN	= Green

★ R18 = 220Ω, R19 = NC : T-Audio without TAPFM or with TAPFM in "TACO-DR" position.

R18 = NC, R19 = 220Ω : T-Audio with TAPFM in "NORMAL" position.

S1
75Ω
ON OFF

DATE	MODIFICATIONS

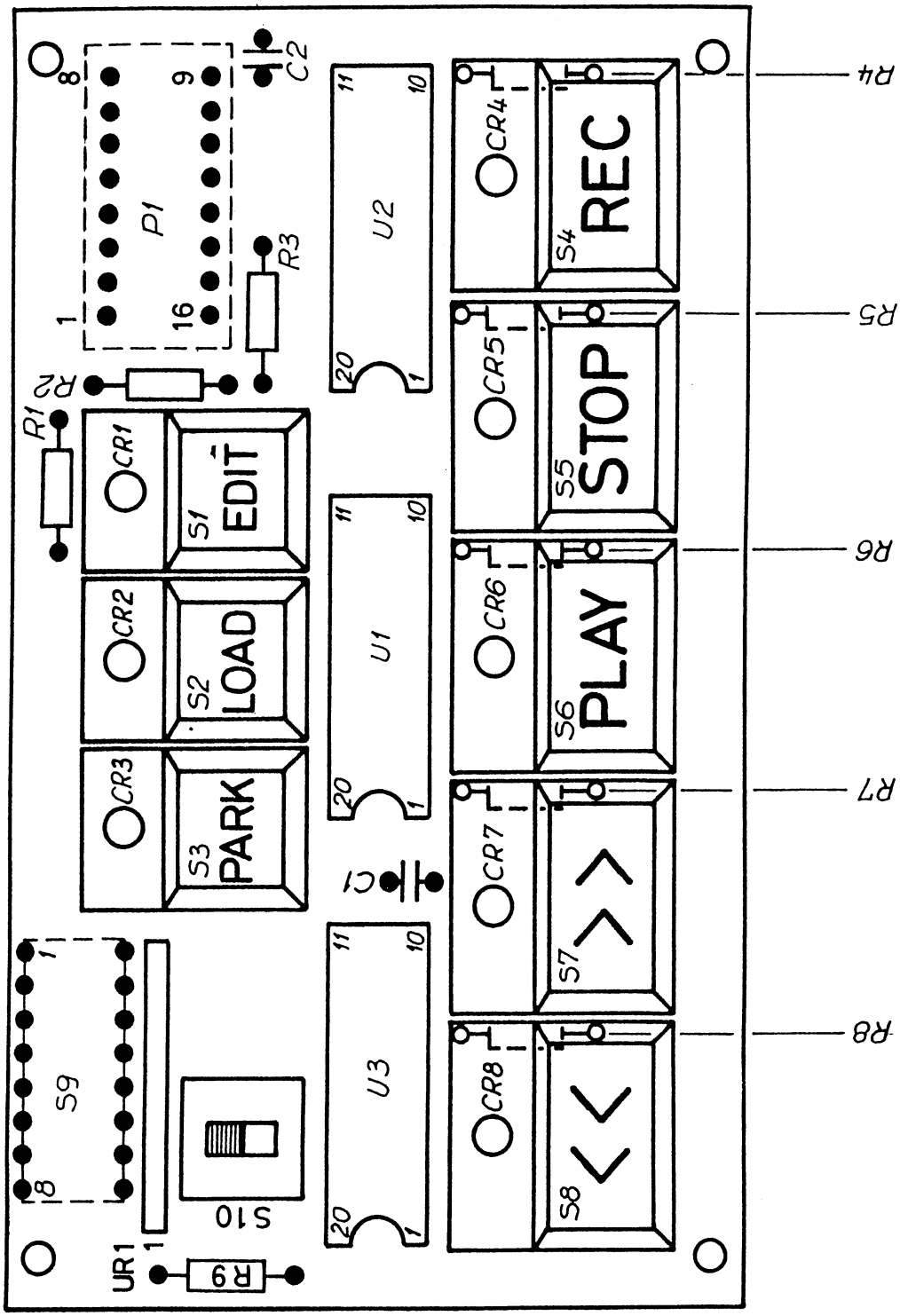
KUDELSKI SA Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10036
19 West 44 th Street

C1
C2

NAGRA-TA-RSA | 09 09 685000 | 16.12.87.

SYNCHRO EXTRACTOR
RS 422 INTERCONNECTION



Valable pour circuit indice (A)

Copie à:	Plan d'implantation Télécde simplifiée TASKR	Echelle 2:1	Dessiné	21.1.87	Wenger
			Contrôlé		
			Alpha numérique	C2	
NAGRA KUDELSKI			91.09.726.0.00		

X = INDIFFERENT

OFF = 1
ON = Ø

S9 / S10

	1	2	3	4	5	6	7	8	S10
Edit free	Ø	Ø							
Edit servo	Ø	1							
Edit ○→	1	Ø							
Edit ←○	1	1							
Display selection TASKR			Ø						
Display selection TADESK			1						
Speed initialization B					Ø	Ø			
Speed initialization C					Ø	1			
Speed initialization D					1	Ø			
Speed initialization Free					1	1			
Keyboard Stop Only							Ø		OFF
Keyboard Enable							X		ON
Keyboard Disable							1		OFF

C2
09.726.0

UR1 F9E-104J 8x100k

R9 1M

U3 74HC244

U1 74HC244

U2 74HC374

C1 0,1µF

C2 0,1µF

R1–R8 8x560Ω

CR1–CR8

S1 EDIT
S2 LOAD
S3 PARK
S4 REC
S5 STOP
S6 PLAY
S7 >>
S8 <<

KEYBOARD OFF / KEYBOARD ON — S10

UNR

P1

+13VP	14
+5V	15
DR1	16
DØ	1
D1	15
D2	2
D3	14
D4	3
D5	13
D6	4
D7	5
MODE	6
KRØ	12
+5V	10
DRØ	11
KEYBOARD	8
UNR	

W1

P1

+13VP	14
+5V	9
MODE	10
KRØ	12
DRØ	13
DØ	1
D1	2
D2	3
D3	4
D4	5
D5	6
D6	7
D7	8
DR1	15
KR1	11
UNR	16

To J1 C1 09.725.0

BJ1

P3

+13V	1
BUS	2
K. EN	3
(±7,5V)	4
(+13V)	6
NC	5
NC	7

+13V TA
SERIAL BUS
KEYBOARD ENABLE
REG
UNR
NC
NC

To T-Audio BJ3 plug

K. EN	8
BUS	10
(+13V)	11
(±7,5V)	24
+13V	25
	13

REMOTE CONTROL INPUT/OUTPUT

P2

SERIAL BUS	15
+13V TA	16
UNR	14
REG	13
KEYBOARD ENABLE	12

To J2 C1 09.725.0

DATE	MODIFICATIONS
1.87	OME 09-088

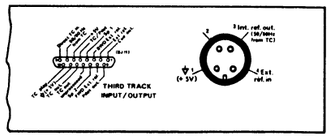
KUDELSKI SA Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

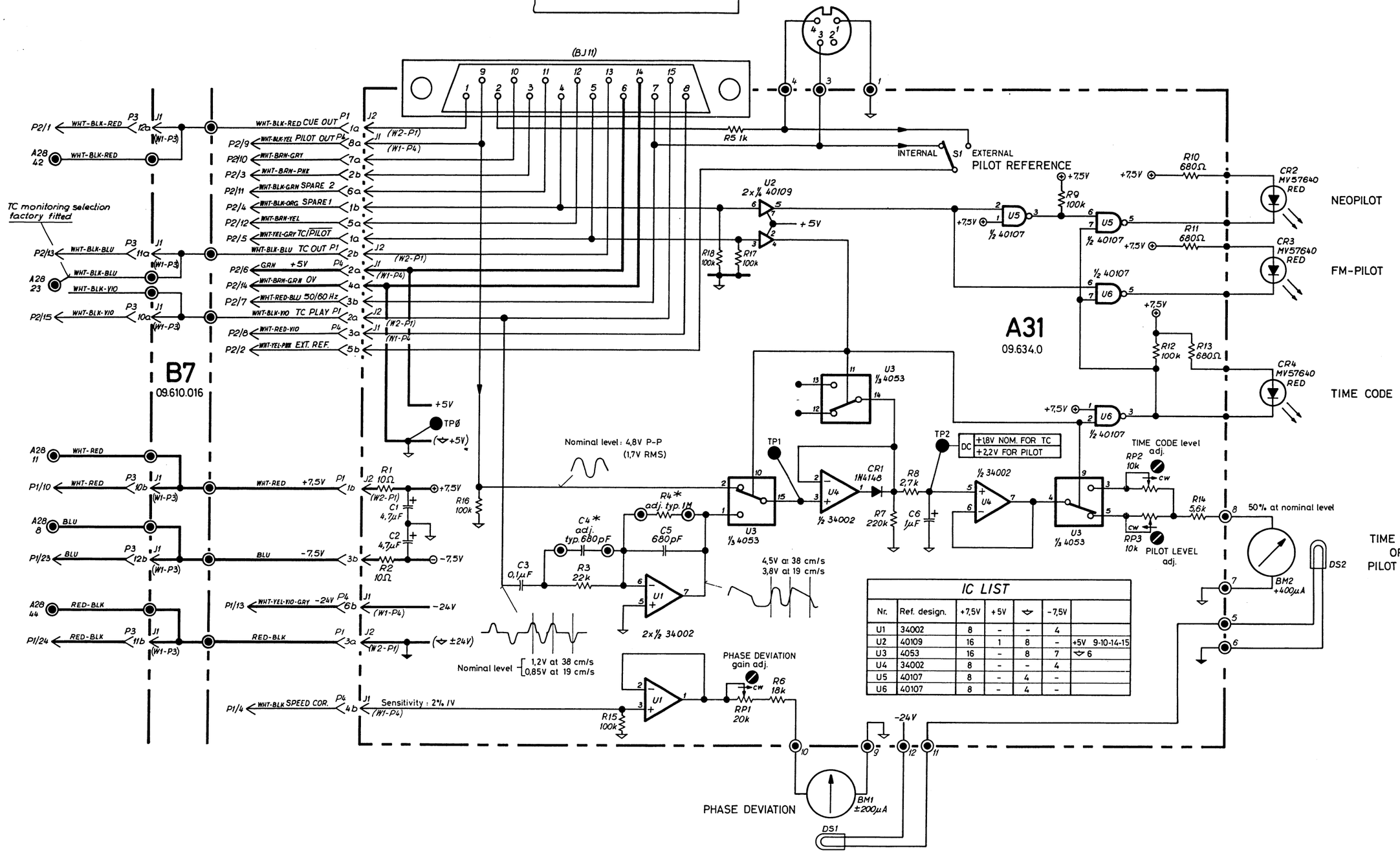
NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10036
19 West 44 th Street

C2 Ⓐ

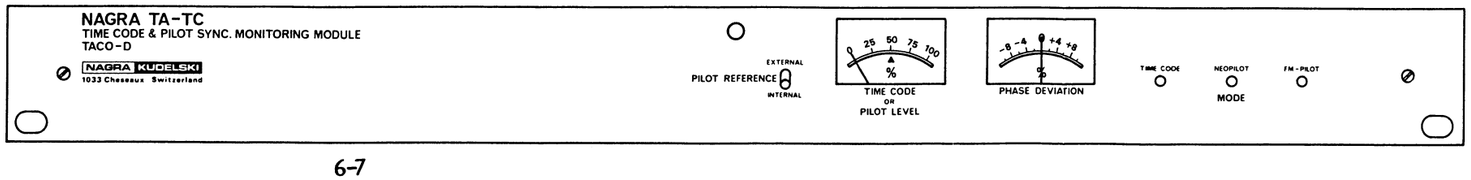
TASKR | 09.09.726.0.00 | 3.9.86

REMOTE CONTROL KEYBOARD

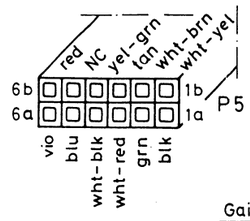


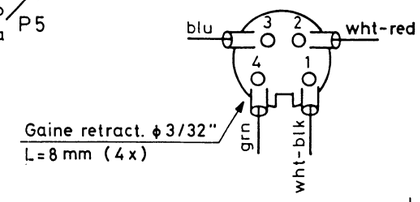


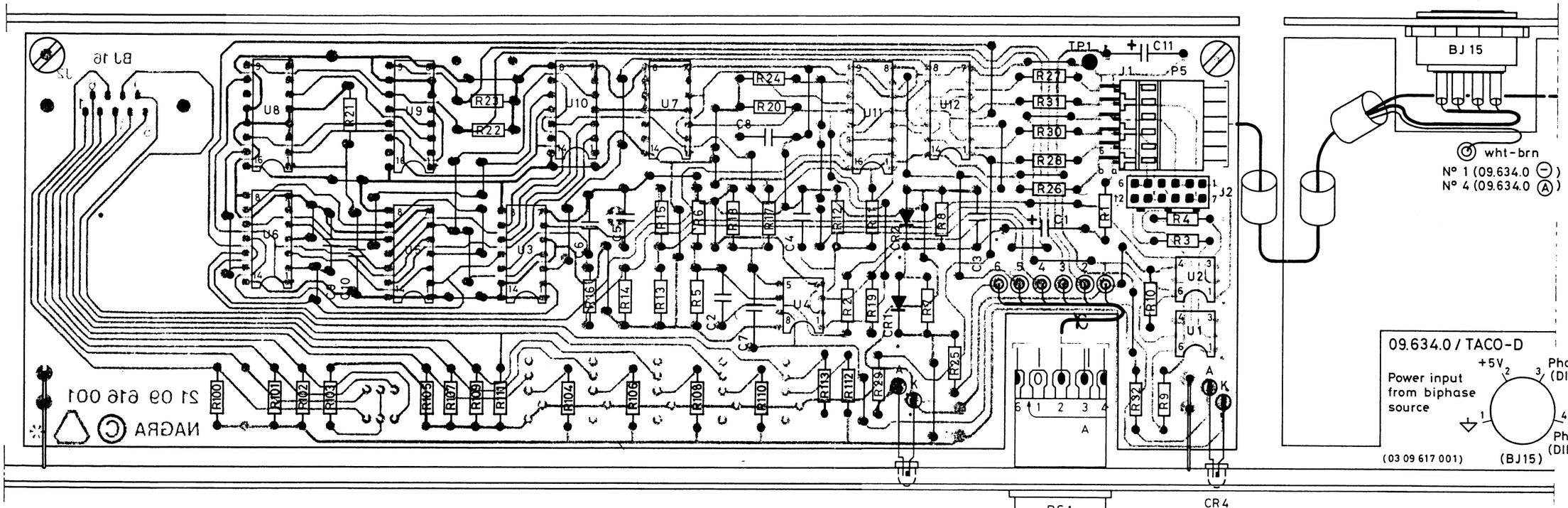
IC LIST						
Nr.	Ref. design.	+7,5V	+5V	⏚	-7,5V	
U1	34002	8	-	-	4	
U2	40109	16	1	8	-	+5V 9-10-14-15
U3	4053	16	-	8	7	⏚ 6
U4	34002	8	-	-	4	
U5	40107	8	-	4	-	
U6	40107	8	-	4	-	



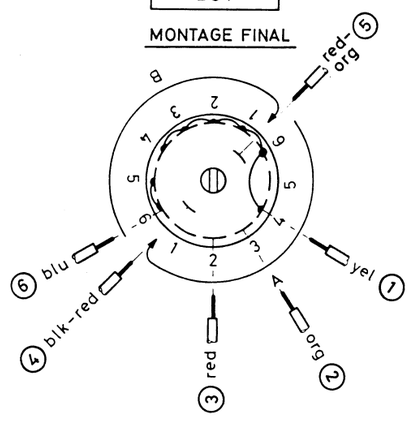
KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	**A31** A
TACO-D	**09.09.615.0.00**	**8 . 1 . 86**
PILOT/TC DISPLAY MODULE		





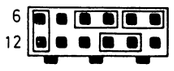


MONTAGE FINAL



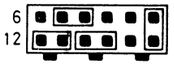
COLOR		CODE
BLK	=	Black
BRN	=	Brown
RED	=	Red
ORG	=	Orange
YEL	=	Yellow
GRN	=	Green
BLU	=	Blue
VIO	=	Violet
GRY	=	Grey
WHT	=	White
PNK	=	Pink
TAN	=	Tan

MODE +5V COMMUN



ST 1 = 3 - 4
ST 2 = 6 -12
ST 3 = 1 - 2
ST 4 = 8 - 9

MODE ⏚ COMMUNE

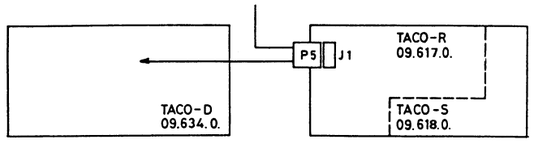


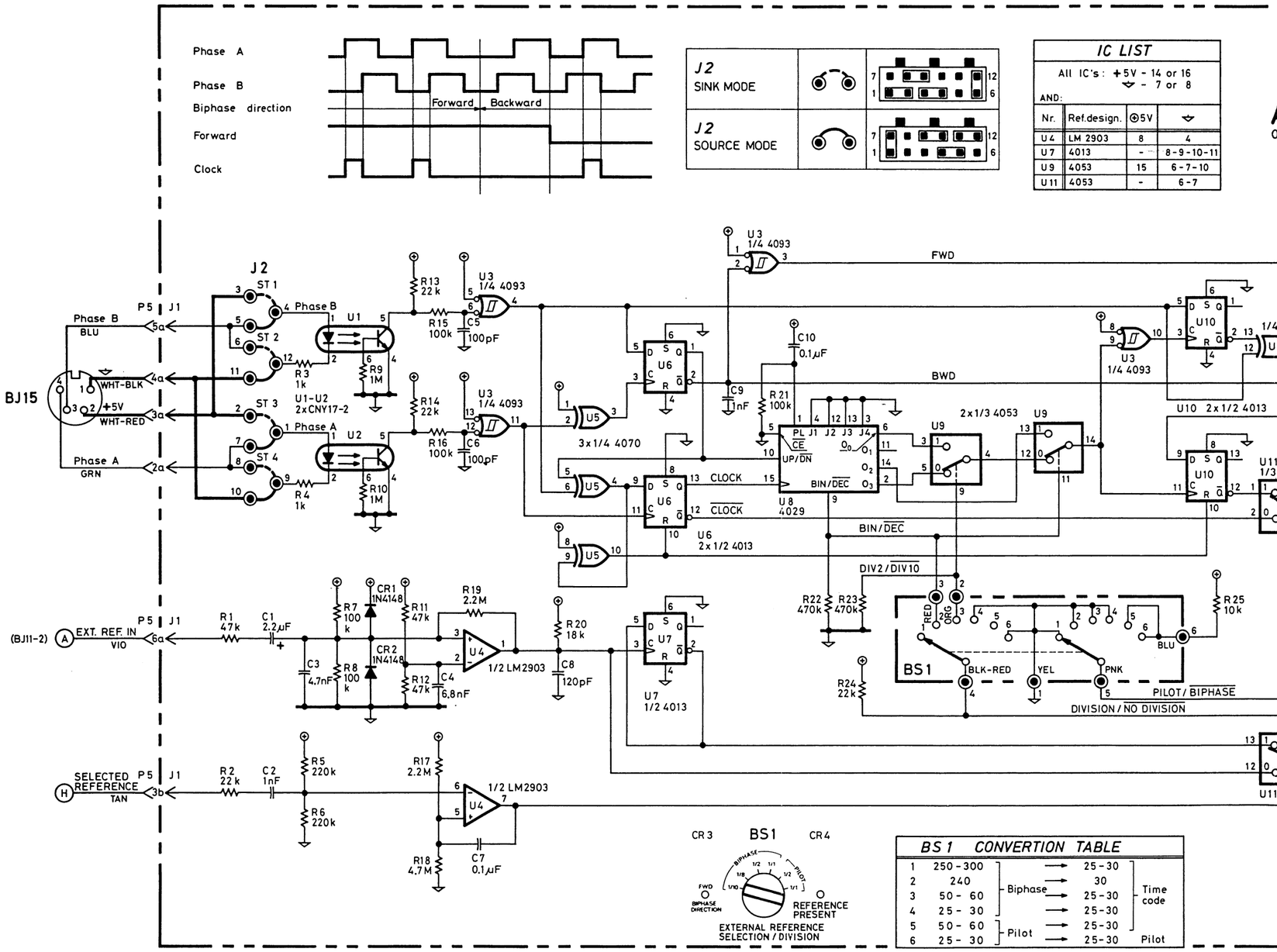
ST 1 = 4 - 5
ST 2 =11-12
ST 3 = 1 - 7
ST 4 = 9-10

Valable pour circuit indice ◯

Copie a : ◯	Plan d'implantation Biphase interface TACO-R	Echelle	Dessiné	13.2.87 Kiraly
			Contrôle	
			Alpha numérique	A33a
NAGRA KUDELSKI			91.09.6170.00	

WIRING OF BJ15 SOCKET





DATE	MODIFICATIONS

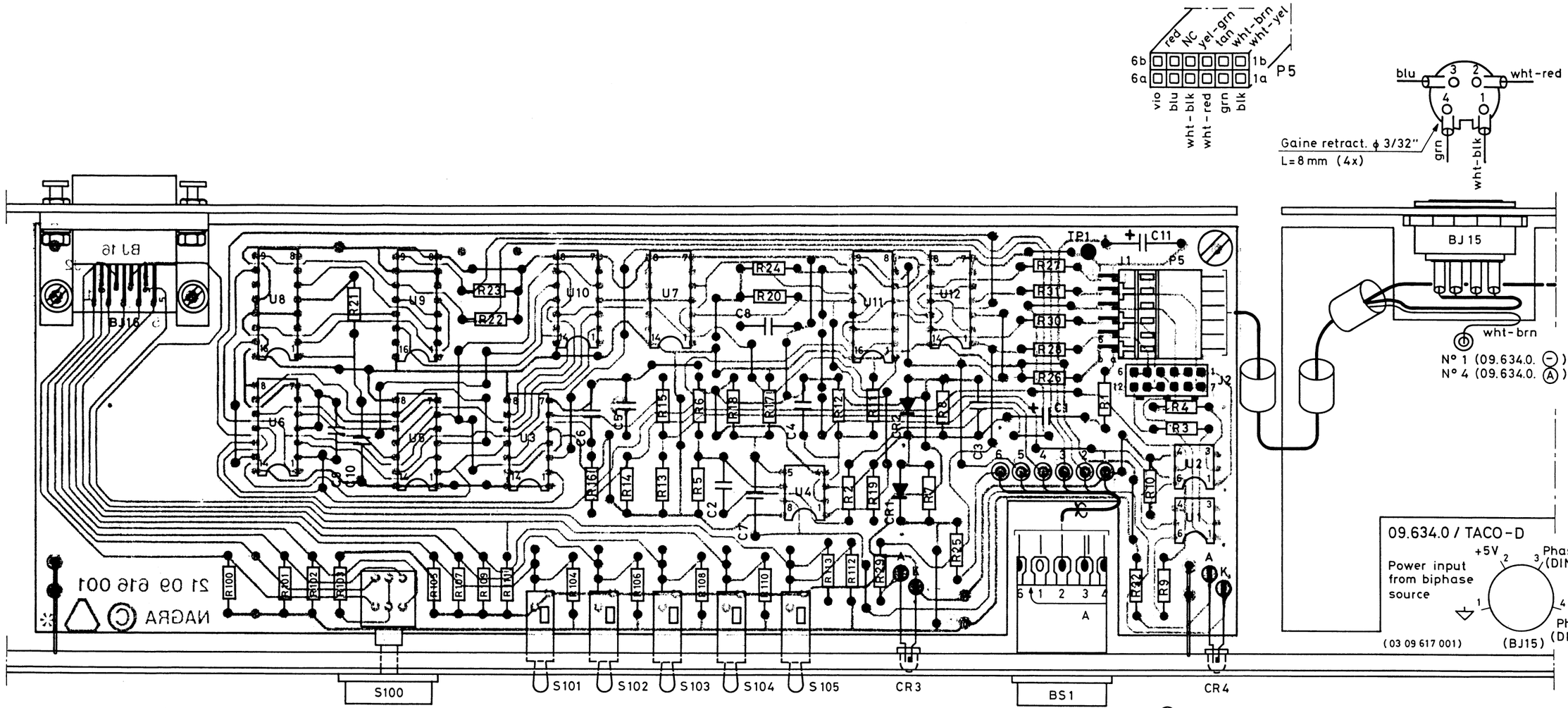
COLOR CODE

BLK	=	Black
BRN	=	Brown
RED	=	Red
ORG	=	Orange
YEL	=	Yellow
GRN	=	Green
BLU	=	Blue
VIO	=	Violet
GRY	=	Grey
WHT	=	White
PNK	=	Pink
TAN	=	Tan

MALE, FEMALE CONTACT
EYELET
TEST-POINT
COMMON

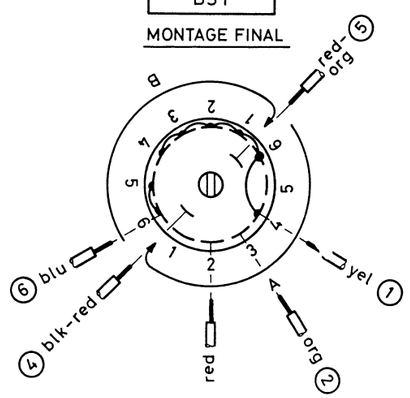
NOTE:
ALL CONNECTIONS — TO TACO-D2

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A33a
TACO-R	09 09 617 000	2. 2.87.
BIPHASE INTERFACE		

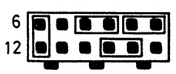


COLOR		CODE
BLK	=	Black
BRN	=	Brown
RED	=	Red
ORG	=	Orange
YEL	=	Yellow
GRN	=	Green
BLU	=	Blue
VIO	=	Violet
GRY	=	Grey
WHT	=	White
PNK	=	Pink
TAN	=	Tan

MONTAGE FINAL

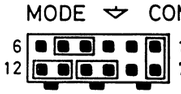


MODE +5V COMMUN



ST 1 = 3 - 4
ST 2 = 6-12
ST 3 = 1 - 2
ST 4 = 8 - 9

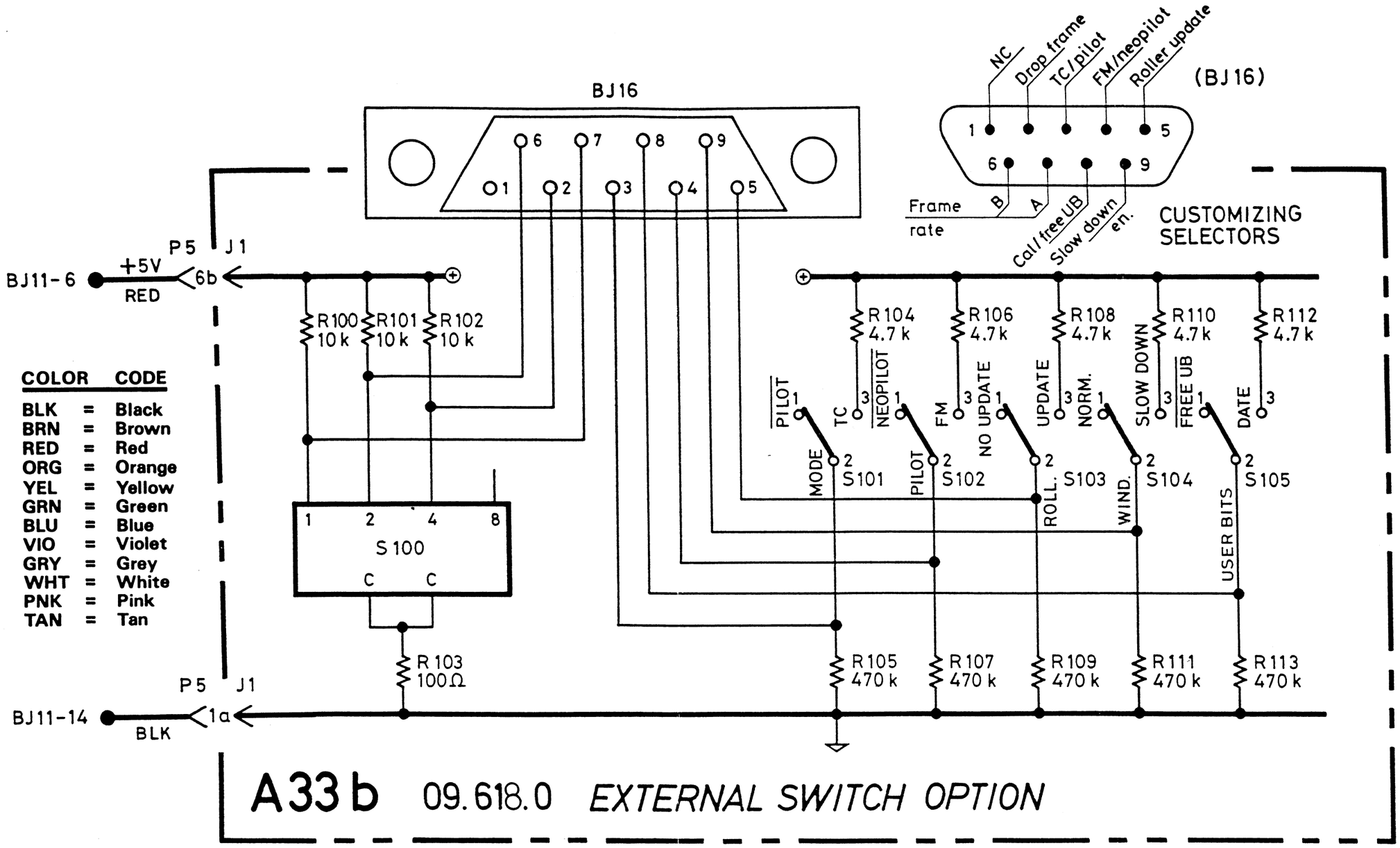
MODE ⏚ COMMUNE



ST 1 = 4- 5
ST 2 =11-12
ST 3 = 1- 7
ST 4 = 9-10

Valable pour circuit indice ◯

Copie a : ◯	Plan d'implantation Biphase interface & External switch option TACO - RS	Echelle	Dessine 13 2.87 Kiraly	
			Contrôle	
			Alpha numerique	A33 a - A33 b
NAGRA KUDELSKI	91 09 618 0 00			



COLOR		CODE
BLK	=	Black
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RED	=	Red
ORG	=	Orange
YEL	=	Yellow
GRN	=	Green
BLU	=	Blue
VIO	=	Violet
GRY	=	Grey
WHT	=	White
PNK	=	Pink
TAN	=	Tan

MALE
FEMALE
CONTACT

COMMON

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	**A33b**
TACO – S	**09 09 618 000**	**24.5.89**
EXTERNAL SWITCH OPTION		

IC LIST

...sign	BK-UP	+ 5P	...	
	14	-	7	...: 3-5-9-13
	14	-	7	
	15	-	8	BK-UP 6-12
	-	20	10	
3818	24	-	12	
225	-	33	6	
	-	24	12	
	-	14	7	
	-	14	7	
	-	16	8	
0-25	-	40	20	

SCHEMATIC DIAGRAM NOTES

- Asterisk denotes a factory adjusted value
- Value shown is typical
- Circuit assembly borderline
- Common connections
- Male Contact
- Female Contact
- Test Point
- Tool aided adjustement
- All connectors viewed from the outside

UNLESS OTHERWISE SPECIFIED

- All resistors chip ± 2%
- All electrolytic capacitors Tantalum ± 10 ± 20%
- All ceramic capacitors chip
  - from 3.3pF to 1nF ± 10% COG (± 30ppm/°C max)
  - for > 1nF ± 10%, X7R (± 5%, from −40 to +85°C)
  - if specified 0°C ⇒ COG ± 10%
- Voltages may vary ± 10%

MEASURING INSTRUMENT

Digital voltmeter Zin ≥ 10 MΩ
AC Voltmeter Zin ≥ 1 MΩ (e.g. B&K 2112 or 2606 + 1515 or equivalent)

REAL TIME CLOCK

EPROM 4k x 8

I/O + TIMERS

CENTRAL PROCESSING UNIT

51.755.0

CTL BUS

A.D BUS

UC4 ½ 40098

UF4 MC146818

UH4 27C32

UE2 40373

UL2 NSC 800-2.5

UJ2 NSC 800-2.5

UB3 4024

UR3 ½ 4069

Y1 4.194304 MHz

TP4

Reset

BACK-UP

CR1 BAW56

R1 1k

R2 100Ω

C1 4.7nF

C2 4.7nF

BT1 3V

S1 SW8

+5P

R3 100k

R4 220Ω

C3 470nF

R26 100k

R27

R28

R29

R30

R31 4.7x100k

C4 25-5 pF

C5 4-adj

C6 22pF

C7 22pF

R15 1M

R16 2.2k

R17 4.7k

C17 1uF

RST A

RST B

WAIT

HM1

BRE..

PS

RFSH

M1

Res IN

Res OUT

X IN

UJ1 ½ 40106

UK1 ½ 4013

UK1

R50 47k

TC IN (5V CMOS)

J1

TC OUT (5V CMOS)

PA7

PC0

PC1

PC2

R12 4.7k

R13 4.7k

R14 4.7k

C1 (Click)

F1 (Frame)

TC OUT

UL1 4046

COMP IN

VCO OUT

SIG IN

INH

VCO IN

R24 33k

R25 47k

C11 10nF

C12 100nF

C10 8.2nF

R22 10k

R23 10k

TP1

TP2

SIGN

DISPLAY

MODE

STANDARD

TC

READ

GEN

EBU

SMPTE

R51 100k

R52 100k

R53 100k

R7 100k

R8 100k

R9 100k

R11 100k

R5 100k

RUN/HOLD

KEY ON/OFF

KEYBOARD

POWER REGULATION

POWER

EXTERNAL

INTERNAL

EXT RED

(+5 to 9V 70mA max)

SW

51 756 0

T1 125mA

CR1 1N4004

D2

J2

COMMON (SHIELD)

UD5 ½ LM358

VR1 LM385 2.5V

R32 47k

R33 4.7k

R34 47k

R35 100Ω

R36 10k

R37 22k

R38 47k

R39 22Ω

D1 5087

Q2 5087

TP6

TP7

C13 2.2µF

POWER ON

POWER OFF

R40 5.6Ω

Q3 5087

R41 1k

BCX52

R42 22Ω

R43 100Ω

C15 1.5nF

R44 47k

TP5

R45 47k

R46 47k

C14 10nF

R47 100k

R48 100k

R49 100k

CR2-3 BAY99

UC4 ½ 40098

R10 10k

DISPLAY

DS1 LC 382080

UR3 µPD 7225

R14 100k

R12 100k

R20 150k

C8 1nF

C9 1nF

C11 1nF

R21 100k

PB6

OFF

DATE	MODIFICATIONS

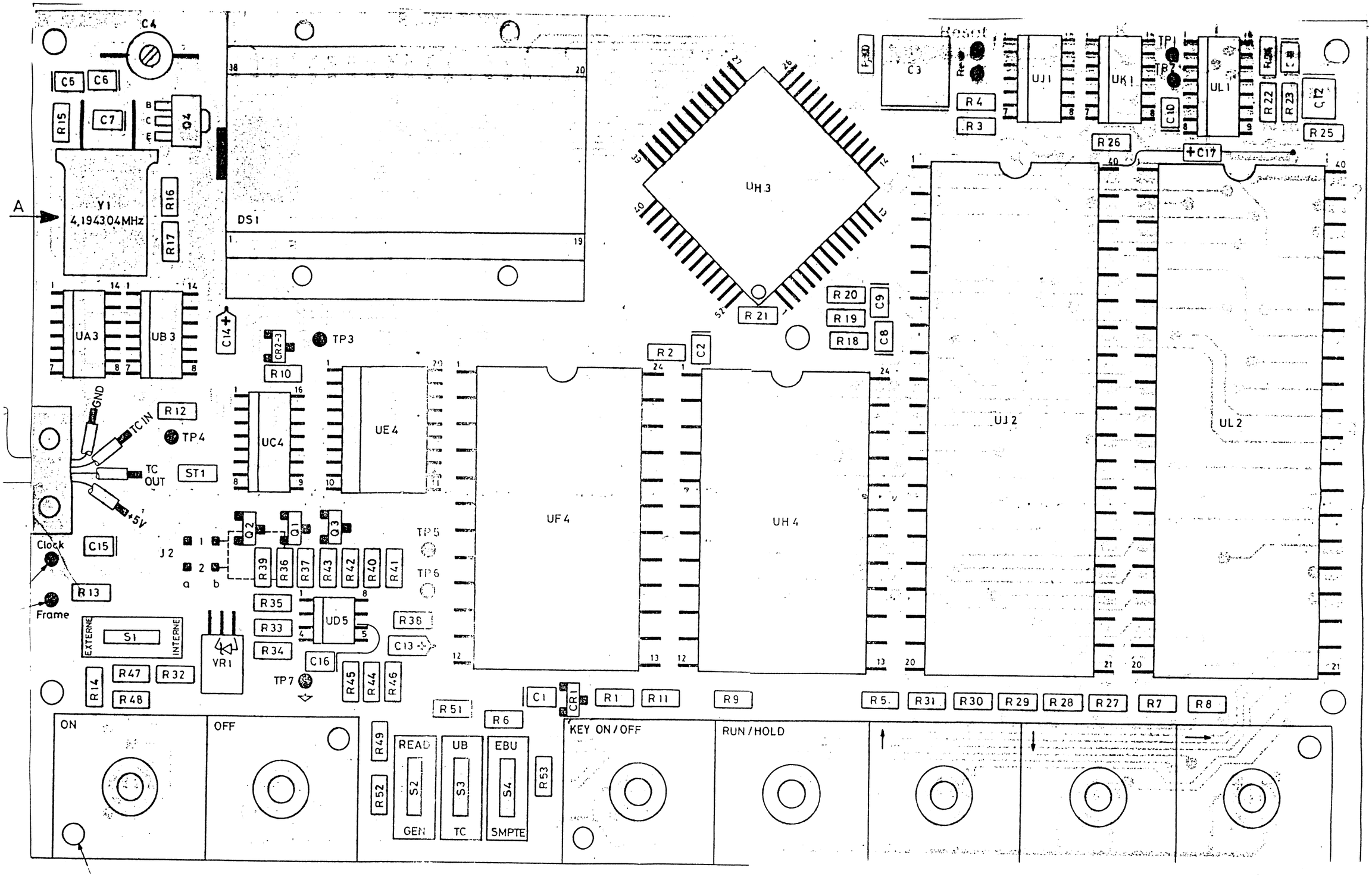
KUDELSKI S.A. Dept NAGRA CH 1033 CHESEAUX Switzerland

NAGRA MAGNETIC RECORDERS INC. 942 Hahn Rd. Westlake, Ohio 44145 U.S.A.

51.755.0
51.756.0

TCGR | 09.51.750.0.00 | 17. 7. 84

TIME CODE GENERATOR/READER SMPTE-EBU


C4
C5
C6
R15
C7
B
C
E
Q4
A
Y1
4,194304MHz
R16
R17
DS1
38
20
1
19
UA3
UB 3
14
1
8
7
C14
CR2-3
TP3
R10
16
UC4
8
9
UE 4
10
GND
TC IN
R12
TP4
TC
OUT
ST1
+5V
Clock
C15
Frame
R13
J2
1
2
a
b
Q2
Q1
Q3
TP5
TP6
R39
R36
R37
R43
R42
R40
R41
R35
R33
R34
UD5
5
R38
C13
C16
TP7
R45
R44
R46
EXTERNE
S1
INTERNE
VR1
R14
R47
R48
R32
UH 3
72
26
53
1
50
25
R 21
R 20
R 19
R 18
C9
C8
R2
C2
24
1
UF 4
UH 4
12
13
20
Reset
C3
R4
R3
UJ1
UK1
TP1
TP2
UL 1
C10
R22
R23
C12
R25
R26
+C17
40
1
UJ 2
UL 2
21
R51
R6
C1
CR1
R1
R11
R9
R5.
R31
R30
R29
R28
R27
R7
R8
R49
R52
READ
S2
GEN
UB
S3
TC
EBU
S4
SMPTE
R53
ON
OFF
KEY ON/OFF
RUN/HOLD

TECHNICAL INFORMATIONS 7

TIE	DESCRIPTION	DATE
09- 1	Power supply incompatibility between logic control circuit A 02 and the servo-editing circuit, risk of damage to the circuit.	April 1982
09- 2	Suppression of automatic Repro to Input switching	February 1983
09- 3	Freezing of the counter when winding or rewinding is completed, or with ”Tape Dump” function	February 1983
09- 4	Speed/Standard & Tape Modify	February 1983
09- 5	Suppression of the audio track erasing frequency crosstalk on the TC track during playback – Improvement of TC playback of tapes recorded at 76 cm/s	December 1985
09- 6	Line input – output A 9a – Power Supply A 30	January 1986
09- 7	New Eprom version 1.4 – Modification of TC circuits	June 1986
09- 8	Tachometric filter in the speed stabilizer circuit	December 1986
09- 9	Not existing	
09-10	Protection of integrated circuits UF1, UD9 and UJ7 on the main time code board	December 1986
09-11a	Tape counter Circuit A 04- A 21 New Eprom Version 3.3	September 1987
09-12	Improvement of TC decoding at 120Kbits/s	August 1987
09-13	Tape Counter Roller circuit, Output level stabilization	November 1987
09-14	Rotating guide in the head block	February 1988
09-15	Tape path alignment and head adjustment	September 1988

09-16	Installation of the TASIM-2	June 1988
09-17	Inhibition of the Remote Control Functions when the Keyboard switch is in “Local”	June 1988
09-18	Reduction of the current consumption of the Time Code Circuit A 05	August 1988
09-19	Activation of the “Muting Enable” in the mode “Listen Time Code”	September 1988
09-20	Procedure for the adjustment of the belts of the reel motors	November 1988
09-21	Modification of the TASC for Time Code Mute	April 1989
09-22	New Logic a 02 for NTA 3 TC	May 1989
09-23	Installation of the new Pinch roller carriage and carriage guides	December 1989
09-24	Rejection of parasitic interference in the video reference of the TA-RSA	December 1989
09-25	Sorage of a Nagra T_audio for long periods without use	November 1990
09-26	Reduction of parasites in the TA-RSA cable	November 1990
	Installation of the TACO-S Option	December 1987
	Modification of the T-Audio for TACO-S	July 1987

PRODUCT: NAGRA TA

DATE: April 1982

Nº 09-1

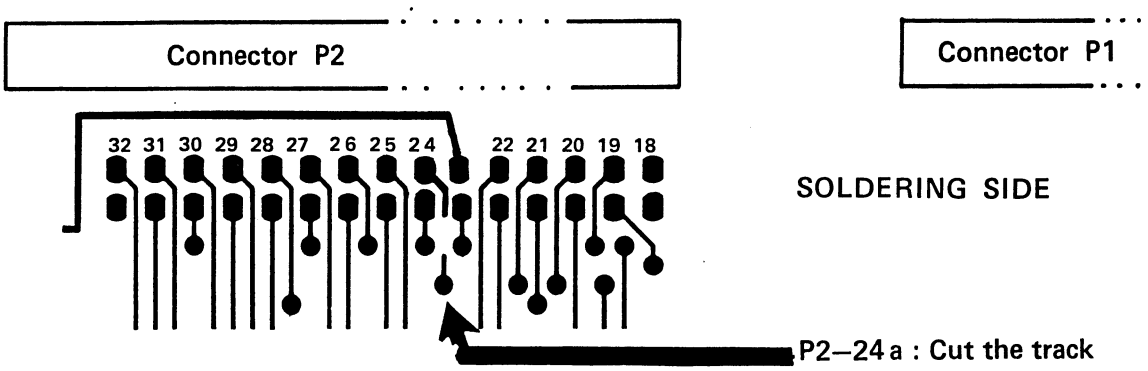
SUBJECT: **Power supply incompatibility between logic control circuit A02 and the servo-editing circuit, risk of damage to the circuit.**

Note: Modification to be carried out up to recorder number 31.
(Recorders already modified: No 06, 08, 25, 28, 29, 30)

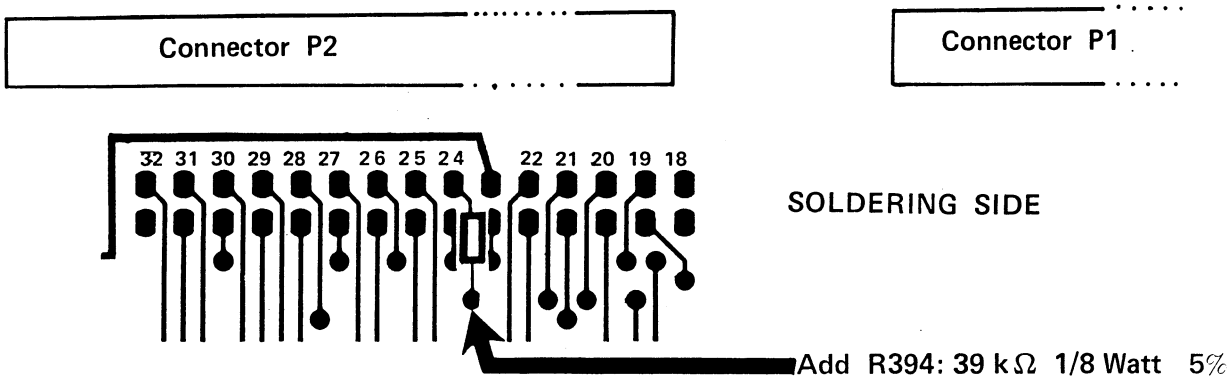
MODIFICATION: On the logic control circuit A02, add in series with the "zero detection" input (P2/24a) a 39 kΩ 5% 1/8 Watt resistor.

OPERATIONS

- **Note:** In order to avoid possible damage to the circuits, switch off the recorder before removing any printed circuit board.
  Logic control board A02 is the third one from the top.
- Slide the board out and locate connector P2: it is the second from the left (components side up)
- At the back of the printed circuit board is a large metallic protection plate. Unscrew its 3 screws and remove it.
- Connector P2 is now on the left. Locate track 24 :it is the ninth from the left.
- Cut this track as shown below:



- Solder resistor R394 (39 kΩ, 5%,1/8 Watt) as shown below:



- Screw again the metallic protection plate with its 3 screws.

PRINTED IN SWITZERLAND BY KUDELSKI SA

KUDELSKI SA 1033 CHESEAUX
SWITZERLAND

NAGRA KUDELSKI

Phone: 021/91 21 21 Telex: 459 302
Telefax: 021/91 41 55

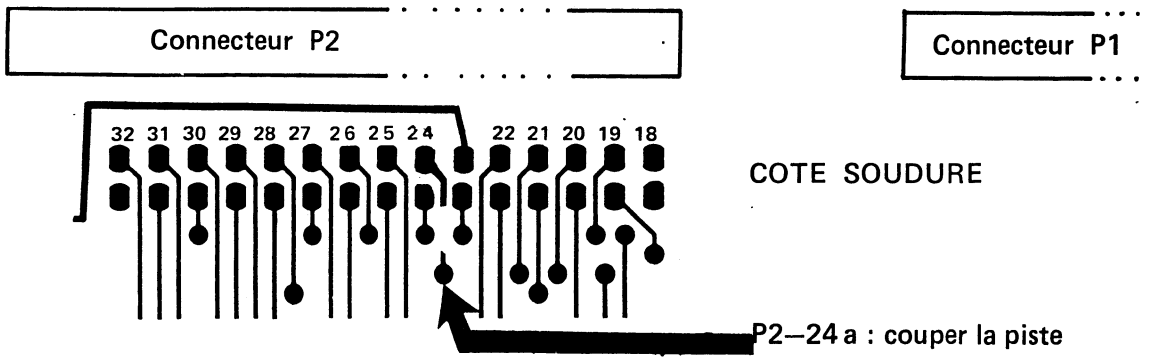
Note: Modification à effectuer jusqu'à l'appareil numéro 31.
(Appareils déjà modifiés: No. 06, 08, 25, 28, 29, 30).

MOTIF : Incompatibilité d'alimentation entre le circuit de commande logique A02 et celui de servo-édition, risque de dommages au circuit.

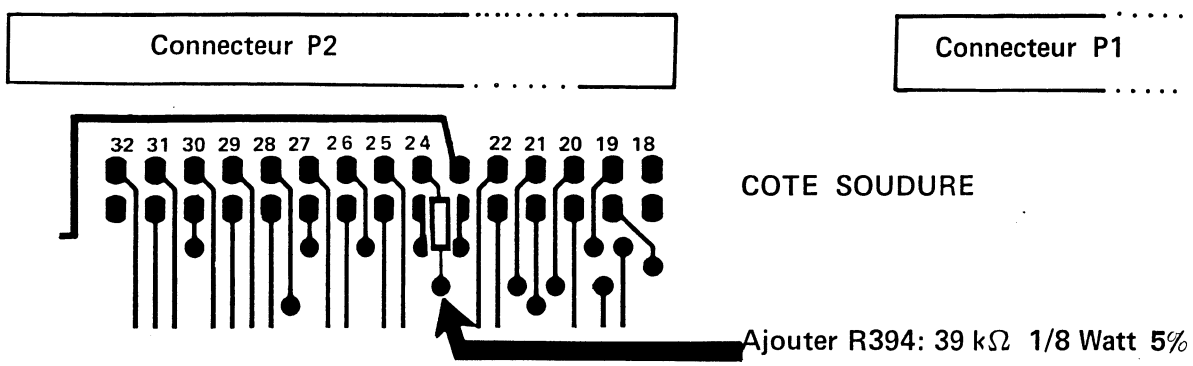
MODIFICATION : Sur le circuit de commande logique A02, ajouter en série sur l'entrée "zéro détection" (P2/24a) une résistance de 39 kΩ 1/8 Watt 5%.

OPERATIONS

- **Note:** Pour éviter aux circuits des dégats possibles, déclencher l'enregistreur avant d'enlever le circuit. ,
  Le circuit de commande logique A02 est le troisième à partir du haut.
- Retirer le circuit et localiser le connecteur P2: le deuxième depuis la gauche (face composants vers le haut).
- Au dos du circuit imprimé se trouve une grande plaque métallique de protection. Dévisser ses 3 vis et l'enlever.
- Le connecteur P2 est maintenant à gauche. Localiser la piste 24 (la neuvième depuis la gauche.)
- Couper cette piste comme indiqué ci-dessous:



- Souder la résistance R394 (39 kΩ, 1/8 Watt, 5%) en lieu et place de la piste coupée, comme indiqué ci-dessous:



- Revisser la plaque métallique de protection avec ses 3 vis.

PRODUCT: NAGRA T–Audio Recorder DATE: February 1983

SUBJECT: Supression of automatic Repro to Input switching

N° 09-2

On the matrix display the position OUTPUT can correspond to REPRO, INPUT or OFF. REPRO is automatically switched to INPUT for the functions "STOP", "FAST FORWARD", "FAST REWIND", loading functions and "PARK". This switching to INPUT can cause troubles (e.g. howl around) when the T–Audio is connected to other units (mixer, amplifier, loudspeakers). Therefore the automatic switching will be suppressed ex-factory for all T–Audio's from serial number 09 00082 on. The following modification can be done on previous T–Audio's.

On the contrary reintroduction of automatic switching on T–Audio's from serial number 09 00082 can be made by removing the wire between pin 5 and pin 1 of Integrated Circuit UG 302.

MODIFICATION

Note: In order to avoid possible damage to the circuits, switch off the recorder before removing any p.c. board.

- Open the front panel.
- Slide out Board A02–A15 (Transport Control Logic), third p.c. board from the top.
- Remove the board protecting plate (unscrew 3 screws).
- Locate Integrated Circuits UG 302 and UG 306 and place the board to expose the soldered side.
  Note: The circuits (A13, A14, A15, etc.) are delimited by lines on Board A02 and easy I.C.'s location is achieved, as they are arranged in matrix lay-out (e.g. A, B, C...and 101, 201, 303...) each with its number (for instance UA 204) marked on the board.
- Cut the track between pin 13 of UG 306 (no. 4078) and pin 5 of UG 302 (no. 4049); see Drawing no. 1.
- Replace the link by soldering to pin 13 of UG 306 and into hole A (facing pin 13) a 47 kΩ resistor in series (R 395) having its leads insulated.

  R 395 : R CAR 47 kΩ 10 % 1/4 W (part no. 55 26013 473)

- Connect pin 5 to pin 1 (7.5 V) of UG 302 by soldering an insulated wire (Drawing no. 2).

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PRODUIT : Enregistreur NAGRA T–Audio

SUJET : Supression de la commutation automatique Repro–Input

Sur l'affichage matriciel la position OUTPUT peut correspondre à REPRO, INPUT ou OFF. REPRO commute automatiquement sur INPUT pour les fonctions "STOP", "FAST FORWARD", "FAST REWIND", fonctions de chargement de bande et "PARK".
Cette commutation automatique peut occasionner des troubles (effet Larsen par ex.) lorsque le T–Audio est connecté à d'autres installations (mixer, amplificateur, haut-parleurs). C'est pourquoi elle est supprimée en usine sur tous les T–Audio à compter du no. 09 00082. La modification suivante peut être effectuée sur les appareils antérieurs.

Il est possible de réintroduire la commutation automatique, si désirée, sur les appareils à compter du no. 09 00082 en supprimant le fil entre les bornes 5 et 1 du circuit intégré UG 302.

MODIFICATION

Note: Pour éviter tout risque de dommage aux circuits, il est préférable de couper l'alimentation du T–Audio avant de sortir un circuit.

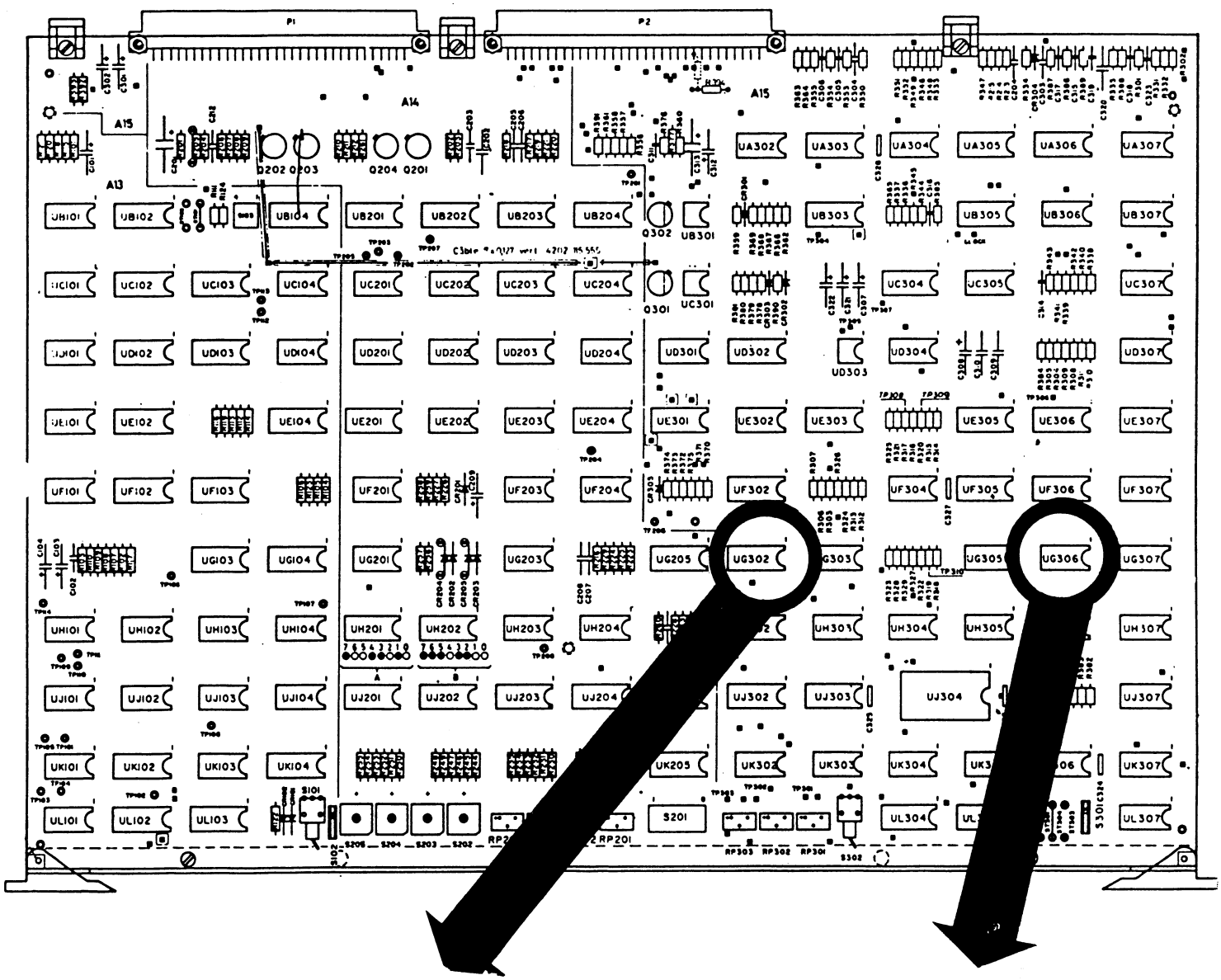
- Ouvrir la face avant.
- Sortir la carte A02–A15 ("Transport Control Logic"), troisième circuit imprimé à partir du haut.
- Enlever la plaque de protection du circuit (3 vis à dévisser).
- Localiser les circuits intégrés UG 302 et UG 306, poser la carte de façon à montrer le côté soudure.
  Note: Les circuits (A13, A14, A15, etc) sont délimités par des lignes sur la carte A02 et le repérage des C.I. est facile, car ils sont placés selon une disposition matricielle (par ex. A, B, C...et 101, 201, 303...) avec chacun son numéro (UA 204 p. ex.) inscrit sur la carte.

- Couper la piste entre la borne 13 de UG 306 (no. 4078) et la borne 5 de UG 302 (no. 4049); voir le dessin no. 1.
- Remplacer cette liaison en soudant sur la borne 13 de UG 306 et dans le trou A (en face de la borne 13) une résistance en série de 47 kΩ (R 395) ayant ses connexions isolées.

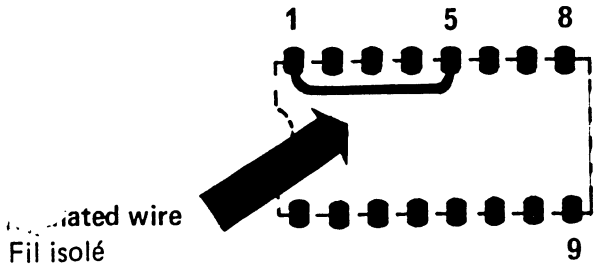
  R 395: R CAR 47 kΩ 10% 1/4 W (no. de composant: 55 26013 473)

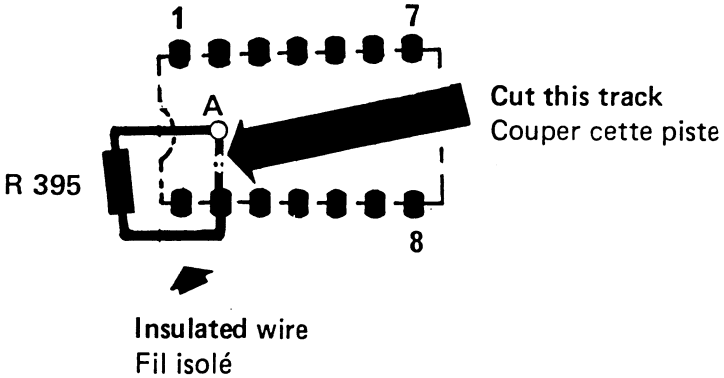
- Connecter la borne 5 à la borne 1 (7,5 V) de UG 302 en soudant un fil isolé (dessin no. 2).

Logic Board A02
Circuit logique A02



Soldering Side View
Vue coté soudure





PRODUCT: NAGRA T–Audio Recorder DATE: February 1983

SUBJECT: Freezing of the counter when winding or rewinding is completed, or with "Tape Dump" function

N° 09-3

To inhibit the count when editing with "Tape Dump" function or when tape winding or rewinding is completed (counter roller rotation due to inertia), it is possible to make a modification using the indication of tensiometers coming to their end stops in order to instantaneously freeze the counter.

The following modification is done ex-factory on all T–Audio's from serial number 0900082 on, and can also be made on previous T–Audio's.

MODIFICATION

Note: In order to avoid damage to the circuits, switch off the recorder before removing any p.c. board.

- Open the recorder front panel.
- Slide out Board A02 (Transport Tape Logic), third p.c. board from the top.
- Remove the board protecting plate (unscrew 3 screws).
- Locate on A02–A15 Integrated Circuits UA 303 and UC 305.
  Note: The circuits (A13, A14, A15 etc.) are delimited by lines on Board A02 and easy I.C.'s location is achieved, as they are arranged in matrix lay-out (e.g. A, B, C... and 101, 201, 303...) each with its number (for instance UA 204) marked on the board.

- Connect UC 305 (no. 4584) and UA 303 (4538) as follows: pin 4 of UC 305 to pin 12 of UA 303 with Diode CR 306 (cathode linked to UC 305), as shown on the drawing.

  a) insulate the anode connection and solder it into hole A (facing UA 304).
  b) solder the cathode to the end of an insulated wire.
  c) thread heat-retractable sheath to protect diode and solder connection.
  d) solder the other wire end into hole B (facing pin 4 of UC 305).

  DIODE CR 306 : Diode Si 1N 4148 75 V

- Customers who do not wish inhibition of counter in "Tape Dump" function can connect CR 306 cathode to pin 2 (left tensiometer standstill) of UC 305 instead of pin 4 (right tensiometer standstill) into hole C (facing pin 2).

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PRODUIT : **Enregistreur NAGRA T–Audio**

SUJET : **Blocage du compteur en fin de bobinage ou rebobinage, ou en fonction "Tape Dump".**

Pour inhiber le comptage lors du montage en fonction "Tape Dump", ou en fin de bobinage ou rebobinage (rotation de la roulette compteur par inertie), il est possible d'apporter une modification utilisant l'indication des tensiomètres au repos pour bloquer instantanément le compteur.

La modification suivante est effectuée en usine sur tous les T–Audio à compter du numéro 0900082 et peut être apportée sur les appareils précédents.

MODIFICATION

Note: Pour éviter tout risque de dommage aux circuits, il est préférable de couper l'alimentation du T–Audio avant de sortir un circuit.

- Ouvrir la face avant de l'appareil.
- Sortir la carte A02 ("Transport Control Logic"), troisième circuit imprimé à partir du haut.
- Enlever la plaque de protection du circuit (3 vis à dévisser).
- Localiser sur A02–A15 les circuits intégrés UA 303 et UC 305.
  Note: Les circuits (A13, A14, A15 etc.) sont délimités par des lignes sur la carte A02 et le repérage des C.I. est facile, car ils sont placés selon une disposition matricielle (par ex. A, B, C... et 101, 201, 303...) avec chacun son numéro (UA 204 par ex.) inscrit sur la carte.

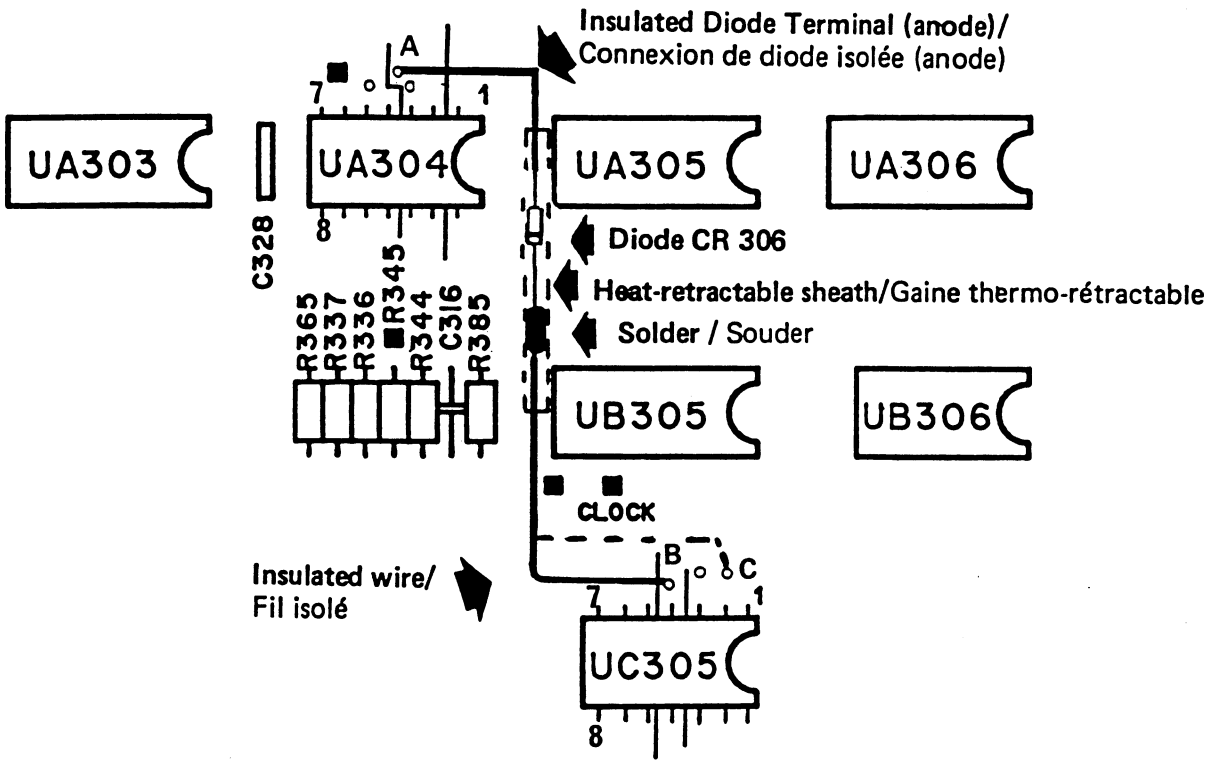
- Connecter UC 305 (no. 4584) et UA 303 (no. 4538) comme suit: la borne 4 de UC 305 à la borne12 de UA 303 par une diode CR 306 (cathode sur UC 305), selon le dessin.

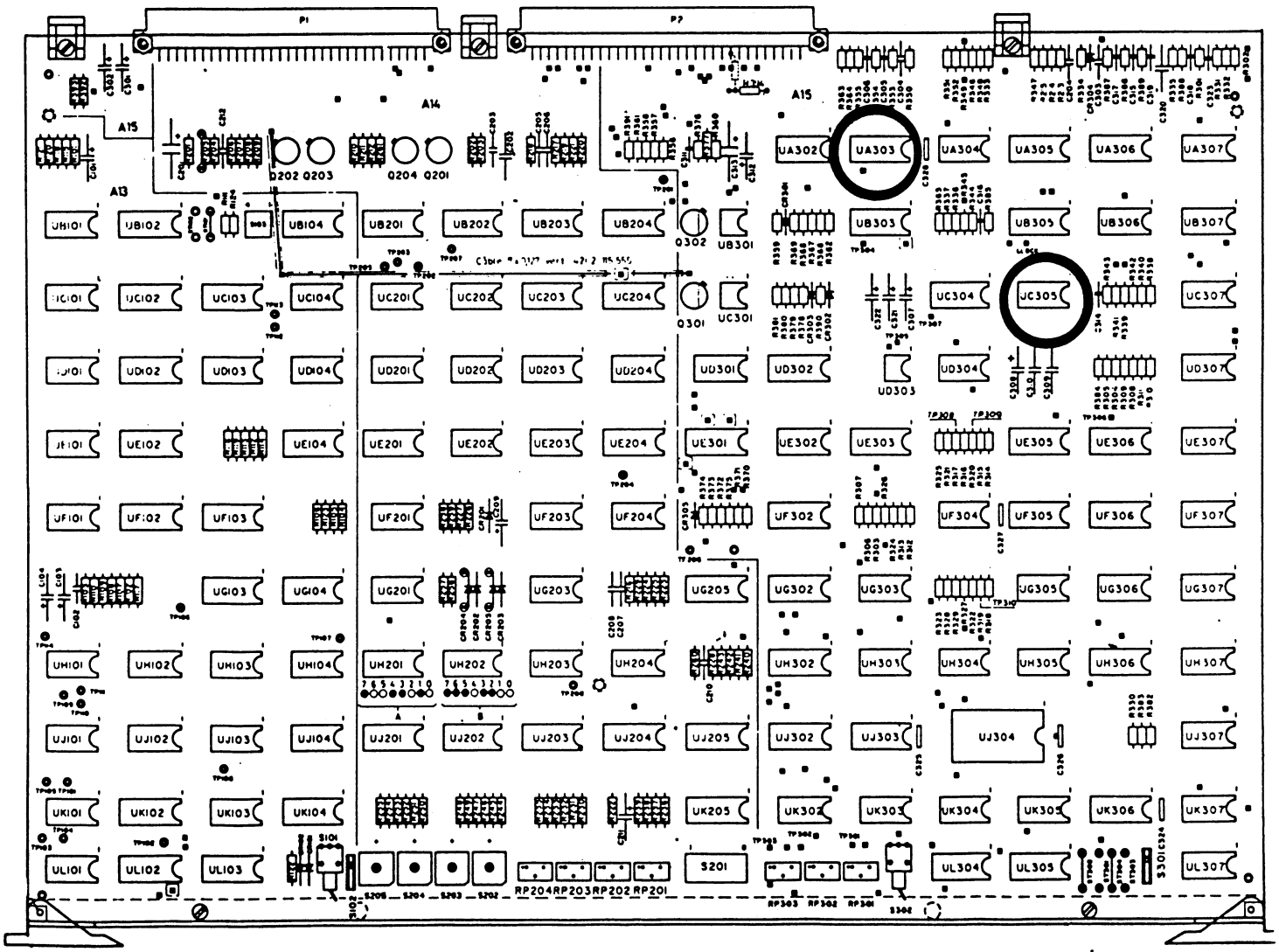
  a) isoler la connexion d'anode et la souder dans le trou A en face de UA 304.
  b) souder la cathode à l'extrémité d'un fil isolé.
  c) enfiler de la gaine thermo-rétractable pour protéger la diode et la soudure.
  d) souder l'autre extrémité du fil dans le trou B en face de la borne 4 de UC 305.

  DIODE CR 306 : Diode Si 1N 4148 75 V

- Les clients qui ne désirent pas l'inhibition du compteur en "Tape Dump" peuvent connecter la diode à la borne 2 (repos tensiomètre gauche) de UC 305 au lieu de la borne 4 (repos tensiomètre droit), dans le trou C (en face de la borne 2).

LOGIC BOARD A02





PRODUCT: NAGRA T–Audio Recorder DATE: February 1983

SUBJECT: SPEED/STANDARD & TAPE Modify

N° 09-4

The T–Audio TACAL standard recording circuits are factory pre-adjusted to allow the use of up to four recording calibrations for any combination of speed, standard and type of tape. Any of the four calibrations can be selected by means of the MODIFY button and is marked by a LED. Switching goes from A to D, then starts again from A.

Concerning recorders fitted with two recording calibrations only a modification allows users to directly go through A and B, then B and A to achieve faster operation. This modification can be carried out ex-factory if specified when ordering or by the agent.

MODIFICATION

Note: In order to avoid possible damage to the circuits, switch off the recorder before removing any p.c. board.

- Open the T–Audio front panel.
- Slide out Board A02 (Transport Tape Logic), third p.c. board from the top.
- Remove the board protecting plate (unscrew 3 screws).
- Locate on A02–A14 Integrated Circuits UJ 204 (no. 4510) and UH 203 (no. 4071).

Note: The circuits (A13, A14, A15 etc.) are delimited by lines on Board A02 and easy I.C.'s location is achieved, as they are arranged in matrix lay-out (e.g. A, B, C... and 101, 201, 303...) each with its number (for instance UA 204) marked on the board.

- Place the board to expose its soldered side.
- Cut the track between pin 14 of UJ 204 and pin 12 of UH 203 (see drawing).
- Connect pin 11 of UJ 204 to pin 12 of UH 203 with an insulated wire between holes A and B (see drawing).

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PRODUIT : **Enregistreur NAGRA T–Audio**

SUJET : **Touche SPEED/STANDARD & TAPE Modify**

Les circuits standards d'enregistrement TACAL du T–Audio sont calibrés en usine pour permettre d'employer jusqu'à quatre calibrations d'enregistrement dans n'importe quelle combinaison de vitesse, norme et type de bande. Chacune des quatre calibrations peut être sélectionnée avec la touche MODIFY et est repérée par une LED. La commutation s'effectue de A à D, puis de nouveau depuis A.

En ce qui concerne les enregistreurs équipés de deux calibrations d'enregistrement seulement, une modification permet aux utilisateurs de passer directement de A à B, et B à A pour augmenter la rapidité d'utilisation. Cette modification peut être faite à l'usine si précisé lors de la commande, ou par l'agent.

MODIFICATION

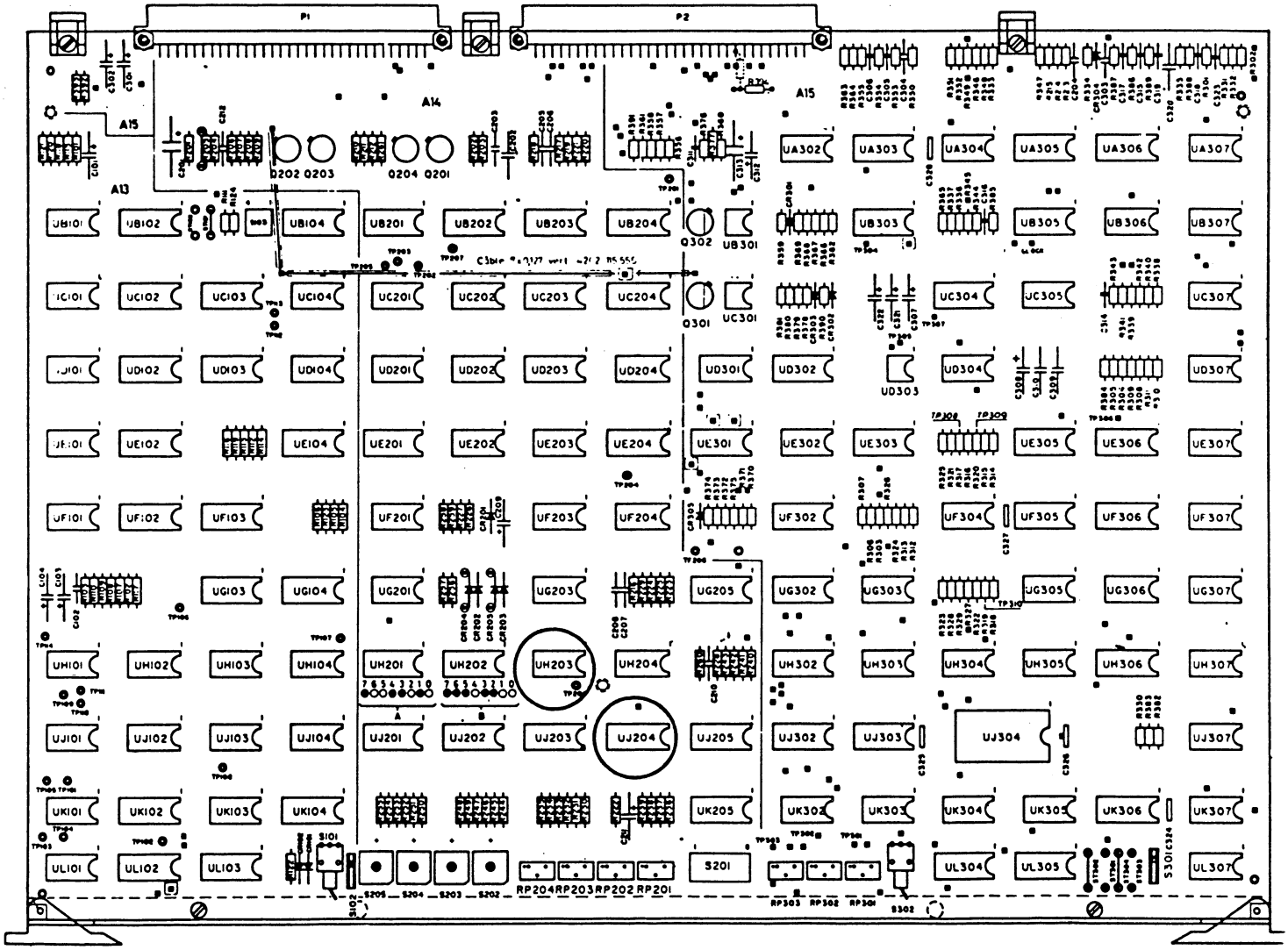
Note: Pour éviter tout risque de dommage aux circuits, il est préférable de couper l'alimentation du T–Audio avant de sortir un circuit.

- Ouvrir la face avant du T–Audio.
- Sortir la carte A02 ("Transport Tape Logic"), troisième circuit imprimé à partir du haut.
- Enlever la plaque de protection du circuit (3 vis à dévisser).
- Repérer sur A02–A14 les circuits intégrés UJ 204 (no. 4510) et UH 203 (no. 4071).

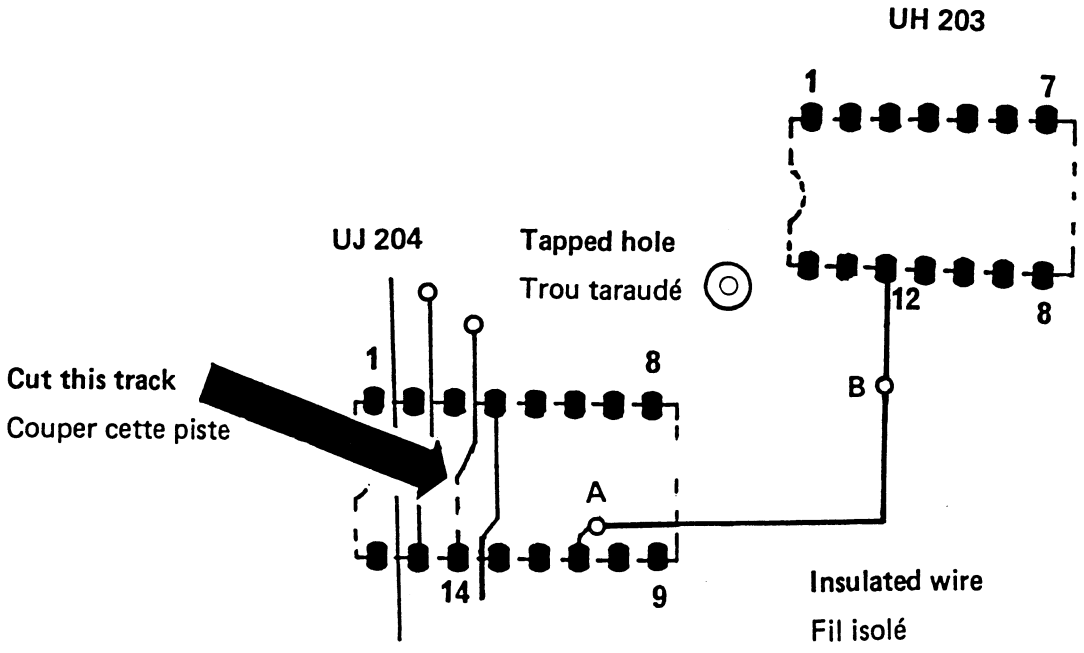
Note: Les circuits (A13, A14, A15 etc.) sont délimités par des lignes sur la carte A02 et le repérage des C.I. est facile, car ils sont placés selon une disposition matricielle (par ex. A, B, C... et 101, 201, 303...) avec chacun son numéro (UA 204 par ex.) inscrit sur la carte.

- Placer la carte de façon à montrer le côté soudure.
- Couper la piste entre la borne 14 de UJ 204 et la borne 12 de UH 203 (voir dessin).
- Connecter la borne 11 de UJ 204 à la borne 12 de UH 203 avec un fil isolé entre les trous A et B (voir dessin).

LOGIC BOARD A02



I.C.'s viewed from soldering side /Vue côté soudure



PRODUCT: NAGRA T–Audio TC

DATE: December 1985

N° 09-5

SUBJECT:
- **Suppression of the audio track erasing frequency crosstalk on the TC track during playback / Suppression de diaphonie du signal effacement audio sur la lecture TC**
- **Improvement of TC playback of tapes recorded at 76 cm/s Amélioration de la lecture des bandes TC enregistrées à 76 cm/s**

Modification: Using existing spacer and screw, install and wire supplementary board P1380 onto the A05–A22 main TC circuit board, with index "A" or "B". Add insulating washer P/N 01 16 950 003.
The 1.4 eprom version must be installed.

Required parts:
- one circuit board P1380
- one insulating washer P/N 01 16 950 003
- one 1.4 eprom version

NOTE: The mounting of this additional board onto the TC board allows the suppression of certain TC playback problems which came up with a number of T–Audio TC during the recording of one or several audio tracks.
We strongly recommend the addtion of this circuit up to serial number 0900239.
Tape recorders no 0900228, 0900233 and 0900234 already have this modification.

Modification: En utilisant une entretoise et les vis existantes, installer et câbler le circuit supplémentaire P1380 sur la carte principale A05–A22, indice "A" et "B". Rajouter une rondelle d'isolation 01 16 950 003.
Installer impérativement une eprom version 1.4

Pièces nécessaires:
- un circuit P1380
- une rondelle isolante P/N 01 16 950 003
- une eprom version 1.4

NOTE: L'installation de ce circuit supplémentaire sur les circuits TC existants supprime les problèmes de lecture du code horaire, constatés sur certains T–Audio TC, lors de l'enregistrement d'une ou plusieurs pistes audio.
Son installation est donc vivement conseillée sur tous les TA–TC jusqu'au no 0900239.
Les appareils no 0900228, 0900233 et 0900234 sont déjà pourvus de cette modification.

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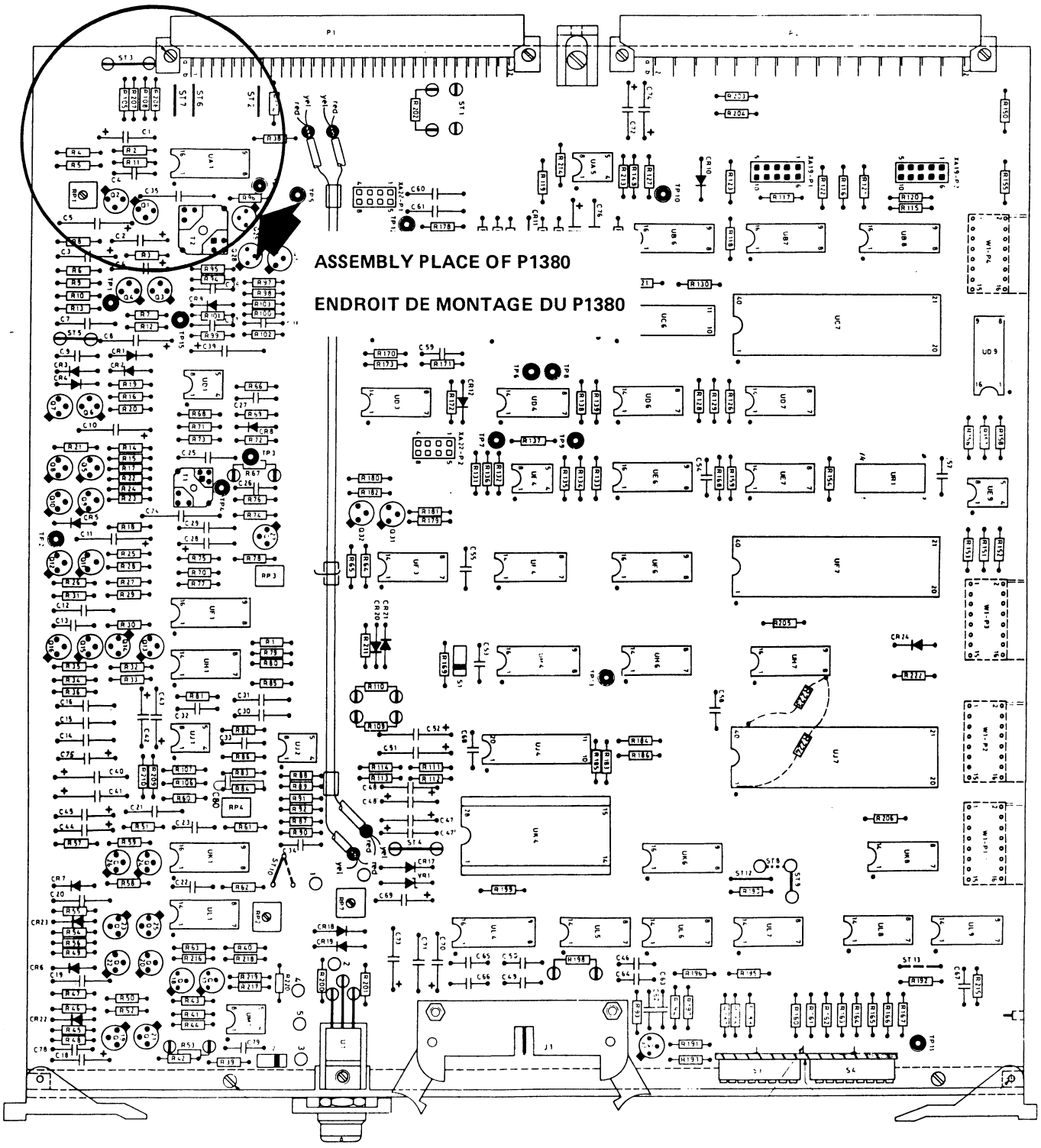
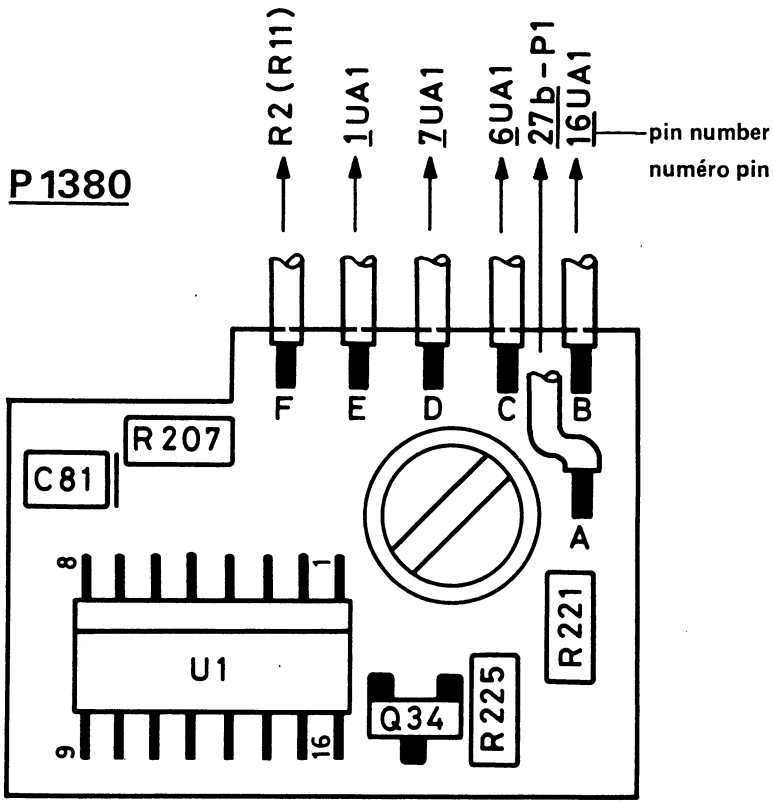
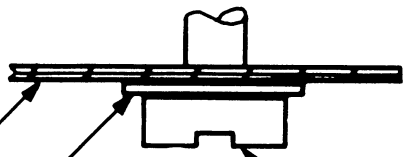
TC BOARD A05



Switchable low-pass filter (-3dB to 24kHz)

Filtre passe-bas commutable (-3dB à 24 kHz)





COTE COMPOSANTS

COMPONENT SIDE

INSERT INSULATING WASHER BETWEEN THE SCREW AND THE CIRCUIT BOARD

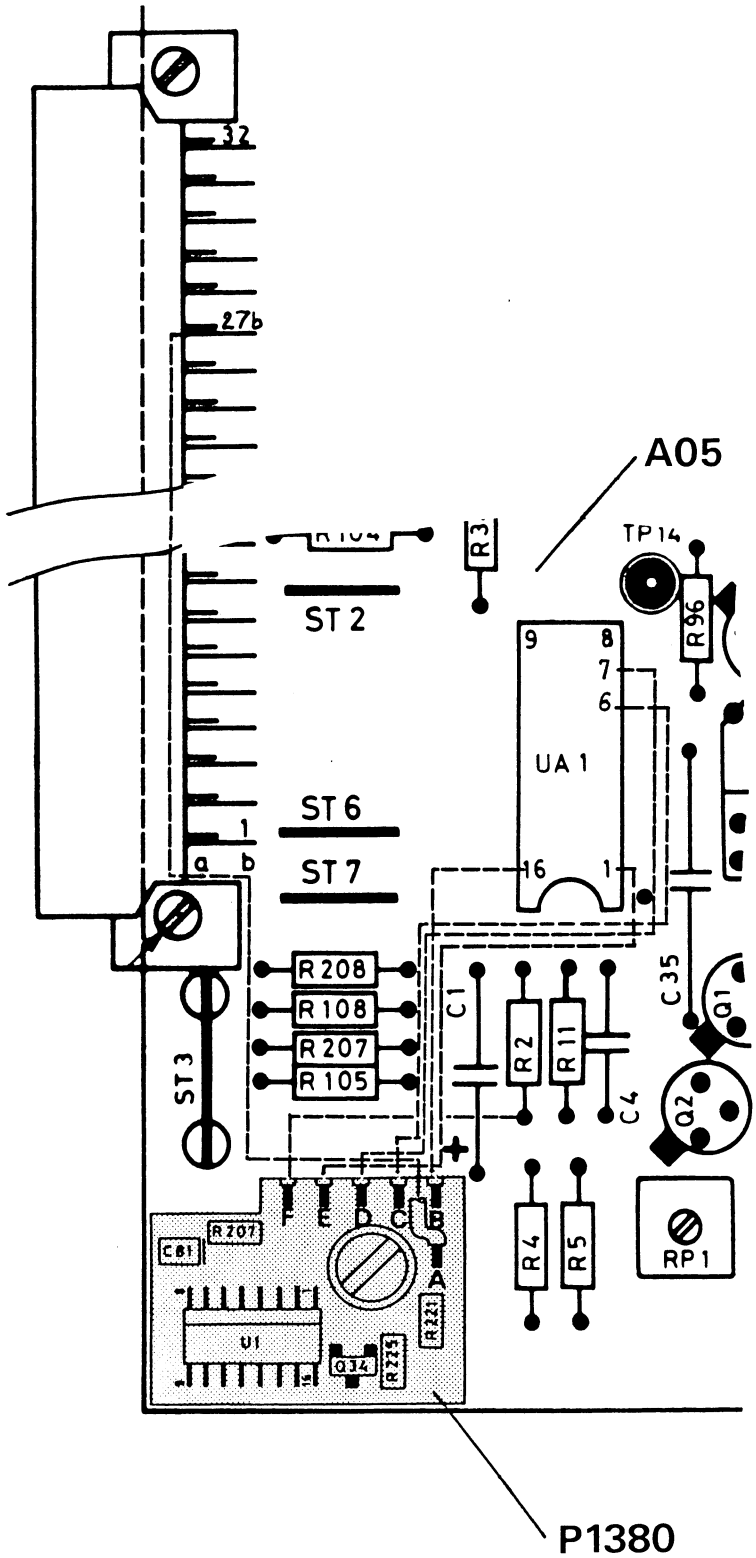
INTERCALER UNE RONDELLE ISOLANTE ENTRE LA VIS ET LE CIRCUIT

SLOTTED CHEESE – HEAD SCREW M2.5 x 10

VIS TETE CYL. M2.5 x 10

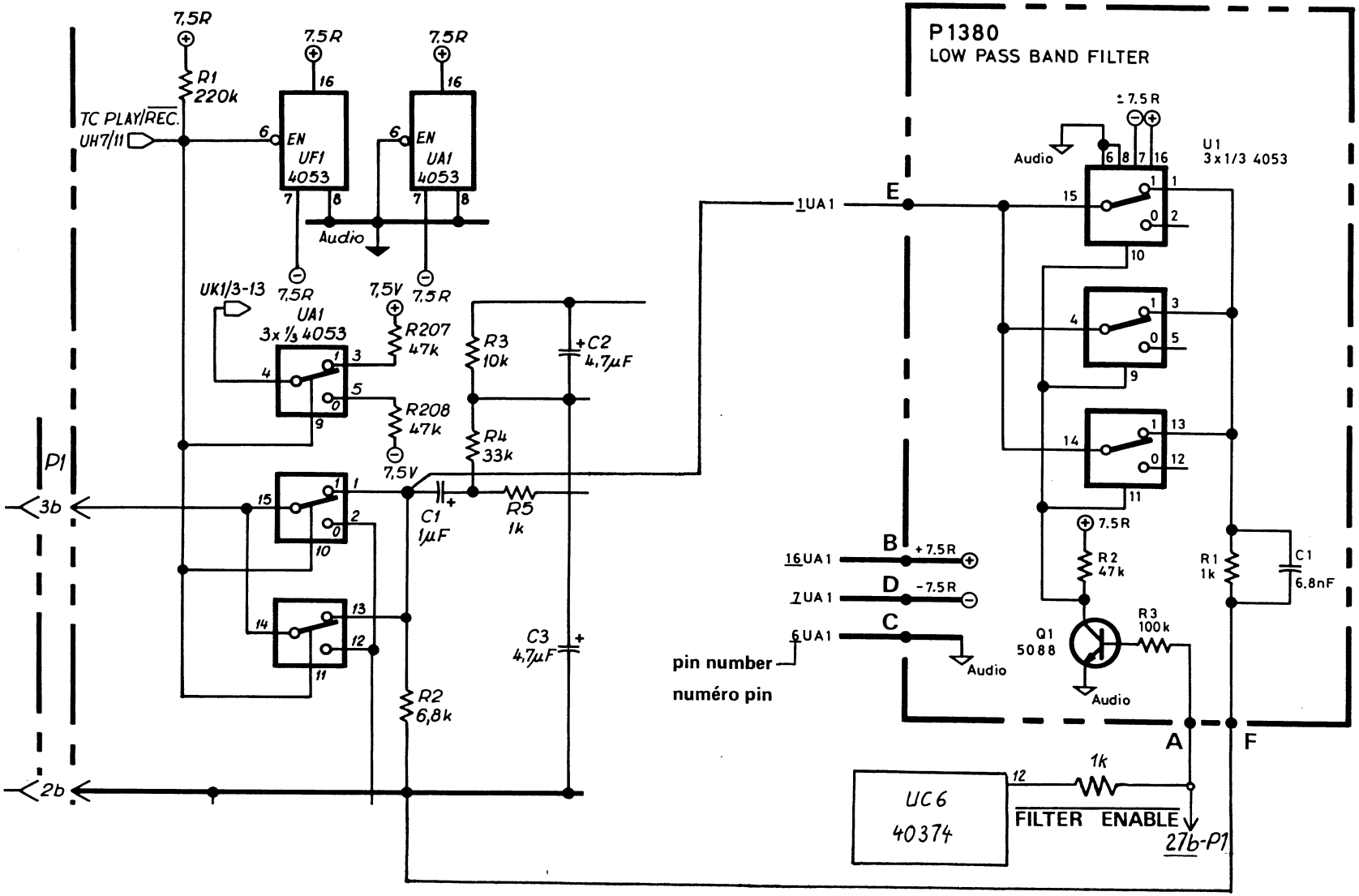
WIRING OF P1380 ONTO A05

CABLAGE DE P1380 SUR A05



UA1 / TC BOARD A05

P1380



PRODUCT: NAGRA T–AUDIO

DATE: JANUARY 1986

N° 09-6

SUBJECT: **Lines input – output A9a – Power supply A30**

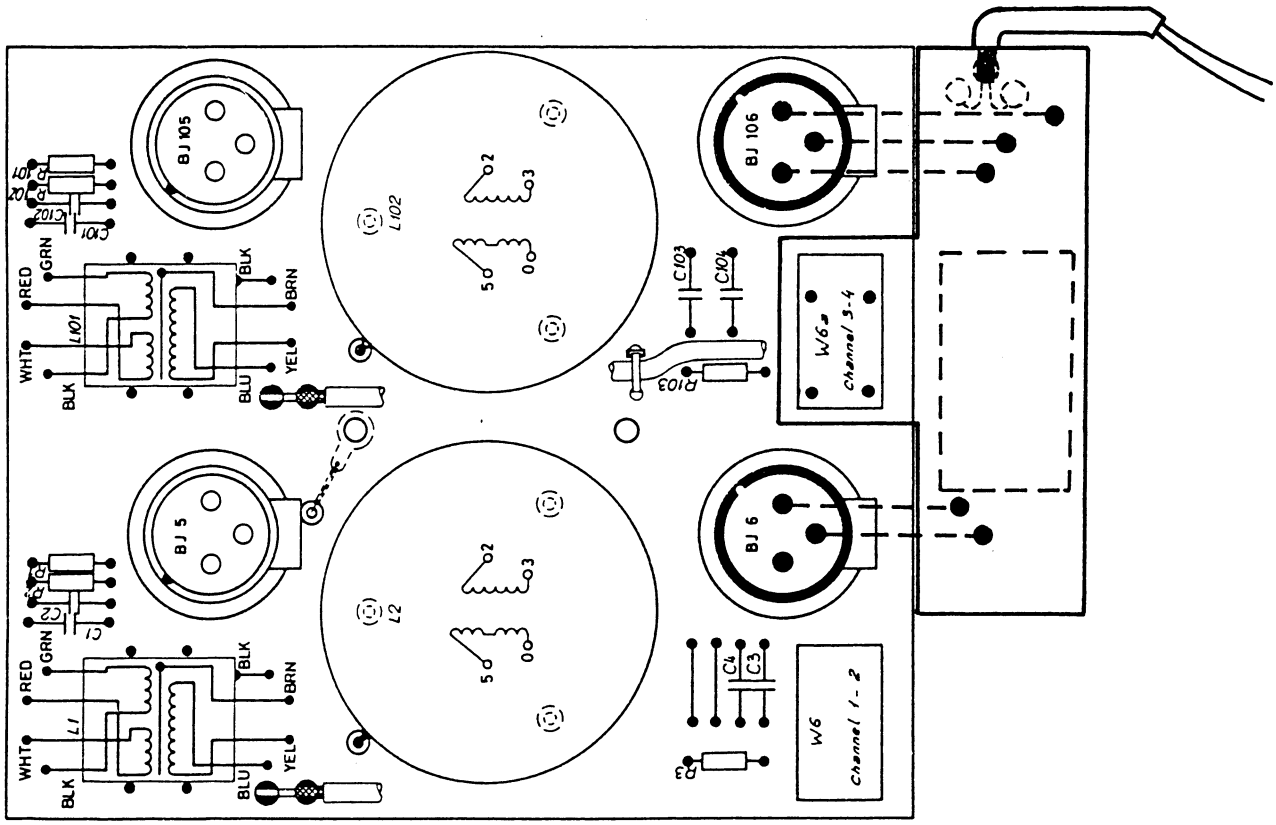
Entrée –sortie lignes A9a – Alimentation A30

Cut off the audio output signals in order to avoid cracking noises on the line outputs when switching ON or OFF the T–Audio

* **Modifications details**

Modifications A : **Line input –output A9a**
- Insert a cut–off relay on the line outputs (up to the introduction of circuit 91 09 326 000)

Operation:
- Unscrew the 4 fixing screws and remove the A9a circuit shielding plate
- Solder 4 contacts in the W6a/A9a conector holes



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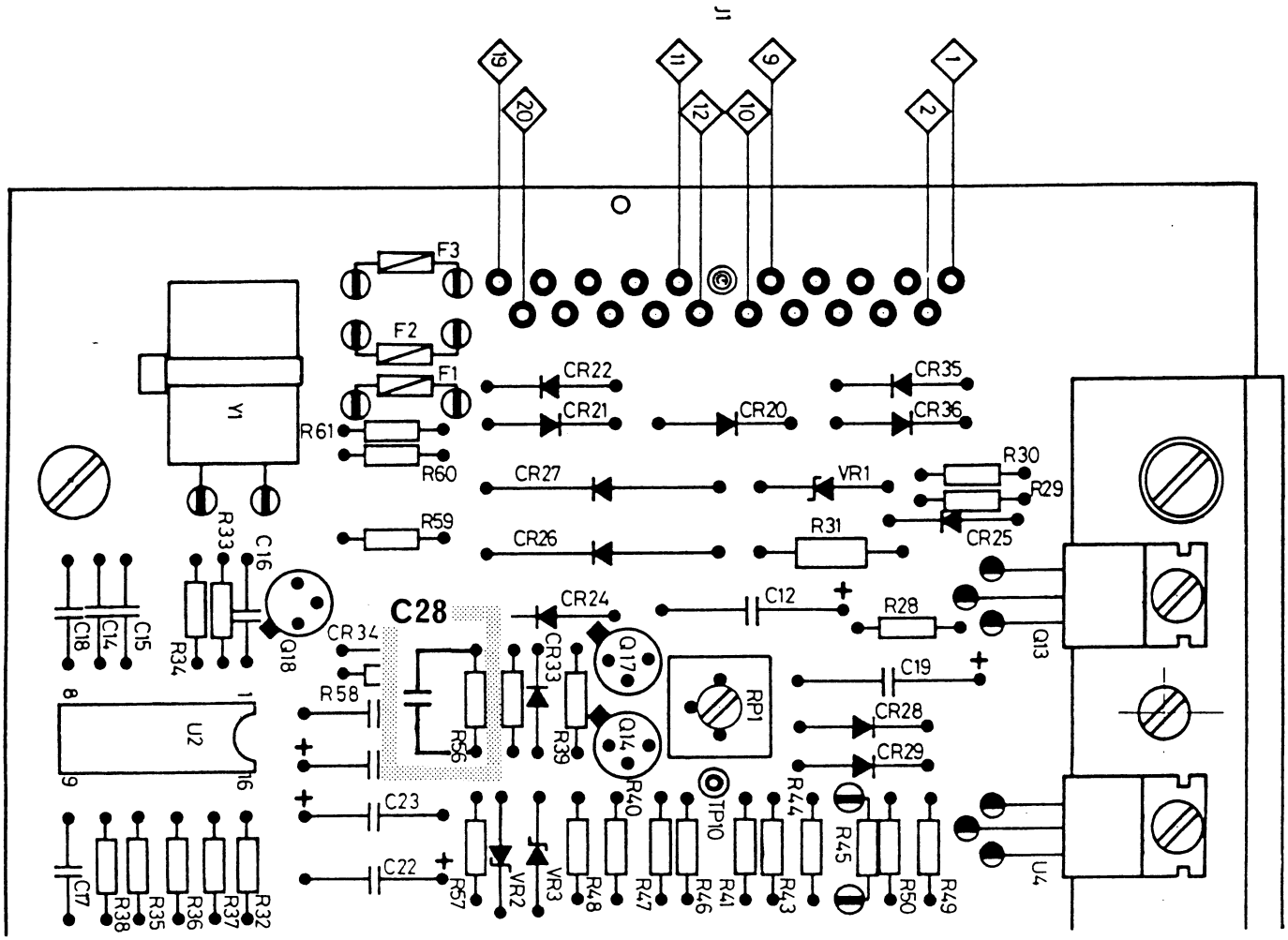
– Plug in and solder the additional board at point W6a
– Connect the line outputs to the break–contacts of the relay. Use 5 wires about 4 cm soldered on the soldering side of the board (outputs short–circuited when the T–Audio is not powered)
– Connect the relay coil to XA03–P1 / B5, points 4ab and 16ab with a shielded cable (connect in parallel with the "safety brake" / A03 – A12 relay coil)

Modification B: **Power supply A30**
– Add a capacitor in parallel with the resistor

Operation:
– Solder capacitor C28 at points R56 / A30
C28 = 52 12 011 010 CTA 100μf 6 V B



Required components

41 42 502 000	Relay V 23012 – A0102 – A001	1 p
21 09 324 001	Printed circuit board	1 p
01 50 612 006	Contact	4 p
01 15 325 002	Lead nylon	+2 p (4 p)
01 07 510 231	Ground nylon	+1 p (3 p)
41 96 122 330	Shealthed cable	1 p
	Black wire about 4 cm	5 p
52 12 011 010	T–Audio 100 μf 6 V B	1 p

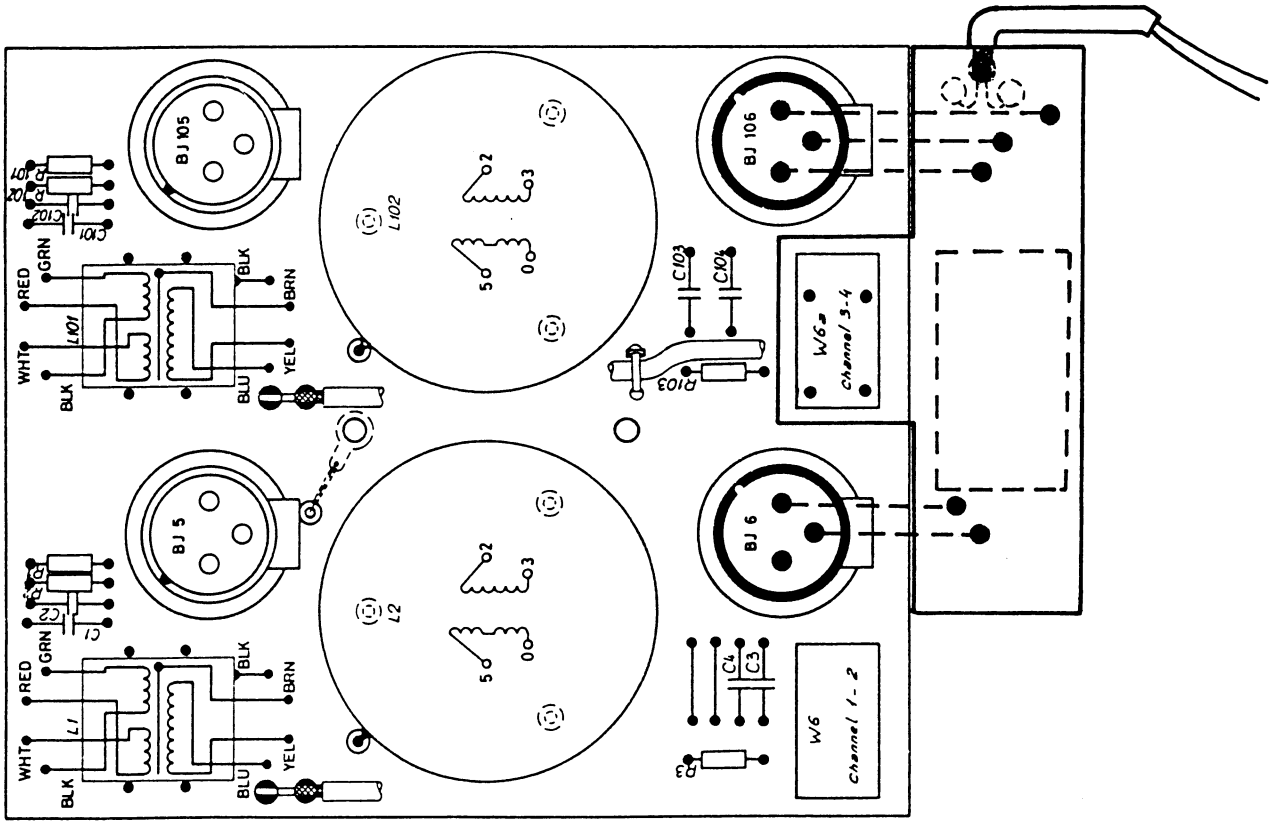
*** Tape recorders already modified from serial number 0900160 (and 131,141-145,155)**

Motif: **Interrompre les signaux de sortie audio , afin d'éviter des crachements sur les sorties ligne lors de la mise EN ou HORS tension du T–Audio**

Détails des modifications

* **Modification A:** **Entrée – sortie ligne A9a**
Installer un relais de coupure sur les sorties ligne (Jusqu'à l'introduction des circuits 91 09 326 000)

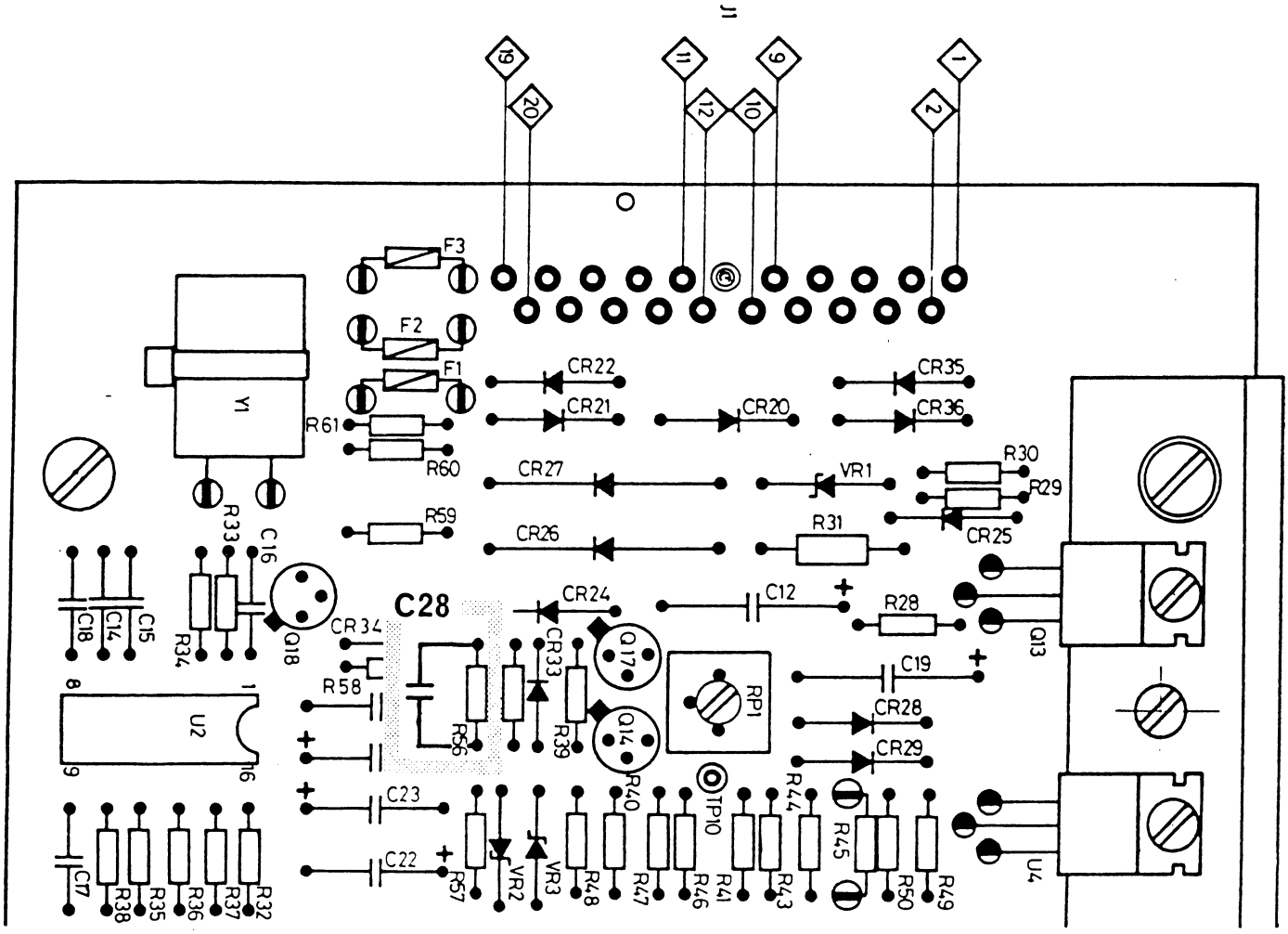
Opération :
– Prendre la carte et enlever le blindage en dévissant les 4 vis
– Souder 4 contacts dans les trous du connecteur nappe W6a / A9a



– Embrocher et souder le circuit additionnel au point W6a
– Relier les sortie lignes aux contacts de repos du relais. Utiliser 5 fils d'environ 4 cm soudés du même côté que les soudures de la carte (les sorties sont en court–circuit lorsque l'appareil est hors–tension)
– Connecter la bobine du relais à XA03–P1 / B5, bornes 4ab et 16ab (en parallèle avec la bobine du relais "safety brake" / A03 – A12) au moyen d'un fil blindé

Modification B : **Alimentation A30**
– Ajouter un condensateur en parallèle avec la résistance

Opération :
– Souder aux bornes de R56 / A30 un condensateur C28 = 52 12 011 010 CTA 100 µf 6 V B



Listes de pièces :

41 42 502 000	Relais V23012 – A0102 – A 001	1 p
21 09 324 001	Circuit imprimé	1 p
01 50 612 006	Contact	4 p
01 15 325 002	Pylone pour fil	+2 p (4 p)
01 07 510 231	Pylone de masse	+1 p (3 p)
41 96 122 330	Câble blindé	1 p
	Fils noirs d'envirion 4cm	5 p
52 12 011 010	CTA 100 µf 6 V B	1 p

*** Appareils modifiés: à partir du no série 0900160 (et 131,141-145,155)**

PRODUCT: NAGRA T-AUDIO TC DATE: June 1986

SUBJECT: NEW EPROM VERSION 1.4 - MODIFICATIONS OF TC CIRCUITS

N° 09-7

To take full advantages of all improvements incorporated in the new 1.4 eprom version, particulary of " self – resolving " (synchronization at playback, using TC or PILOT, with reference to the internal TC generator), the following modifications of TIME CODE circuits, TA-PFM circuit, and connectors circuit should be applied.
These modifications concern essentially external reference and exlusion of Rtc (real time clock) interruptions at the NMI (non maskable interrupt) input.

To be applied :

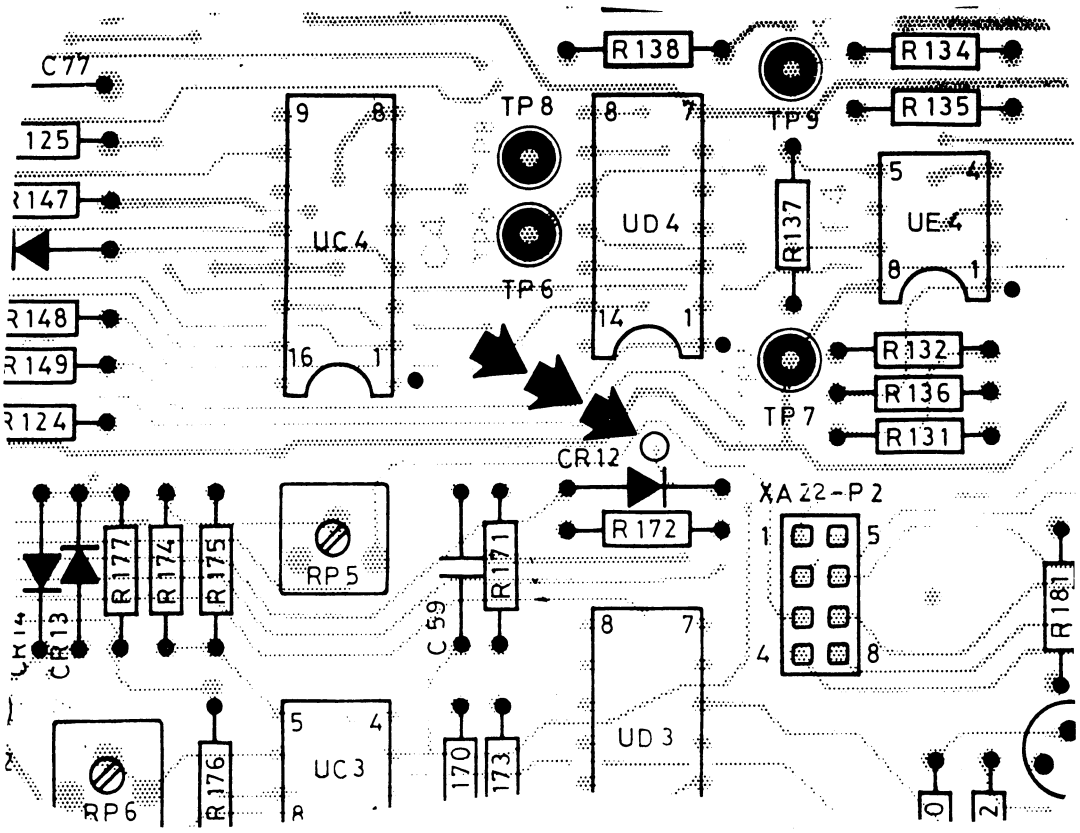
On all the T-Audio TC up to S/N 307, except S/N 280, 281, 291 and 302.

Modifications :

A) SYNCHRONIZATION ON "RECORD"

On the main TC board A05-A22/A23 (97 09 361 000), with index (B) only, a hole for the connection between two faces is missing. As a result, synchronization on "RECORD" was not possible.
Drill a hole of 0.8 mm diameter through the eyelet on the lead between CR12 cathode and pin 19/UC6. Put a 0.4 mm diameter copper wire through the hole and solder it to the eyelets on both faces of the board.

To be applied on all the T-Audio TC up to S/N 288, except S/N 279, 280, 281, 283, 284 and 286.



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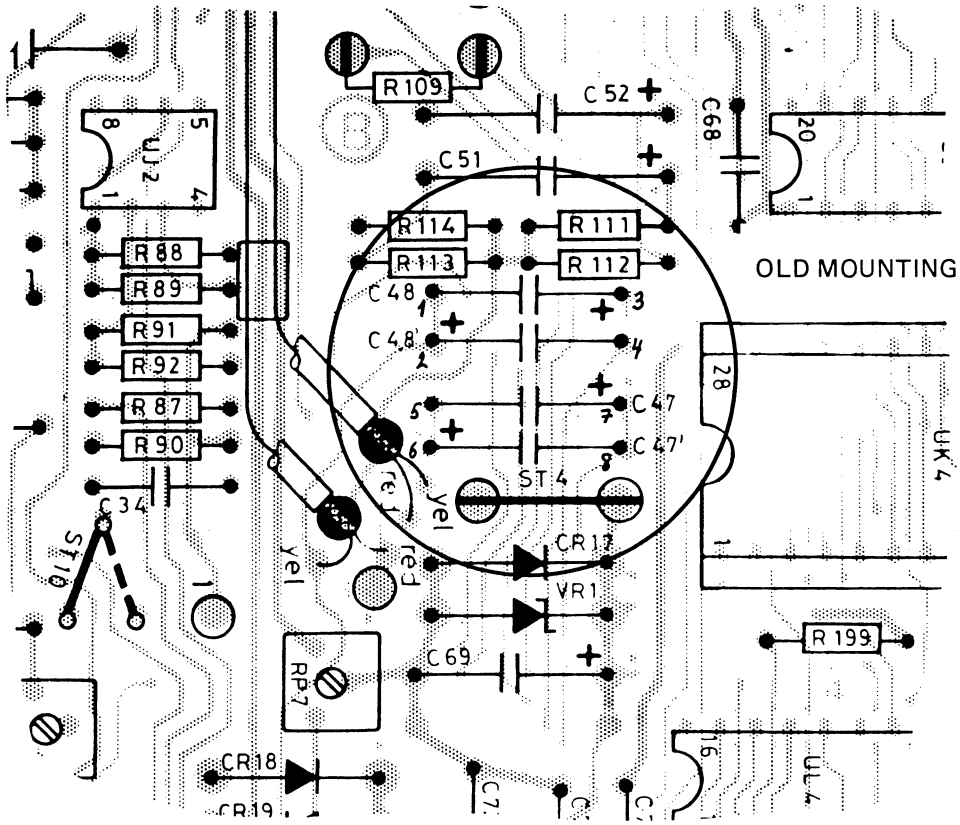
B) TC INPUT DECOUPLING CORRECTION

On the main TC board A05-A22/A23 (97 09 361 000), mount two pairs of capacitors in series (not in parallel), changing their value :

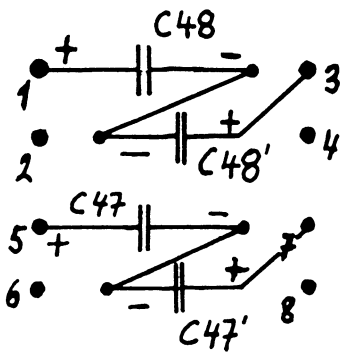
C47, C47' 2 x 52 12 031 500, tantalum capacitor 15 μF, 20%,20V.
C48, C48' - as above (old value 3.3μF).

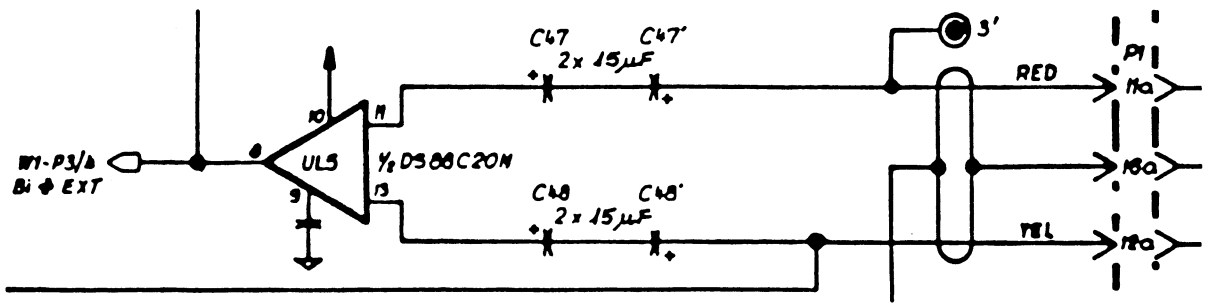
To be applied on all the T-Audio TC up to S/N 288, except S/N 279, 280, 281, 283, 284 and 286.



OLD MOUNTING (in parallel)

NEW MOUNTING (in serie)





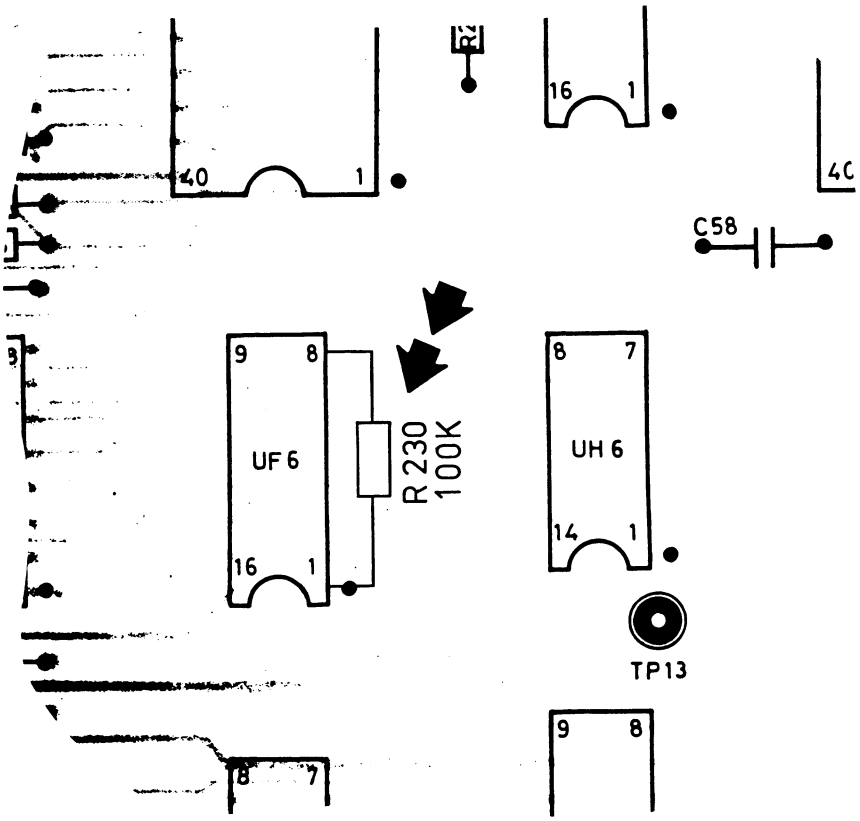
C) EXTERNAL REFERENCE

C1) Pull- down resistor on the " EXT.REF." input is missing.

On the main TC board A05/A23 (97 09 361 000) with index Ⓒ :

– Connect pin 1/UF6 (or central point of SI) to the common (pin 8/UF6) through a pull-down 100K resistor (2%, 1/4W) – R230.

Note : on the main TC board with index Ⓓ , R230 resistor is implanted.

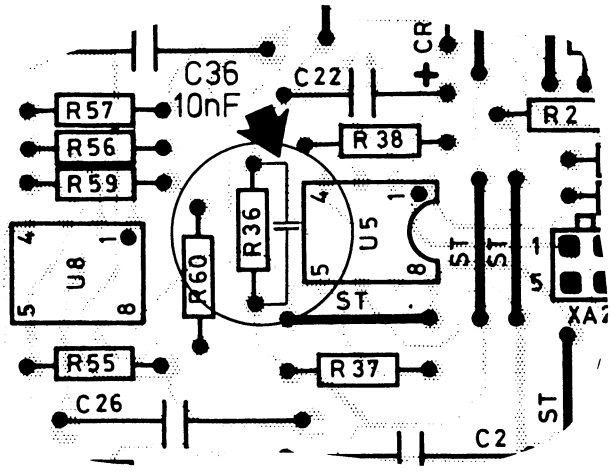


C2) External reference input filtering.

On the FM PILOT and NEOPILOT TA-PFM board A25 (70 09 375 000), with index Ⓑ and Ⓐ

– Solder ceramic capacitor C31 S/N 53 50 331 052, 10 nF, 10%, 50V, parallel to the R36 resistor (47K).

To be applied on the T-Audio TC up to S/N 278, equipped with TAPFM.



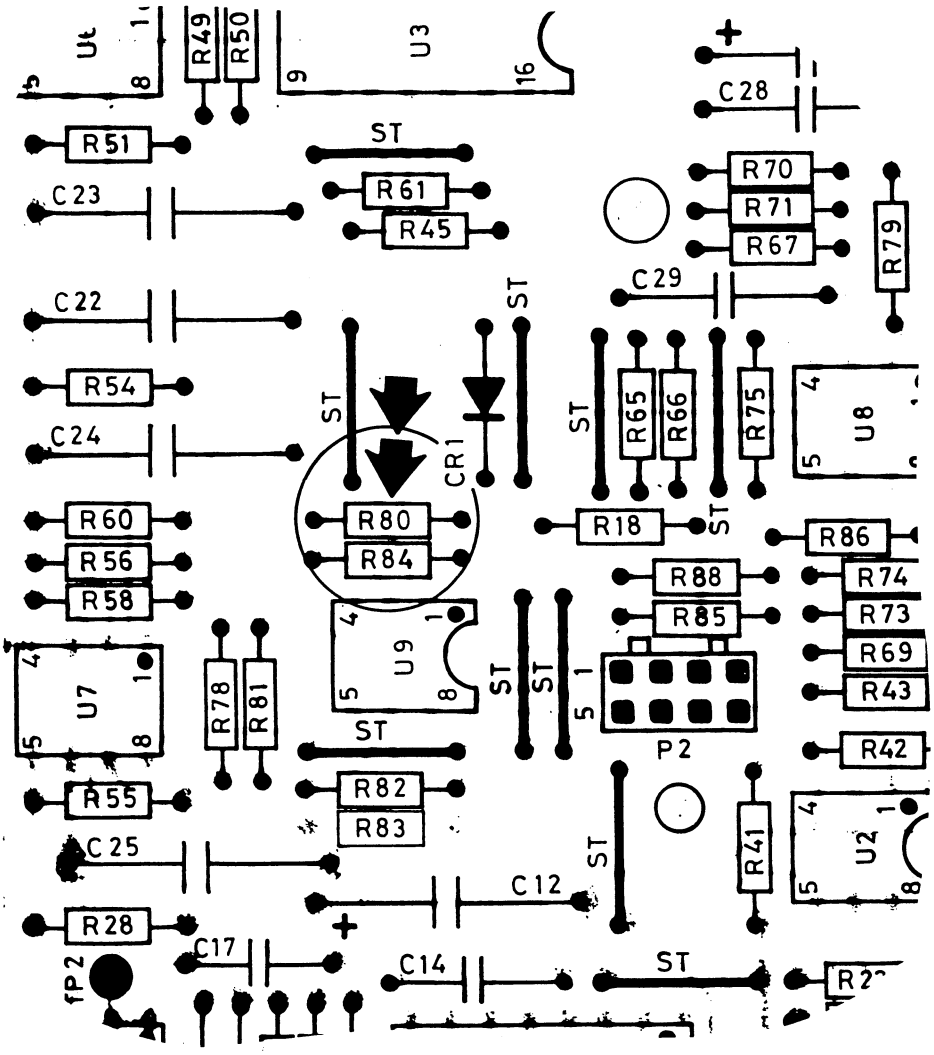
C3) External reference signal DC decoupling.

On the FM PILOT and NEOPILOT TA-PFM board A25 (70 09 375 000), without index :

– Remove R80 resistor, 1K, 1/4W

– On its place, solder C30 tantalum capacitor 2.2μF, 20%, 20V (P/N 52 120 322 50), with its negative pole at pin 2/U9.

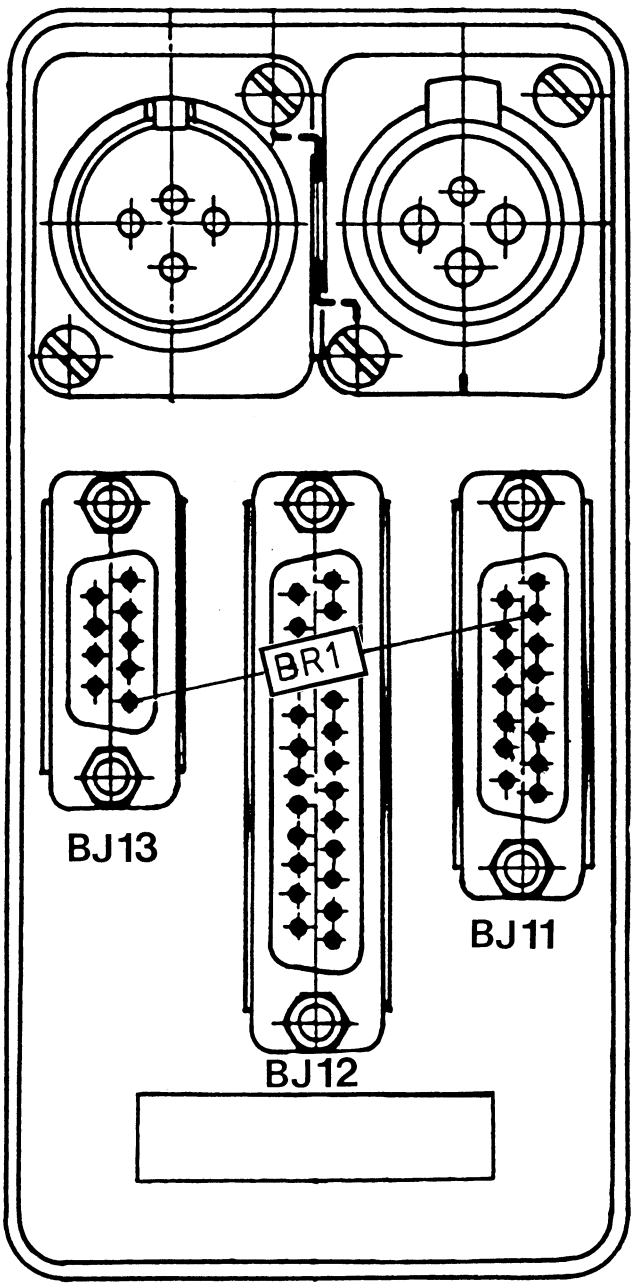
-- Solder R89 resistor (47K, 2%, 1/8W, P/N 55 271 824 73) between the negative pole of C30 and the common, on the face opposite to the components.



C4) External reference signal transfer through RS 422 socket.

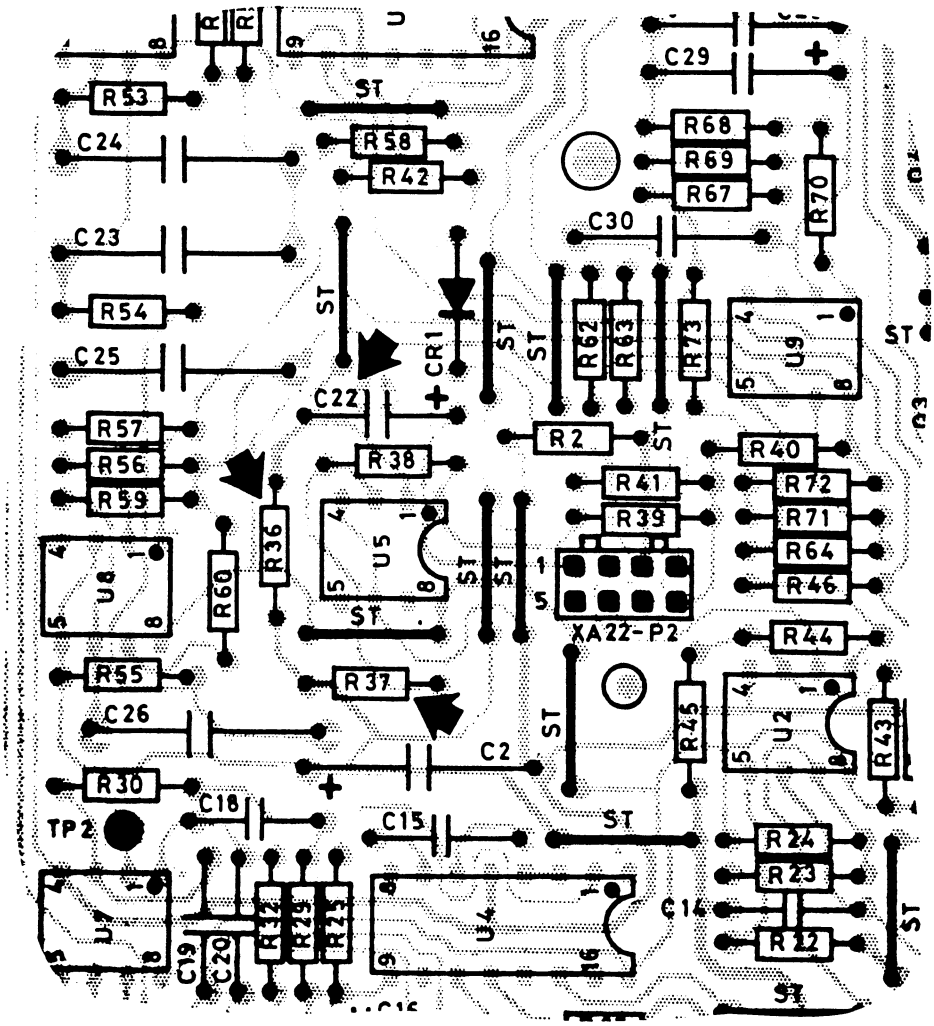
On the interconnection socket holder board B6 (71 09 201 000) with index (B) :

– Solder BR1 resistor (1K, 2%, 1/4W between pin 2 of BJ11 and pin 5 of BJ13.



Note : on the A25 board with index (A) , the above mentioned modifications are already incorporated, but the components are re-numbered as follows :

- C22 tantalum capacitor 2.2 μF, 20%, 20V (old C30)
- R36 resistor 47K, 2%, 1/4W (old R89)
- R37 resistor 12K, 2%, 1/4W (new one), installed between pin 3 of U5 (old U9) and the common.

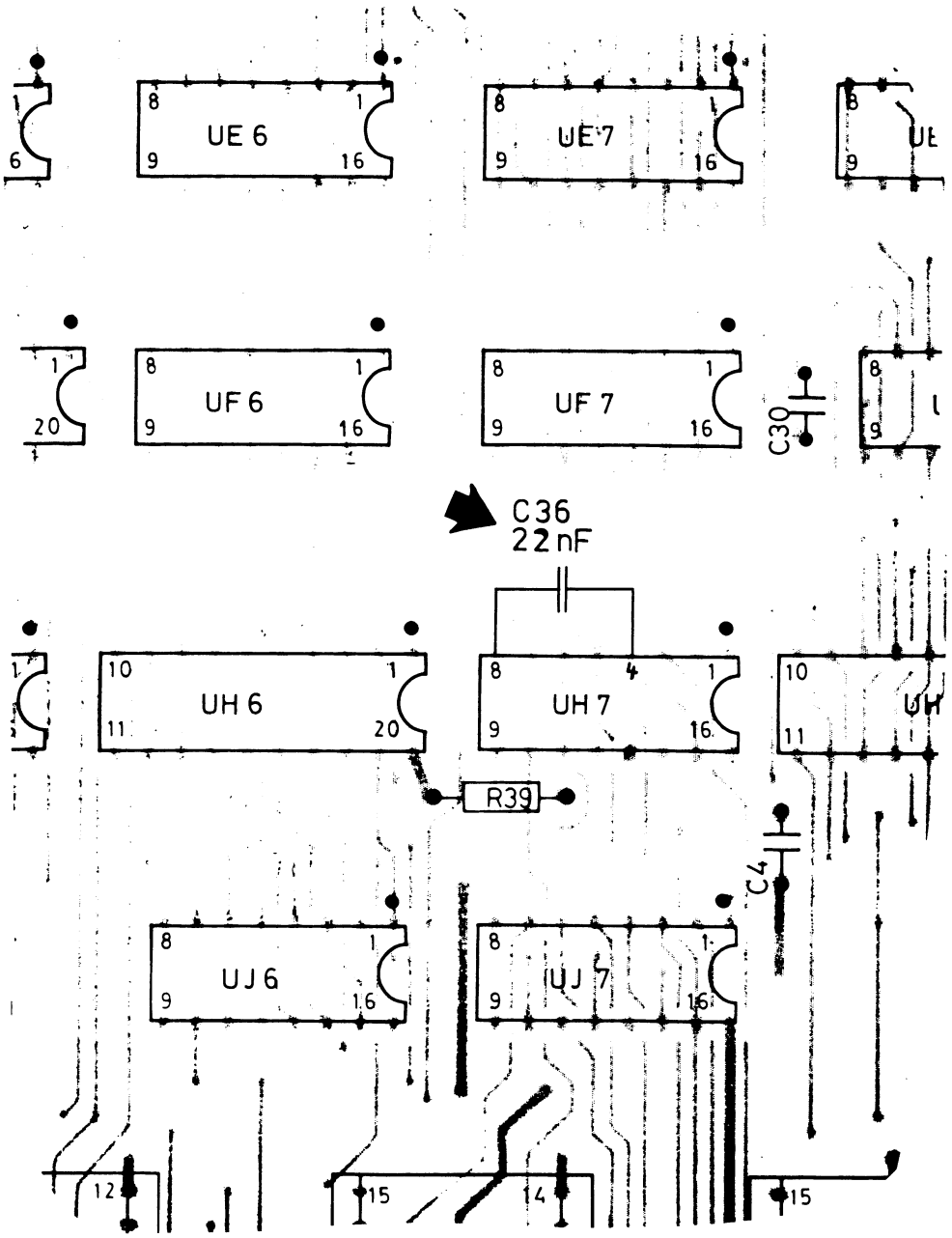


C5) External reference input filtering.
Exclusion of Rtc interruptions at the NMI input, to enable self-resolving.

On the counter-decoder board A05-A24 (97 09 362 000) with index (C):

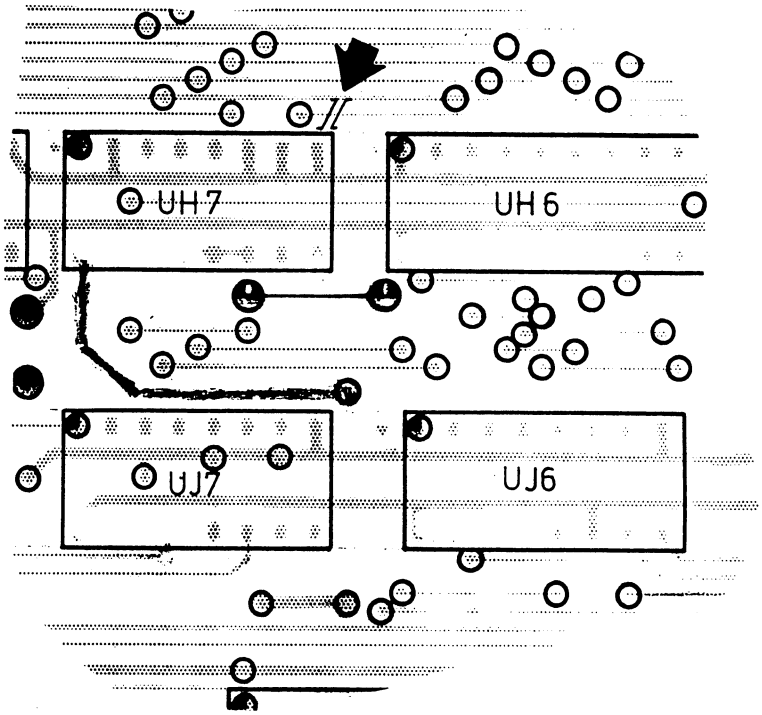
– Solder ceramic capacitor C36, 2.2 nF, 10%(P/N 53 50 322 254) between pin 4 of UH7 and the common (pin 8 of UH7).

To be applied on the TA S/N up to 288, without S/N 279, 280, 281, 283, 284, and 286.

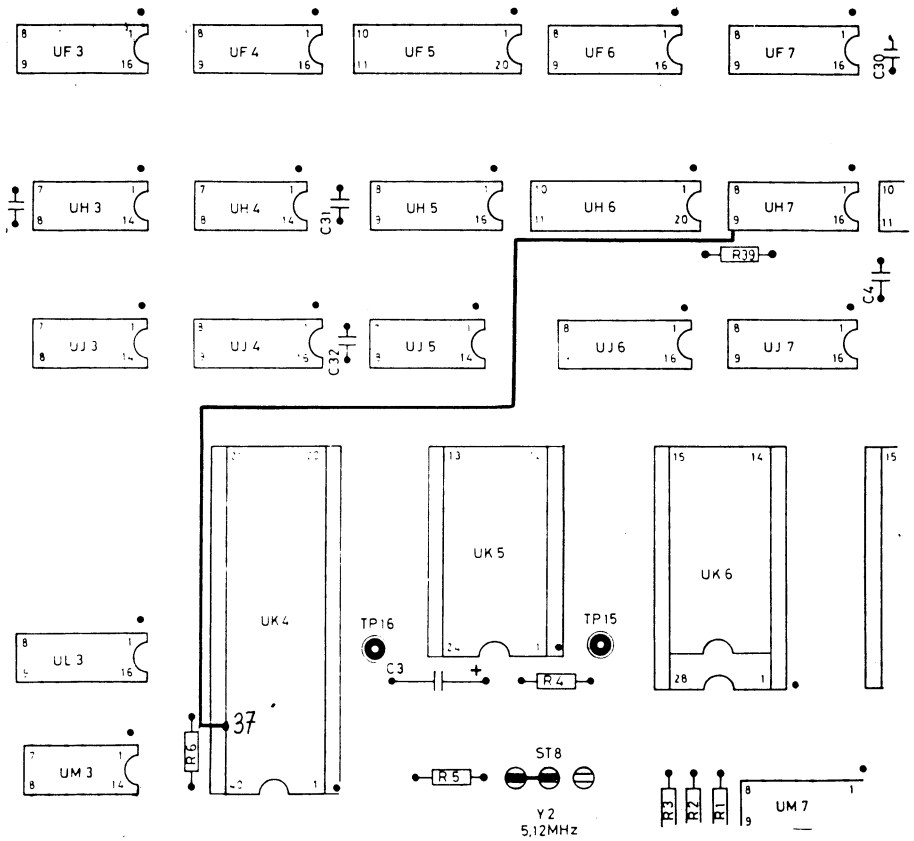


– On the opposite face of the board, cut the lead arriving to the pin 9 of UH7, at the drill hole close to pin 8 of UH7.

To be applied on the TA S/N up to 307, without S/N 280, 281, 291 and 302.



– Wire pin 9 of UH7 to the pin 37 of UK4 ("RESET OUT" of NSC 800).
The green wire 7 x 0.08 (P/N 42 08 115 555) is used at the factory.



PRODUCT: Nagra T–Audio DATE: December 1986

SUBJECT: Tachometric filter in the speed stabilizer circuit
Filtre tachymétrique dans le circuit stabilisateur de vitesse

N° 09-8

Additional tachometric filter to eliminate possible inductive interaction between capstan motors, resulting in the hum of the audio chain.
Installation of the additional tachometric amplifier board and modifications on the speed stabilizer board are explained below.

Required parts:
a kit of necessary parts consists of:

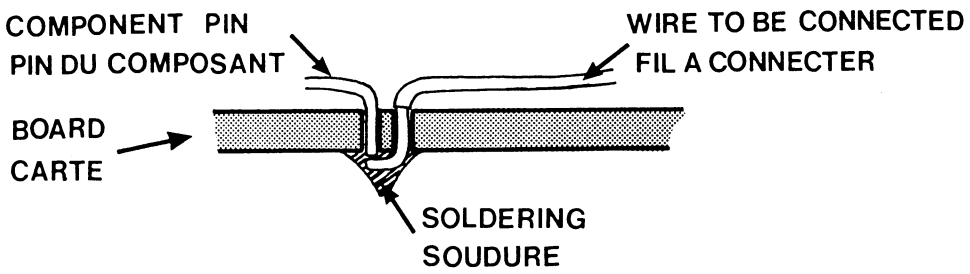
91 09 341 000	Tachometric filter board with connection wires
01 09 341 002	Spacer - nut M1.6x4.2 (2pcs)
30 01 011 965	Scew, slotted countersunk head M1.6x4
30 01 012 265	Scew, slotted countersunk head M1.6x8
32 01 001 665	Nut, hex M1.6
55 42 183 315	Resistor 15 kOhm, 2%1/4W 100ppm (R72 and R172) (2pcs)

Modification and installation:

On the speed stabilizer board A0-3 (P/N 91 09 340 000):

- Remove resistors R1 10k, R2 10k, R101 10k, and R102 10k.
- Unsolder and lift pin11 of U6 and U106. Solder then a resistor R72 15kOhm between pin 11 of U6 and pin 6 of U8 (or the junction of R48, R49 and R50).
- Also fix a resistor R172 15kOhm between pin 11 of U106 and pin 6 of U108 (or junction of R148, R149, and R150).
- Fit an additional tachometric filter circuit and solder the connection wires, as shown on the attached drawings.

Note:
Solder the wires on the lower face of the speed stabilizer board (opposite to the components side). Drill a 1 mm diameter hole close to the specified connection points (existing soldering eyelets) taking care not to damage existing printed tracks. Fit the end of connection wire to the hole and bend it to solder on the eyelet on the lower face of the board. Use existing holes from removed resistors if possible.



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L'adjonction d'un filtre tachymétrique a pour but d'éliminer le ronflement dans la chaine audio résultant des interactions inductives entre les moteurs cabestan.
L'installation du circuit du filtre tachymétrique ainsi que les modifications à effectuer sur la carte du circuit stabilisateur de vitesse sont décrites ci-dessous.

Pièces nécessaires:
un kit de montage comprennant:

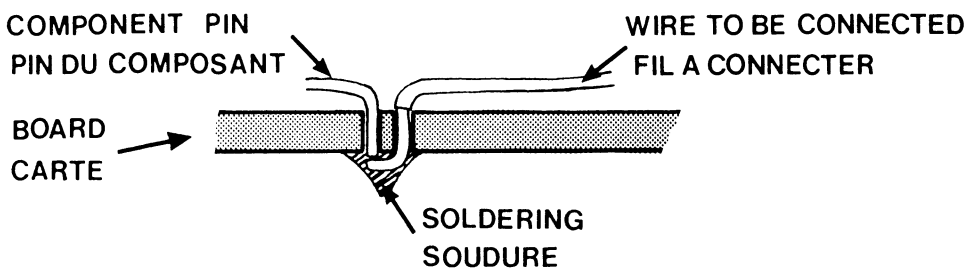
91 09 341 000	circuit du filtre tachymétrique avec câbles de connexion
01 09 341 002	entretoise/écrou M1.6x4.2 (2pcs)
30 01 011 965	vis à tête cylindrique M1.6x4
30 01 012 265	vis à tête cylindrique M1.6x8
32 01 001 665	écrou 6 pans M1.6
55 42 183 315	résistance 15 kOhm, 2%1/4W 100ppm (R72 and R172) (2pcs)

Installation et modifications:

Sur la carte stabilisateur de vitesse A0-3 (P/N 91 09 340 000):

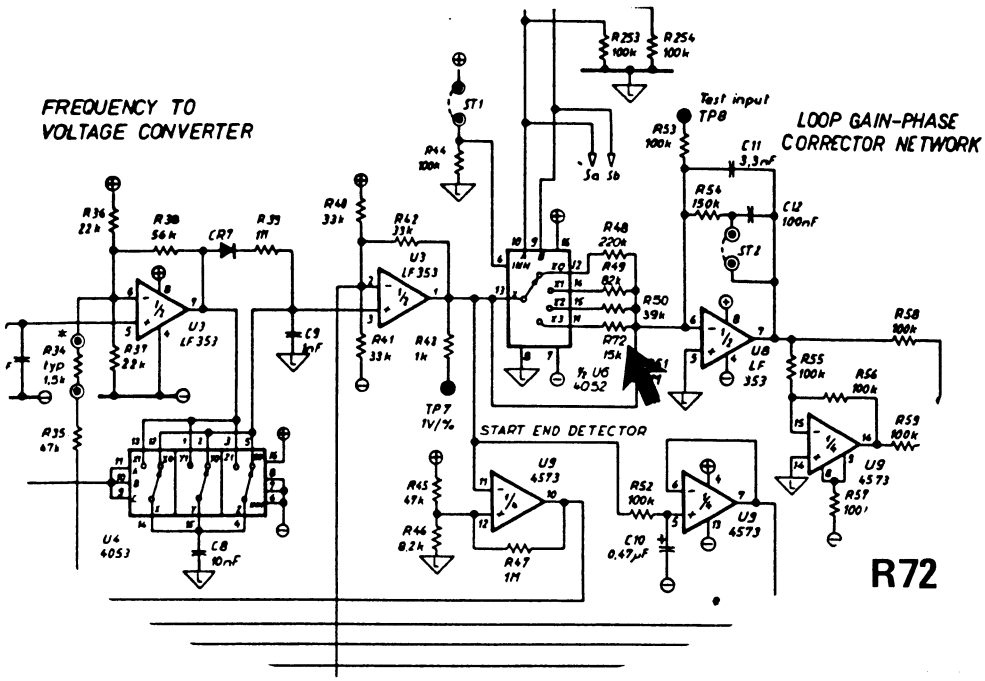
- Enlever les résistances R1 10k, R2 10k, R101 10k et R102 10k.
- Désouder et soulever la pin 11 de U6 et U106. Souder ensuite entre la pin 11 de U6 et la pin 6 de U8 une résistance R72 15kOhm (ou le point commun de R48, R49 et R50).
- De la même manière souder une résistance R172 15kOhm entre la pin 11 de U106 et la pin 6 de U108 (ou le point commun de R148, R149 et R150).
- Placer et connecter le circuit du filtre tachymétrique commme indiqué sur les dessins ci-joints.

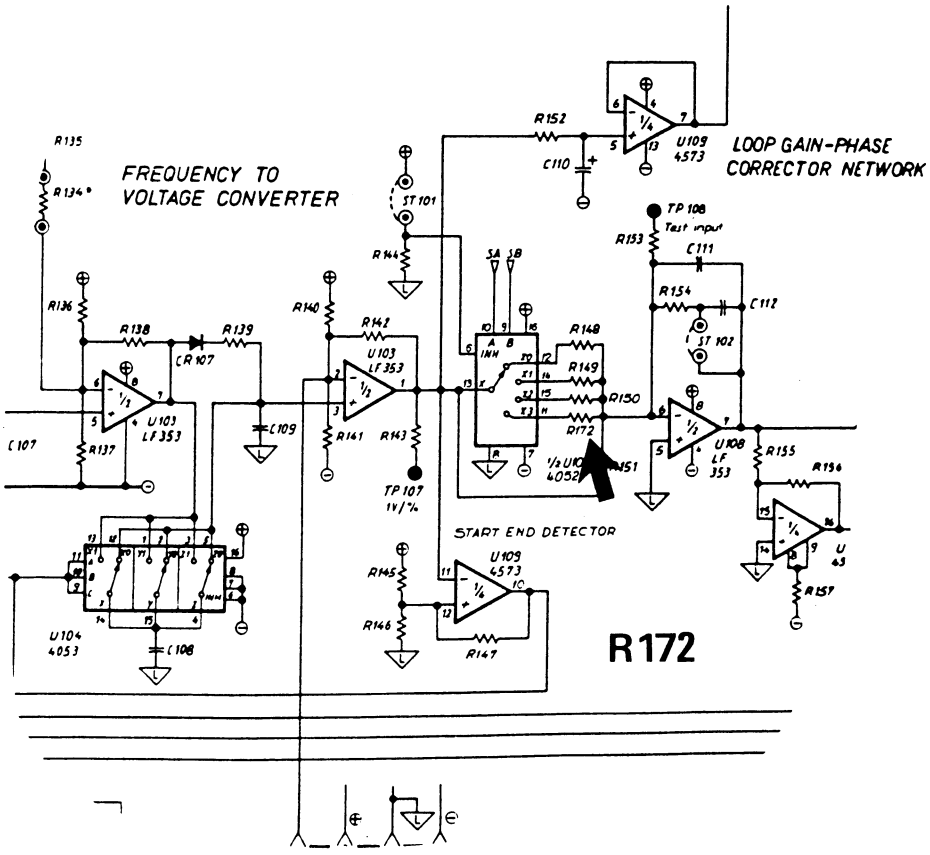
Note:
Souder les fils sur la face inférieure de la carte stabilisateur de vitesse (côté opposé aux composants). Percer un trou de 1 mm de diamètre près du point de soudure choisi, en prenant garde de ne pas endommager les pistes de la carte. Placer le bout du connecteur dans le trou et replier l'extrémité sur la soudure du composant existant. Effectuer ensuite la soudure. Utiliser si possible les trous des résistances enlevées.



LOCATION ON DIAGRAM AO3-A11

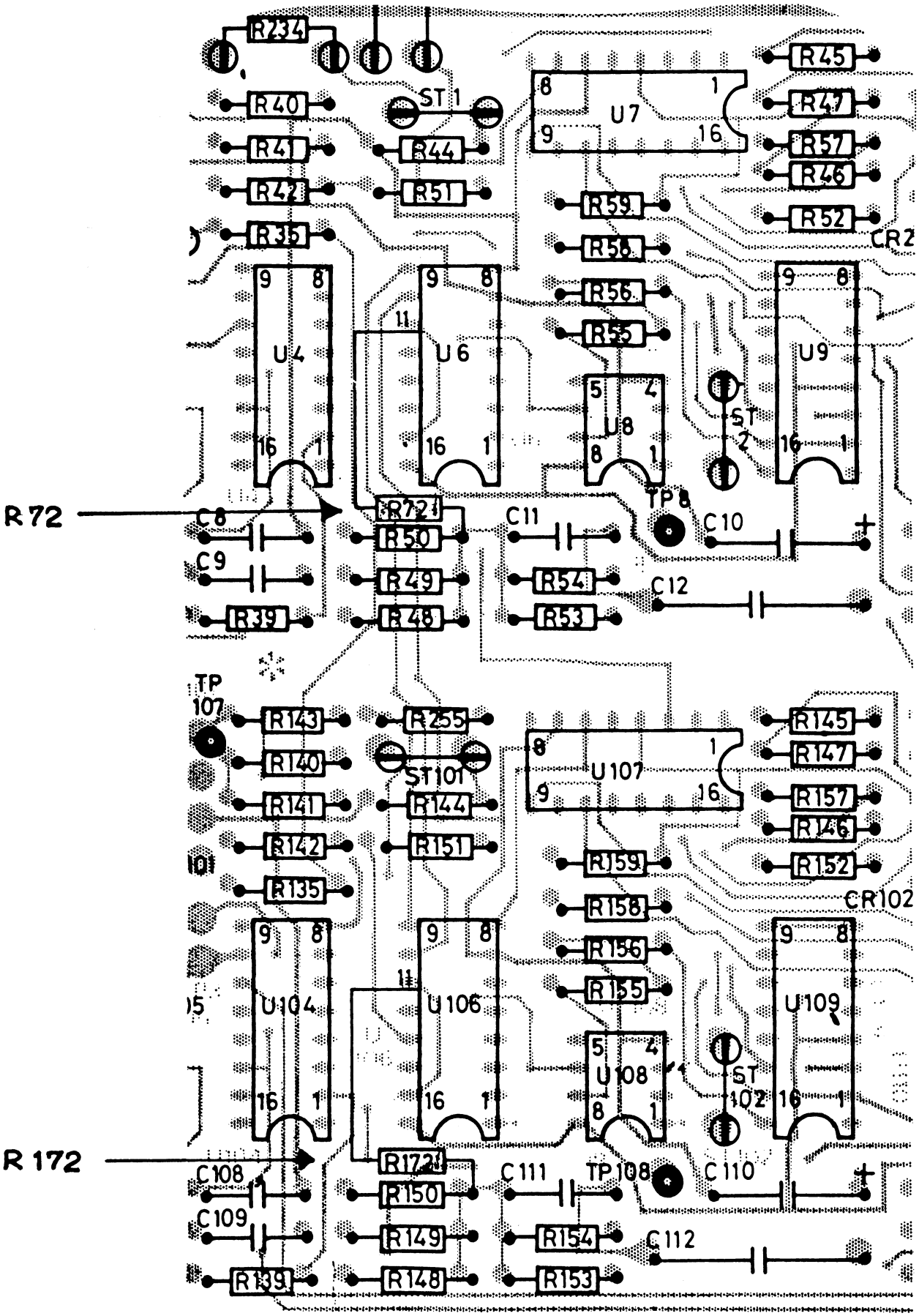
ENDROIT SUR LE SCHEMA AO3-A11





LOCATION ON BOARD AO3-A11

ENDROIT SUR LA CARTE AO3-A11



PRODUCT: NAGRA T-AUDIO Time Code **DATE:**

SUBJECT: Protection of integrated circuits UF1,UD9 and UJ7 on the main time code board.

N° 09-10

Under certain circumstances, these integrated circuits may be exposed to immediate or delayed destruction.

For protection, a few additional components should be installed on the Main Time Code Board

P/N 97 09361 000 with index C or D

These components will be integrated in the new circuit board with index E.

N o t e : Index is printed in the circle, close to the board number.

M O D I F I C A T I O N S O N T H E M A I N T C B O A R D 9 7 0 9 3 6 1 0 0 0

1) A05-A22 Playback, Record & Erase

UF1 (4053) P/N 50 74040 531

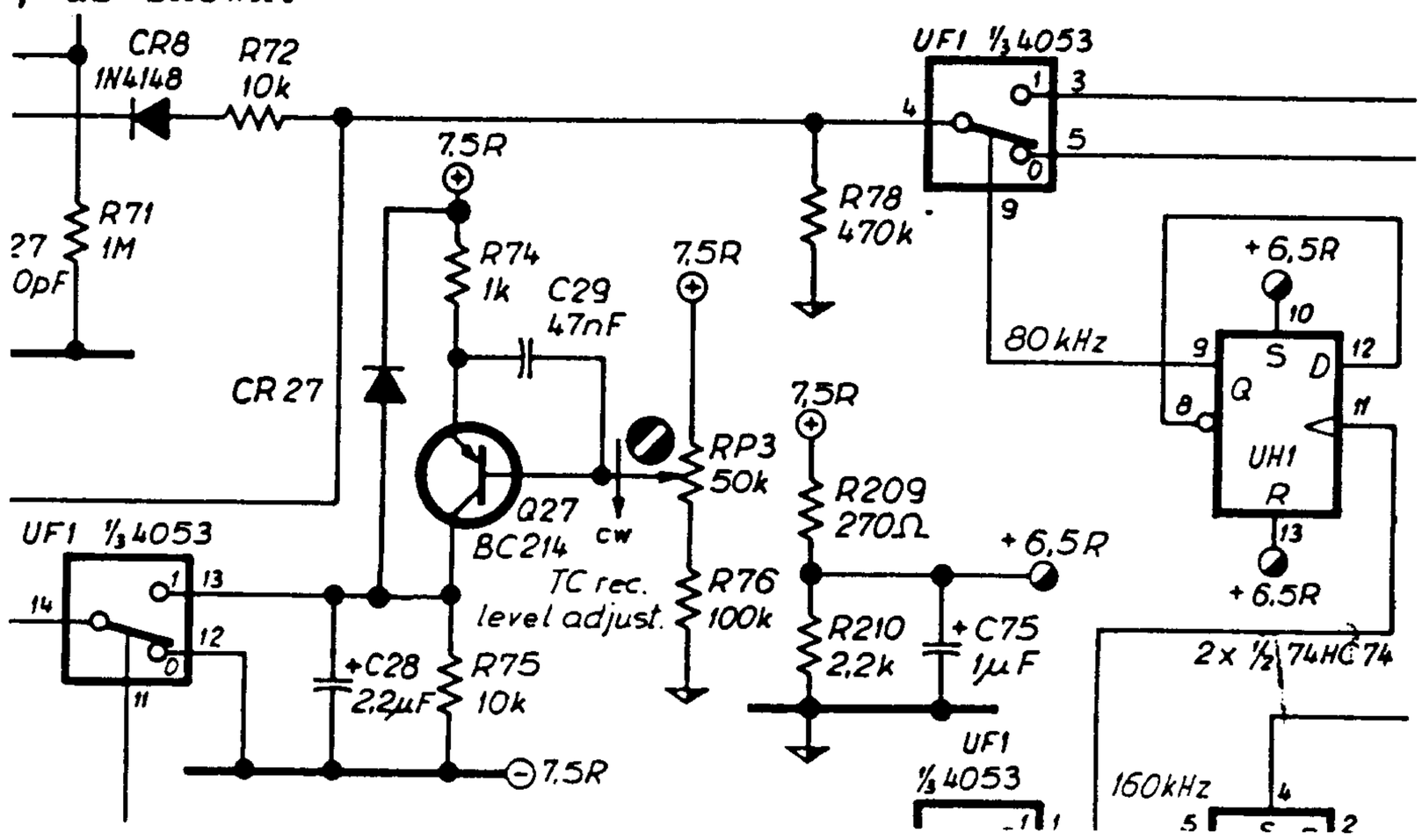
UF1 integrated circuit may be destroyed by discharge of C28 capacitor (2.2 µF) through UF1 protection diodes.

Fault shown is no or bad TC recording.

Install Schottky diode

CR27 1N5819 P/N 51 35514 102

between pin 13 of UF1 and +7.5V (pin 16 of UF1), cathode at +7.5V, as shown.



Playback, Record & Erase A05-A22

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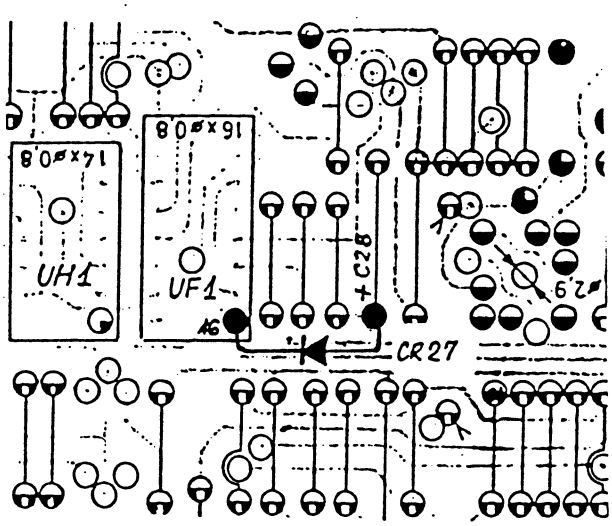


Soldered side

2) A05-A23 Machine Interface & Synchronizer

UD9 (4053) P/N 50 74040 531

UD9 integrated circuit may be destroyed by overvoltage on the "Pot" input (pin 9 of Remote Control connector).

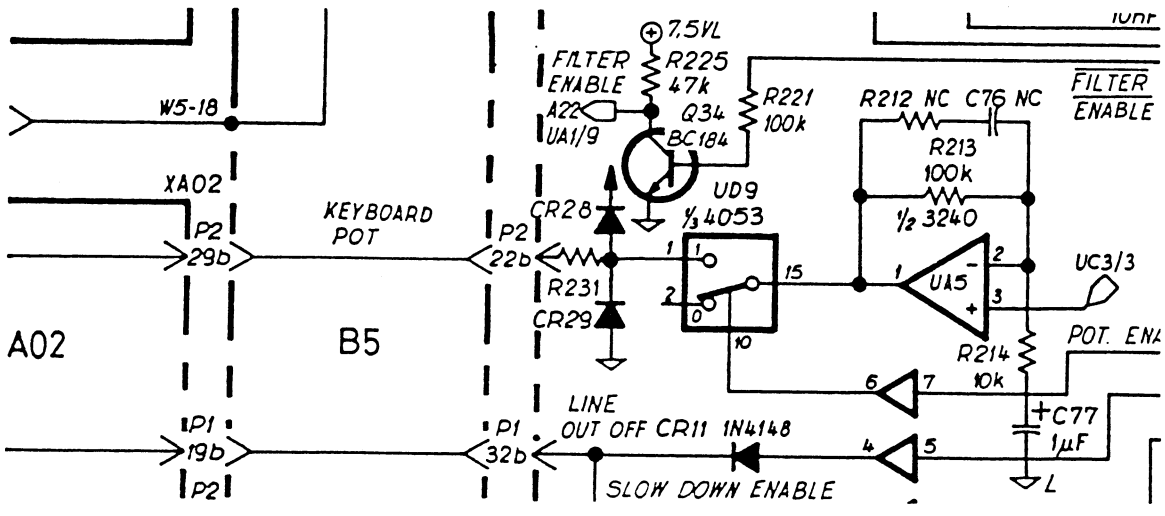
Fault shown is that SPOOLING function does not work - nor does the VARI-SPEED or the LOCATOR function.

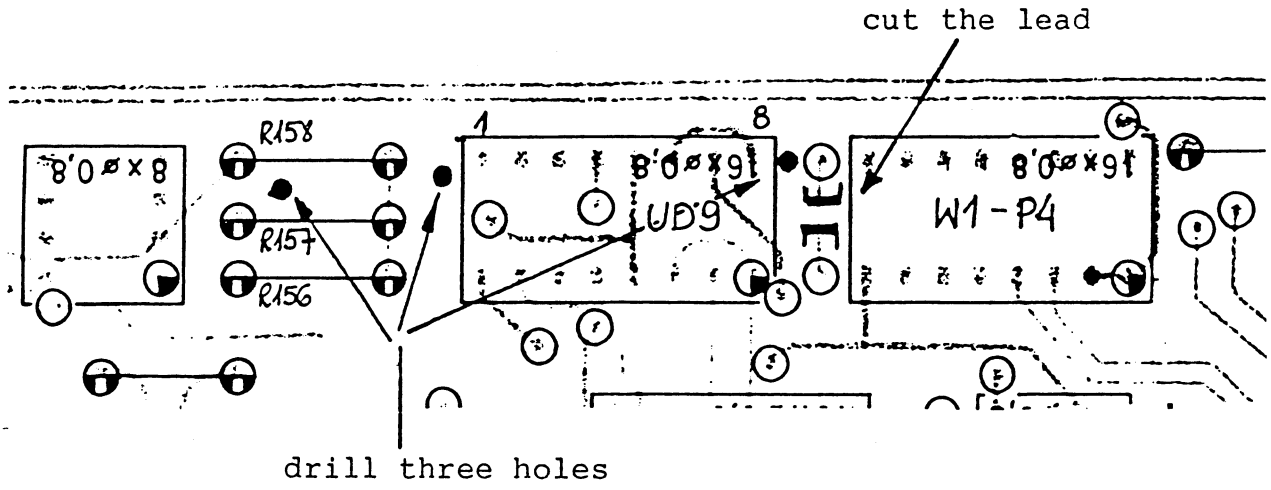
Install, as shown:

- R231 100 Ω 1/8W resistor, P/N 55 27182 101
  between pin 1 of UD9 and pin 22b of P2 connector.
  Use the two through plated holes between UD9 and W1-P4. Cut the lead between these two holes on the soldered side.

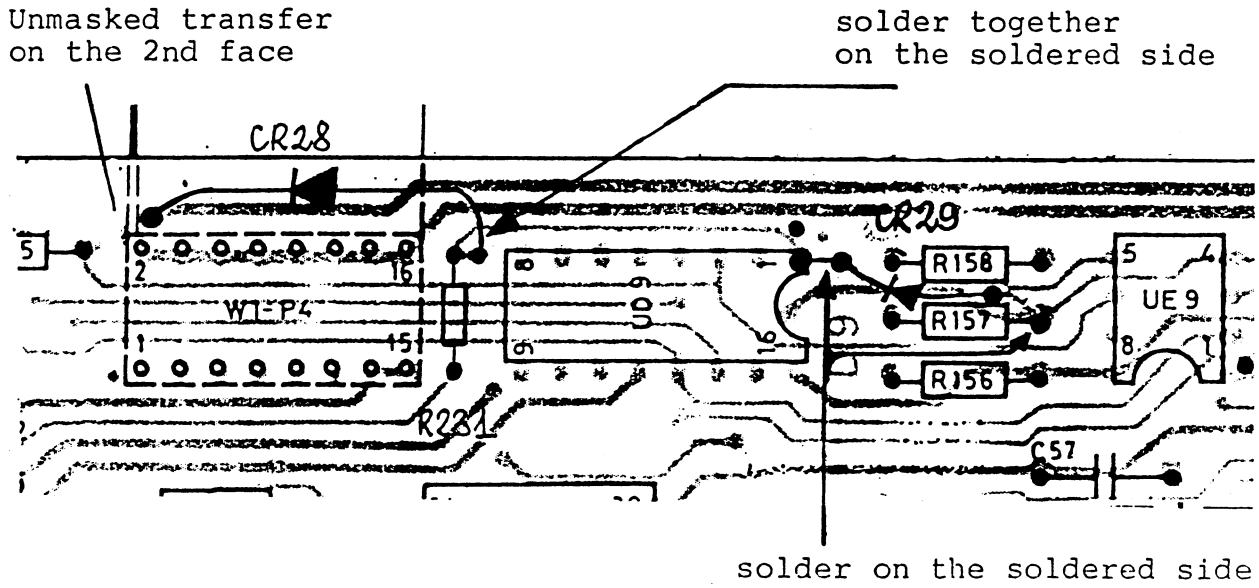
- CR28 1N4148 diode, P/N 51 16002 000
  between pin 1 of UD9 and +5V (pin 1 or 3 of W1-P4), cathode at +5V.

- CR29 1N4148 diode, P/N 51 16002 000
  between pin 1 of UD9 and the ground (pin 8 of UD9), cathode at pin 1 of UD9.





Soldered side



Components side

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3) A05-A23 Machine Interface & Synchronizer

UJ7 NSC 810 NI P/N 50 76008 108

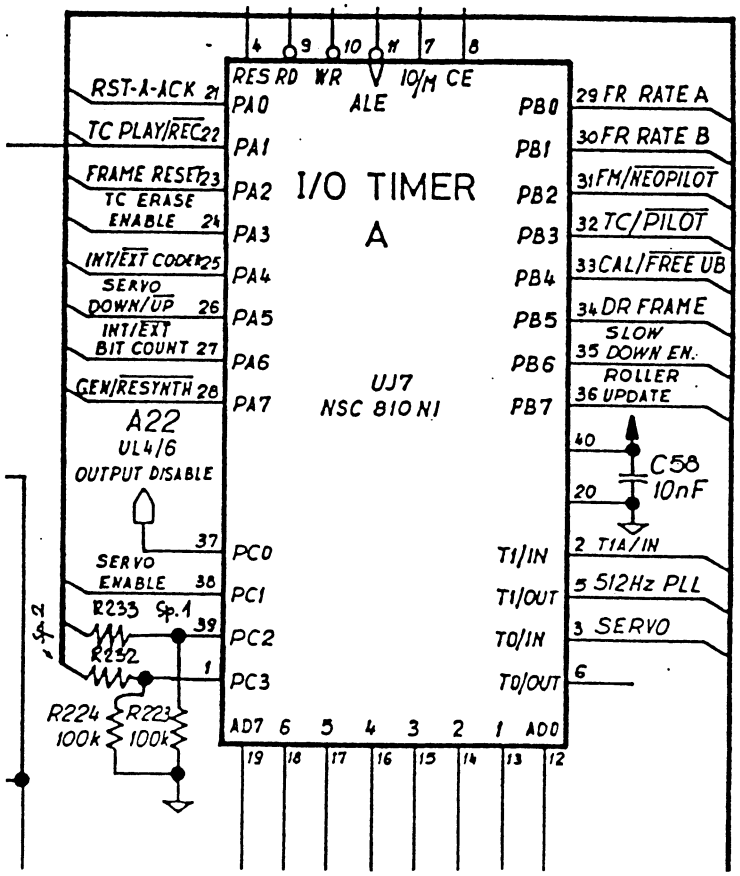
Protection of UJ7 I/O Timer A protects Spare 1 and Spare 2 inputs/outputs of T-Audio Time Code machine.

Fault shown is erratic behaviour of the T-Audio in one of the four Spare 2 programmable functions.

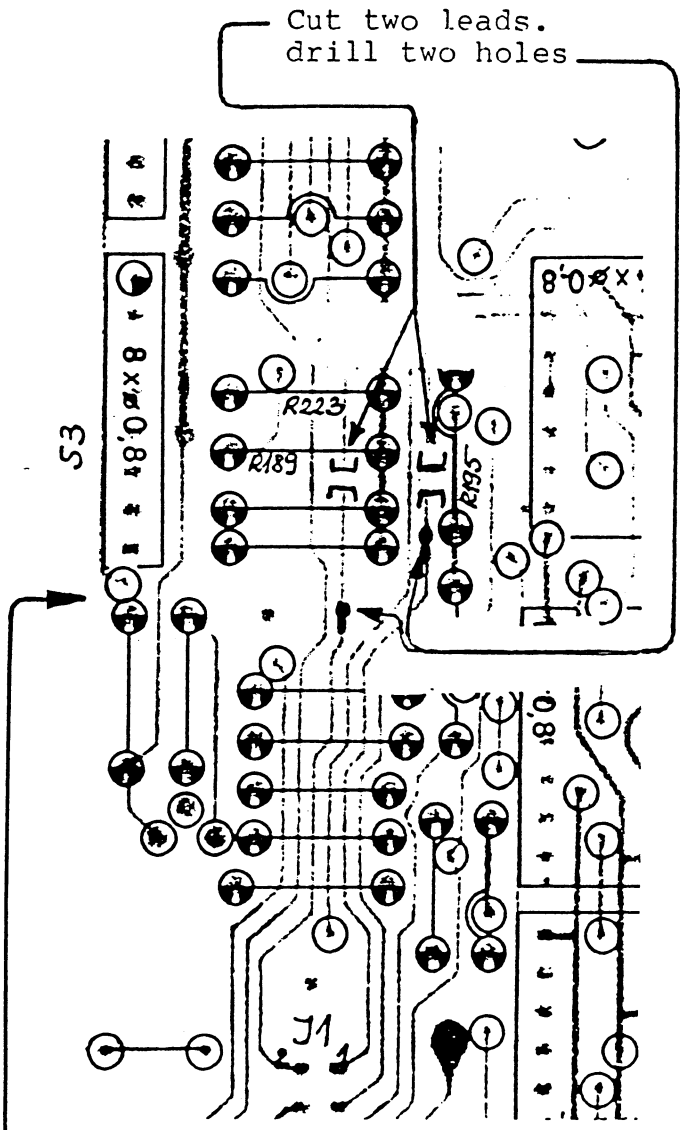
Install, as shown:

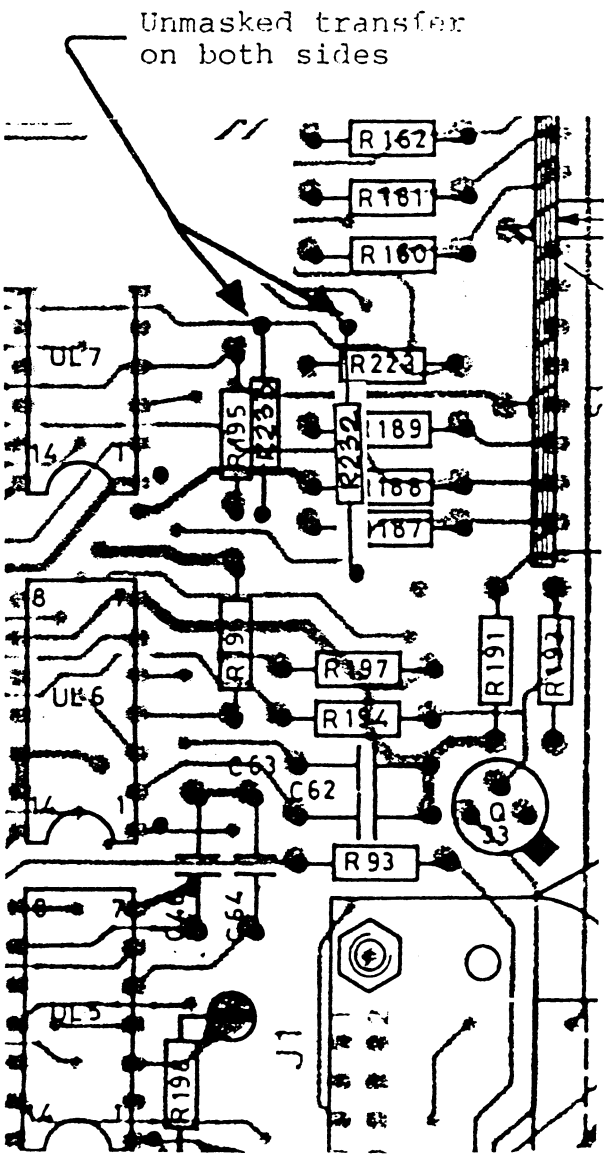
- R232 4.7 kΩ 1/8W resistor, P/N 55 27182 472
  between pin 1 of UJ7 and pin 2 of J1. Use through plated hole situated close to R223 resistor. Cut the lead, as shown, on the soldered side.

- R233 4.7 kΩ 1/8W resistor, P/N 55 27182 472
  between pin 39 of UJ7 and pin 1 of J1. Use through plated hole situated close to R223 resistor. Cut the lead, as shown, on the soldered side.



N°
09-10
5/5





Unmaske the leads going to J1, just after the two drilled holes, to solder R232 and R233

Protect wires of R232 with silicone sleeve (P/N 42 27800 555, gr[illegible])

Soldered side

Components side

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PRODUCT: NAGRA T-AUDIO ..... **DATE:** Sept.... 1987

SUBJECT: Tape Counter Circuit A04-A21 P/N 91 09350 000
New EPROM 3.3

N° 09-11a

T-Audio machines with S/N from **160** onwards have a new, high resolution tape counter roller (71 09133 000) and require new, improved **3.3** EPROM version (or preceeding 3.1 or 3.2 versions) on the A04-A21 Counter Board.

T-Audio machines with S/N up to **159** have former tape counter roller type (71 09146 000) and require **2.4** EPROM version on the Counter Board.

New, improved 3.3 EPROM version has the following additional features as compared to the former 2.4 version:

1. NORMAL COUNTER — SHIFT + LOAD

Enables to display the tape counter expressed in hours, minutes and seconds, without frames. This is a default mode when switching the power on.

2. 25 F/S COUNTER — SHIFT + LOAD LEFT

Enables the display of the tape counter expressed in hours, minutes, seconds and frames (standard 25 fps).

3. 30 F/S COUNTER — SHIFT + LOAD RIGHT

Enables to display the tape counter expressed in hours, minutes, seconds and frames (standard 30 fps).

4. FADER PLAY — SHIFT + EDIT LEFT

Displays "PL" (PLAY) instead of frames, on the two most right digits. It allows remote control with an external fader, selecting PLAY if switch is closed or STOP if switch is open.
To cancel this mode, press STOP key.

5. FADER RECORD — SHIFT + EDIT RIGHT

Displays "rE" (RECORD) instead of frames, on the two most right digits. It allows remote control with an external fader, selecting RECORD if switch is closed or STOP if switch is open.
To cancel this mode, press STOP key.

6. RUN-IN — SHIFT + DUMP

Displays "rO" instead of frames to activate automatic run-in mode of approx. 12 hours. The machine runs at 19 cm/s speed and repeats 33 times tape passage, 21 minutes 50 seconds each. Then it stops.
N o t e : Reserved for KSA use only.

7. IDENTIFICATION

While switching the power ON, T Audio displays EPROM version number for approx. 1½ second.

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8. GOTO LAST TAKE SHIFT + GOTO ZERO

It returns the T-Audio to the last place where PLAY or RECORD function was executed. Pressing PLAY to exit from RECORD mode does not store a new "last take" point until STOP key is pressed, in order not to lose record entry point.

9. INC HOURS SHIFT + SKIP --->
DEC HOURS SHIFT + SKIP <---

Executes the increment or decrement at all speeds (formerly, this function was valid only for 19 cm/s and 38 cm/s).

N o t e :

The features 1, 2, 3 and 6 could be found as well in the 3.1 EPROM version. Remaining features are found in the 3.2 EPROM version.

IMPROVEMENTS OF SOFTWARE IN 3.3 VERSION

RESET COUNTER

In version 3.2, pressing RESET COUNTER key causes the T-Audio to stop. This is now corected and RESET COUNTER only resets the tape counter.

GOTO LAST TAKE

In version 3.2, this feature only worked with positive tape counter values. In version 3.3, it also works with negative values.

PRODUCT: NAGRA T-AUDIO Time Code **DATE:** August 1987

SUBJECT: Improvement of TC decoding at 120 Kbits/s

N° 09-12

Applies to:	T-Audio Time Code,	S/N up to 248 (exc. 247)
	Time Code Counter board	09.362.0 Index A and B
	Time Code Decoder circuit	A05-A24
Ref.:	T-Audio Technical Manual, page	8.7-5 8.7-6

T-Audio machines equipped with Time Code Counter board 09.362.0 with index A and B (a letter in the triangle to the left of the board number) may at the maximum speed reproduce incorrectly the tapes with time code recorded at 19 cm/s and 25 fps.

As a remedy, cut off UC3:

UC3 Quad Exclusive "OR" Gate HEF 4070BP

clean soldering holes and solder in this place a piggy-back circuit:

P 1381

containing Quad Exlusive "OR" Gate 74HC86T.

N o t e s :

1. P 1381 Circuit Boards are available on request, free of charge.
2. On the Time Code Counter boards 09.362.0 with index C and D, UC3 and some other integrated circuits have been replaced with 74HC series, faster ones.

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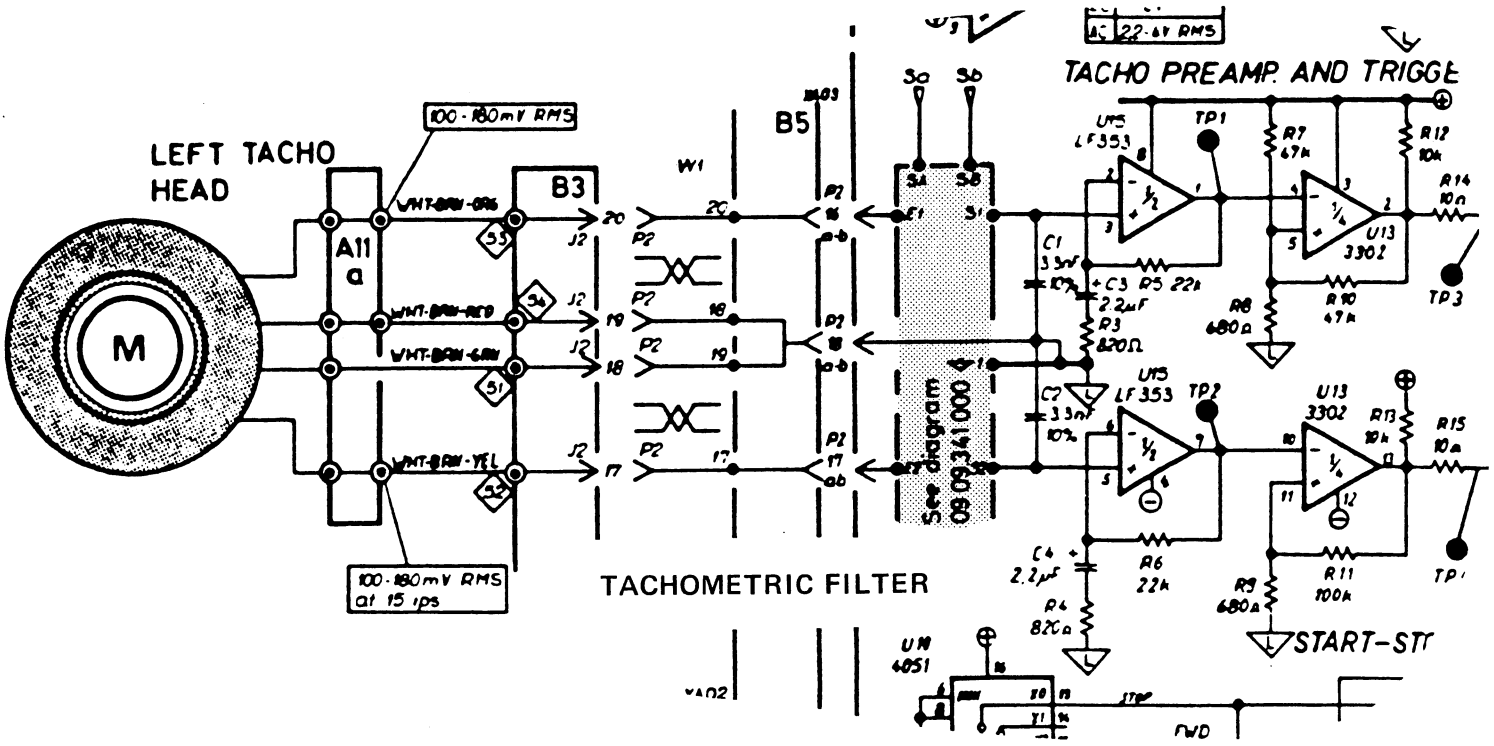
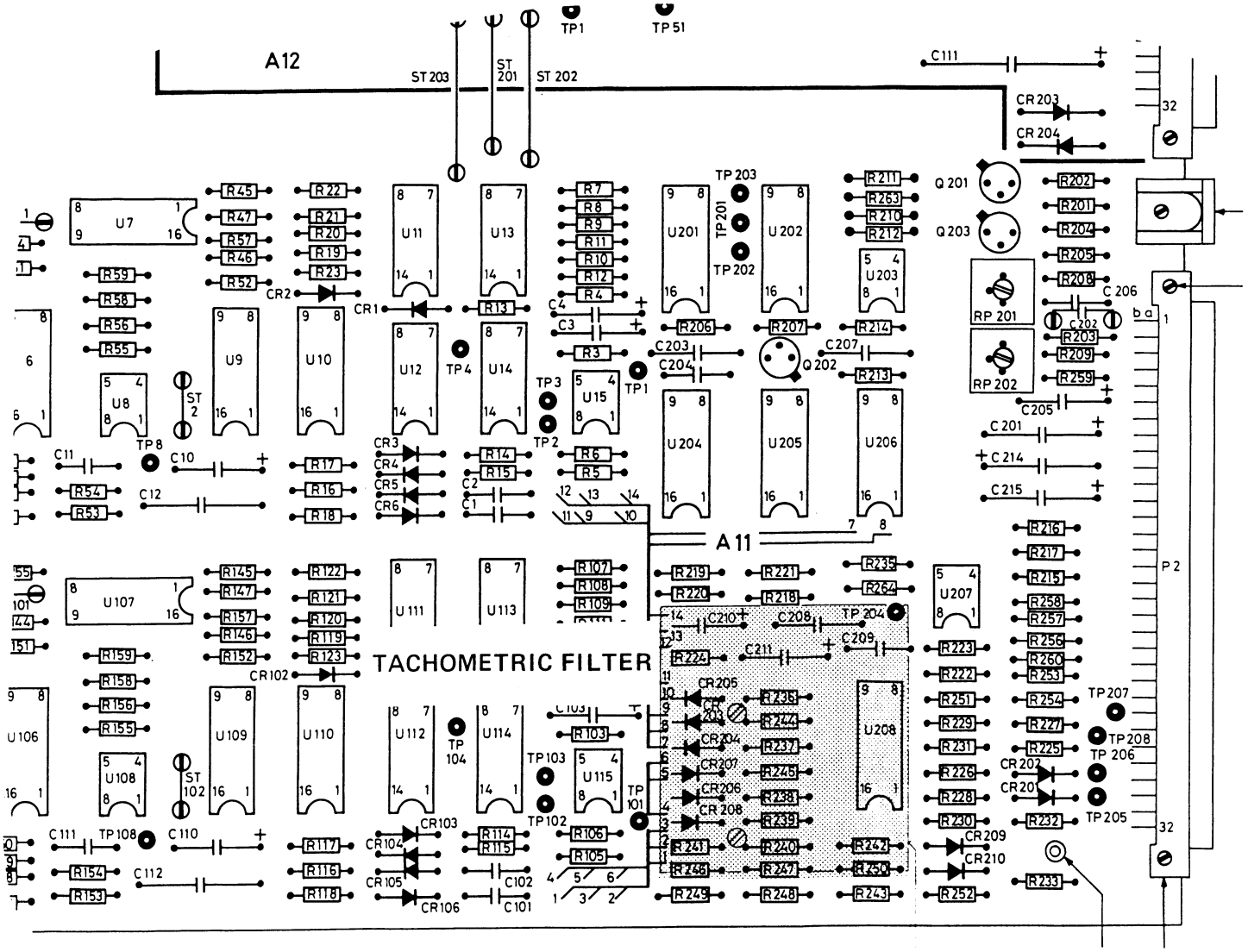
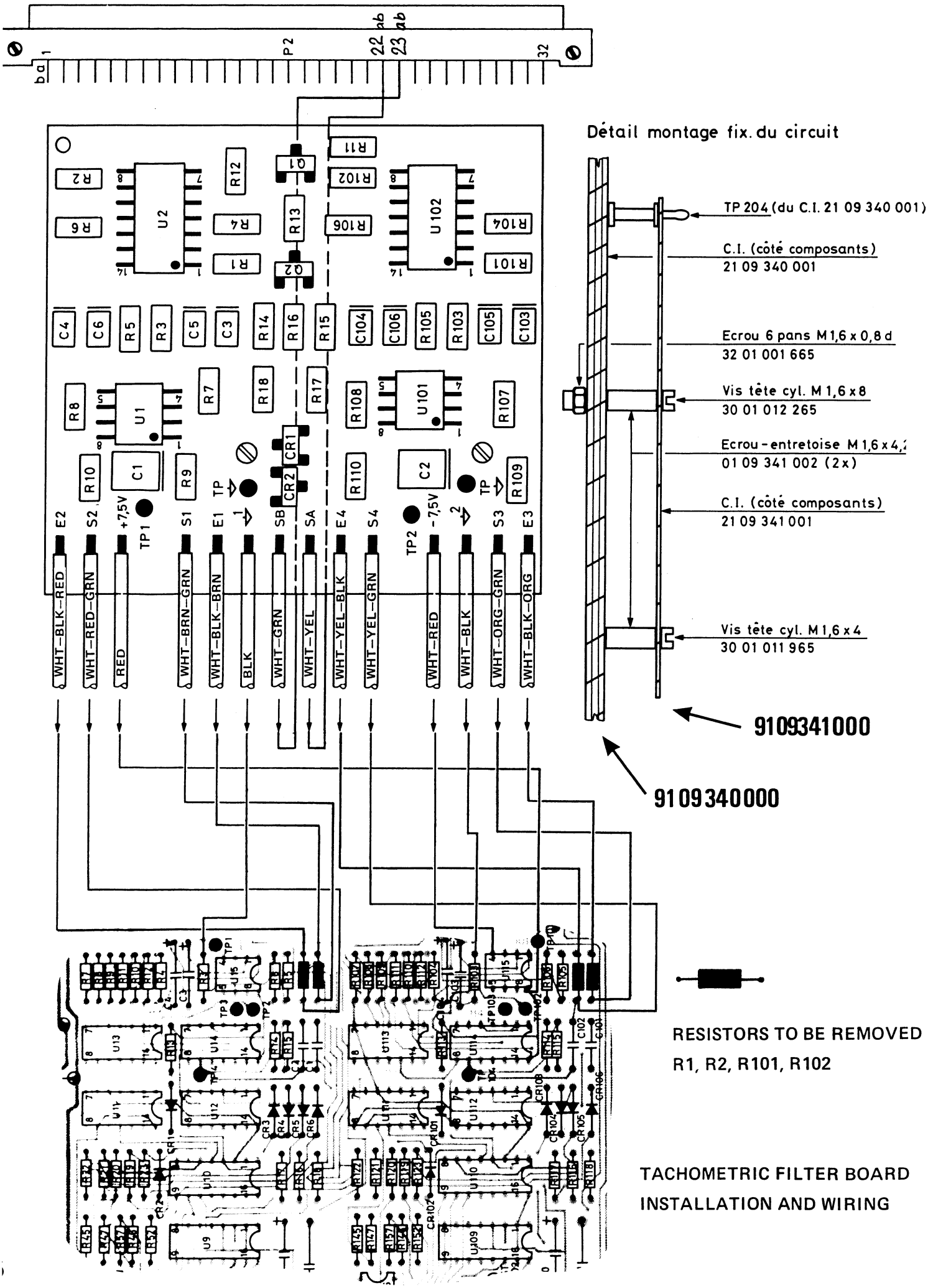
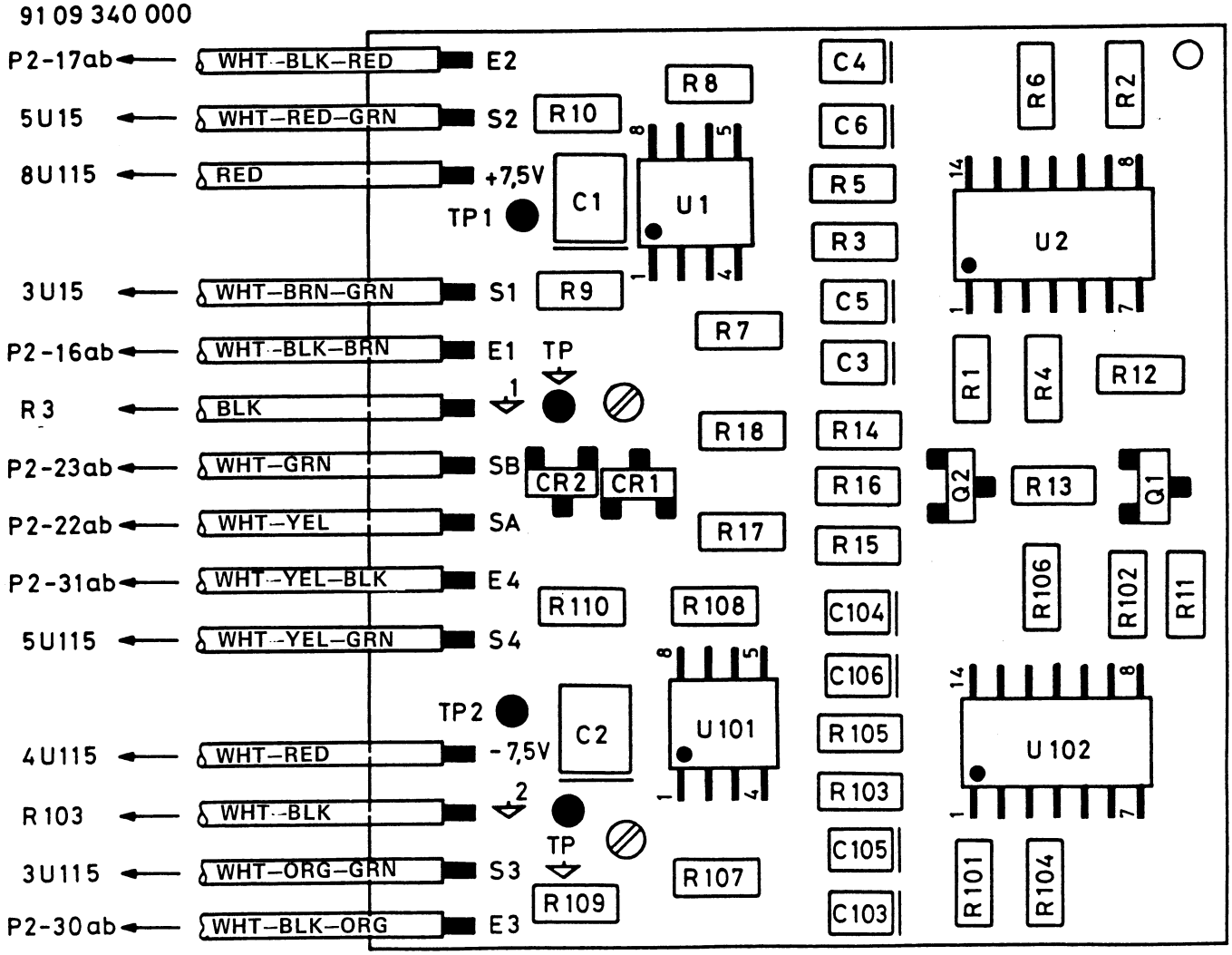

LEFT TACHO HEAD
M
A11 a
B3
B5
100 - 180mV RMS
100 - 180mV RMS at 15 ips
WHT-BRN-GRN
WHT-BRN-RED
WHT-BRN-GRN
WHT-BRN-YEL
W1
TACHO PREAMP AND TRIGGE
TACHOMETRIC FILTER
See diagram 08 09 341 000
START-STT
FWD


A12
ST 203
ST 201
ST 202
TP1
TP51
A11
TACHOMETRIC FILTER
CR203
CR204
Q201
Q203
Q202
RP 201
RP 202
P2


Détail montage fix. du circuit
TP 204 (du C.I. 21 09 340 001)
C.I. (côté composants)
21 09 340 001
Ecrou 6 pans M1,6 x 0,8 d
32 01 001 665
Vis tête cyl. M 1,6 x 8
30 01 012 265
Ecrou - entretoise M 1,6 x 4,2
01 09 341 002 (2x)
C.I. (côté composants)
21 09 341 001
Vis tête cyl. M 1,6 x 4
30 01 011 965
9109341000
9109340000
WHT-BLK-RED
WHT-RED-GRN
RED
WHT-BRN-GRN
WHT-BLK-BRN
BLK
WHT-GRN
WHT-YEL
WHT-YEL-BLK
WHT-YEL-GRN
WHT-RED
WHT-BLK
WHT-ORG-GRN
WHT-BLK-ORG
+7,5V
-7,5V
TP1
TP2
RESISTORS TO BE REMOVED
R1, R2, R101, R102
TACHOMETRIC FILTER BOARD
INSTALLATION AND WIRING

To Basses vitesses
91 09 340 000



TACHY FILTER
09.341.0

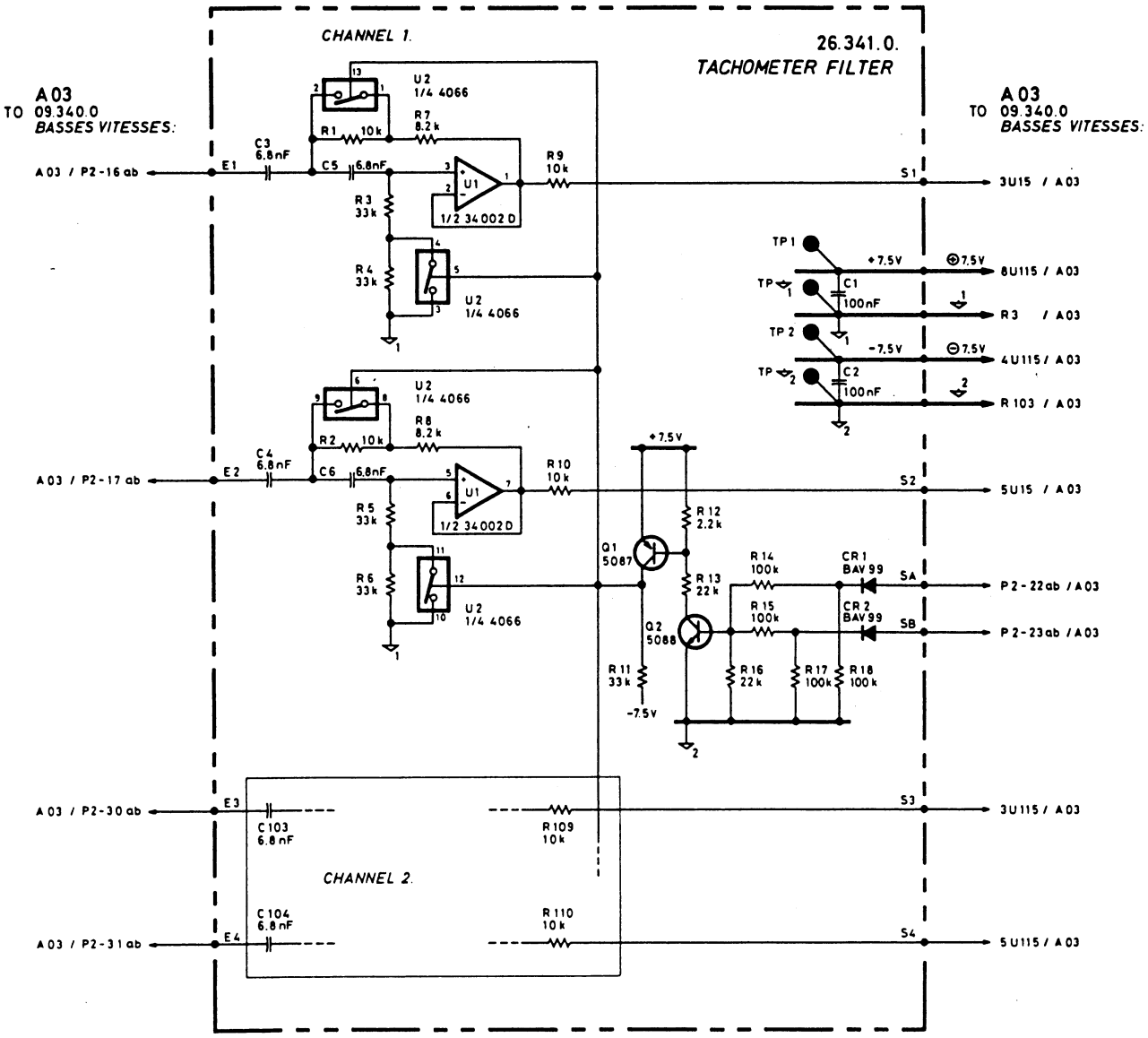
IC LIST			
N°	Ref design	⊕7.5V	⊖7.5V
CHANNEL 1			
U1	34002D	8	4
U2	4066	14	7
CHANNEL 2			
U101	34002D	8	4
U102	4066	14	7

SCHEMATIC DIAGRAM NOTES

— — — Circuit assembly borderline

Test Point

Common connections



		A
T-AUDIO	09 09 341 000	19.3 86.
TACHOMETER FILTER		

PRODUCT: NAGRA T-AUDIO November 1987

SUBJECT: Tape Counter Roller circuit, Output level stabilization

N° 09-13

The output signal level from Tape Counter Roller circuit was not stable and decreased with time. This was caused by the ageing of new series of photoelectric components on this circuit, infra-red LEDs or phototransistors. As a result, duty cycle adjustment was shifted and might cause the phase inversion, seriously perturbing the functioning of the machine.

To cure the problem, the additional ALC circuit, No 91 09347 000 has been introduced between the output of the tape counter roller circuit and the control logic board.

Tape Counter Roller exchange, except in extreme cases, is not necessary.

M O D I F I C A T I O N S

These modifications are valid for the Control Logic circuit board

A02 P/N 91 09345 000 with index C, D, E and F

N o t e :

The above noted index is a letter in a circle, close to the number of the circuit on the board.

On the circuit A02 - A15 :

- Remove the capacitors C303 and C304 (old values 3.3 nF)
- Remove counter encoder sensitivity adjustments potentiometers RP301 and RP302 (old values 1 kΩ)
- Change value of R349 and R353 resistors to 470 kΩ using 10% 1/8W resistors, P/N 55 26012 474, (old value 10 kΩ)
- Position the additional piggy-back circuit board, 9109347000, in the place of the removed potentiometers RP301 and RP302, as shown on the schematic. The pins soldered to the 9109347000 board fit into the soldering eylets of RP301 and RP302 potentiometers: points 3, 4 and 5 on the 9109347000 board to the RP301, and points 1 and 2 on the 9109347000 board to the RP302. Solder these five pins to the logic board.

Connect soldering point "A" on 9109347000 board to pin 16 of UJ302 (+ 7.5V) using the brown wire, 40 mm long, soldered to the 9109347000 board.

Connect soldering point "B" on 9109347000 board to pin 10 of UF304 (- 7.5V) using the blue wire, 115 mm long, soldered to the 9109347000 board.

Fix these two wires to the logic control board, using epoxy resin (Araldite AW 106, for example).

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- On the front printed label of the control logic circuit board, remove or cover over the print "Counter Encoder Sensitivity", which is placed just below removed RP301 and RP302 potentiometers.

On the circuit B3 P/N 91 09260 100
Tape Deck Interconnection Circuit :

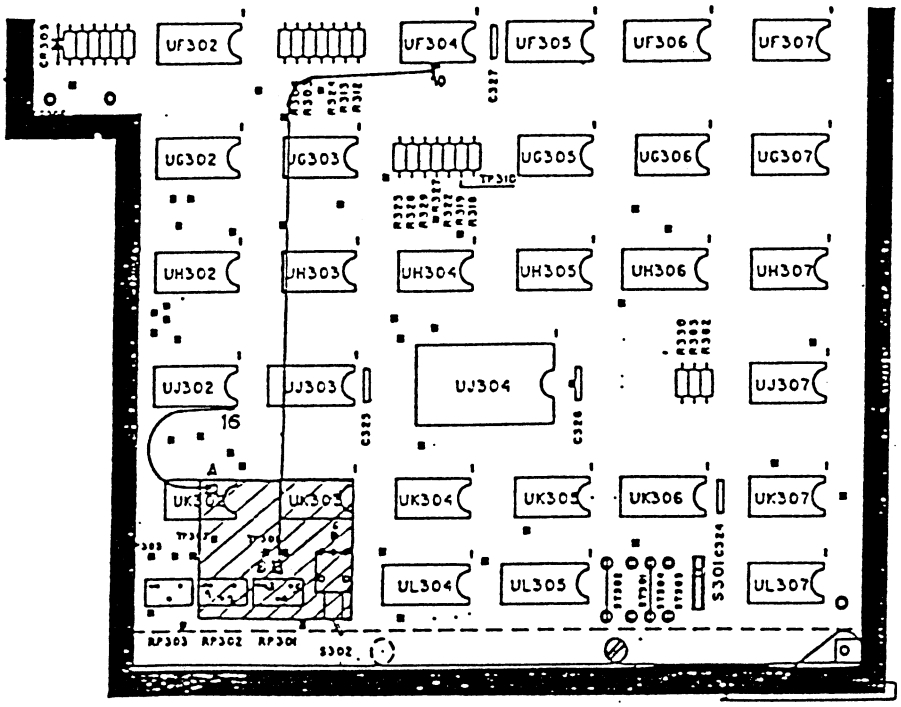
- Make sure that in place of the resistor R1 there is a jumper.

F U N C T I O N A L C H E C K

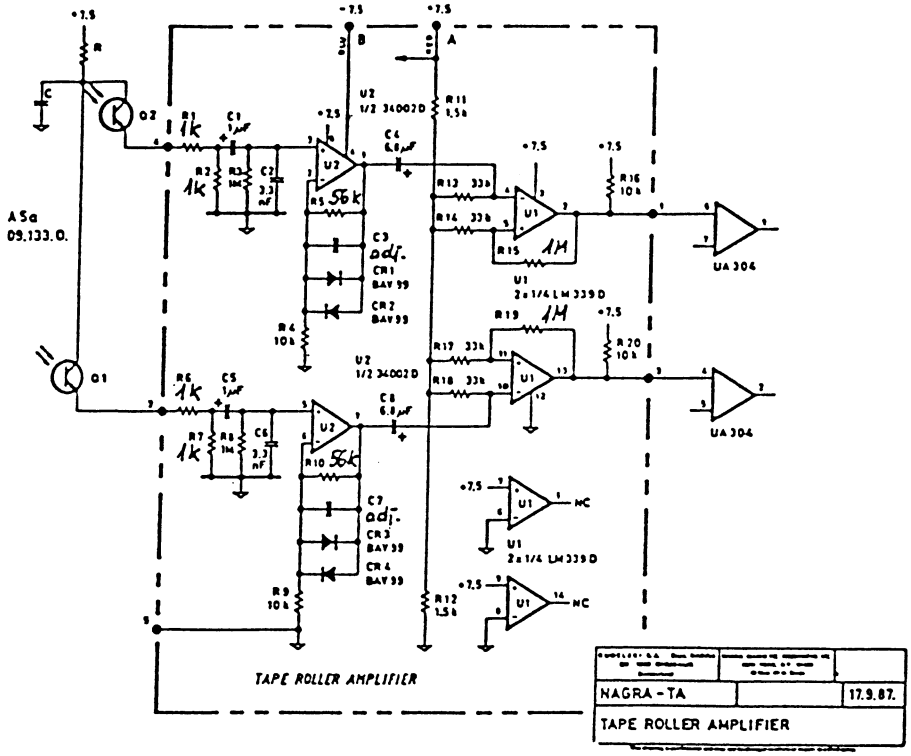
Connect an oscilloscope to the outputs of UA304 comparator, pins 1 and 2 (schematic A02-A15).
Check that the phase shift between two signals is 90° ± 70° and remains within these tolerances at all speeds of the machine, and as well during fast tape winding in both directions.

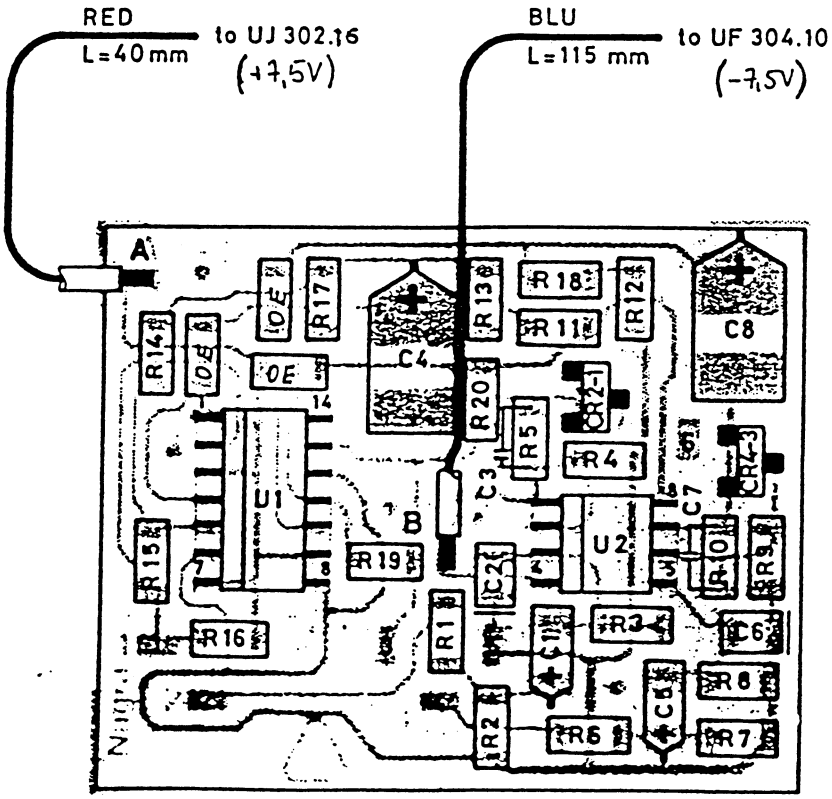
N o t e :

91 09347 000 Tape Roller Amplifier additional piggy-back circuit board will be supplied free of charge, on request.



Position of the Tape Roller Amplifier
on the Logic Control board





Tape Roller Amplifier P1 09347 000

PRODUCT: NAGRA T-AUDIO DATE: February 1988

SUBJECT: Rotating guide in the head block

N° 09-14

2 Pages

Since December 1987, the head block of NAGRA T-AUDIO (S/N > 549) is equipped with a new rotating guide, which improved mechanical construction assures smooth tape transport and decreases to a negligible level the phase shift between tracks when using tapes of different thicknesses.

The necessary parts are supplied as a kit:

Central Rotating Guide Kit	P/N	71 09190 000

ROTATING GUIDE INSTALLATION INSTRUCTIONS

- Drive in special nut (A), P/N 01 09155 033, to the head block frame. Respect its orientation and position, as shown on the drawing: the nut should not exceed the frame surface oriented towards the guide. Position in it the M2x2 screw (B).

- Fix the rotating guide, using

the fixing rod (screw-nut)	(C)	01 09155 019
the compression spring	(D)	25 09155 034
the screw M2.5x6	(E)	30 01033 136

Tight the screw (E), then release it by a quarter of a turn to leave the play necessary for the height and squearing adjustments. The play is controlled by the spring (D).

- Adjust the height of the guide with the screw (B). The red ruby limiter (F) should be found at the same height above the tape deck, as the limiters in the fixed guides at both sides of the head block.

To proceed this adjustment , as well as the squearing with necessary precision, use the new alignment table P/N 71 09900 000. It provides the comparator for the height adjustments and the gauges for the heads and guide squearing. This new tool is necessary for the correct and precise alignements.

- Adjust the rotating guide squearing with the screw (G), using the alignment table. This adjustment will change the previously done height adjustment. Since both height and squearing adjustments influence each other, repeat these two steps until both adjustments will be completed correctly.

Lock the height adjustment screw (B) using the soft Loctite 222.

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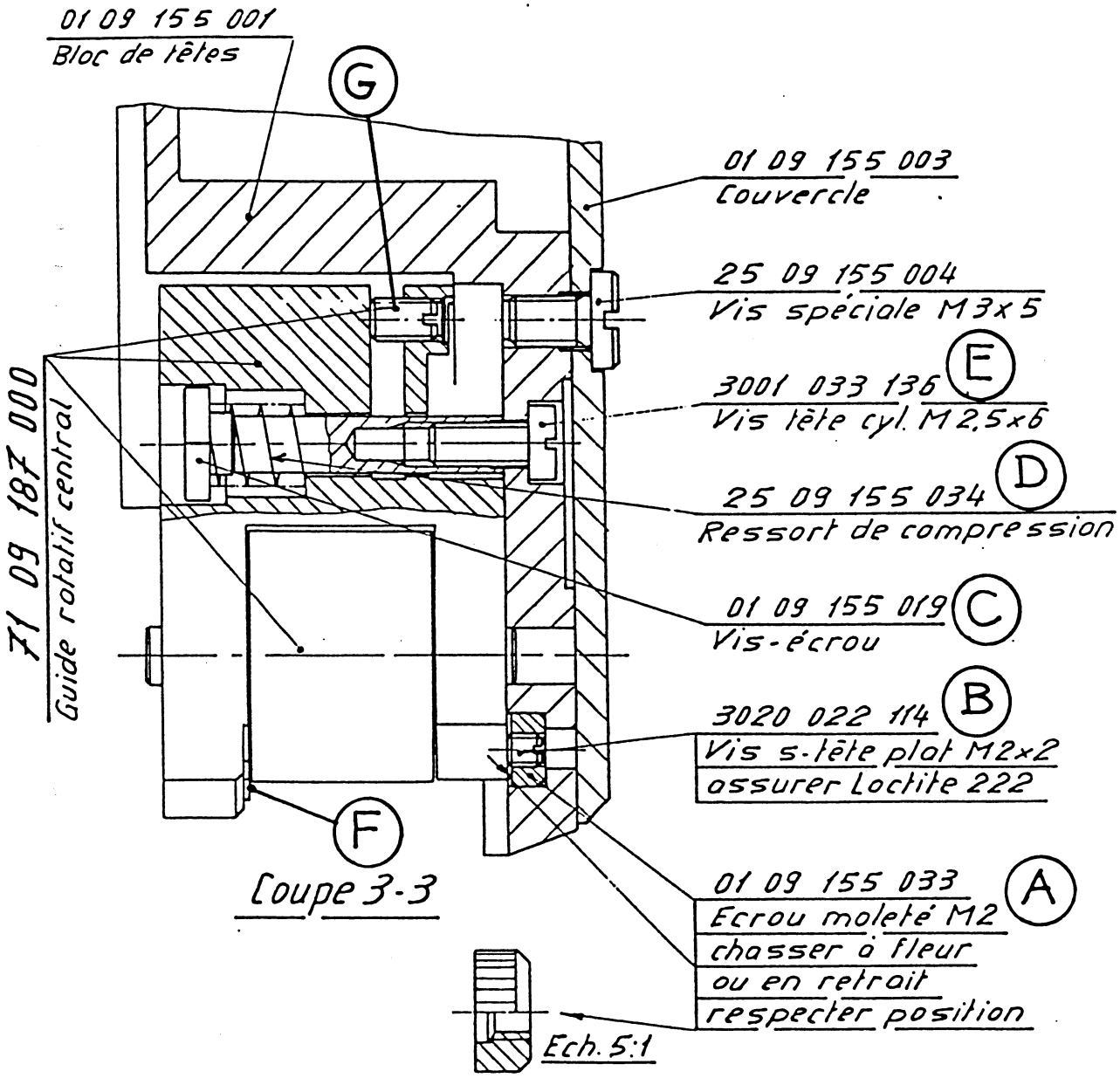
01 09 155 001
Bloc de têtes
G
01 09 155 003
Couvercle
25 09 155 004
Vis spéciale M3x5
E
3001 033 136
Vis tête cyl. M2,5x6
D
25 09 155 034
Ressort de compression
71 09 187 000
Guide rotatif central
01 09 155 019
Vis-écrou
C
B
3020 022 114
Vis s-tête plat M2x2
assurer Loctite 222
F
Coupe 3-3
01 09 155 033
Ecrou moleté M2
chasser à fleur
ou en retrait
respecter position
A
Ech. 5:1

PRODUCT: T-AUDIO TIME CODE

DATE: SEPT. 1988

Nº 09-15

SUBJECT: TAPE PATH ALIGNMENT AND HEAD ADJUSTMENT

To align the tape path of machines carrying serial numbers higher than 0900537 with the necessary precision, as well as to mechanically adjust the tape heads, a special alignment base plate and comparators must be used.

K.S.A. part no 71 09900 000

T-Audio machines carrying serial numbers lower than 0900538 can be aligned using the former base plate.

K.S.A. part no 01 09901 044

The precision will be slightly lower however still satisfactory. This tool only allows the tape alignment. To align the heads another base plate is necessary.

K.S.A. part no 01 90901 043

The new kit (71 09900 000) consists of the following:

-Base plate
-Comparator
-Three guages.

All of which are supplied in a foam filled protective case (see photographs 1 & 2)

ALIGNMENT PRINCIPLE

The base plate represents a reference plane, and is very flat to a greater precision than the deck plate of the machine itself. This base plate must be used for all tape height adjustments, and all head height and squaring adjustments. The base plate is fixed to the deck plate of the machine in three places, giving perfect positioning.

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PROCEDURE

Firstly, remove the cover from the head block, using the two screws towards the middle of the head block. Then position the base plate onto the deck of the machine, and attach it by means of the three spring-loaded hooks (as shown in photographs 3 & 4). Two of the hooks are attached to the rims of the cover of the rotating guides and the third to the rim of the head block.

NOTE : Tape height is referenced to the height of the two fixed guides, positioned either side of the head block, and the tolerance for all the height adjustments is +/- 0.01 mm.

Check, using the comparator (as shown in photographs 5 & 6), that the lower limiters (the red ruby cylinders) on both of the fixed guides are at the same height. The difference between them should be equal to or less than 0.01 mm. If this is not the case, then the head block must be replaced. This alignment can only be done at the factory.

NOTE : It is possible to adjust the height of the head block itself using small 0.05 mm washers on the M3 screws that fix the head block to the tape deck. These washers are available from the factory upon request.

Measure the squaring of both the fixed guides, using the double guage, as shown in photograph 7. Again if this is incorrect replace the head block. Then, using the height of the fixed guides as a reference, set the comparator dial to zero.
Check the height of the two fixed guides either side of the tape tension transducer as shown in photographs 8 & 9. If necessary, adjust the height by turning the screw on the top of the tape tension transducer as shown in photograph 10. If adjustment is made then re-check the alignment and repeat if necessary.

Check the height of the lower limiter of the rotating guide (the red ruby cylinder) see photograph 11, and if necessary adjust its height using the screw on top of the roller shaft see photograph 12.
Height adjustment of the roller will alter the squaring, thus it is important to re-check the squaring afterwards using the simple guage as shown in photograph 13. If this needs adjusting then use the screw on top of the rear part of the rotating guide assembly as shown in photograph 14. Repeat these successively until both are within specification.

Verify the head squaring adjustments using the double guage as shown on photograph 15 (time code head). To adjust the head squaring slightly loosen the Allen screw at the rear of the head and turn the cylindrical adjuster using a flat 4 mm spanner.

Move the pinch-roller assembly towards the head block and check the height of both of the pinch-roller leavers with the comparator (i.e. the height of the lower ruby limiters). If necessary adjust the height by loosening the Allen screw "m" and rotate the Allen screw "n" and then re-tighten the screw "m". (see NAGRA T-Audio service manual chapter 3 page III 2.6-1) - see photograph 16.

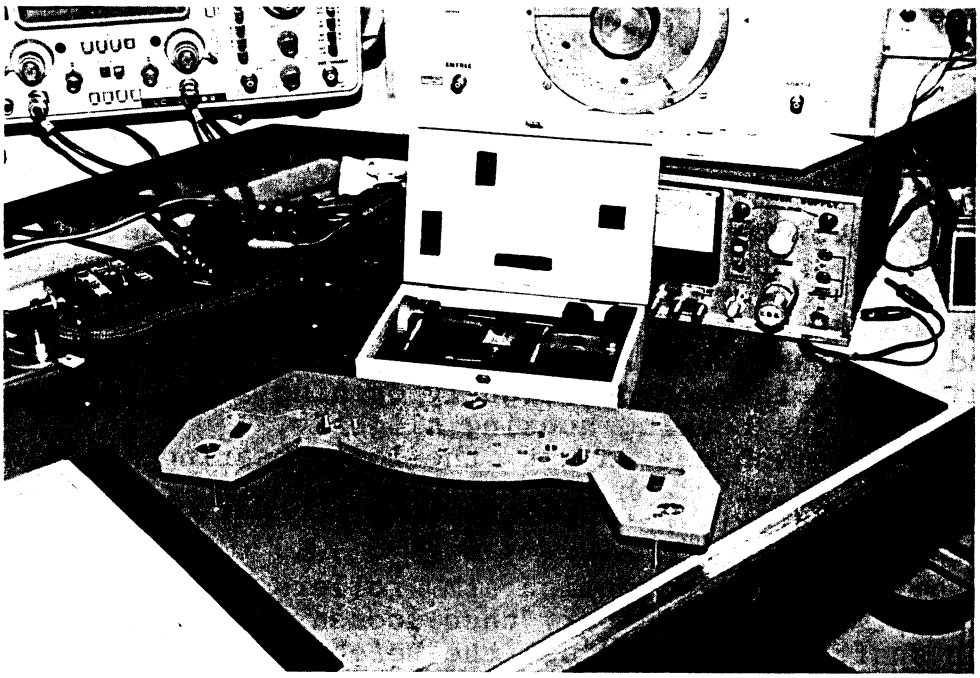
Check the height of all four rotating guides as shown on photograph 17. If adjustment is necessary, remove the black plastic cover on the rotating guide (two screws) and loosen the fixing screw of the upper bearing housing. Then open the tape deck and adjust the height of the lower bearing housing by turning it with a screw driver as shown on photograph 18. Tighten the fixing screw of the top bearing housing being sure to leave a small vertical play on the roller shaft. Re-check the height and adjust again if necessary. Once correctly adjusted protect the lower bearing housing with a small amount of Loctite, to be sure that it does not change. Check finally that the roller spins freely and silently in both directions.

NOTE : On older machines the lower bearing housing was not threaded and was fixed in place with a large circlip. In this case the adjustment is made by slightly opening the circlips and then rotating the bearing housing slightly.
On newer machines adjust the lower bearing housing only as shown in photograph 18 without removing the black plastic cover as this is not necessary.

Check the height of both tension arm rollers as shown on photograph 19. If adjustment is necessary then loosen the Allen screw holding the roller shaft and then adjust the height, as shown on photograph 20. Then check that the roller spins freely and that there is a tiny vertical play on the roller shaft itself.to adjust the play , remove the roller cover and adjust the amount of play with the position of this cover.

Check the squaring of both capstan shafts, using the special guage as shown in photograph 21. The capstan shaft squaring should always be assured by the tolerances of the relevant motor, the motor ball bearing, the capstan motor mounting plate and capstan shaft bearing bracket. Thus unless there has been a serious shock to this area it should not need adjusting. If however this is the case, then carefully examine all the mechanical parts and sub-assemblies involved and try changing the motor bearing. (see service manual).

Check the height of all the heads by running a transparent tape. If head height is still necessary repeat the adjustments above. Actual head height adjustment is done by changing the azimuth discs which have different thicknesses in increments of 0.03 mm. Their part numbers run from 01 09155 020 to 01 09155 029. (see spare parts list) For the time code head repeat the height and squaring adjustments until specification is met. (refer to service manual).



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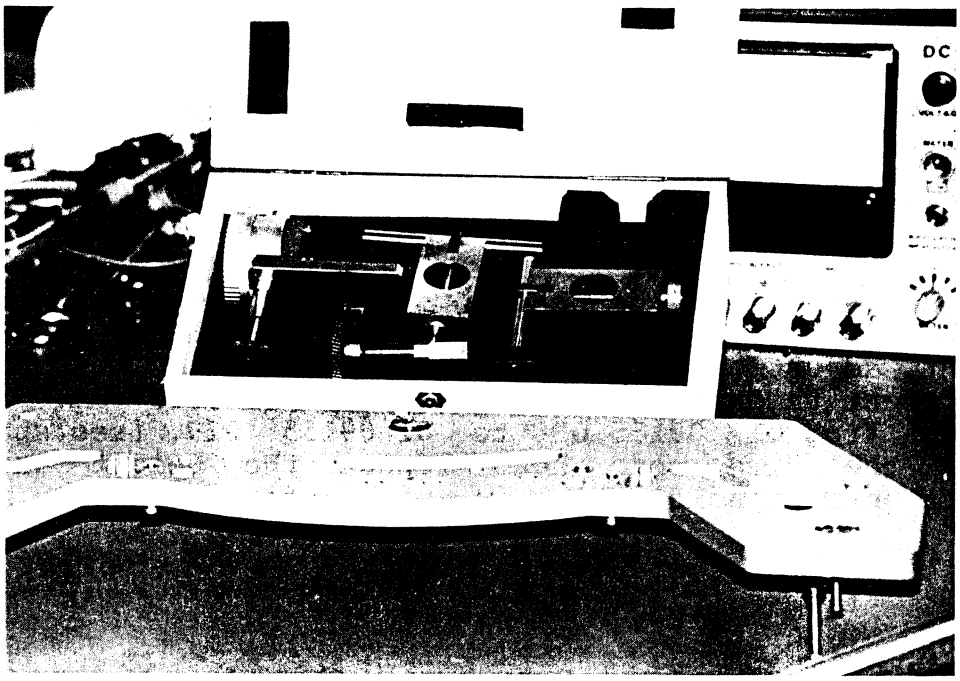

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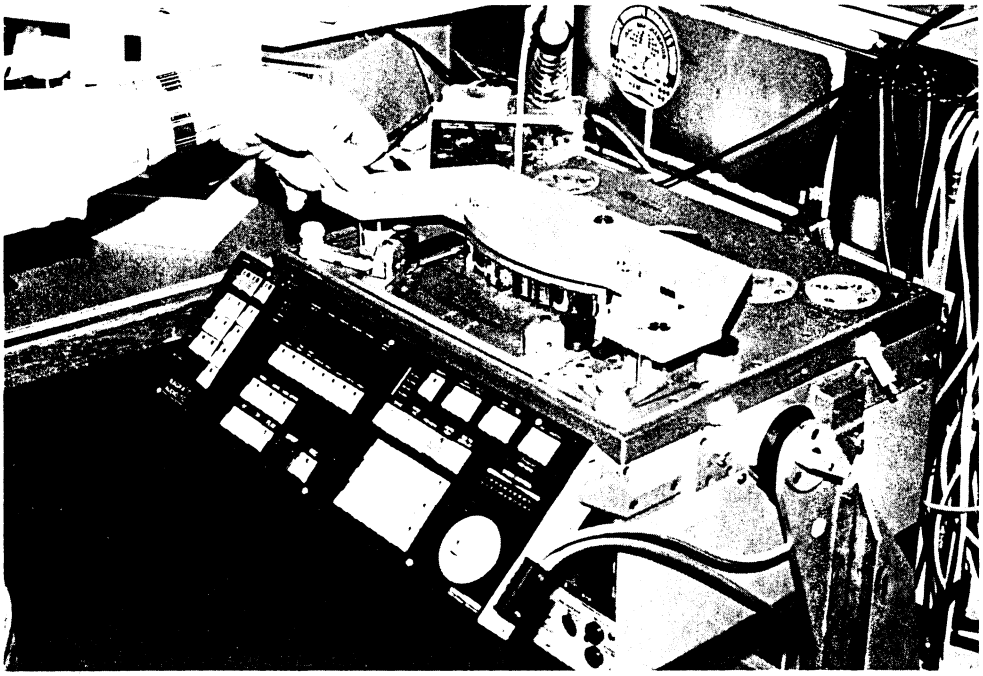

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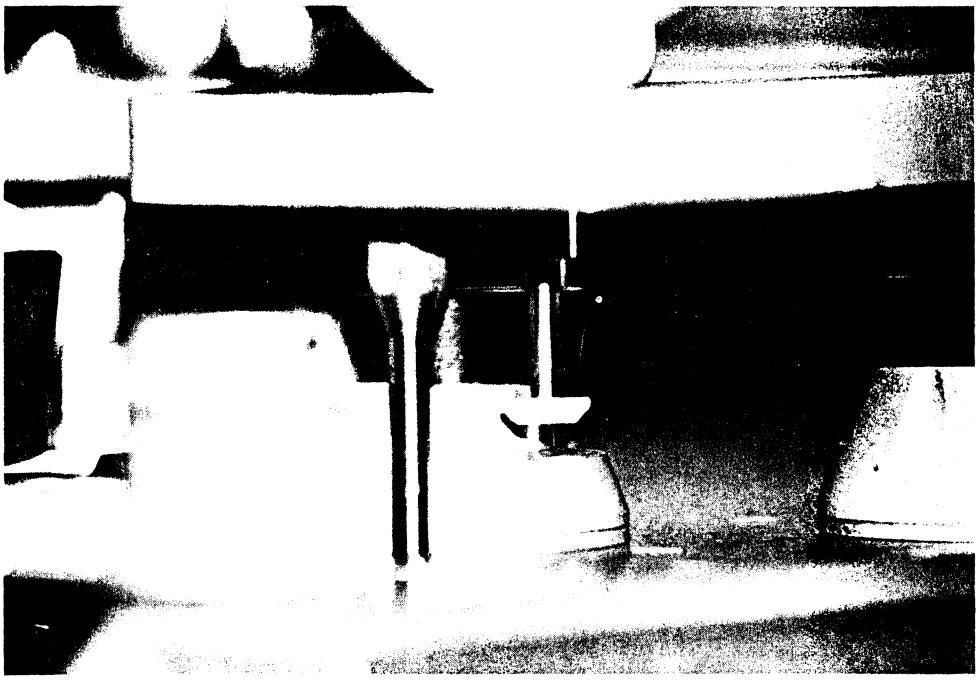

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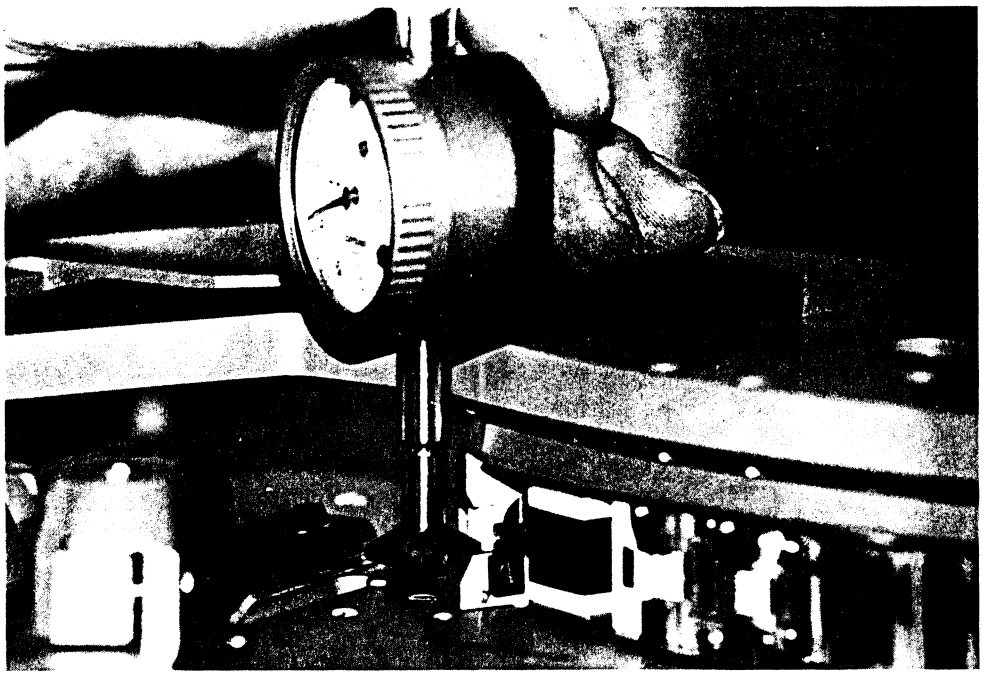

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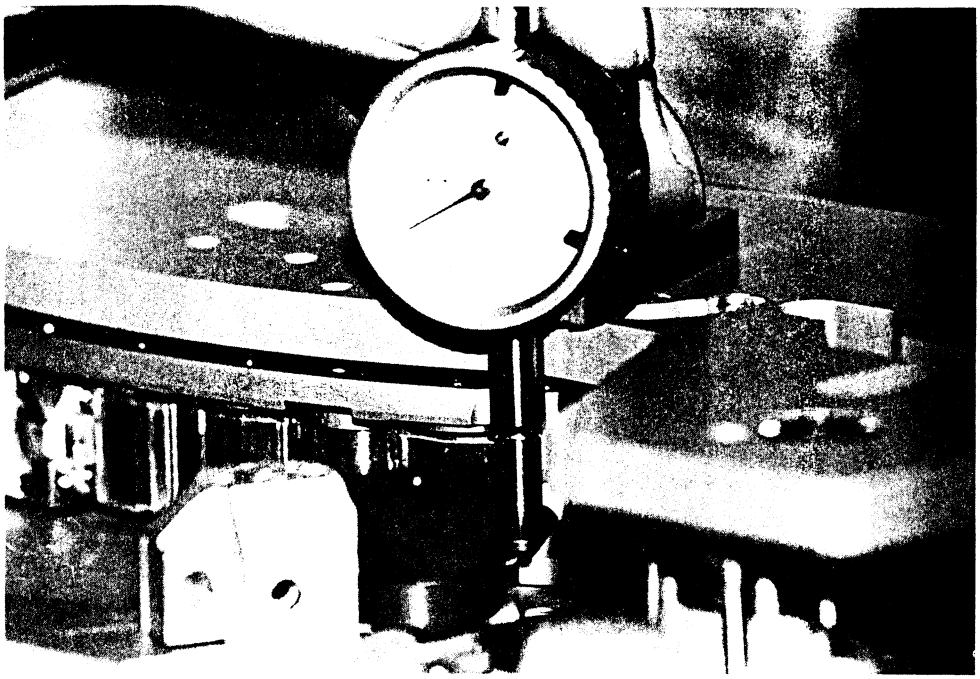

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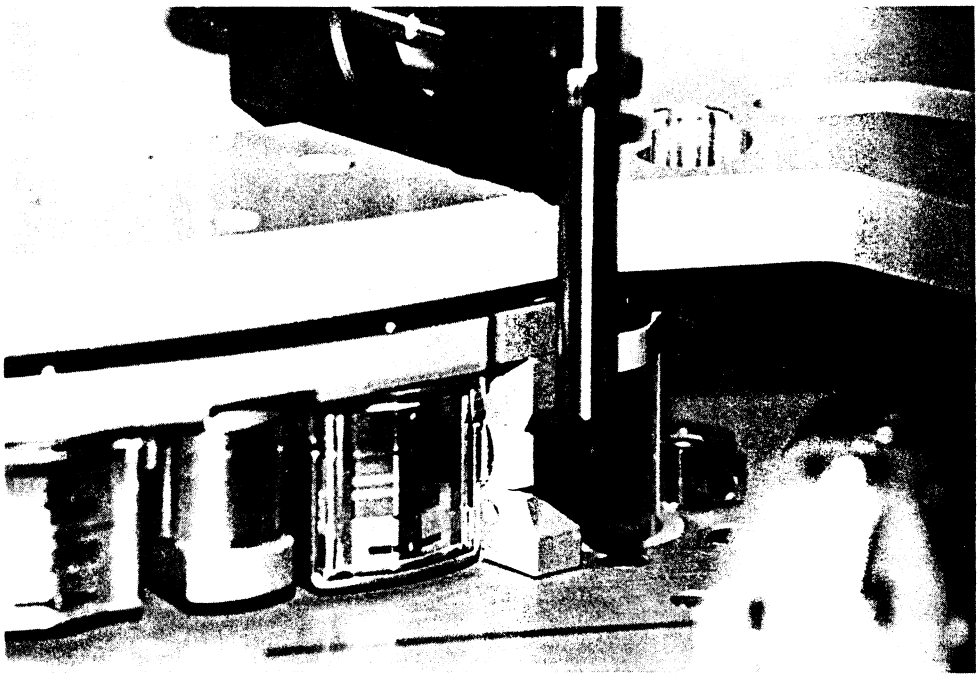

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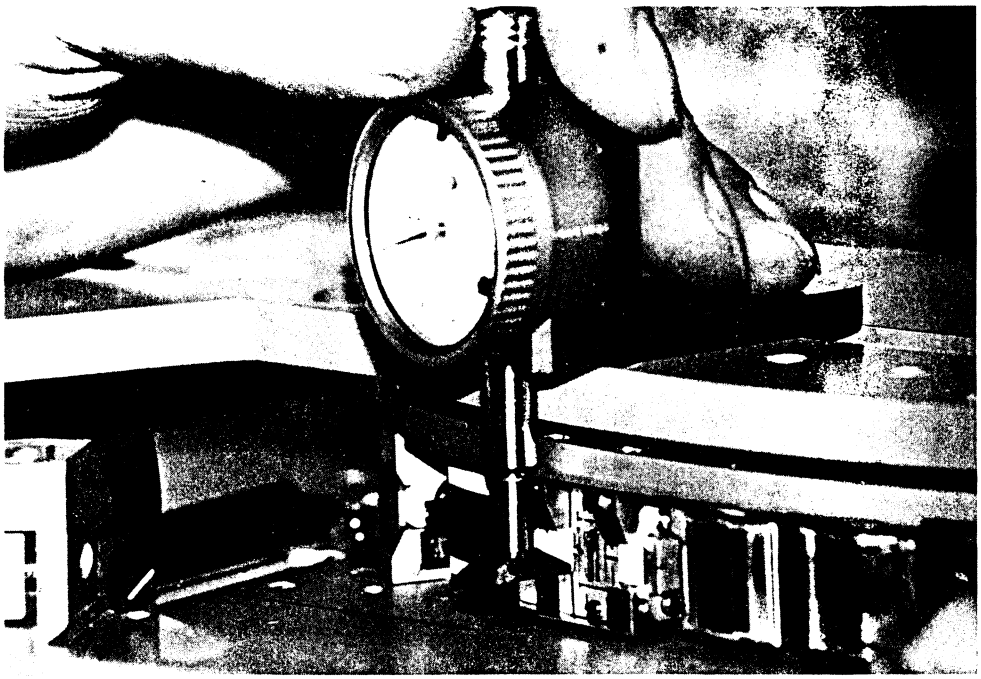

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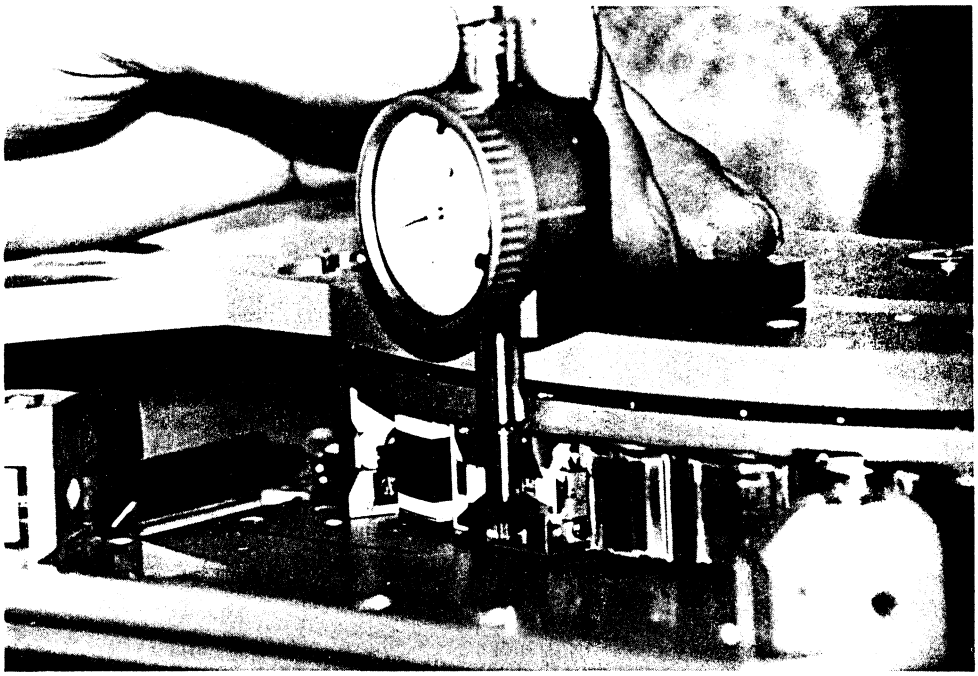

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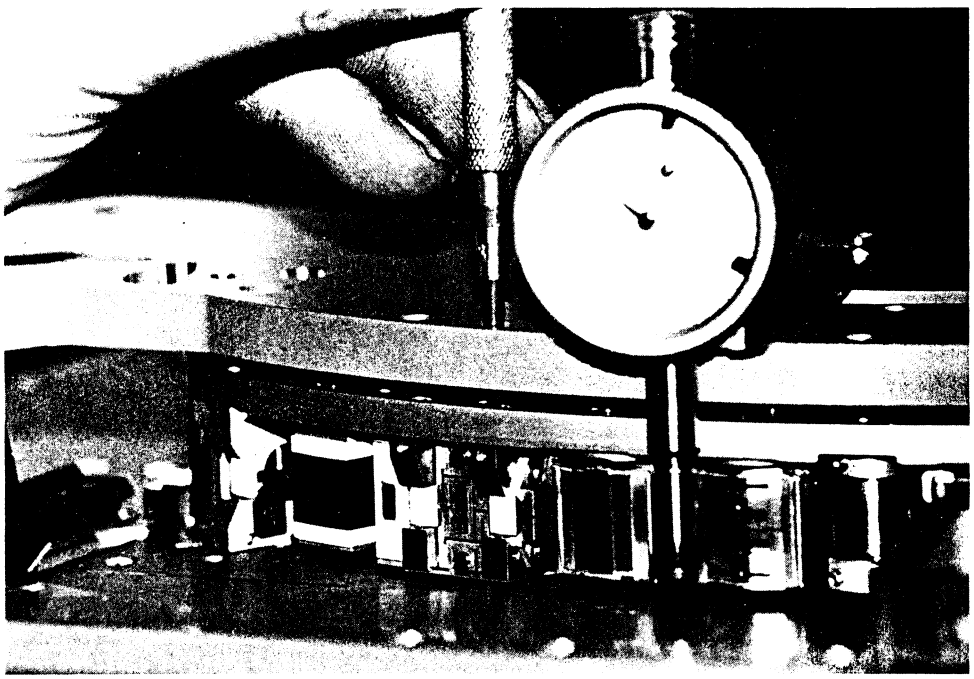

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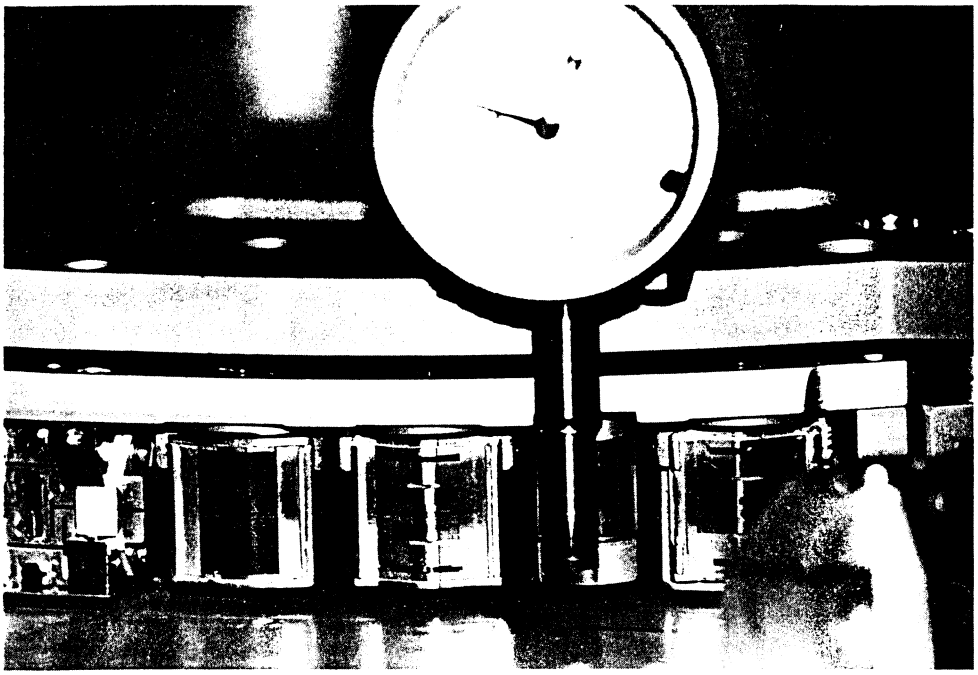

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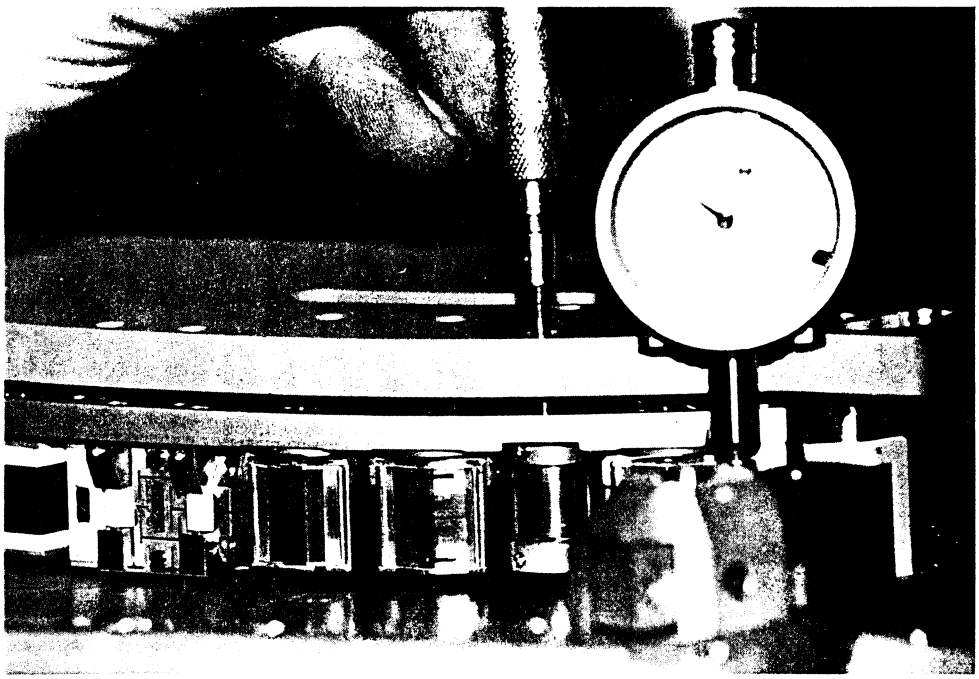

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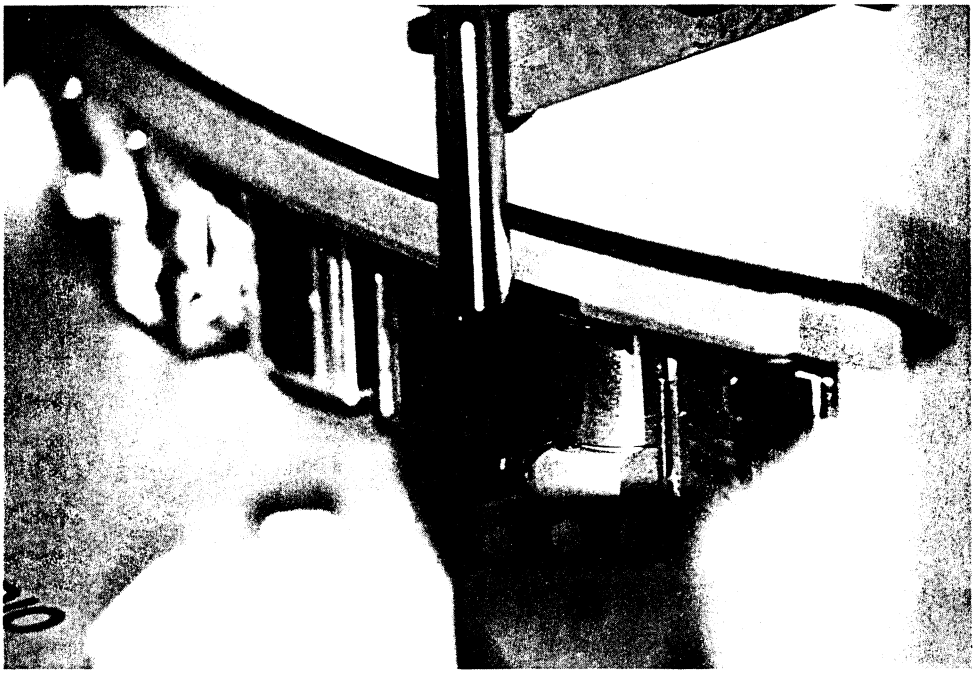

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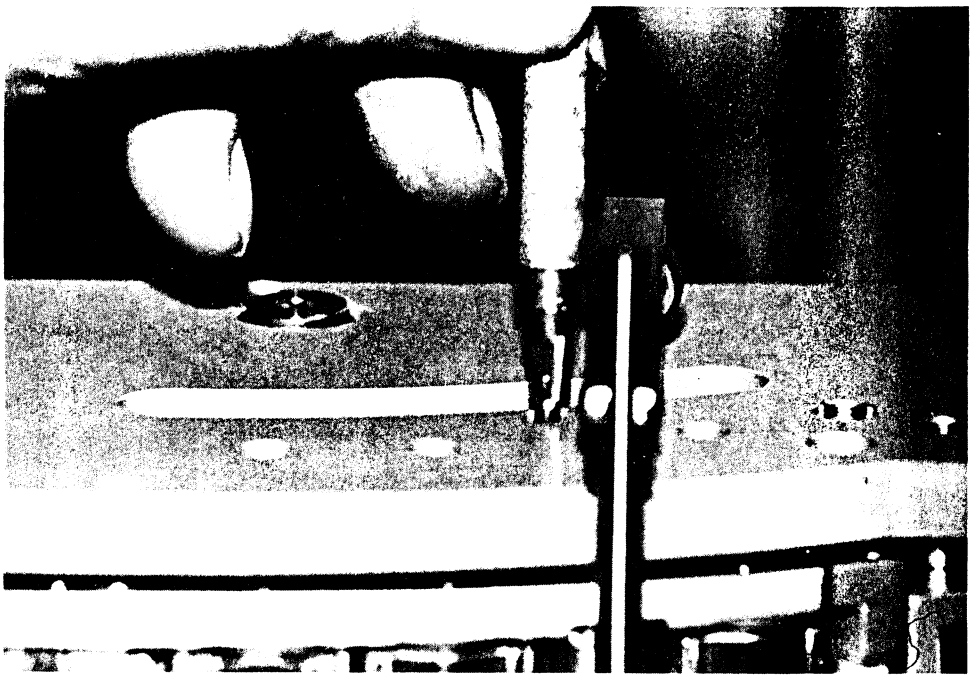

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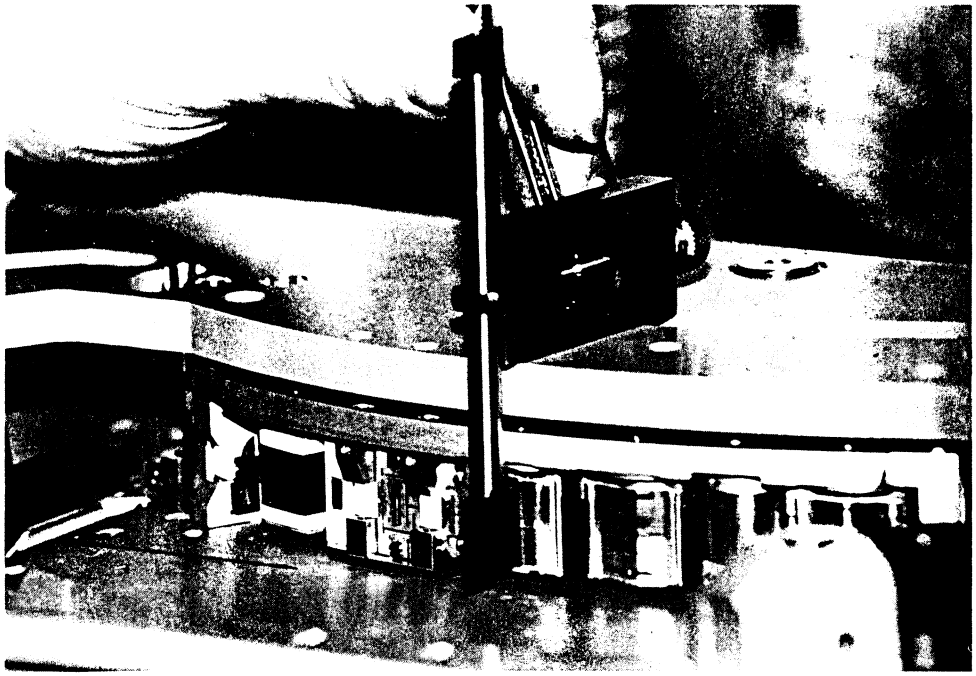

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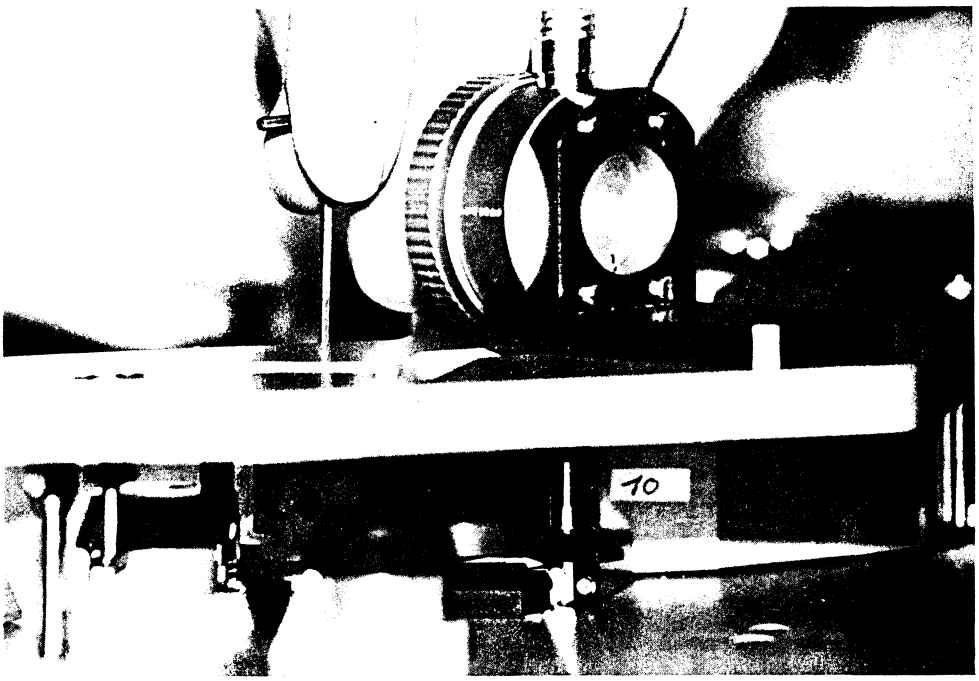

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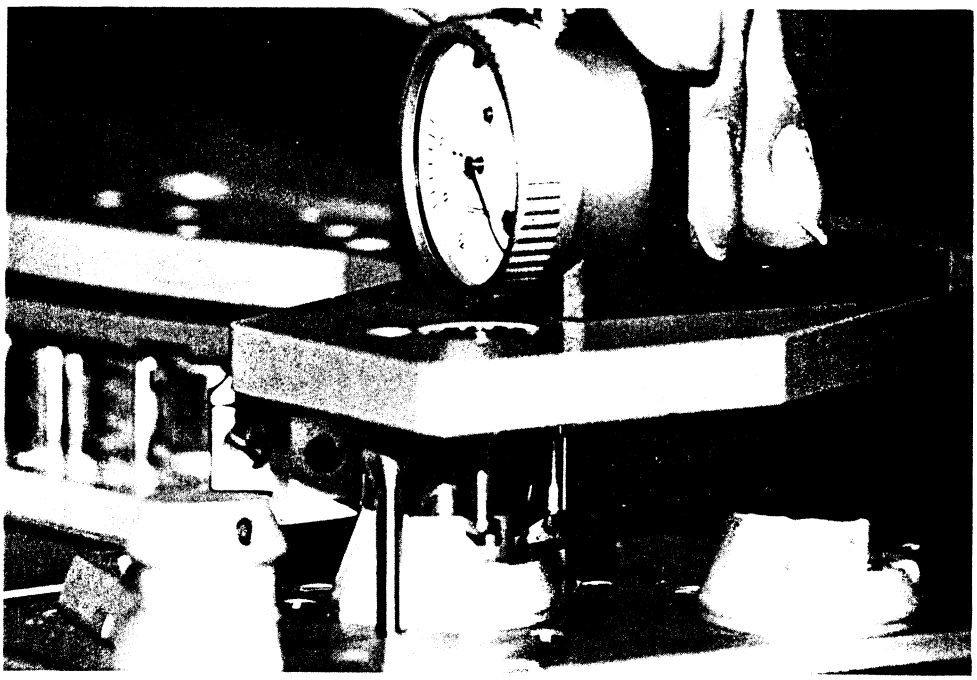

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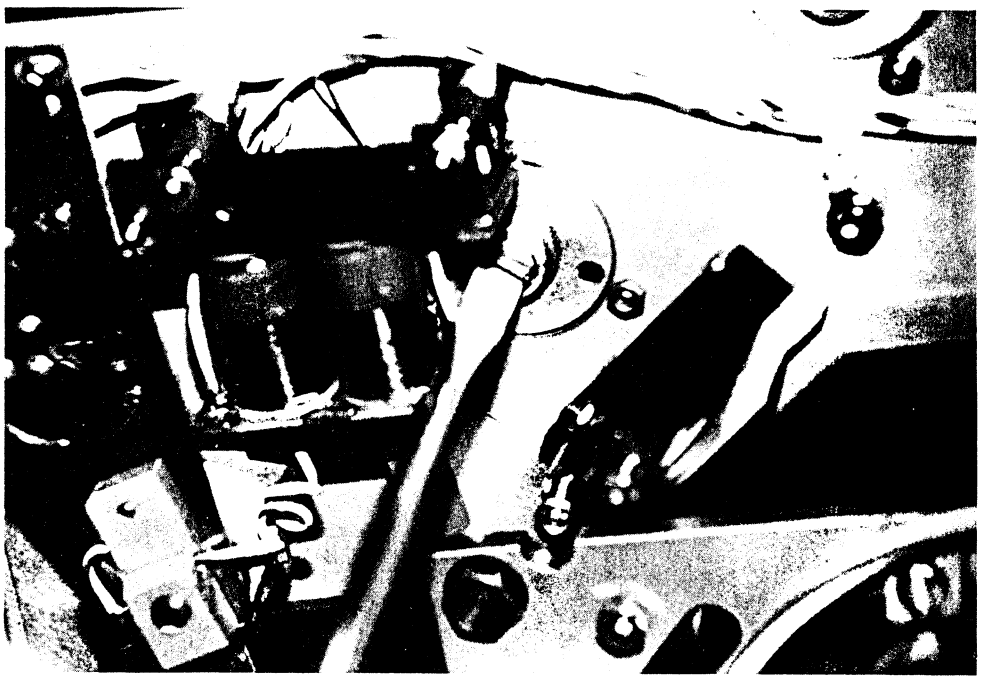

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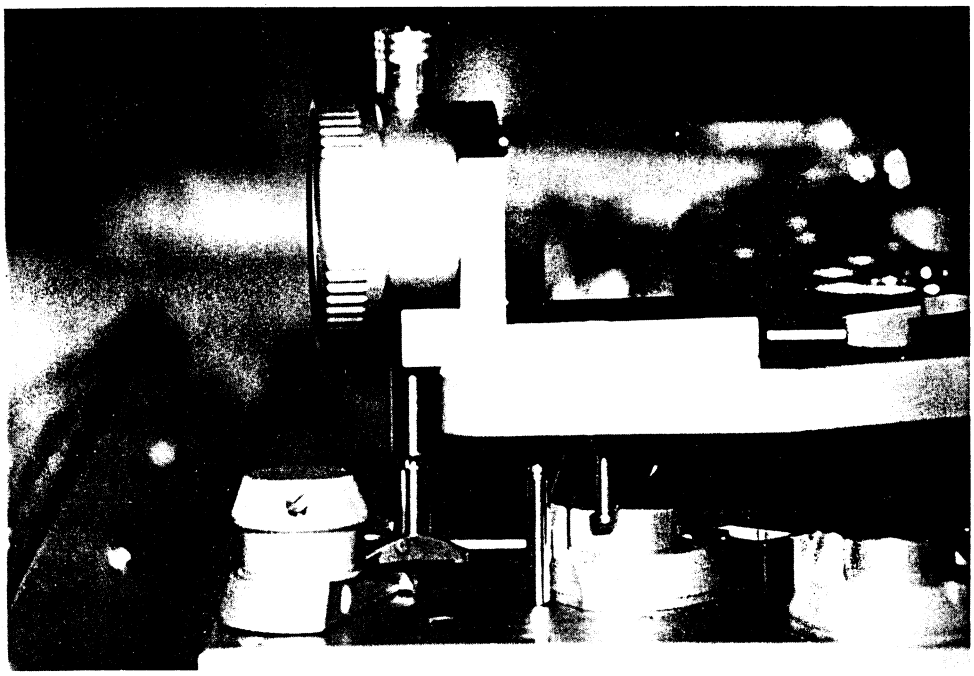

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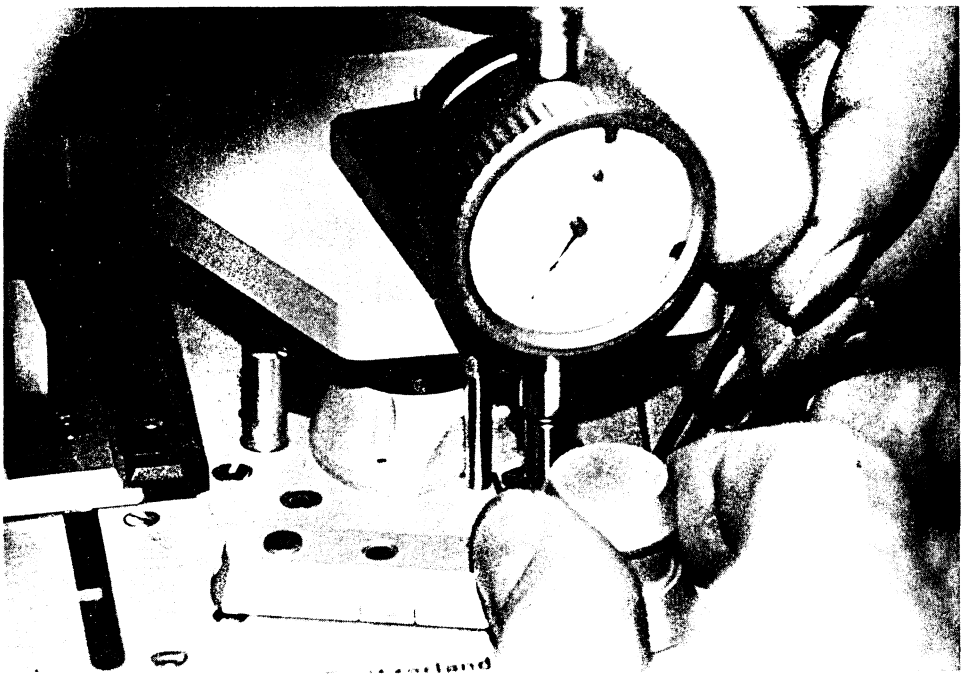

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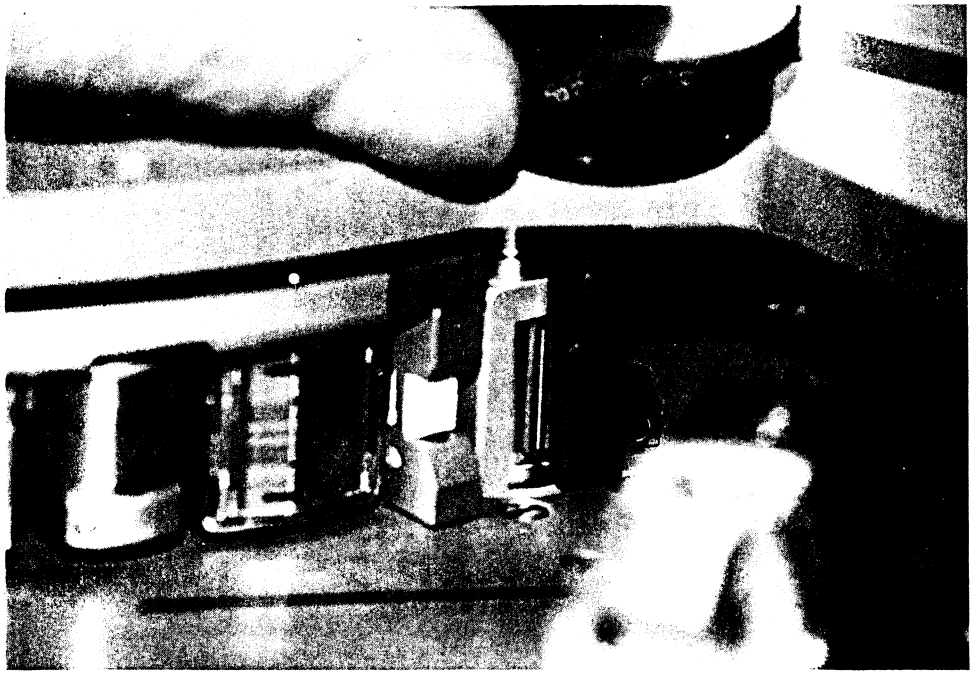

21

PRODUCT: NAGRA T - AUDIO TIME CODE DATE: JUNE 1988

SUBJECT: INSTALLATION OF THE TASIM-2 SELF SYNC AMPLIFIER (09372)

N° 09-16

The introduction of the new TASIM-2 self sync amplifier has called for some modifications to the audio circuits A 01 and the speed stabilizer circuit A 03. The necessary parts for these modifications are in the kit (P/N 71 09041 000) including the TASIM-2 circuits.

2 X 91 09374 000	TASIM-2 circuits
2 X 01 09374 002	Insulation for circuits
1 X 01 09340 008	Shielding for relay
6 X 30 01022 536	Fixing screws
1 X 71 09108 100	Recording head shield
1 X 09-16	Technical Information sheet
1 X MANUAL	Calibration instructions

MODIFICATION OF AUDIO CIRCUITS A 01

The following modification applies only to the T-Audio machines carrying the serial number lower than 0900660. Machines carrying a serial number equal to or higher than 0900660 are fitted with a new logic board (P/N 91 09345 100 which generates two separate "record head enable" signals (one for each channel) and therefore do not require the same modification.

T-Audio machines with their serial number between 0900575 and 0900660 have a wire connecting XA1 P1-7 to P1-16b which must first be removed.

The new TASIM-2 circuit requires an additional signal in order to cut its input while the bias is being applied to the recording head. This signal is the inverted "Record head enable" generated by pin 13 of integrated circuit U4 on A01-A4.
Make a connection between the connector XA1 P1-7 and the common point of the resistors R 18 and R 19, using a short piece of enameled copper wire (diameter 0.3 mm) (P/N 42 18833 030) according to the following diagram:

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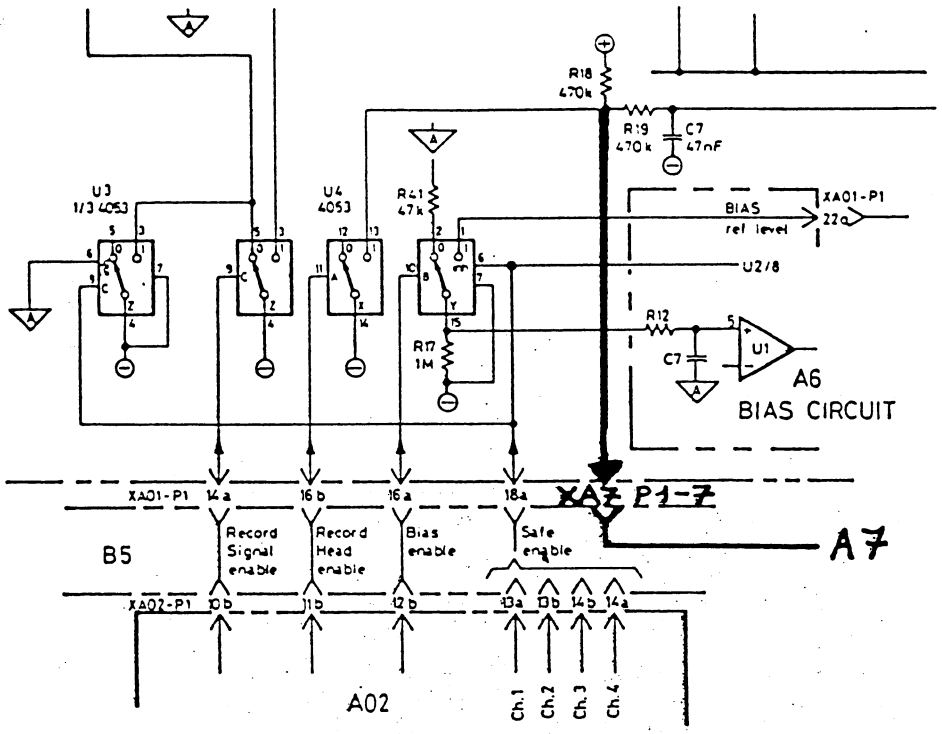
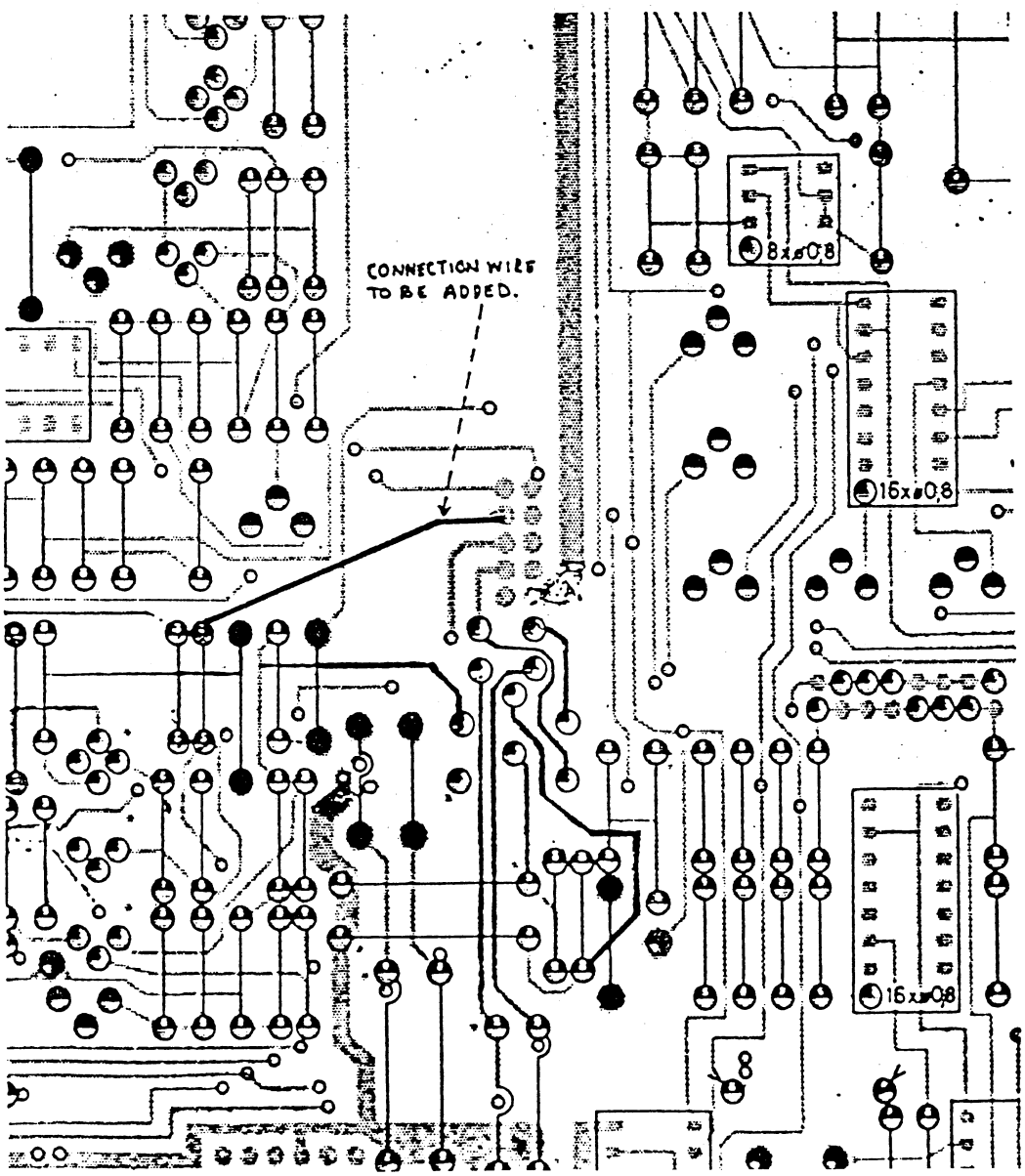

R18
470k
R19
470k
C7
47nF
U3
1/3 4053
U4
4053
R41
47k
BIAS
ref level
XA01-P1
22
U2/8
R12
C7
U1
R17
1M
A6
BIAS CIRCUIT
XA01-P1
14a
16b
16a
18a
XA7 P1-7
A7
B5
Record
Signal
enable
Record
Head
enable
Bias
enable
Safe
enable
XA02-P1
10b
11b
12b
13a
13b
14b
14a
A02
Ch.1
Ch.2
Ch.3
Ch.4


CONNECTION WIRE
TO BE ADDED.
8x⌀0,8
16x⌀0,8
16x⌀0,8

MODIFICATION OF THE TASIM-2 CIRCUITS.

The following modification only applies to machines with serial numbers lower than 0900660 (see previous modification)

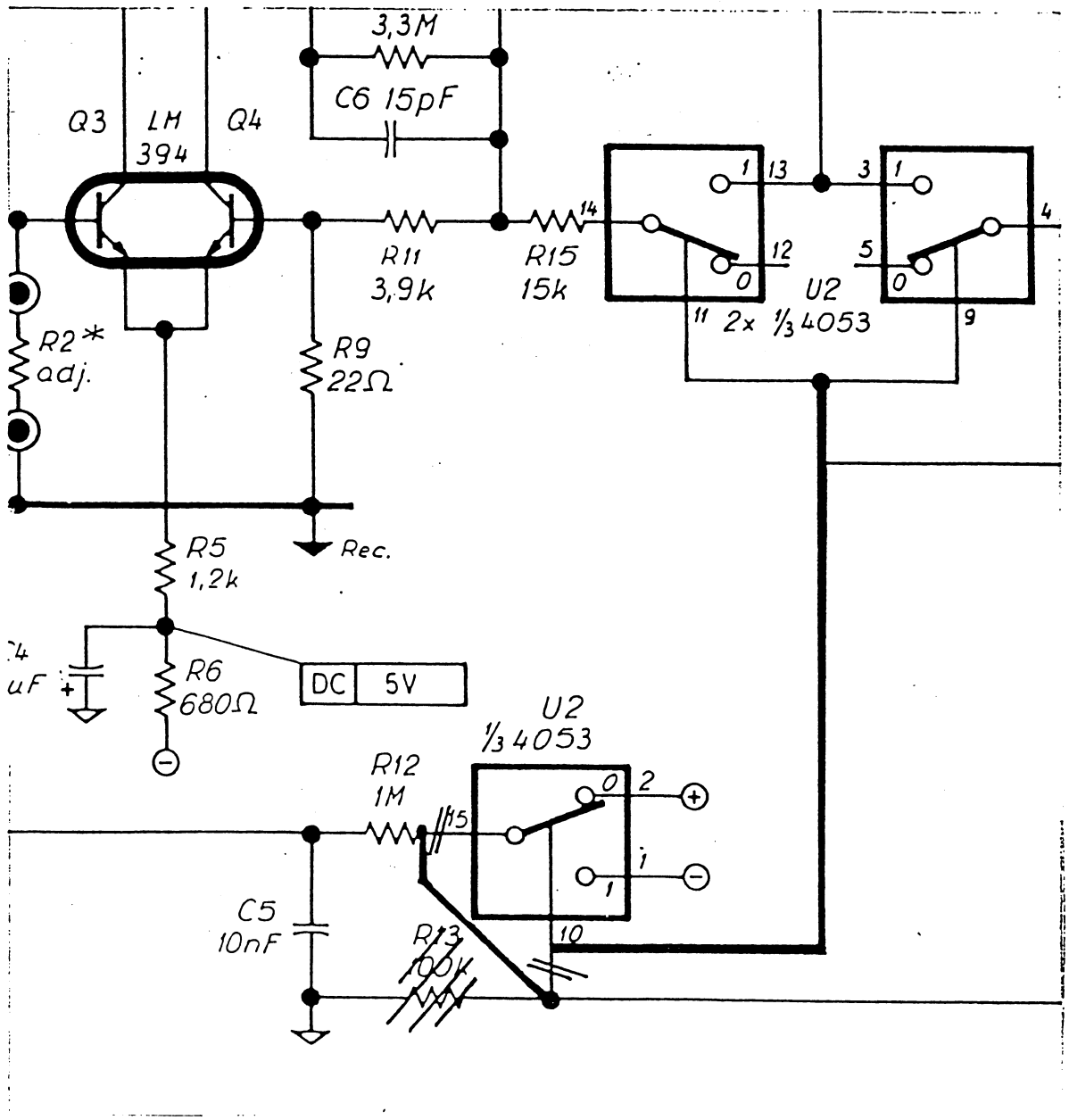
In order to be compatible with the inverted "record head enable" signal, the following changes must be made:

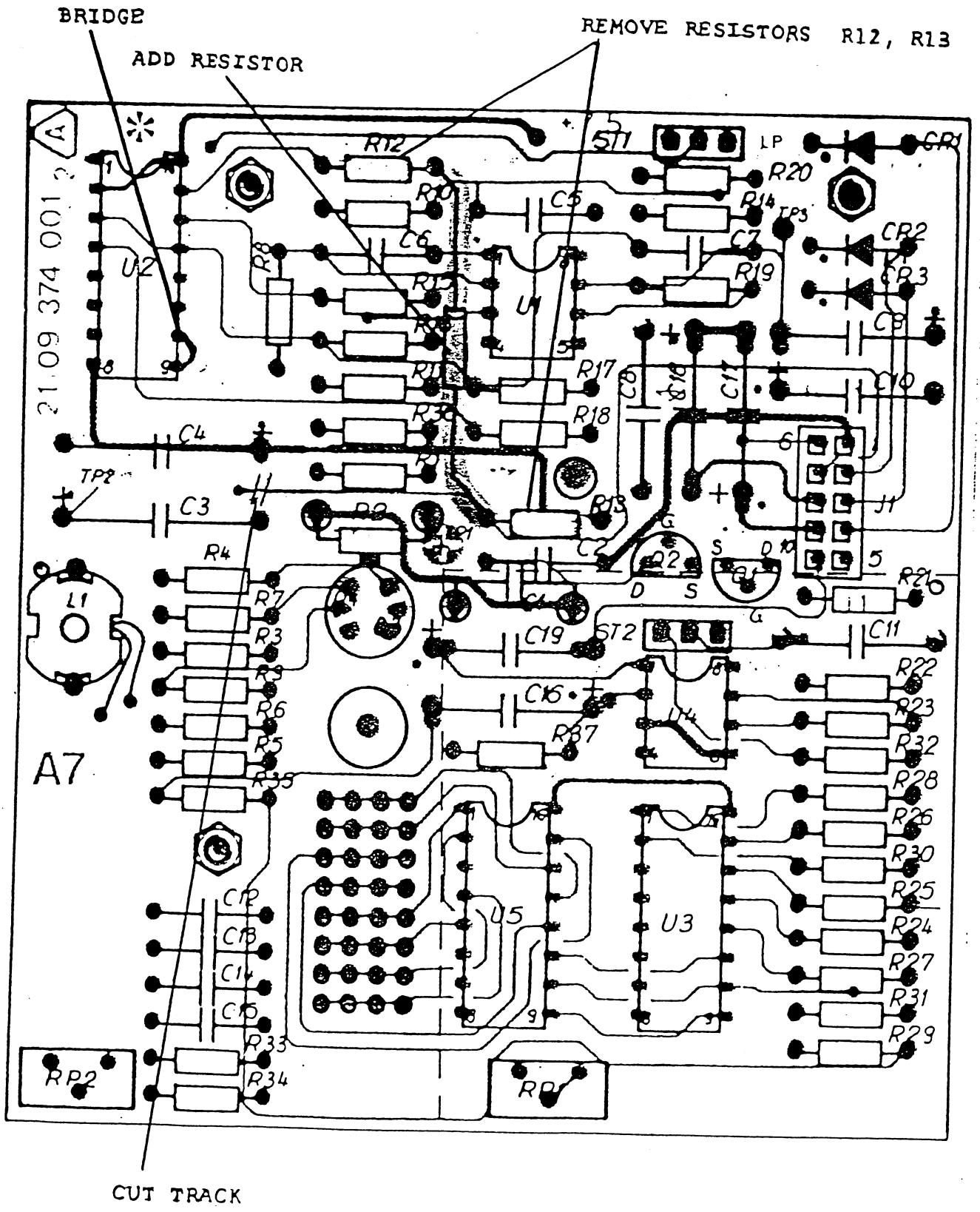
Remove resistor R 13 (100 kΩ)
Remove resistor R 12 (1 MΩ)

Solder a new resistor of 1 MΩ (P/N 55 53443 100) between the gates of Q1 / Q2 and the connector XA7 P1-7 as shown on the following diagrams. This resistor replaces the old resistor R 12. Care must be taken to properly insulate both ends of this resistor to avoid any possible short circuits.

Cut the track connecting pin 10 of U2 to the old resistor R 13 as shown on the following diagrams.

Connect pins 9 and 10 of U2 together to avoid leaving an open input to the CMOS circuit.

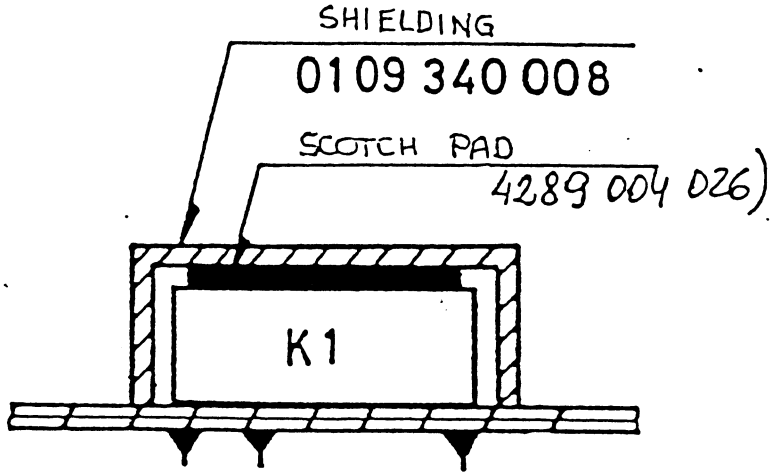



BRIDGE
ADD RESISTOR
REMOVE RESISTORS R12, R13
CUT TRACK
A7
21 09 374 001 2
R12
R20
C5
C6
R19
C7
CR1
CR2
CR3
C9
C10
C8
C11
R17
R18
C4
TP2
C3
R13
C2
J1
R21
L1
R4
R7
R3
R6
R5
R35
C19
ST2
C16
R37
C11
R22
R23
R32
R28
R26
R30
R25
R24
R27
R31
R29
U5
U3
C12
C13
C14
C15
R33
R34
RP2
RP1

MODIFICATION OF SPEED STABILIZER CIRCUIT A 03
(91 09340 000)

The following shielding is already installed ex-factory on all T-Audio machines carrying serial number higher than 0900585.

The improved signal-to-noise ratio of the TASIM-2 makes it more sensitive to the hum radiated from the relay located on the speed stabilizer circuit A 03. In order to reduce the amount of hum picked up by the TASIM-2 (particularly channel 2) a new shielding for the relay is provided.
Fix the shielding (P/N 01 09340 008 onto the relay K1 by means of the scotch mount (P/N 42 89004 026) (length 25 mm) as shown below.



In order to take the full advantage of the signal-to-noise ratio provided by the TASIM-2, check finally that the pinch wheel carriage is fitted with a shielding (P/N 71 09108 100) in front of the recording head.

PRODUCT: **PARALLEL INTERFACE TAERP** DATE: **JUNE 1988**

N°
09-17

SUBJECT: **INHIBITION OF THE REMOTE CONTROL FUNCTIONS WHEN THE KEYBOARD SWITCH IS IN "LOCAL"**

These modifications are to disable the operation of the TAERP parallel remote control interface when either the LOCAL / REMOTE switch S1 on a TACA-TC keyboard is switched to the LOCAL position, or if a TACA-TC2 keyboard is fitted the status is LOCAL.

Parts needed : 1 X 1N 4148 Silicon diode (P/N 51 16002 000)
1 X 220 kΩ Resistor (P/N 55 27162 224)

On the CPU circuit connect the anode of the 1N 4148 diode to the junction of resistor R1 (10 kΩ) and the base of the transistor Q1 (MMBT 222A). Solder the cathode of the diode to the keyboard enable line on ST 6 as shown in the circuit diagram overleaf.
Then solder the 220 kΩ resistor between the cathode of the 1N 4148 diode and the +5 V power supply (pin 9 of connector J1).

On the INPUT / OUTPUT ports circuit connect a wire between W2-6 (keyboard enable line) and the soldering pad (labeled A) next to BJ 1 (9 pin connector also marked keyboard enable)

These modifications mean that whenever the "keyboard enable" line is grounded (by the keyboard of the machine being in the "LOCAL" position) the TAERP is inhibited from passing commands onto the serial bus of the T-Audio.

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PRODUCT: T-AUDIO TIME CODE **DATE:** AUGUST 1988

SUBJECT: REDUCTION OF THE CURRENT CONSUMPTION OF THE TIME CODE CIRCUIT A 05

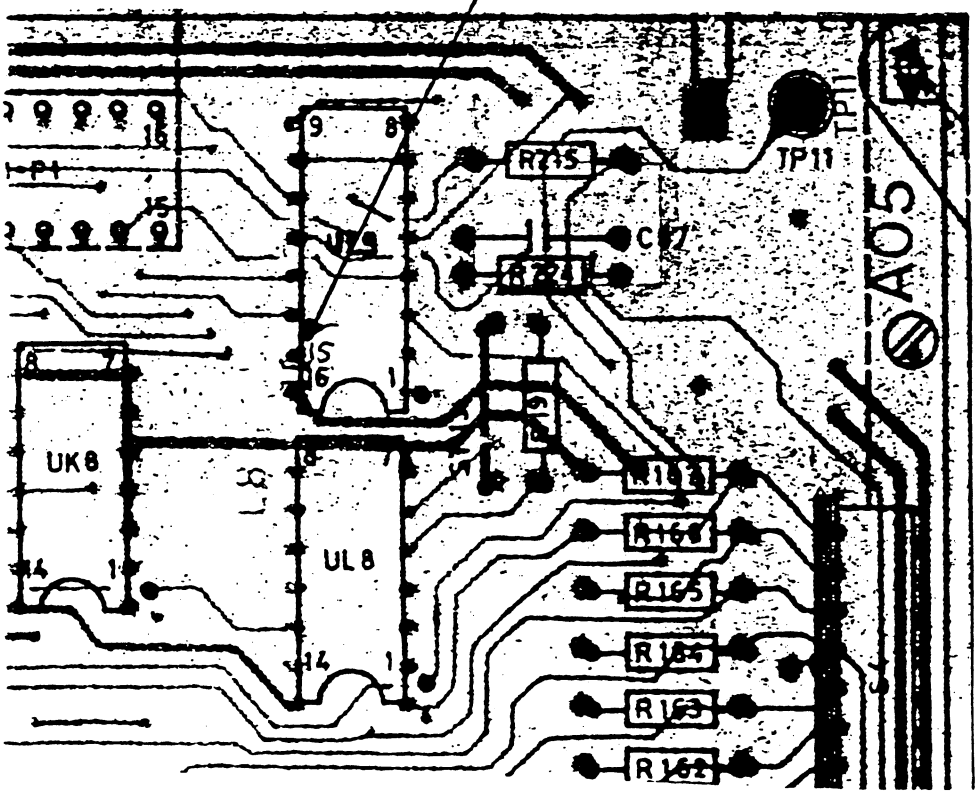
N° 09-18

The following modification reduces the current consumption of the time code circuit of the T-Audio by 25 mA. This modification is valid for all circuit boards carrying index C, D and E only.

Pin 15 of UL 9 which is not used is currently connected to pin 16 which is the + 5 V.

MODIFICATION

Cut this link by cutting the pin 15 of UL 9. On A05-A22



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PRODUCT: T-AUDIO TIME CODE **DATE:** SEPT 1988

SUBJECT: ACTIVATION OF THE "MUTING ENABLE" IN THE MODE "LISTEN TIME CODE"

N° 09-19

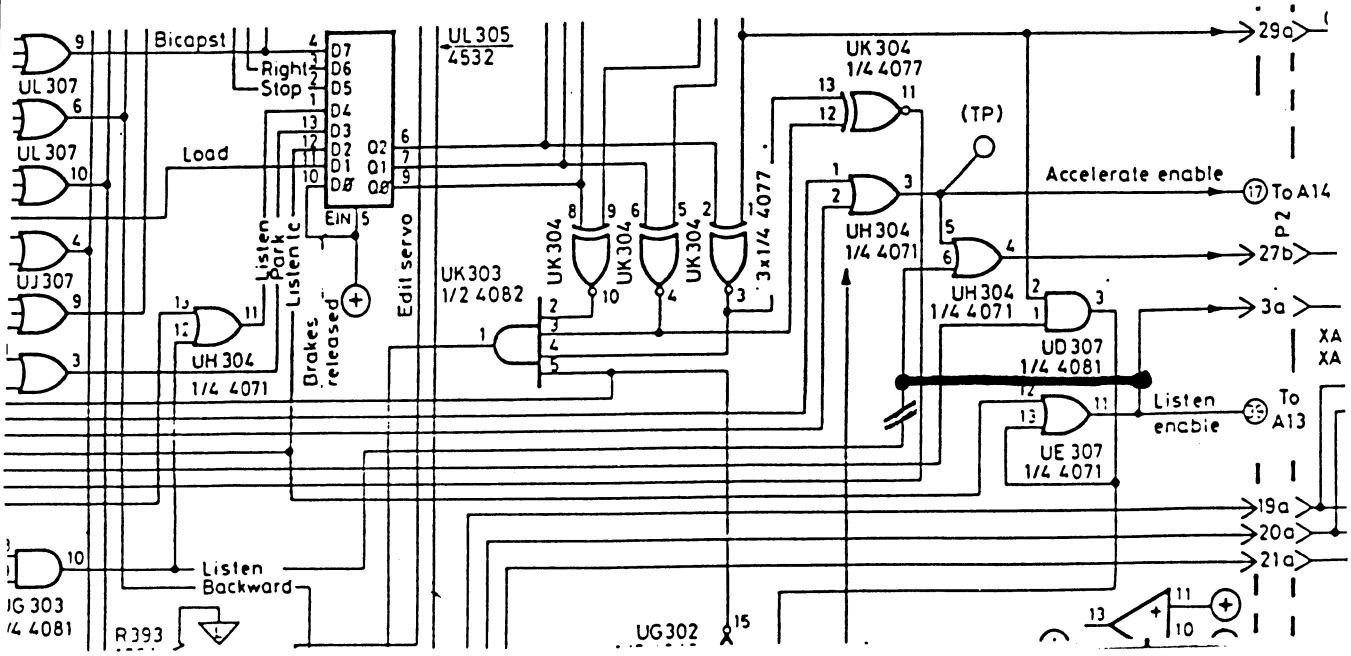
AIM

This modification will allow the muting of the audio outputs during SHUTTLE, GOTO DISPLAY, and other locating features. It is valid for all machines carrying serial numbers lower than 0900697 inclusive.

Modification of the Main control logic (91 09345 000) A02 A15.

PROCEDURE

Unsolder and lift up the pin 6 of the integrated circuit UH 304 and then rejoin this leg to pin 11 of UE 307 by means of a small piece of insulated wire (42 08115 555). As shown on the layout overleaf. Once the wire is in place glue it to the circuit board with a little Araldite.



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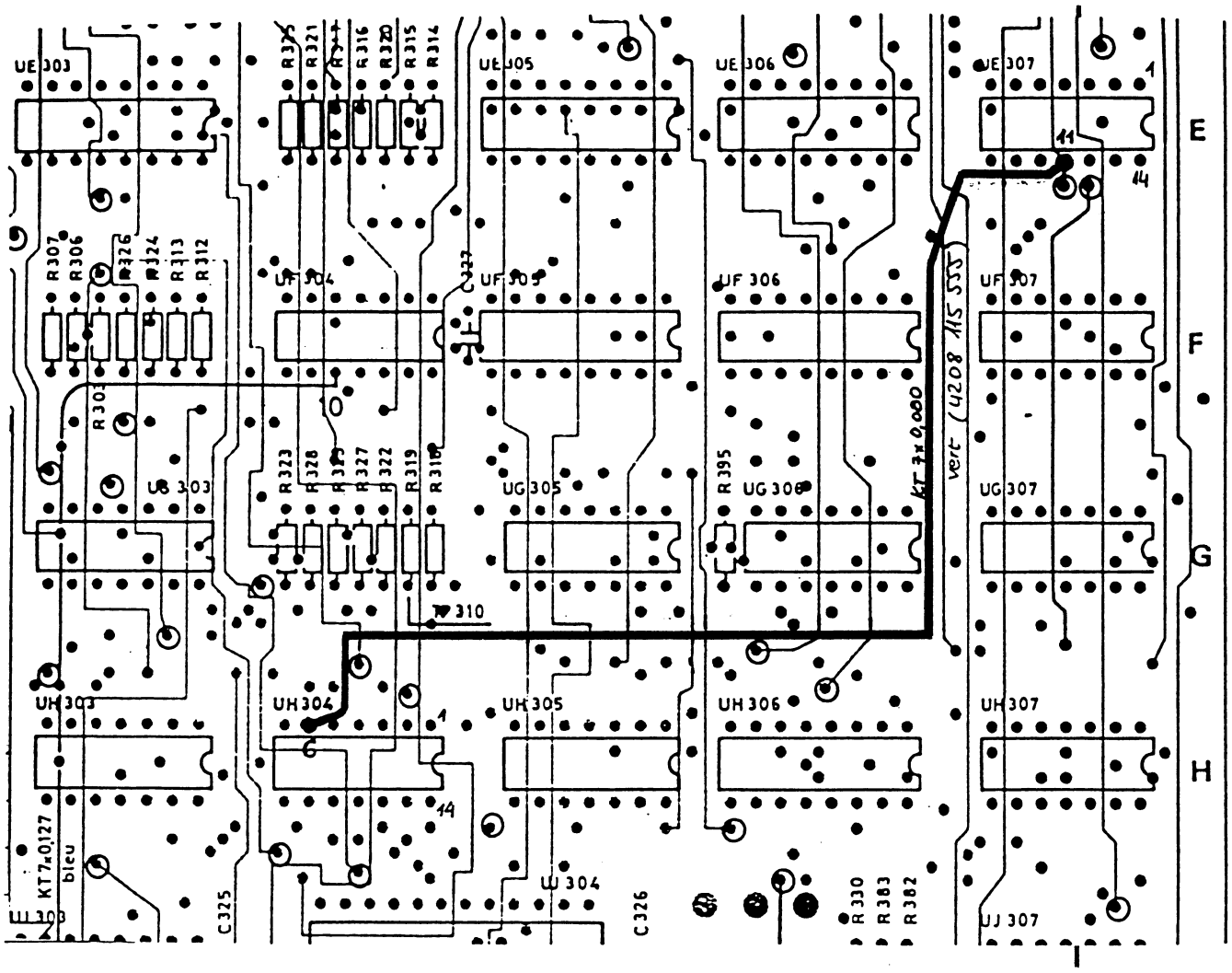
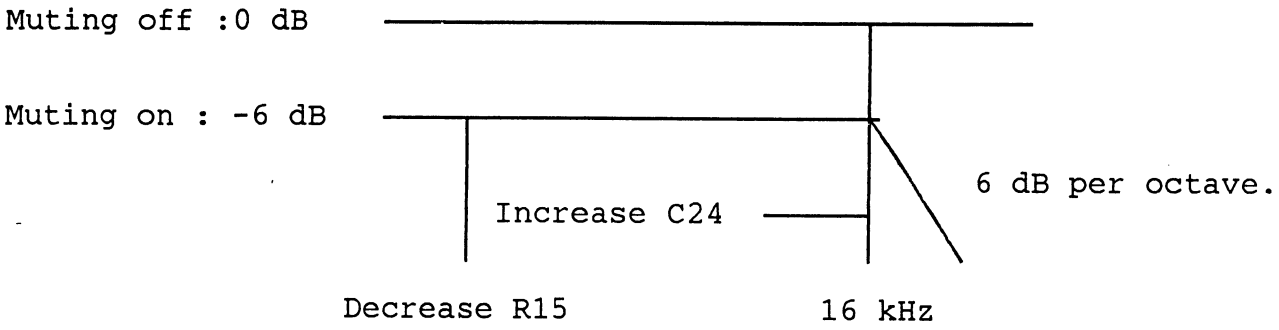

UE 303
UE 305
UE 306
UE 307
UF 304
UF 305
UF 306
UF 307
UG 303
UG 305
UG 306
UG 307
UH 303
UH 304
UH 305
UH 306
UH 307
UJ 304
UJ 307
R 307
R 306
R 326
R 324
R 313
R 312
R 323
R 328
R 327
R 322
R 319
R 318
R 395
R 330
R 383
R 382
C 325
C 326
C 332
KT 7x0,127
bleu
KT 3x0,000
vert (4208 MS SSS)
E
F
G
H
1
11
14
6

Low Frequency - line output A01-A9 modification valid for all versions of audio circuit 91 09365 000.

Modification of the audio circuit A01 A9

The amount of attenuation of the audio outputs by the activation of the signal "muting enable) can if needed be increased if considered insufficient during fast winding modes. Actually the "muting enable" creates a drop in level of 6 dB at the output and filters the high frequencies after 16 kHz giving a loss of 6 dB per octave. Two components R 15 (presently 1.8 kOhms) and C24 (presently 10 nF) can be changed depending on the level and frequency curve required.



The problem is that the frequency spectrum goes rapidly towards the high frequency range during spooling. The increasing of the value of C24 to 100 nF (cut off frequency 1.6 kHz) will give good results and will be more acceptable for the tweeters during spooling and tape searches.

PROCEDURE

Replace C 24 (original value 10 nF) with a ceramic capacitor 0.1 uF. K.S.A. part no 53 41470 410 0.1 uF 20% 100V.

PRODUCT: T-AUDIO TIME CODE **DATE:** NOVEMBER 1988

N° 09-20

SUBJECT: PROCEDURE FOR THE ADJUSTMENT OF THE BELTS OF THE REEL MOTORS

Experience has revealed that the drive belts of the reel motors can be the source of noise in the form of severe vibrations which are clearly apparent during fast winding of the machine in either or both directions. This defect is due to the irregular cut of the belts by their manufacturer. (see photograph 1).
Due to the very high precision of our mechanical assemblies, this has proved to be a very disturbing factor which compels us to specifically select the belts and thus refuse a great many of them. In order to make sure the correct belts have been selected when changing the following method should be used:

When first mounting the belts check that they have a lateral play of 4 to 6 mm from one extreme to the other.(see photographs 2 and 3). Then before refitting the reel motor assembly to the T-Audio, feed a 30 V DC supply to the motor and make it rotate in both directions, by reversing the supply.
The following two points must now be checked:

ABSENCE OF ANY NOISE:

By using a stethoscope (or screwdriver as a form of stethoscope i.e. by pressing the blade onto the inner motor tightening screw and then pressing your ear to the handle), make sure that you cannot hear any noise (impression that the the belt is rubbing or catching). (see photographs 4 and 5).

CURRENT

Check that the current consumption is identical in both directions and does not exceed 80 mA.

Obtaining these situations by using the above method is not very easy. Satisfactory results may only be obtained after several trials and by slightly adjusting the belt tension each time. However, avoid either an OVER, or UNDER tension of the belt in order to prevent any mechanical malfunction.

- Overtension: If the belt is too tight then it will not stretch during the slowing down of the motor and the sudden direction change will be very severe on the motor itself and cause the motor spindle assembly to unscrew itself.

- Undertension: If the belt is not tight enough it will slip whenever the direction of spooling is changed or when stopping the machine from spooling. This will make a lot of noise and will damage the toothed belt.

In case the adjustement is not satisfactory, replace the belt and repeat the whole of the above proceedure once again.

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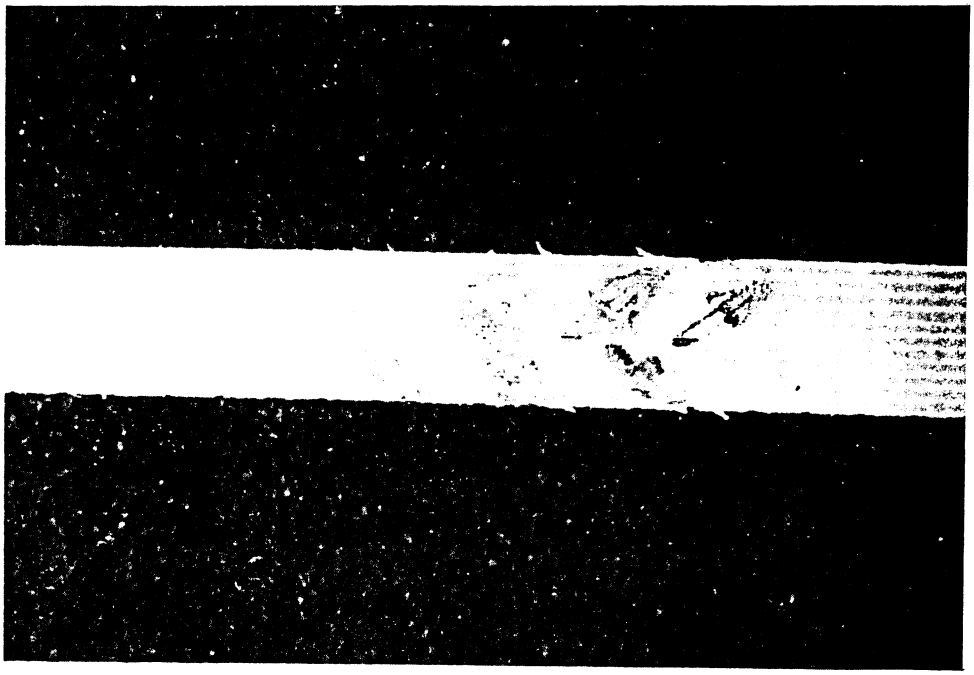
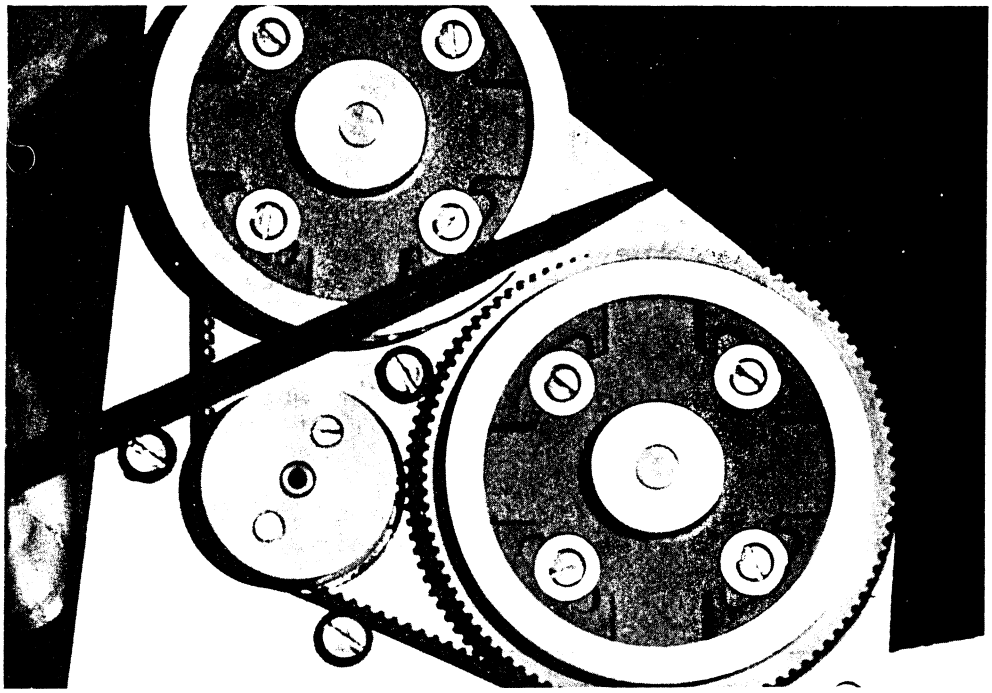
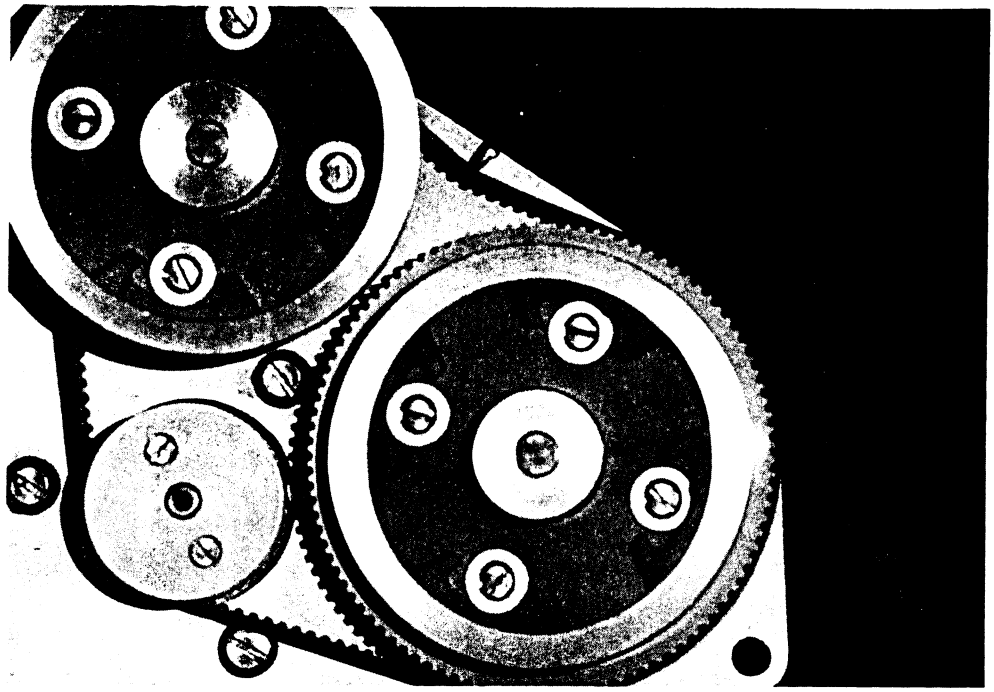


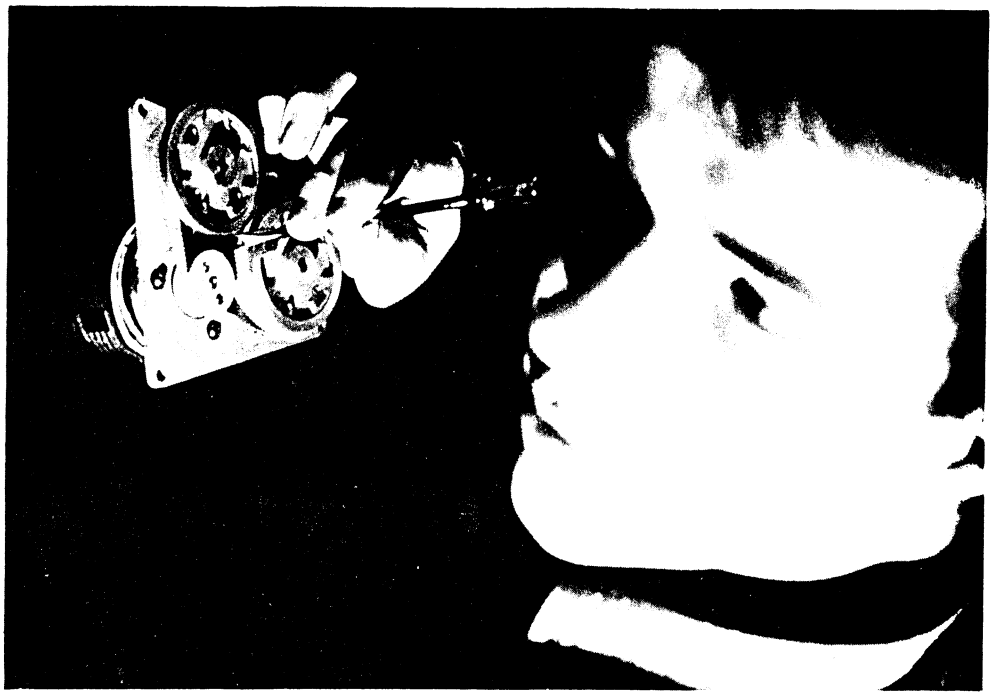
Photograph 1



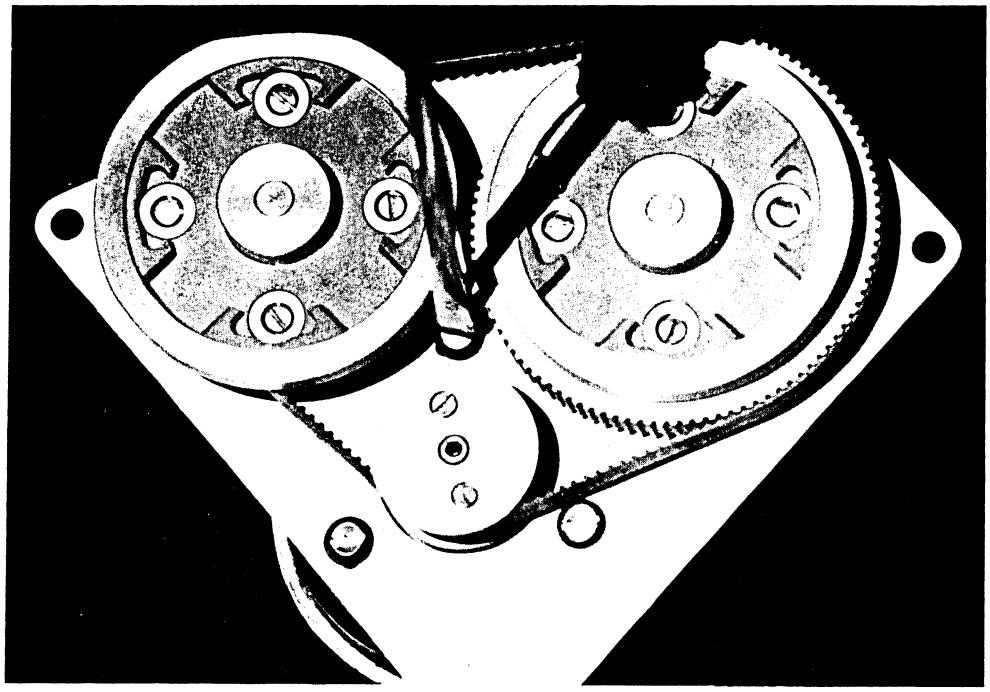
Photograph 2



Photograph 3



Photograph 4



Photograph 5

PRODUCT: T-AUDIO TIME CODE DATE: APRIL 1989

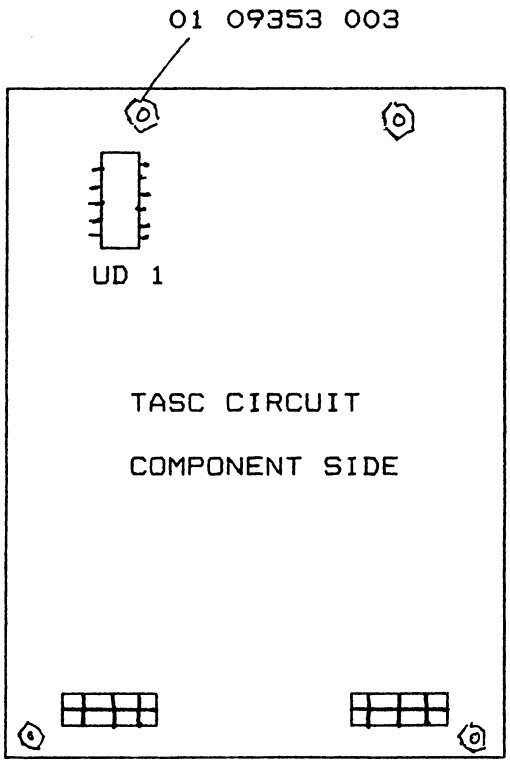
SUBJECT: MODIFICATION OF TASC FOR TIME CODE MUTE

N° 09-21

It has been noticed that on some TASC circuits one of the supporting pillars can touch a track on the time code circuit and cause a short circuit to earth. The effect of this is that the time code output mute mode will not function. This mode is used to prevent time code being fed to the time code output when the machine is not at nominal speed, when connected to an external synchronizer.

MODIFICATION

A new pillar part number 01 09353 003 must replace the pillar next to the circuit UD 1 on the TASC circuit. When looking at the component side of the circuit board with the two green connectors towards you, the pillar to be replaced is in the far left corner of the circuit.



This modification has been carried out at the factory on all machines from serial number 0900730 onwards.

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PRODUCT: T-AUDIO TIME CODE DATE: MAY 1989

Nº 09-22

SUBJECT: NEW LOGIC CIRCUIT A02 FOR NTA3.TC

A new implantation of the Main Control Logic circuit has been developed and is fitted to all T-Audio time code recorders from serial number 0900659.
This new implantation is done on a single printed circuit board, thus allowing us to get rid of the "sandwich" board with four layers of conductive tracks and interboard connection pins. This important improvement in terms of maintenance and reliability, has been achieved by removing all unnecessary components that were originally designed for four channel operation.

Simultaneously the logic was redesigned to incorporate the former "Insert timing" piggy back A02-A17 allowing simultaneously a more convenient of the precise erase ramp delays, with their corresponding trimmers now located on the front edge of the logic board. The new design of the "Insert timing" circuitry improves the bias ramp timing accuracy by replacing R/C time constants by clocked shift registers. Although this new design marginally increases the former delay of approx 50 ms up to about 64 ms (half an NTSC time code frame added delay in punch-in and punch-out timing) it does enable the T-Audio time code to handle much shorter audio inserts (down to 2 or 3 time code frames). With the old logic circuit the length of edits was limited to a minimum of 8.12 cm of tape (corresponding to 426 ms at 19 cm/s and to 213 ms at 38 cm/s)

Simultaneously with this new design it was decided to enable true two track operation of the "Insert timing" circuitry (separate "Bias enable" and "Record signal enable" for each channel) which requires a hardware modification on the B5 box interconnection board. This means that the old and the new logic circuits are not interchangeable as they are not completely hardware compatible. The modification needed on all machines with serial number lower than 0900659, if the new logic circuit is to be fitted is as follows:

Cut the tracks linking the following:

XA02-P1.11ab and XA01-P1.16b channel 2.
XA01-P1.16b channel 2 and XA01-P1.16b channel 1.
XA01-P1.14a channel 2 and XA01-P1.14a channel 1.
XA01-P1.16a channel 2 and XA01-P1.16a channel 1.

When this is done relink the following:

XA02-P1.7ab to XA01.P1.14a channel 1
XA01-P1.14a channel 1 to XA01-P1.16b channel 1
XA02-P1.11ab to XA01-P1.16a channel 1
XA01-P1.14a channel 2 to XA01-P1.16b channel 2

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PRODUCT: T-AUDIO TIME CODE DATE: DECEMBER 1989

N° 09-23

SUBJECT: INSTALLATION OF THE NEW PINCHROLLER CARRIAGE AND CARRIAGE GUIDES

AIM

These are the instructions for the fitting of the new style pinchroller carriage and the locating guides which are not fitted on machines carrying serial number less than 0900559. This modification greatly improves the positioning of the tape and is recomended if the heads are replaced.

PROCEDURE

Firstly remove the headblock from the machine, and then the four screws which hold the headblock connector in place on the deck plate. If the connectors are blocked, then tap them gently in order to free them from the deck. Remove the small grub screws securing of the top bearing for each of the capstan motors (see figure 5 position A), and remove the small ball bearings located on the top of the capstan shafts.

Open the deck plate of the machine and unsolder the connection wires of both capstan motors, and the connection wires of the two tachometric heads on the inter connection circuit B3.

Remove the screws according to figure 1 and then remove the capstan motor mounting plate complete with capstan motors. Now remove the head block connectors without de-soldering the wires.
Undo the fixing nuts, and remove the shielding according to figure 2.

Remove the height adjustment spacers as shown in figure 3.(one on each capstan support). Unscrew the six screws holding the capstan supports to the deck plate. (the four shorter screws are no longer needed). (two from each side).

Install the pinchroller carriage guides with the capstan supports using M2.5 X 12 screws. (see figure 5). Do not forget to put the height spacers under the guides before mounting them and the height adjustment turrets (one for each side).(see figure 7 part D).
Replace the height washers as shown on figure 6.

Mount the new shielding, and the connector block for the head block. Refit the capstan motor plate complete and then resolder the tachometric head wires and the motor connection wires to the inter connection B3.

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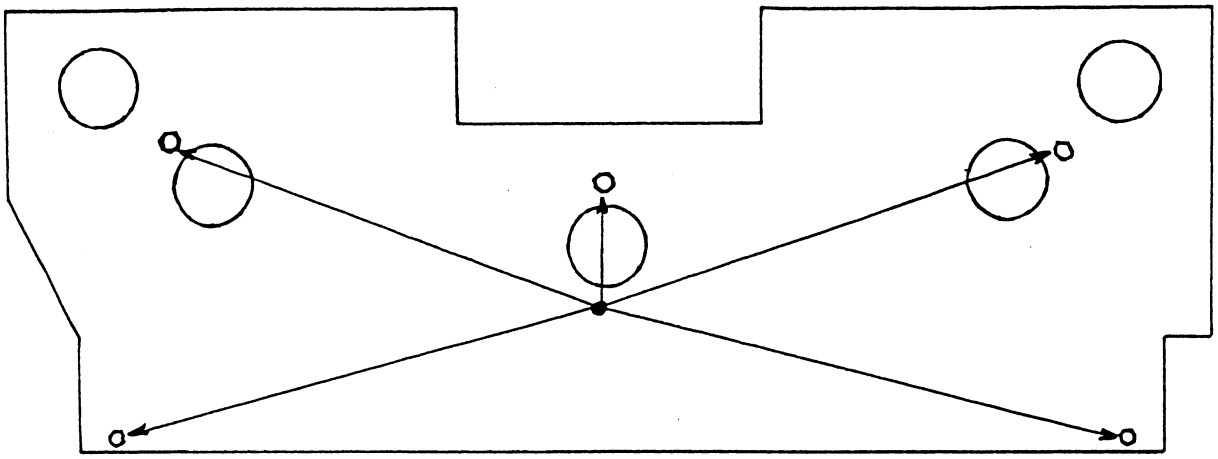

Figure 2

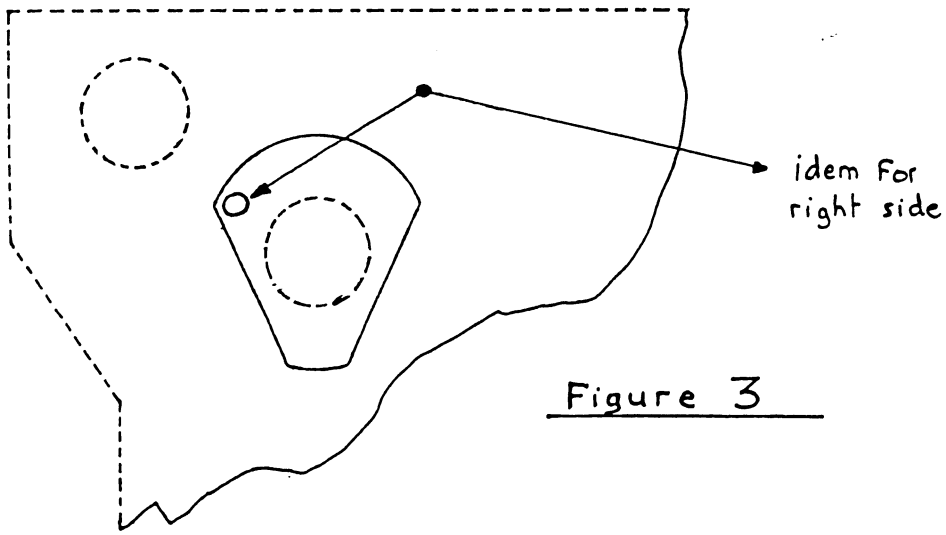

Figure 3

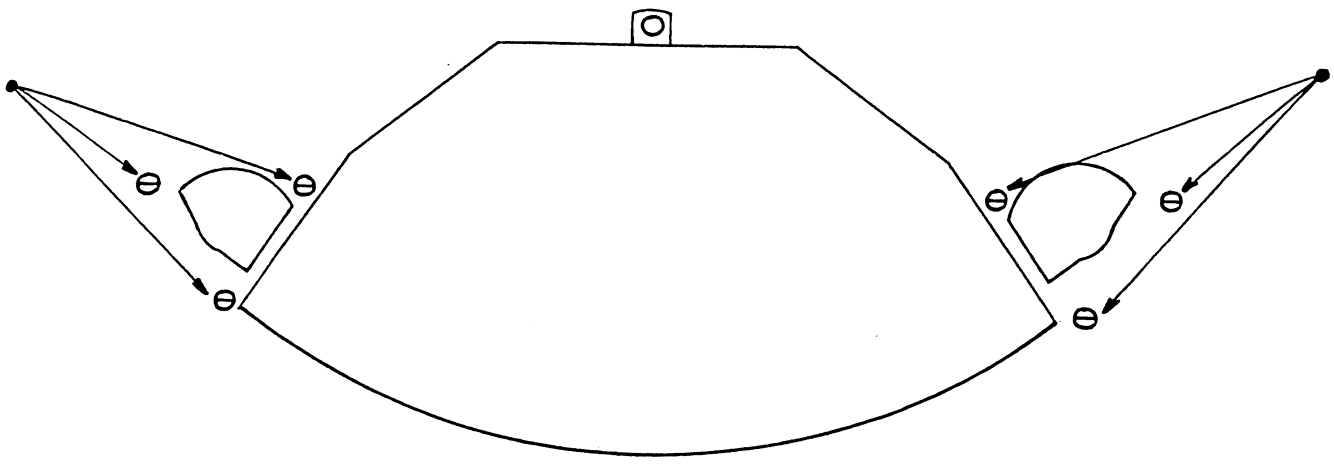

Figure 4

PRODUCT: T-AUDIO TIME CODE DATE: DECEMBER 1989

SUBJECT: REJECTION OF PARASITIC INTERFERENCE IN THE VIDEO REFERENCE OF THE TA-RSA

N° 09-24

AIM

To reduce the interference picked up by the shielding of the cable carrying the video reference in locations where there is a large amount of RF noise present. This interference can result in random desynchronization by ± 1 frame during video locked playback or recording. If this occurs during recording this situation WILL cause the recording to be aborted.

PROCEDURE

The earth of the video signal and the earth of the TA-RSA must be linked together by low impedance. This is done as follows:

Remove the resistance R3 (original value 5.6 kΩ) on the circuit C1 (Synchro Extractor) inside the TA-RSA. This is an SMD device. Replace this resistor with a 1 Ω SMD resistor.

KSA Number 54 60810 030 Resistor 1 Ω 5% 1/8 W

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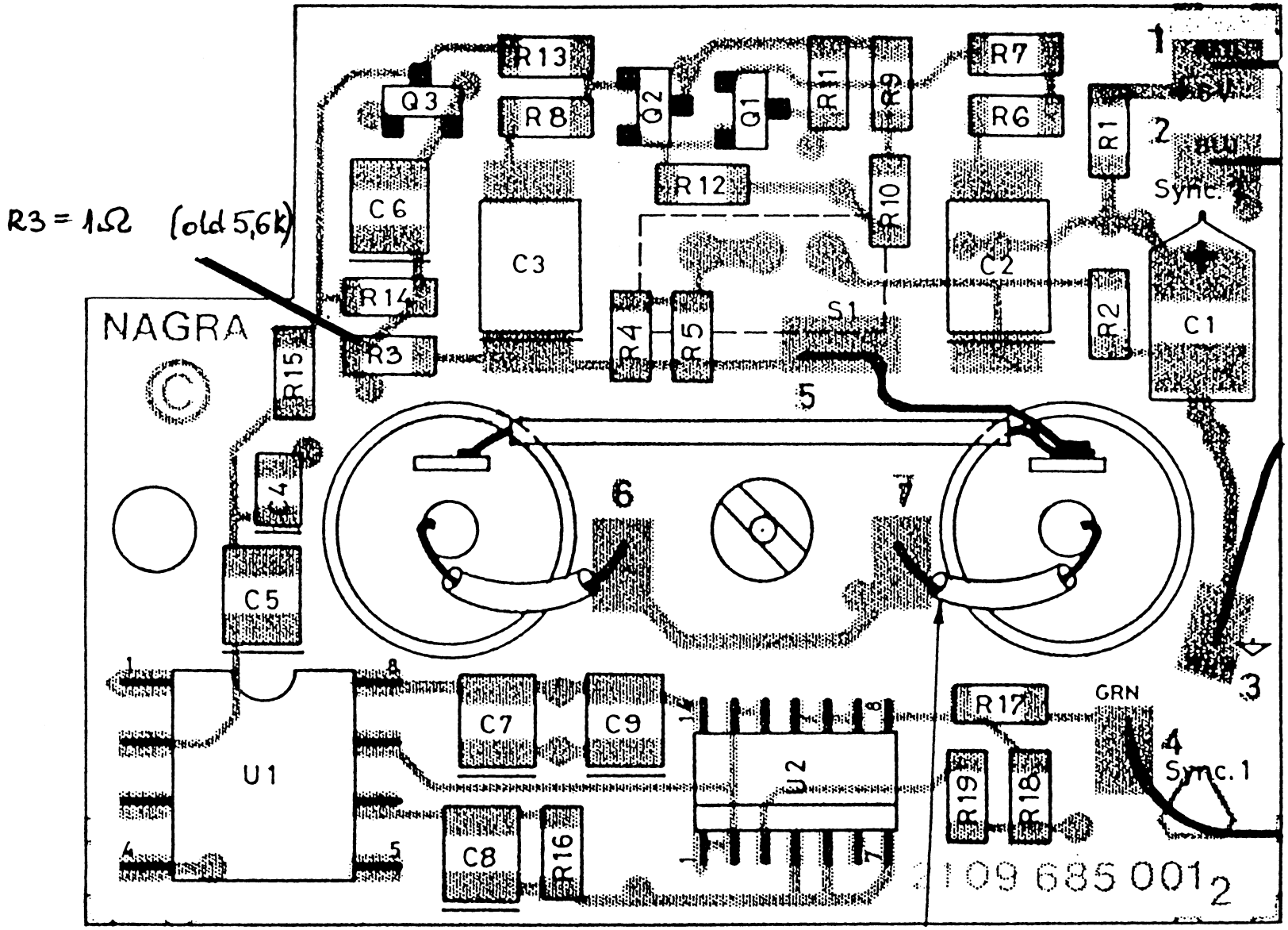
R3 = 1Ω (old 5,6k)
NAGRA
R13
Q3
R8
Q2
Q1
R11
R9
R7
R6
R1
R12
R10
C6
C3
C2
C1
R14
R3
R4
R5
S1
R2
R15
C5
U1
C7
C9
U2
C8
R16
R17
R19
R18
GRN
Sync.1
2109 685 001 2

PRODUCT: T-AUDIO TIME CODE DATE: NOVEMBER 1990

N° 09-25

SUBJECT: STORAGE OF A NAGRA T-AUDIO FOR LONG PERIODS WITHOUT USE

When a NAGRA T-AUDIO is stored, or simply left unused for a long period of time, the machine must be put in the "LOAD" position rather than "PARK" before being switched off.
The PARK brakes of the reel motors have leather surfaces, which after being left for a long periods of time become flat. This will affect the future operation of these brakes. When the machine is set to the LOAD position then these brakes are released.

This fault may occur when the machine is left for periods in excess of two to three weeks.

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PRODUCT: T-AUDIO TIME CODE DATE: NOVEMBER 1990

SUBJECT: REDUCTION OF PARASITES IN THE TA-RSA CABLE

N° 09-26

In certain installations, the screening of the TA-RSA cable picks up electromagnetic radiations that can affect the synchronization of the machine. In order to prevent this, the ground of the video reference signal must be connected to the ground of the TA-RSA via a low impedance. In order to do this, replace the R3 resistor in the TA-RSA (old value 5.6 kΩ) with a 1 Ω resistor.

R3 is a surface mounted resistor.

KSA P/N 54 60810 030 5% 1/8W chip.

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I N S T R U C T I O N N O T E

DATE: December 1987

PRODUCT: TACO-D2R

SUBJECT: Installation of TACO-S Option

To convert TACO-D2R into TACO-D2RS, use conversion kit:

TACO-S Option , P/N 70 09618 000

Kit 70 09618 000 consists of:

- Front plate
- Connector, 9 pole female Cannon connector BJ 16
- Fixing screws, nuts and washers for BJ16 connector
- Rotary switch FRAME RATE S 100
- Knob with fixing screw and positioning pin, for S100 switch
- Plastic collar for S100 switch
- Five SPDT ON-ON switches (MODE, PILOT, ROLLER, WIND., USER BITS) S 101 to S 105
- Blank label for serial number
- Cable to connect TACO-D2RS to Nagra T-Audio TC
- Mechanical drawing 70 09616 000
- Schematics (0909616000, 090961X000, 0909617000, 9109634000, 9109618000)
- Instruction Note (2 pages)
- Kit to modify T-Audio TC for TACO-D2RS 71 09618 000

I N S T A L L A T I O N

1) Modify T-Audio TC, as explained in the Instruction Note "Modifications of T-Audio for TACO-S", enclosed in the Kit P/N 71 09618 000.

2) Install TACO-S option in the TACO-D2R, as explained in the following instructions.

I N S T A L L A T I O N I N S T R U C T I O N S

Reference: Mechanical drawing and the Schematics.

1) Undo the knob of BS1 switch (EXTERNAL REFERENCE SELECTION/ DIVISION) and two screws fixing the front panel. Replace the front panel and fix it, using the same screws, security washers and nuts. Make sure that the Serial Number is well visible through the opening in the front panel. If not, engrave the serial number on the supplied blank label and position it correctly on the front plate.

2) Undo the two screws fixing the Biphase Interface circuit board (TACO-R) to the vertical spacer-nuts, and undo the three screws behind the TACO-R board, fixing the rear panel to three hex

circuit backwards and to separate this circuit from the frame. You do not need to disconnect the wiring cables. Undo the white plastic vertical spacer-nut, fixed to the rear panel at the left side.

3) On the TACO-R circuit, position and solder the rotary switch S100 and five switches S101 to S105. Make sure that all the switches are positioned flat on the board.

4) Position the BJ16 connector and its two fixing screws on the TACO-R circuit board, do not tighten the fixing screws. Slide back the TACO-R circuit into the frame, take care of the two LED's (BIPHASE DIRECTION and REFERENCE PRESENT). Install, but not tighten, two special screws fixing the BJ16 connector to the rear panel.
- Install and tighten the three screws fixing the rear panel to three hex transversal bars.
- Tighten the two screws fixing the BJ16 connector to the TACO-R circuit board.
- Tighten the two special screws fixing the BJ16 connector to the rear panel.
- Install and tighten the screw fixing the TACO-R circuit board to the white plastic vertical spacer-nut (the only one left).
- Solder the BJ16 connector pins to the TACO-R circuit.

5) Reinstall the knob of BS1 switch (EXTERNAL REFERNCE), leaving aprrox. 0.4 mm gap between the knob surface and the front panel surface.

6) Prepare the knob of the new S100 switch: position the fixing Allen screw and drive the black positioning pin into the hole in the rotary knob - this will act as an end stop for the switch. The pin should stick out slightly underneath, but should not exceed the knob rim surface.
Note: You may find the pin (and fixing screw) already installed on the knob.

7) Turn the S100 switch shaft fully clockwise, until the stop. Drive the white plastic collar on the switch shaft, the collar rim oriented outwards (the only one way to drive it fully on).

8) Position the knob on the S101 switch shaft and tighten the fixing screw when the knob is in the 29.97 DROP FRAME position, as indicated by the knob pin. It is the last clockwise position. The knob should be slightly pressed against the front panel, the white collar rim assures necessary gap between the knob and the front panel surface. Turn the knob fully CCW, to the 30 FULL FRAME position. Make sure that there is still a tiny gap between the pin on the knob and the stop pin on the front panel, close to the 30 FULL FRAME position. You should be able to turn the knob just a little bit to the left, when in 30 FULL FRAME position. If necessary, loosen the knob fixing screw and turn the knob slightly, to obtain this gap and to assure the correct indications of the switch positions. Check the switch positions, turning it from fully CCW to fully CW position.

9) Connect the TACO-D2RS to the T-Audio TC and check functioning.

I N S T R U C T I O N N O T E

DATE: July 1987

PRODUCT: T-AUDIO Time Code

SUBJECT: Modifications of T-Audio for TACO-S

Using TACO-D2 RS (TACO-S option installed in the TACO-D2 R Monitoring Module) requires modifications of Time Code circuit and T-Audio wiring. Necessary parts are supplied as a kit,
P/N 71 09618 000.

Kit 71 09618 000 consists of:

- Connector plate (P/N 01 09200 033), Canon 9 pin female connector and flat cable, preassembled.
- Wiring harness (8 wires) for Time Code circuit.
- Printed label.
- Instruction note.

MODIFICATIONS OF THE MAIN TIME CODE CIRCUIT, P/N 97 09361 000

1. Switch the Nagra T-Audio OFF, remove Time Code Circuit Block A05 from the machine.
2. Undo four screws fixing upper board - main time code circuit P/N 97 09361 000 - and unfold this board. These screws, fixed to the spacers, are located in the four corners of the board.
3. Position the wiring harness on the soldered side of this board and solder the wires on both ends of the harness, as follows:
- to the XA04-P1 connector pins on the one side of the board (longer ends of wires)
- to R160 up to R167 resistors, to their ends connected to the S4 DIL switch pins, on the other side of the board.

	XA04-P1		Resistors (S4 DIL Switch)
Pins:	10 b	red (brownish) wire	R 161
	15 a	yellow thinner wire	R 162
	15 b	black wire	R 160
	16 b	blue (grayish) wire	R 164
	17 b	green wire	R 163
	25 a	gray (slightly violet) wire	R 165
	27 a	white wire	R 166
	31 b	yellow thicker wire	R 167

4. Fix the above wiring harness to the board with epoxy resin glue, Araldite AW 106 (P/N 39 80221 106), for instance. Apply the glue to the harness sleeves only. Let it harden (12 hours).
6. Fix the main time code circuit with four screws and reinstall Time Code Circuit Block in the machine.
7. Slide all eight switches of the S4 DIL Switch to OFF (contacts opened).

INSTALLATION OF THE BJ 17 ADDITIONAL CONNECTOR

1. Open the tape deck and the rear side panel.
2. Undo three screws fixing a connector plate, located above TAPS Mains Power Supply unit.
3. Undo four special screws fixing to this plate two 25-pin connectors.
4. Separate these connectors from a plate. To do this, fold the flat cable at 90° very close to connector, pull out the connector few centimeters from the plate and push it backwards through the hole in the plate, perpendicularly to it. Work gently, do not damage flat cable.

   Do not unsolder other ends of flat cables from the main interconnection board for easier replacement. It may damage soldering eylets.
5. Install these two connectors on the new plate supplied in a kit, working as in step 4. Use the same screws and nuts (step 3.):

01 15395 004 Special screw
32 01002 565 Nut, M2.5
33 10002 500 Safety washer.

6. Unfold the flat cables, fix new connector plate in the machine with three screws.
7. Position the flat cable of the additional BJ 17 connector at the bottom of the T-Audio box, fixing it with the existing clips (note: in older machines, which may not have these clips, fix the cable with double face adhesive tape).
8. Solder the cable from BJ 17 connector to the XA04-P1 connector pins on the B5 Box Interconnection board.

   C a u t i o n : Do not short circuit pins a and b of XA04-P1 connector.

	BJ 17		XA04-P1	
Pins:	1	———	NC	(red marked wire, insulated)
	6	———	10 b	
	2	———	15 a	
	7	———	15 b	
	3	———	16 b	
	8	———	17 b	
	4	———	25 a	
	9	———	27 a	
	5	———	31 b	

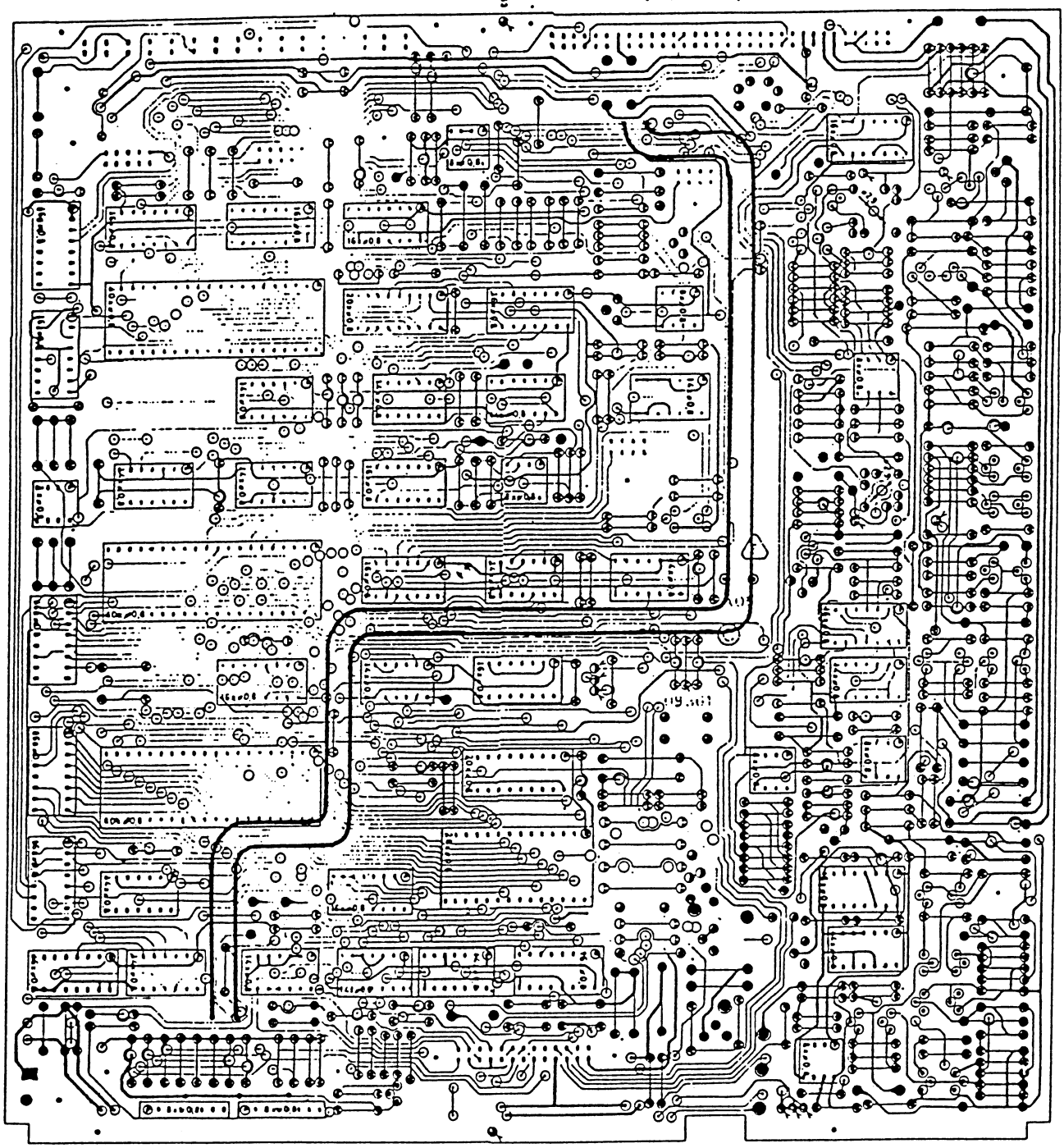
   N o t e : The wires are shown in the same order like in a flat cable.
9. Fix self-adhesive printed label on the inside face of the rear panel of the machine. It explains pin connections of all three connectors installed on the new support plate.

CONNECTIONS

Connection cable: TACO D2 RS-TA, P/N 82 09662 000

This cable is supplied with TACO-D2RS. It has a 9 pin male Canon connector at each end, and connects Nagra T-Audio BJ 17 (new) connector to the BJ 16 connector of TACO-D2RS.

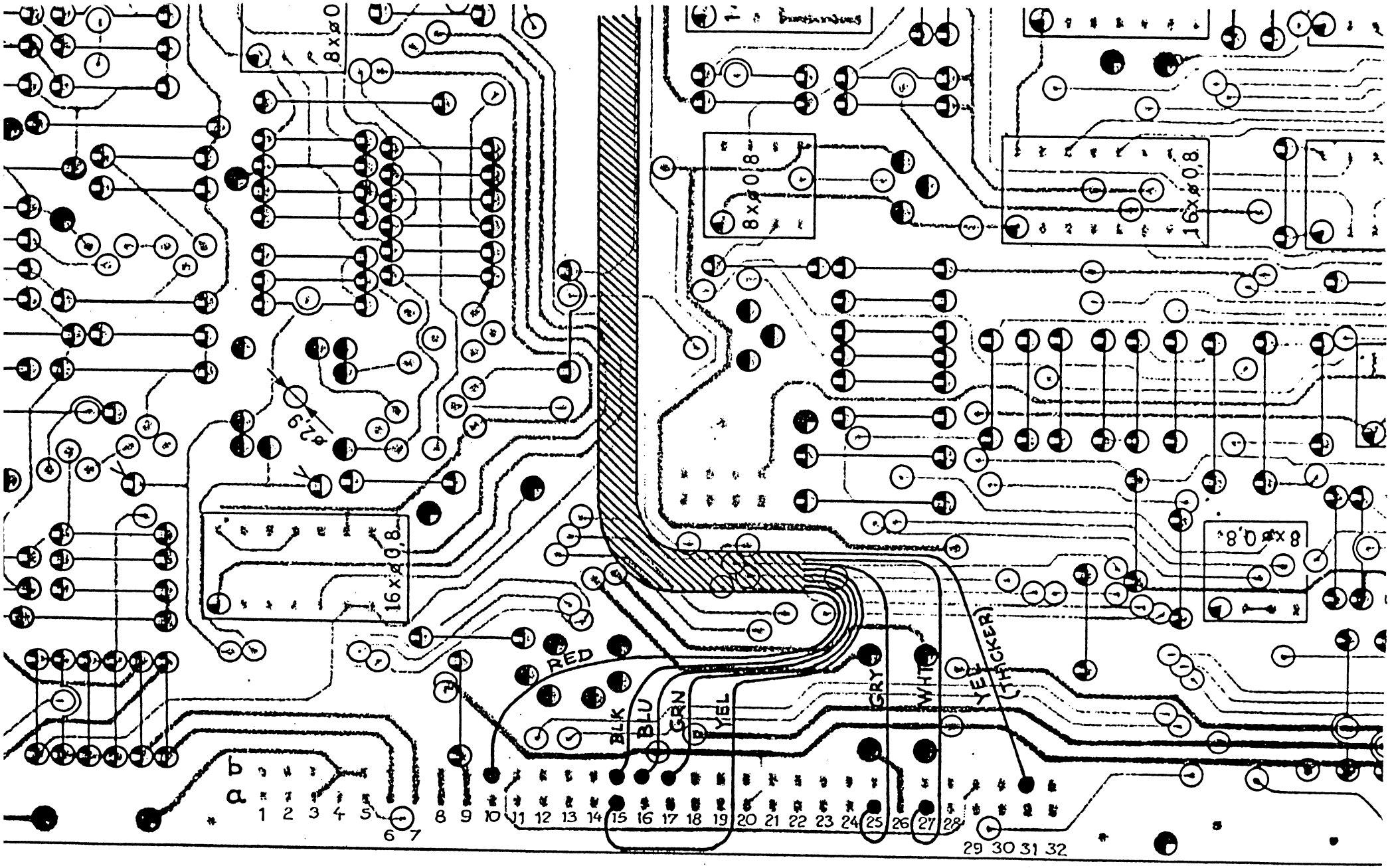
XA04 -P1



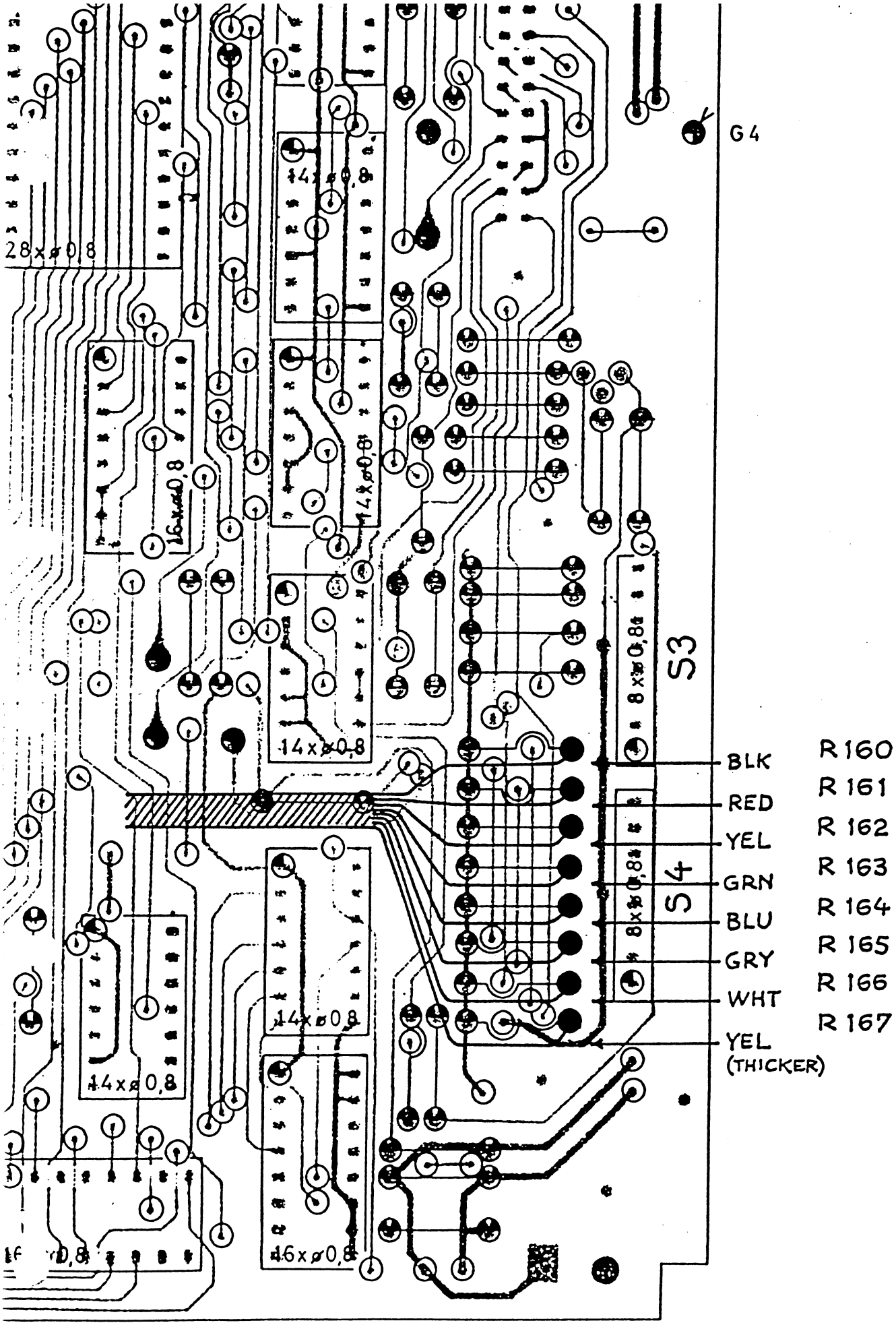
S4

SOLDERED SIDE

97 09361 000


8x⌀0
⌀2.9
16x⌀0.8
8x⌀0.8
16x⌀0.8
8x⌀0.8
RED
BLK
BLU
GRN
YEL
GRY
WHT
YEL (THICKER)
b
a
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

XA04-P1


G4
28xø0,8
14xø0,8
16xø0,8
14xø0,8
14xø0,8
8xø0,8
S3
S4
BLK
RED
YEL
GRN
BLU
GRY
WHT
YEL
(THICKER)
R 160
R 161
R 162
R 163
R 164
R 165
R 166
R 167
14xø0,8
14xø0,8
14xø0,8
16xø0,8

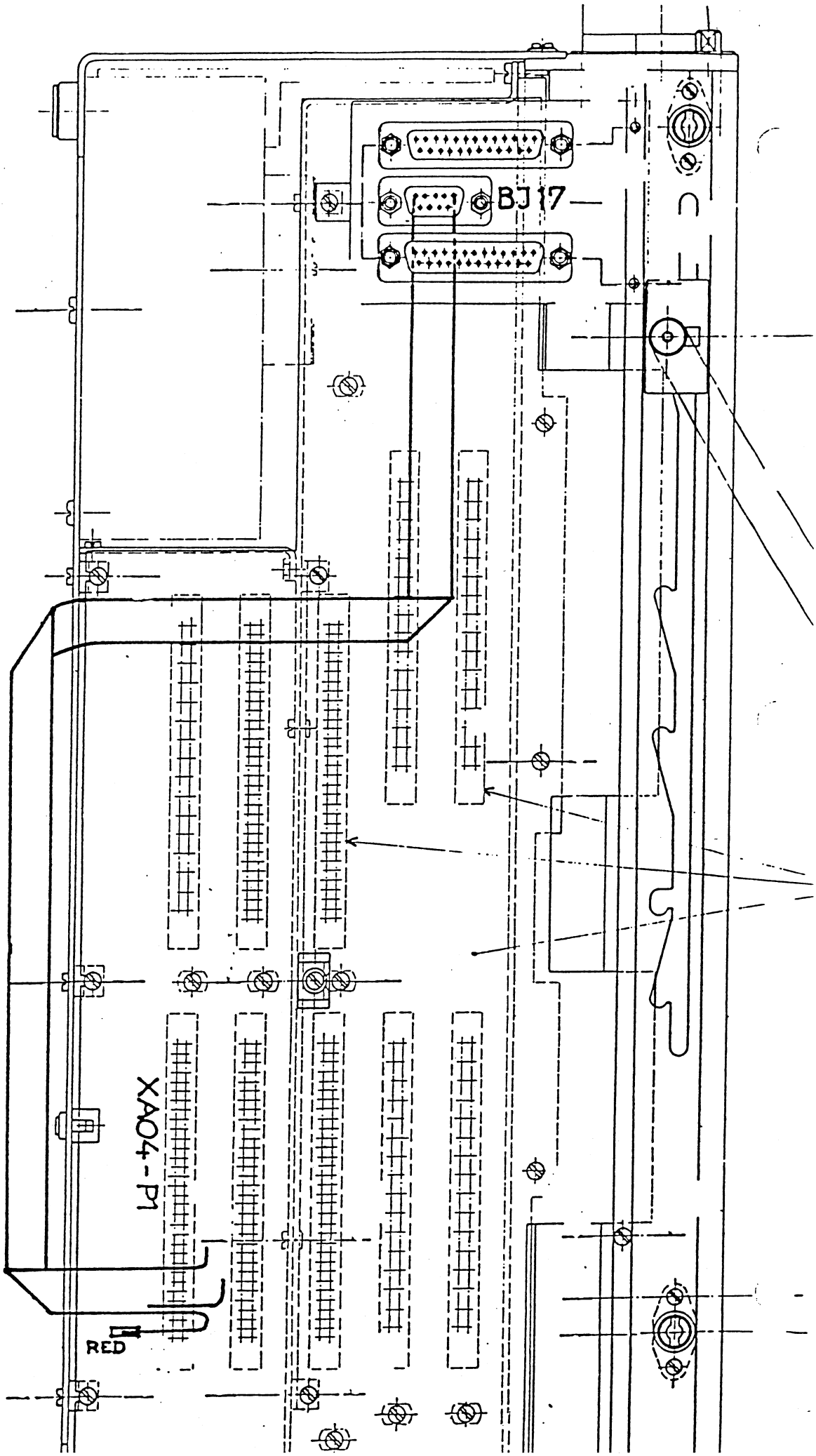

BJ17
XA04-P1
RED

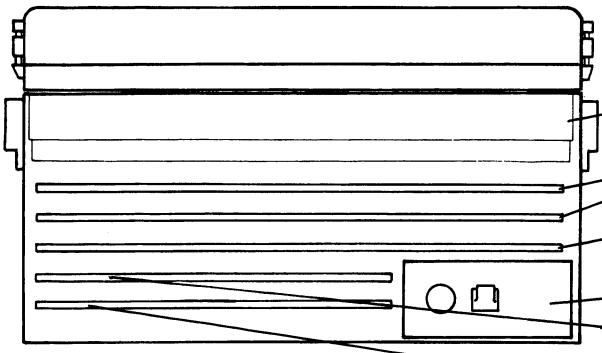
TABLE OF CONTENTS

IMPORTANT TO USE THE SCHEMATICS

THE TABLE BELOW SHOWS THE CONVERSION BETWEEN THE NUMBER GRAVED ON THE FLAT CABLE CONNECTOR AND THE CORRESPONDING NUMBER ON THE CIRCUIT DIAGRAM.

on the connector	on the circuit diagram	on the connector	on the circuit diagram
1	2	9	15
2	4	10	13
3	6	11	11
4	8	12	9
5	10	13	7
6	12	14	5
7	14	15	3
8	16	16	1

PC BOARDS LOCATION



Front View

A20 TAHP Option

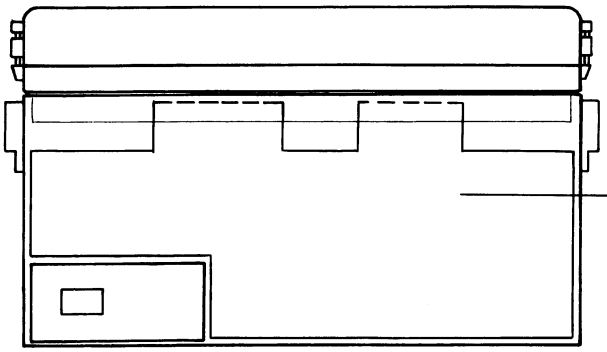
A01 Audio

A02 Control Logic

A30 Power Supply

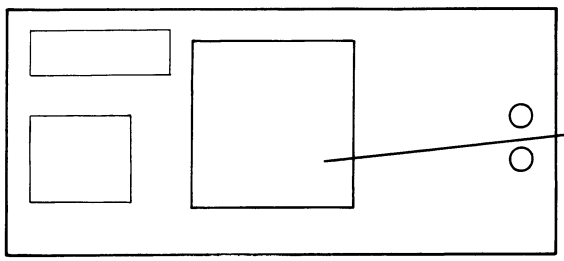
A03 Speed Stabilizer / Transport Control

A04 Counter / Servo Encoder

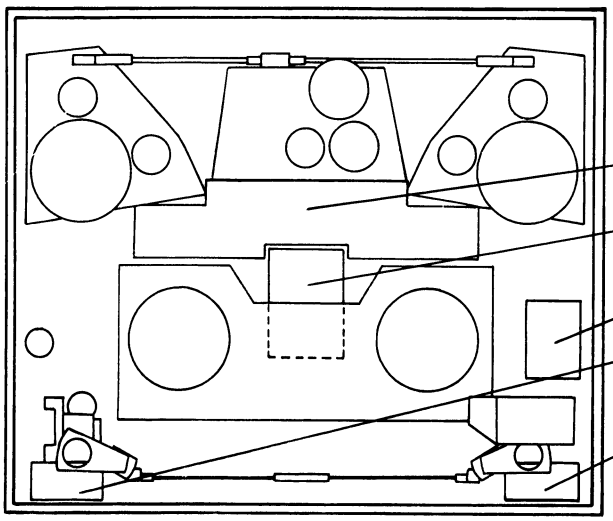


Rear View

B5 Interconnection



A9a Line IN / OUT Transformers



Tape Deck
Bottom View

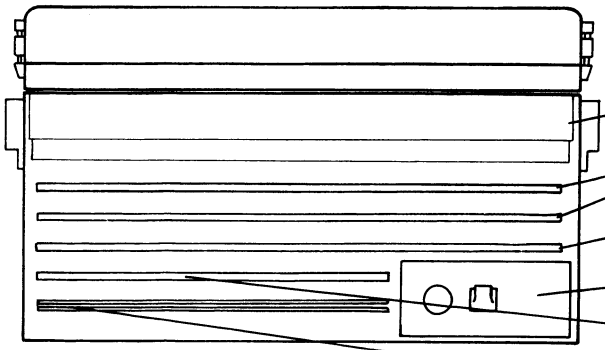
B3 Interconnection

B1 Interconnection

B2 Interconnection

A12b Right Tensiometer

A12a Left Tensiometer



Front View

A20 TAHP Option

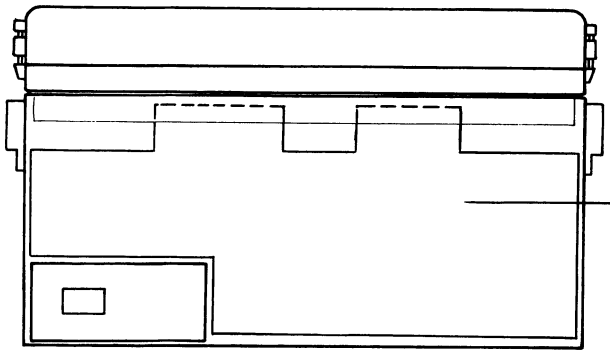
A01 Audio

A02 Control Logic

A30 Power Supply

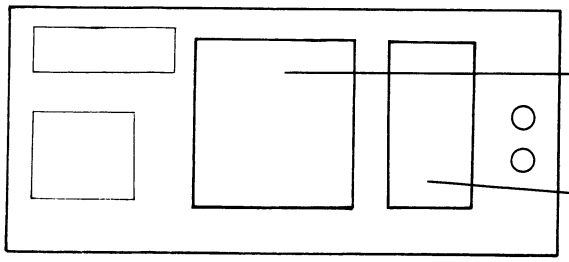
A03 Speed Stabilizer / Transport Control

A05 Time Code Board



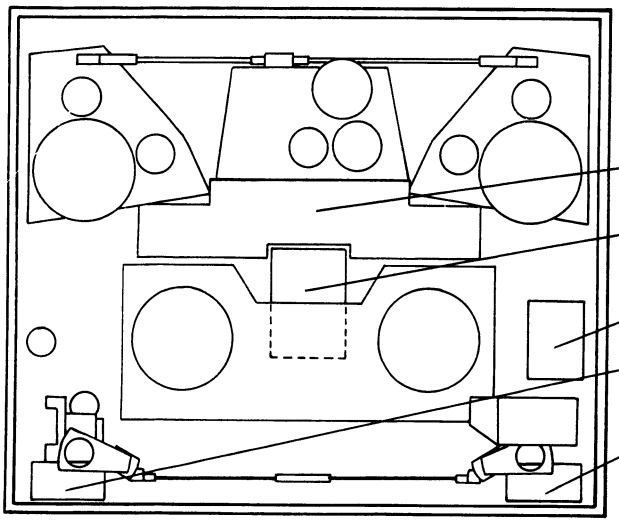
Rear View

B5 Interconnection



A9a Line IN / OUT Transformers

B6 Interconnection



Tape Deck
Bottom View

B3 Interconnection

B1 Interconnection

B2 Interconnection

A12b Right Tensiometer

A12a Left Tensiometer

SECTION 8.2

SYNOPTIC DIAGRAMS

Left reel motor

Right reel motor

Tensiometer lock

Tensiometer contacts

Reel motors servo control
A 03

Cam motor

Cam potentiometer

M

Cam servo control
A 03

Left capstan motor

Tape tension transducer

Right capstan motor

Left tacho head

Right tacho head

M

M

Capstan speed stab.
Intercapstan tape tension stabilizer
A 03

Servo editing
A 04

Warnings

Transport control logic
A 02

Keyboard pot.

Tape displacement signals - Speed code

Audio logic
A 02

Audio record & reproduce

Clear tape detector

Counter tape displacement encoder roller

Display MUX

I/O BUS

I/O BUS
D1
D2
D3
D4
D5
D6
Shift
Clock

Remote control input / output

BJ3

Servo encoder signals

Serial bus multiplexer
A 02

Display MUX

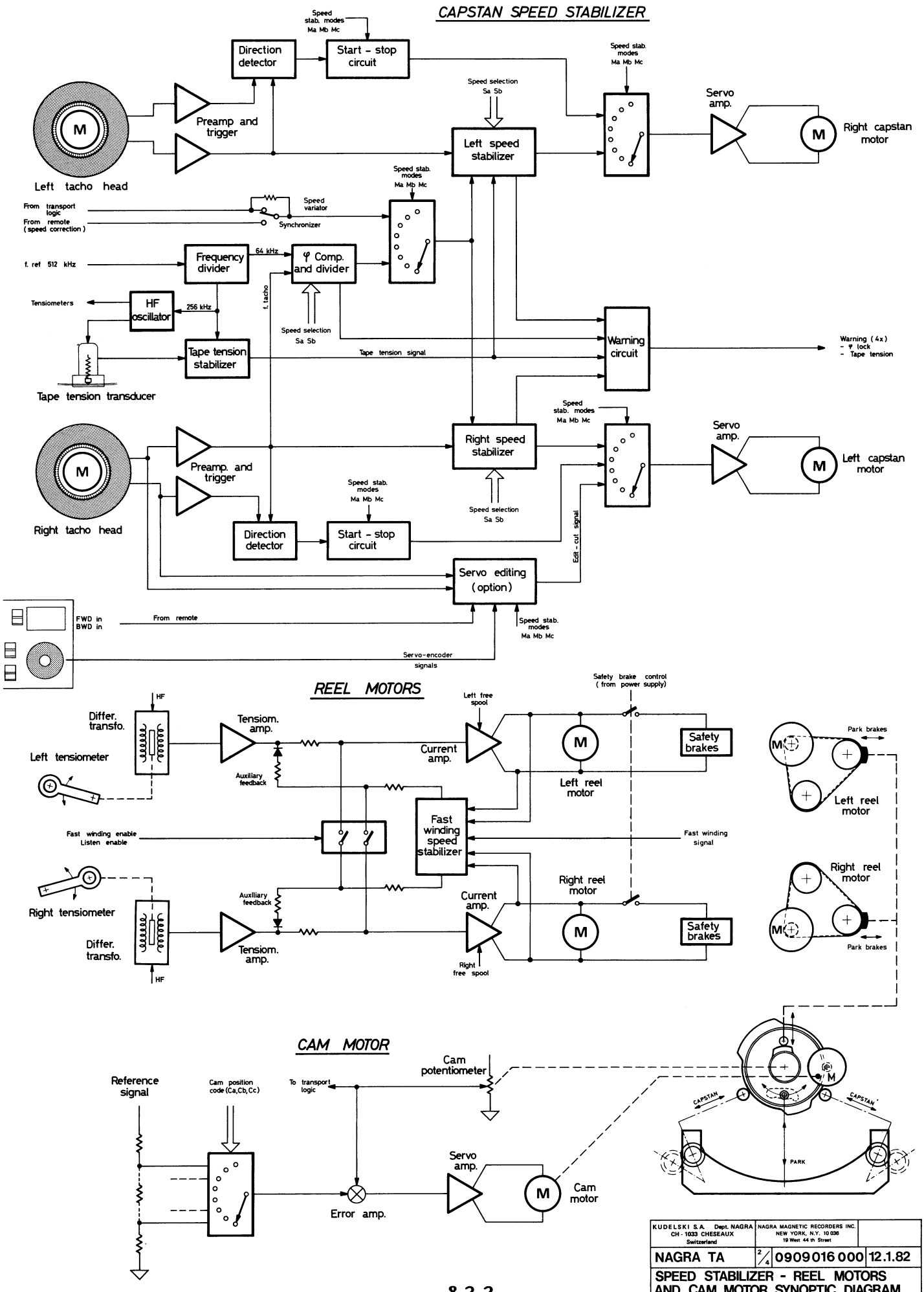
f. ref 512 kHz

Tape counter
A 04

Keyboard encoder
Display buffers
A 16

Servo encoder signals

KUDELSKI S.A. Dept. NAGRA CH - 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10 036 19 West 44 th Street	
NAGRA TA	1/4	09 09 016 000 7.1.82
TAPE TRANSPORT SYNOPTIC DIAGRAM		

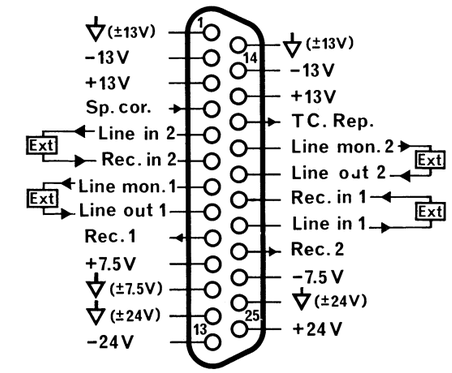


KUDELSKI S.A. Dept. NAGRA CH - 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th. Street	
NAGRA TA	2/4 0909016 000	12.1.82
SPEED STABILIZER - REEL MOTORS AND CAM MOTOR SYNOPTIC DIAGRAM.		

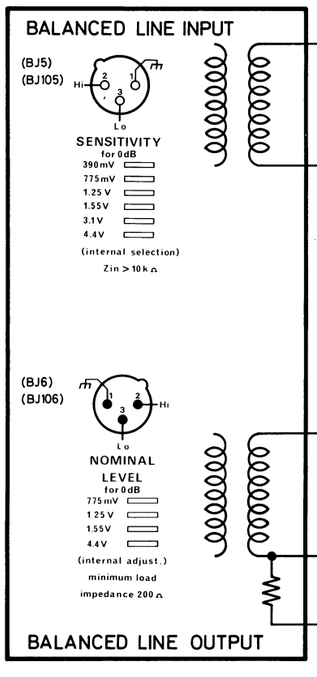
freq. ref. 512 kHz
(from power supply)
COUNTER
A02-S101
Mono
Multi-track
Stereo
Audio MUX
AUDIO MATRIX MULTIPLEXER
Mono enable
Channel 1 to channel 2
Ch1
Ch2
Ch3 from TC
from audio
SPEED VARIATOR
Keyboard pot.
SERVO CONTROL EDITING
Servo encoder signals (A,B)
to servo editing option
3 STATE BUS DRIVER
CHANNEL DECODER
MUX
Counter
Audio
Transport
Init. switches
A02-S201 1 to 5
DISPLAY DATA MULTIPLEXER
INITIALIZATION CIRCUIT
Data
Serial BUS
SERIAL BUS GENERATOR
Sync+clock
sync. inhibited
A02-S201/6
FUNCTION DECODER AND LATCH
Audio matrix functions (5)
Ch1
Ch2
Ch3
sync switch-over selector
Off
Input
A02-S103$_1$
LINE OUT SELECTION AND AUTOMATIC SWITCH-OVER
Line out select. (La,Lb)
Erase + safe enable
Channel 1
Δt
Erase 1 delay fine adjust.
A02-S103$_2$
Line out select. (La2,Lb2)
Channel 2
Erase 2 delay fine adjust.
A02-S103$_3$
Line out select. (La3,Lb3)
Erase + safe enable
Channel 3/TC
DEPRESSED KEY
SYNC DATA AND CLOCK DETECTOR
KEYBOARD SCAN
sync.
data
clock
SHIFT-STORE AND DISPLAY BUFFERS
Keyboard
Display
LDR
DEPRESSED KEY DETECTOR
Keyboard enable
SPECIAL KEY DECODER FUNCTIONS INHIBITION
Pause enable
Audio record
"MODIFY" COUNTER
A
B
C
D
REPRO SPEED STD. SELECTION
BIAS REF. LEVEL SELECTOR
Counter speed selection
Sa
Sb
Ra
Rb
Rc
Speed Stab.
Repro. Speed std Selection
A03
Ch1 to Ch2
Record speed std selection
Bias ref. voltage
Ch1 to Ch3
Remote control INPUT/OUTPUT
Keyboard enable
Keyboard pot
Serial BUS
Tape FWD + BWD signal
Counter MUX
TAPE COUNTER
0 to 5V
I/O BUS
Ch1 Ch2 Ch3 Ch4
REC. PERMITTED
Tape forward signal
RECORD START-STOP DELAY
Rec. signal enable
Bias enable
Rec. head enable
Channel 1 to channel 2
Warnings (from tape transport)
Rec. inhibited
A02-S301
FUNCTION DECODER-LATCH
AUDIO REC. FUNCTIONS
No signal on line output
Input signal on line input
Bicapstan enable
Tape delay (Recording delayed till erased tape)
CAM SERVO MOTOR CIRCUIT
Cam position code (Ca,Cb,Cc)
ENCODER
Tape FWD + BWD signal
TAPE SPEED DETECTOR
SPEED STAB MODES
Speed stab. modes (Ma,Mb,Mc)
Capstan start
OFF
STOP
REWIND
A02-S302
Clear tape function
Cam potentiometer
CAM POSITION DETECTOR
Thermal protection
TAPE
TAPE END
Park
FUNCTION GENERATOR
Clear tape
+5V
8kHz
CLEAR TAPE EMITTER DRIVER
CLEAR TAPE DETECTOR AMP.
Free spool if park
TENS. LOCK FREE SPOOL CIRCUITS
L + R free spool
Tensiometer contacts
Tensiometer lock
Fast winding permitted
FAST WINDING CIRCUIT
Fast winding enable
Fast winding signal
to speed stabilizer
Transport MUX
WARNING AND FUNCTIONS MULTIPLEXER
Functions
Warnings

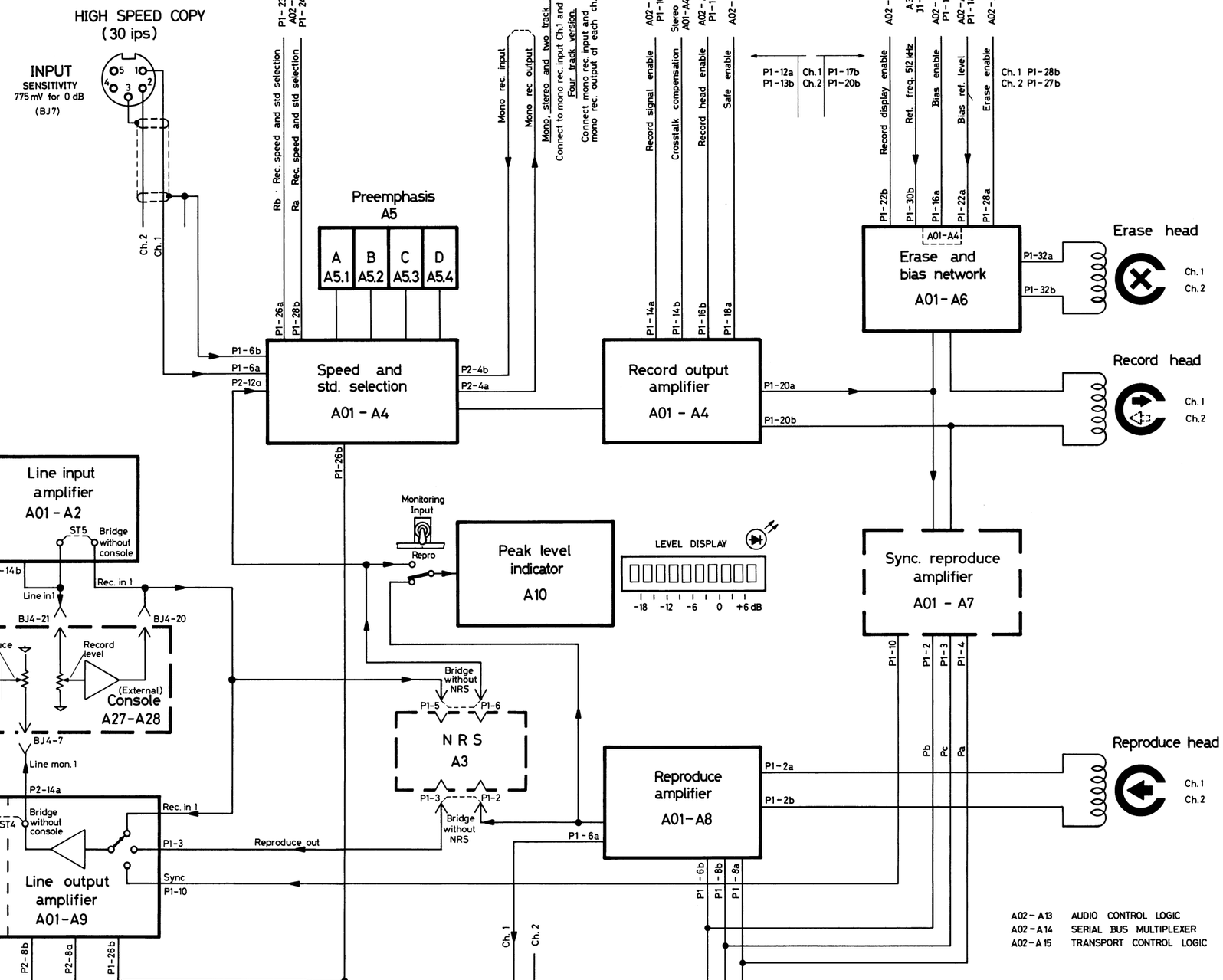
8.2-3

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street		
NAGRA TA	3/4	09.09.016.0.00	23.2.82
CONTROL LOGIC SYNOPTIC DIAGRAM			



(BJ4) **AUDIO MONITORING OUTPUT**



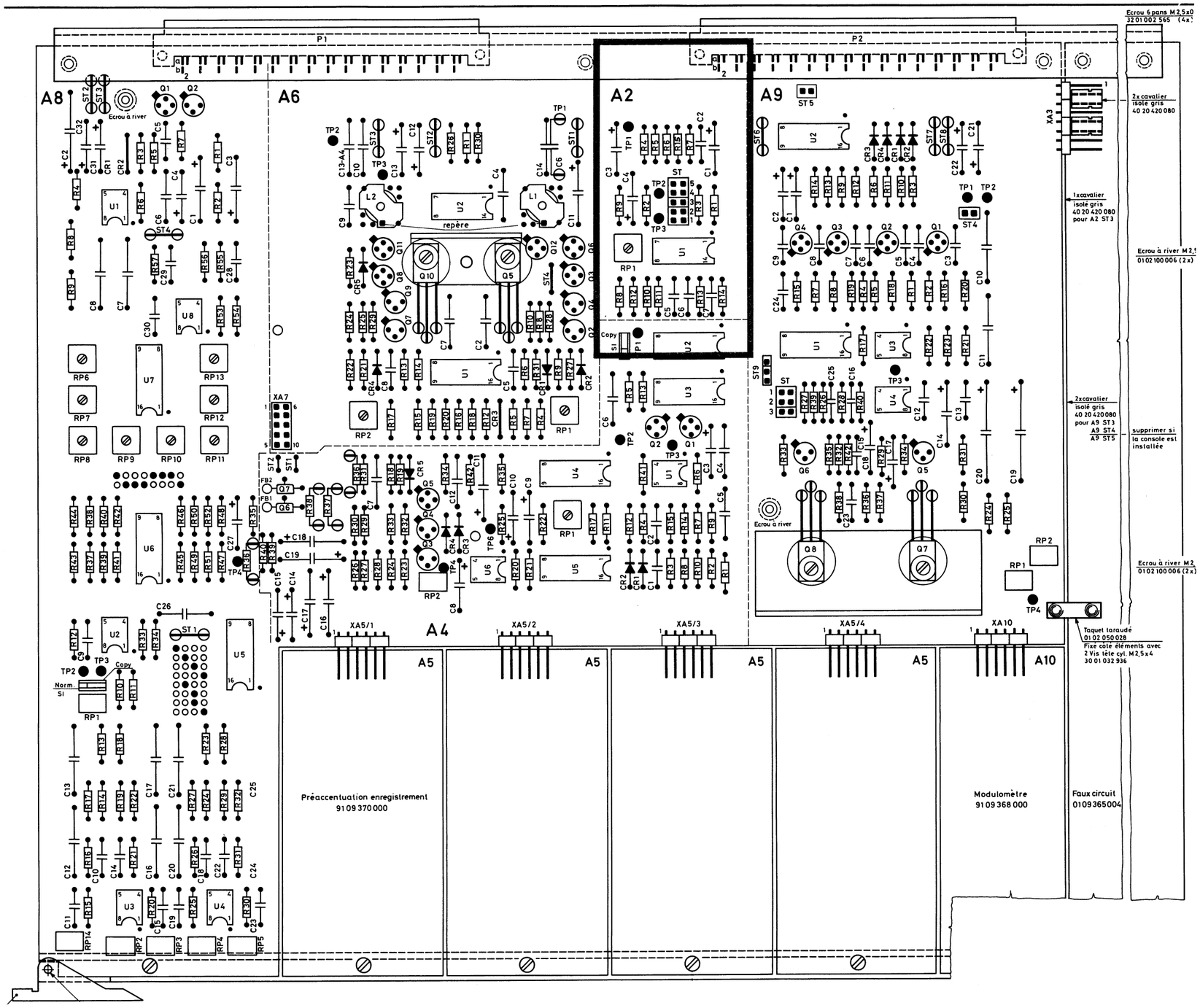


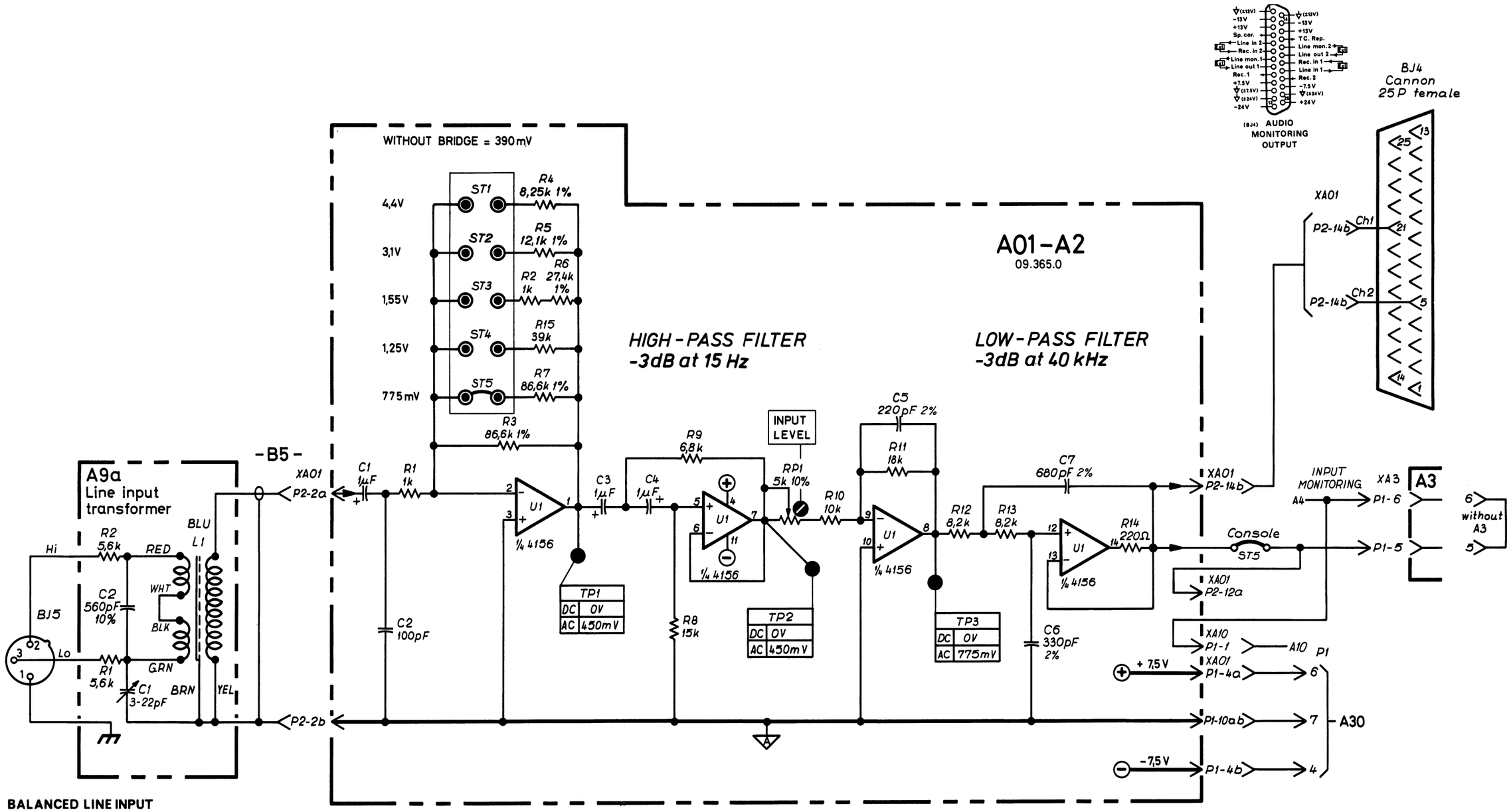
KUDELSKI S.A. Dept. NAGRA CH - 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10 036 19 West 44 th Street	
NAGRA TA	4/4 09.09.016.000	5 . 9 . 85
RECORD REPRODUCE SYNOPTIC DIAGRAM (one channel viewed) Ch.1		

SECTION 8.3

A-01

A2 LINE INPUT AMPLIFIER
09.365.0 index D





BALANCED LINE INPUT

CHANNEL 1 (left) (BJ5)

CHANNEL 2 (Right) (BJ105)

SENSITIVITY for 0dB
390mV
775mV
1.25 V
1.55V
3.1V
4.4V
(internal selection)
Zin > 10kΩ

MALE CONTACT
FEMALE
EYELET
TEST-POINT
AUDIO COMMON
FRAME

ARROW INDICATES SIGNAL FLOW

COLOR		CODE
BLK	=	Black
BRN	=	Brown
RED	=	Red
ORG	=	Orange
YEL	=	Yellow
GRN	=	Green
BLU	=	Blue
VIO	=	Violet
GRY	=	Grey
WHT	=	White

TEST CONDITION

A C MEASUREMENT SHOULD BE MADE AT 1kHz FOR 0dB LEVEL 510 mWb/m

MEASURING INSTRUMENT

D C VOLTMETER 40 000 Ω / V
A C VOLTMETER (e.g. B & K Type 2112 or 2606 + 1615 or equivalent)

UNLESS SPECIFIED

VOLTAGES MAY VARY ± 10 %

ALL RESISTORS ¼W ± 2 %
ALL CAPACITORS ± 20 %

ALL CONNECTORS VIEWED FROM THE OUTSIDE

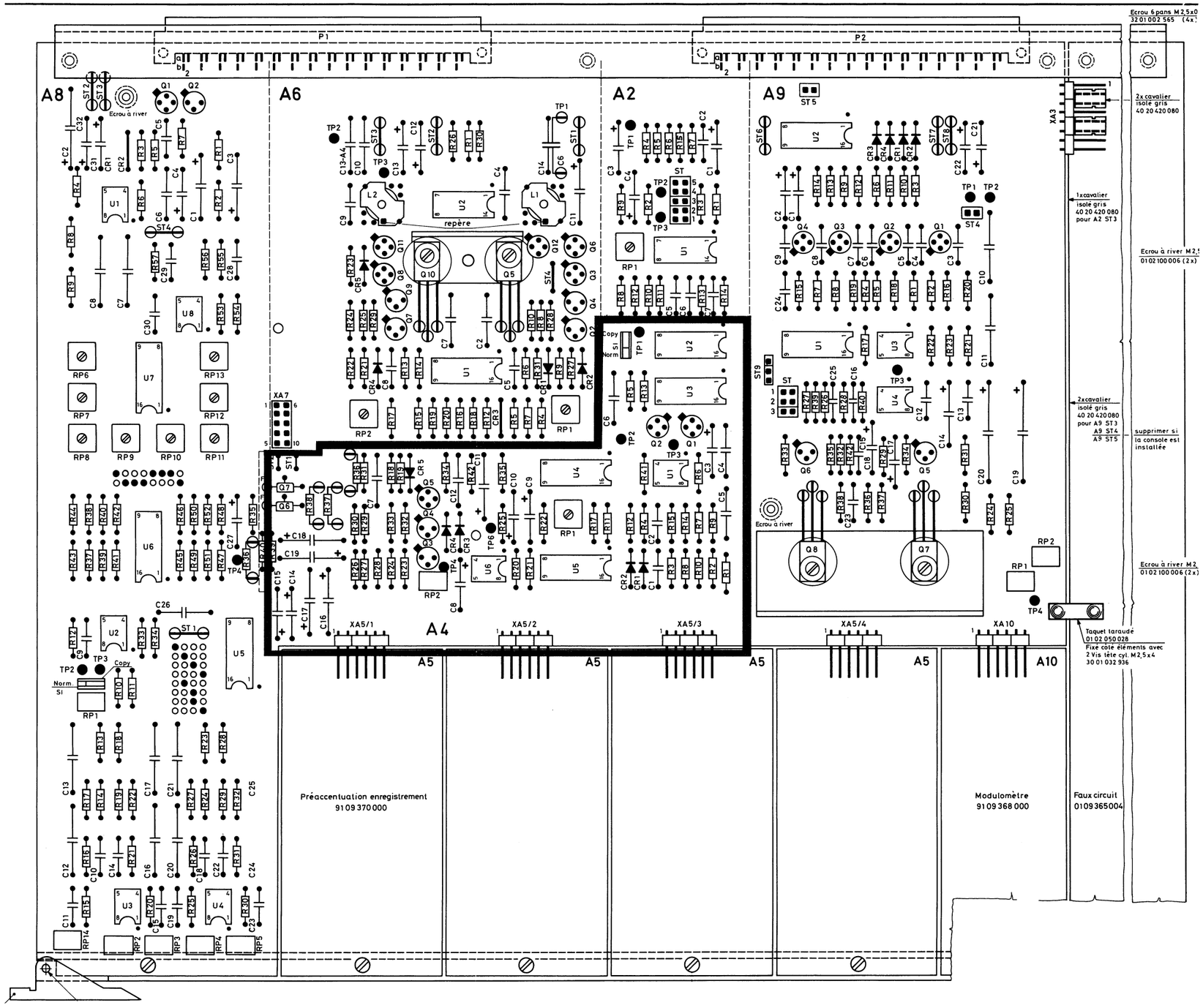
A 01 AUDIO RECORD / REPRODUCE BOARD including

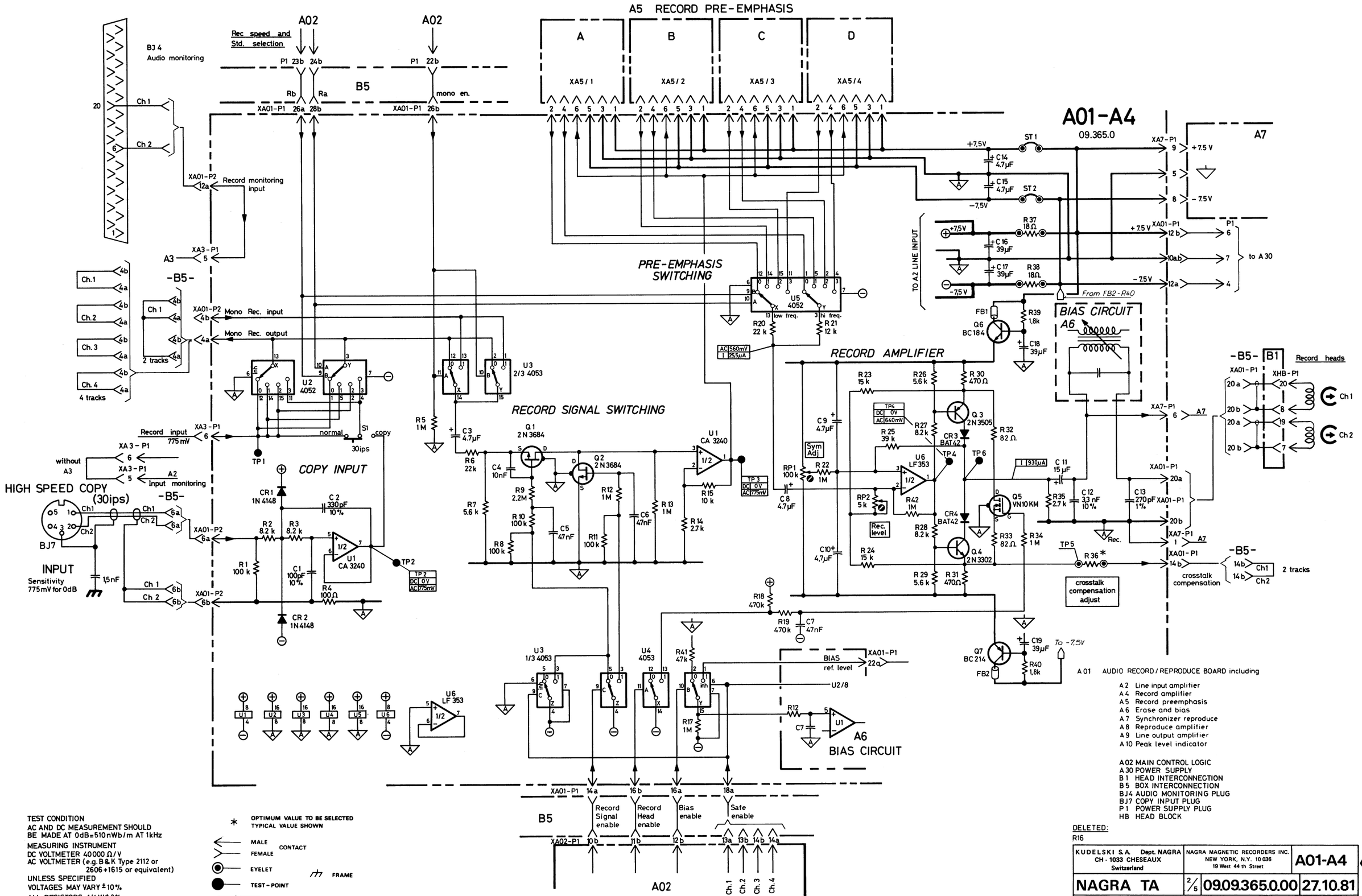
- A 2 Line input amplifier
- A 4 Record amplifier
- A 5 Record preemphasis
- A 6 Erase and bias
- A 7 Synchronizer reproduce
- A 8 Reproduce amplifier
- A 9 Line output amplifier
- A 10 Peak level indicator

A3	OPTIONAL BOARD
A9a	INPUT/OUTPUT–LINE TRANSF. BOARD
A30	POWER SUPPLY
B5	BOX INTERCONNECTION
BJ4	AUDIO MONITORING PLUG
BJ5	BALANCED LINE INPUT
BJ105	BALANCED LINE INPUT
P1	POWER SUPPLY PLUG

KUDELSKI S.A. Dept NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK N.Y. 10036 19 West 44th Street	A01-A2	(D)
NAGRA TA	1/5	09.09.365.0.00	29.10.81
LINE INPUT AMPLIFIER			

A4 RECORD AMPLIFIER
09.365.0 index D





TEST CONDITION
AC AND DC MEASUREMENT SHOULD BE MADE AT 0dB=510 nWb/m AT 1kHz
MEASURING INSTRUMENT
DC VOLTMETER 40000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)
UNLESS SPECIFIED
VOLTAGES MAY VARY ±10%
ALL RESISTORS 1/4W ±2%
ALL CAPACITORS ±20%
ALL DIODES 1N4148

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE, FEMALE — CONTACT
EYELET
TEST-POINT
FRAME
ARROW INDICATES SIGNAL FLOW
AUDIO COMMON

ALL CONNECTORS VIEWED FROM THE OUTSIDE

8.3-4

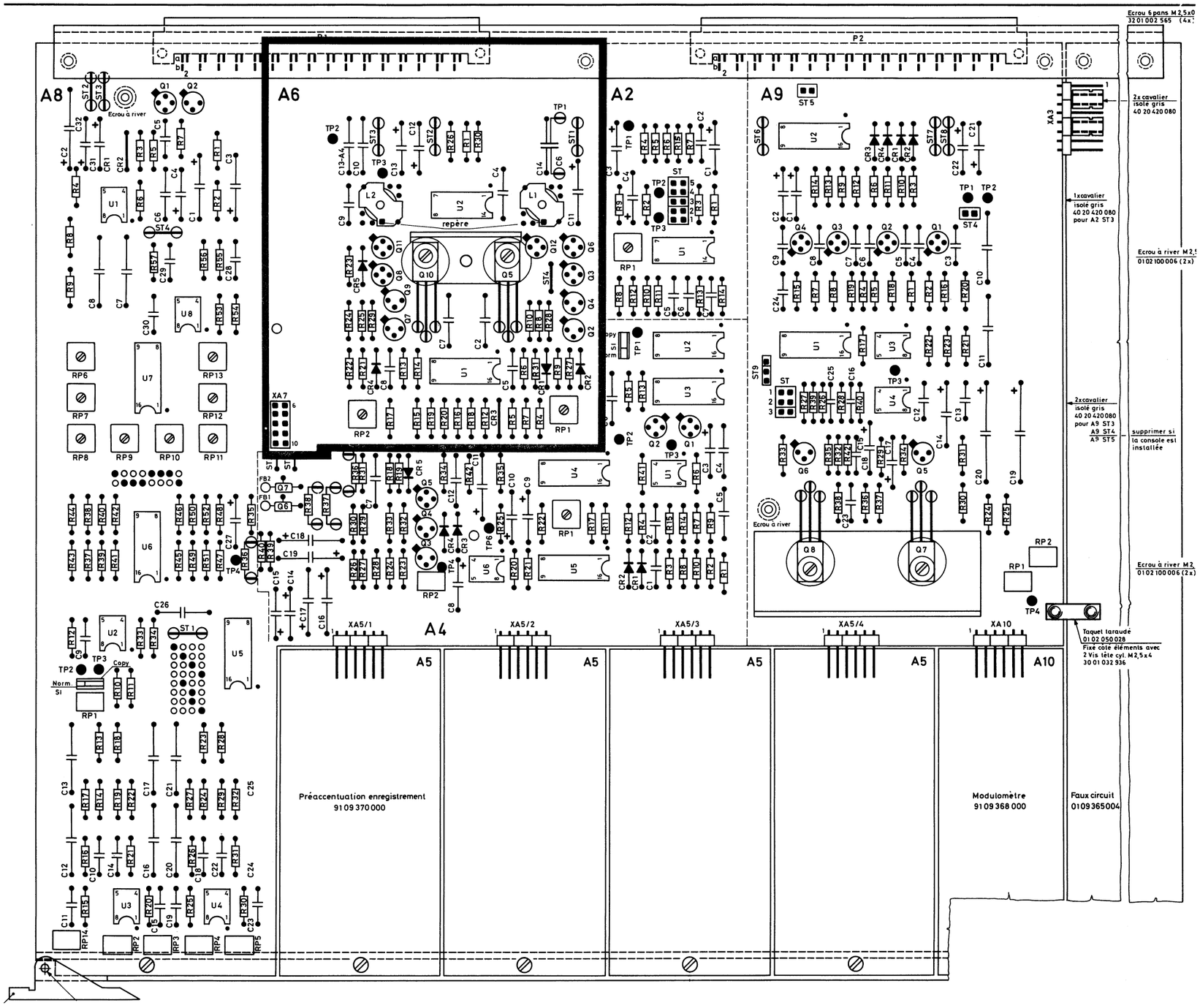
A 01 AUDIO RECORD / REPRODUCE BOARD including
A 2 Line input amplifier
A 4 Record amplifier
A 5 Record preemphasis
A 6 Erase and bias
A 7 Synchronizer reproduce
A 8 Reproduce amplifier
A 9 Line output amplifier
A 10 Peak level indicator

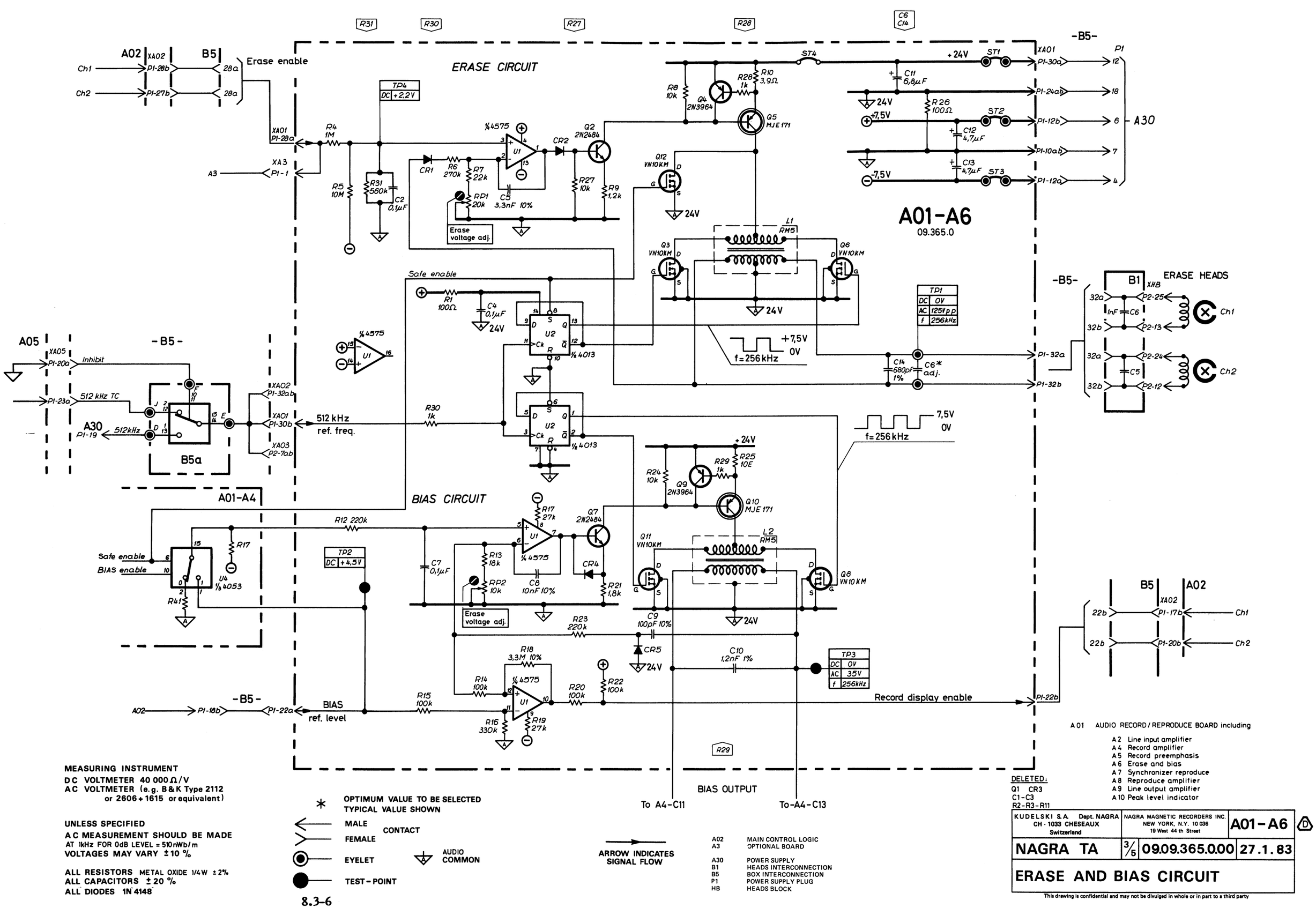
A 02 MAIN CONTROL LOGIC
A 30 POWER SUPPLY
B 1 HEAD INTERCONNECTION
B 5 BOX INTERCONNECTION
BJ 4 AUDIO MONITORING PLUG
BJ 7 COPY INPUT PLUG
P 1 POWER SUPPLY PLUG
HB HEAD BLOCK

DELETED:
R16

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A01-A4	D
NAGRA TA	2/5	09.09.365.0.00	27.10.81
RECORD AMPLIFIER			

A6 ERASE AND BIAS CIRCUIT
09.365.0 index D





MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

UNLESS SPECIFIED
AC MEASUREMENT SHOULD BE MADE AT 1kHz FOR 0dB LEVEL = 510nWb/m
VOLTAGES MAY VARY ±10 %

ALL RESISTORS METAL OXIDE 1/4W ±2%
ALL CAPACITORS ±20 %
ALL DIODES 1N4148

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE, FEMALE — CONTACT
EYELET
TEST-POINT
AUDIO COMMON

ARROW INDICATES SIGNAL FLOW

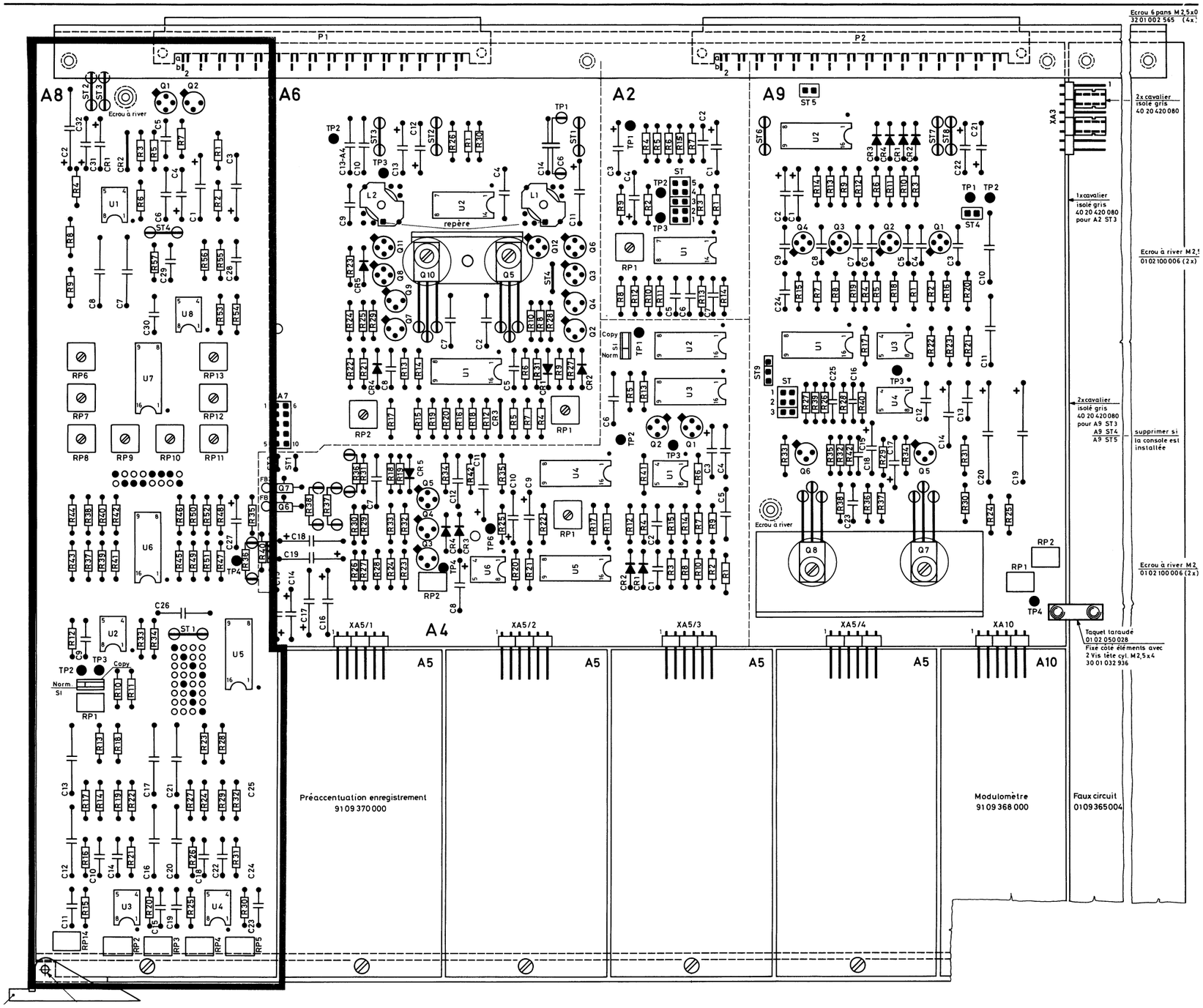
A02 MAIN CONTROL LOGIC
A3 OPTIONAL BOARD
A30 POWER SUPPLY
B1 HEADS INTERCONNECTION
B5 BOX INTERCONNECTION
P1 POWER SUPPLY PLUG
HB HEADS BLOCK

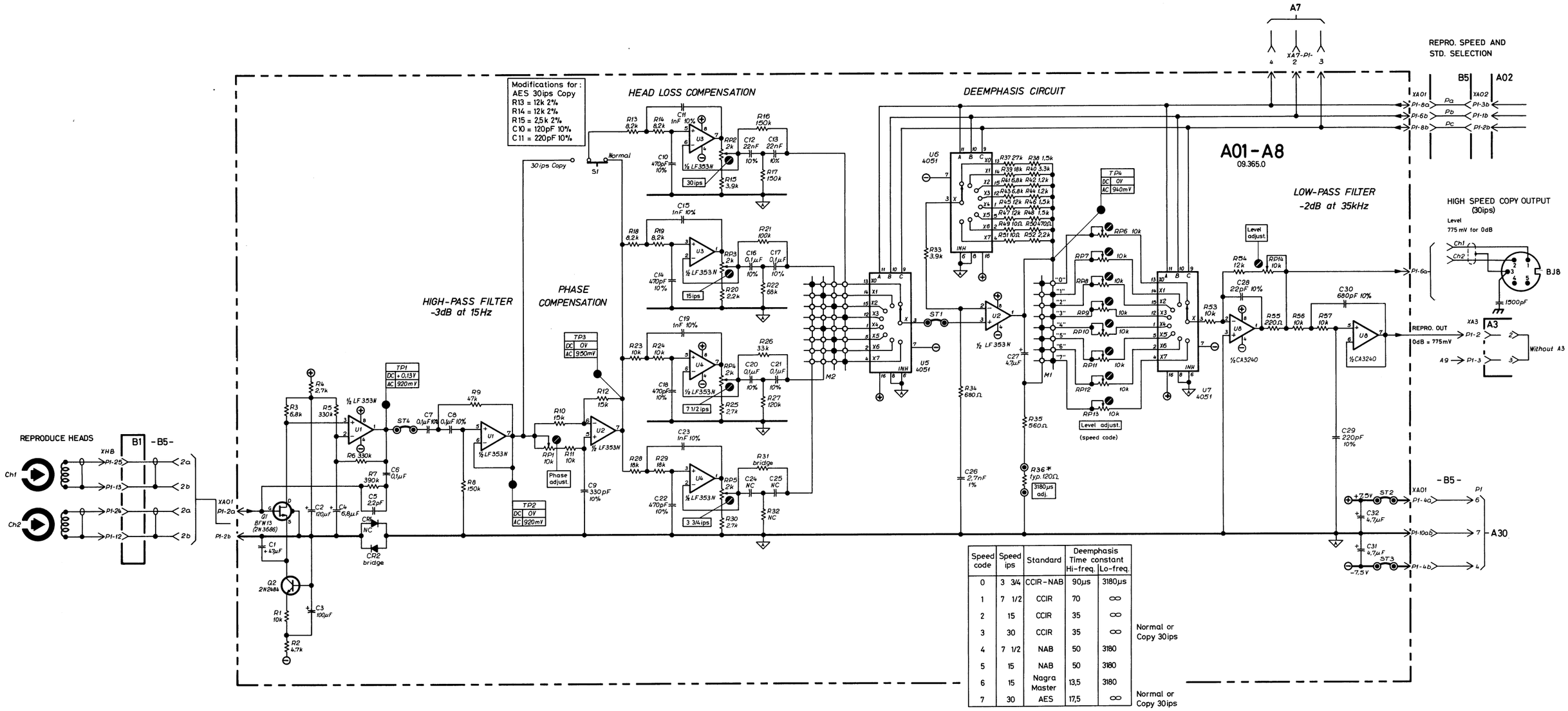
A01 AUDIO RECORD/REPRODUCE BOARD including
A2 Line input amplifier
A4 Record amplifier
A5 Record preemphasis
A6 Erase and bias
A7 Synchronizer reproduce
A8 Reproduce amplifier
A9 Line output amplifier
A10 Peak level indicator

DELETED:
Q1 CR3
C1-C3
R2-R3-R11

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A01-A6	D
NAGRA TA	3/5	09.09.365.0.00	27.1.83
ERASE AND BIAS CIRCUIT			

A8 REPRODUCE AMPLIFIER
09.365.0 index D





Speed code	Speed ips	Standard	Deemphasis Time constant Hi-freq.	Lo-freq.	
0	3 3/4	CCIR-NAB	90µs	3180µs	
1	7 1/2	CCIR	70	∞	
2	15	CCIR	35	∞	
3	30	CCIR	35	∞	Normal or Copy 30ips
4	7 1/2	NAB	50	3180	
5	15	NAB	50	3180	
6	15	Nagra Master	13,5	3180	
7	30	AES	17,5	∞	Normal or Copy 30ips

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606 + 1615 or equivalent)

UNLESS SPECIFIED
AC AND DC MEASUREMENT SHOULD BE MADE AT 15 ips AND AT 1kHz FOR 0dB LEVEL (510nWb/m)
VOLTAGES MAY VARY ±10 %

ALL RESISTORS METAL OXIDE 1/4W ±2%
ALL CAPACITORS ±20 %

ALL CONNECTORS VIEWED FROM THE OUTSIDE

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE, FEMALE — CONTACT
EYELET — AUDIO COMMON
TEST-POINT — FRAME
ARROW INDICATES SIGNAL FLOW

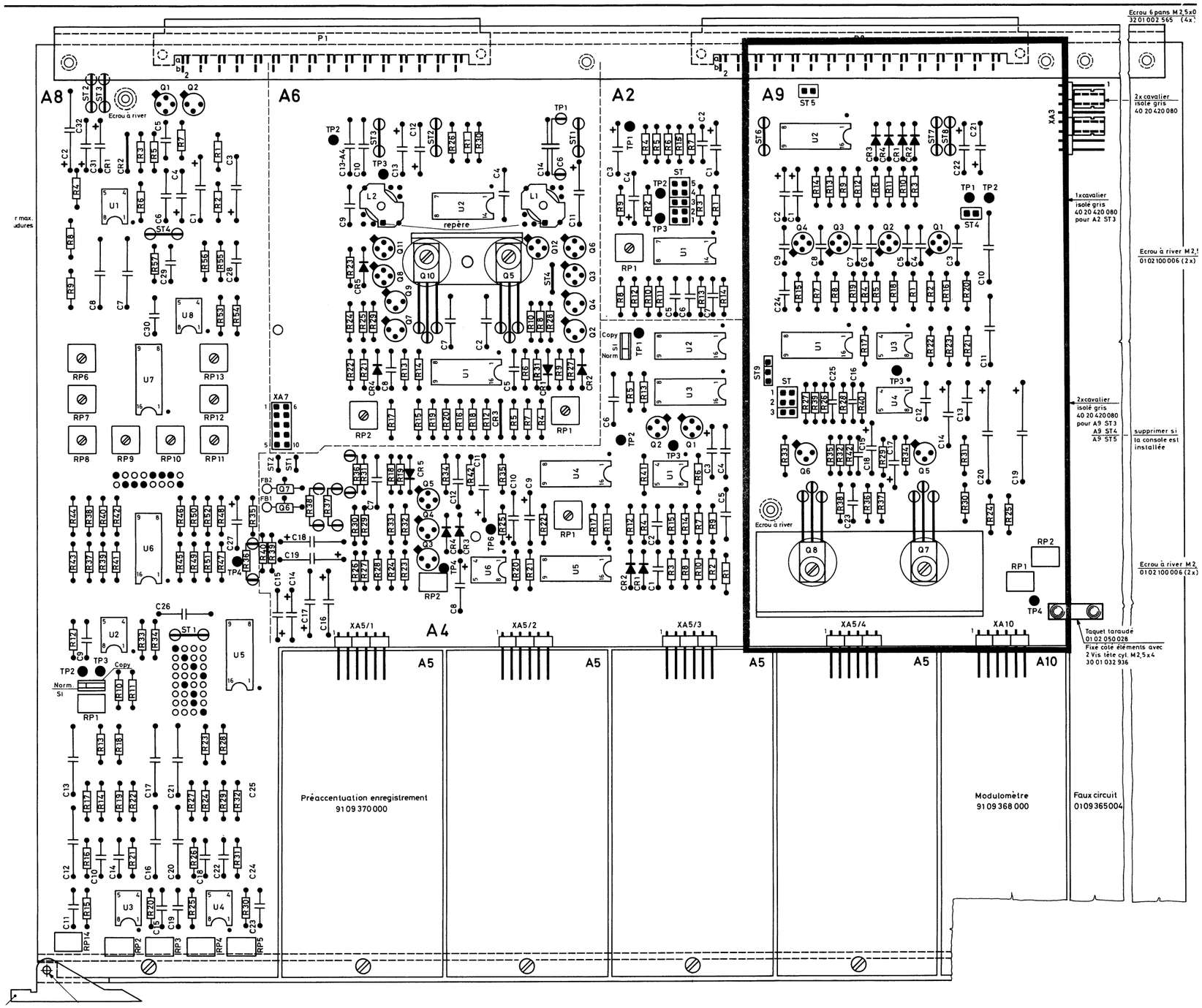
A01 AUDIO RECORD / REPRODUCE BOARD including
A2 Line input amplifier
A4 Record amplifier
A5 Record preemphasis
A6 Erase and bias
A7 Synchronizer reproduce
A8 Reproduce amplifier
A9 Line output amplifier
A10 Peak level indicator

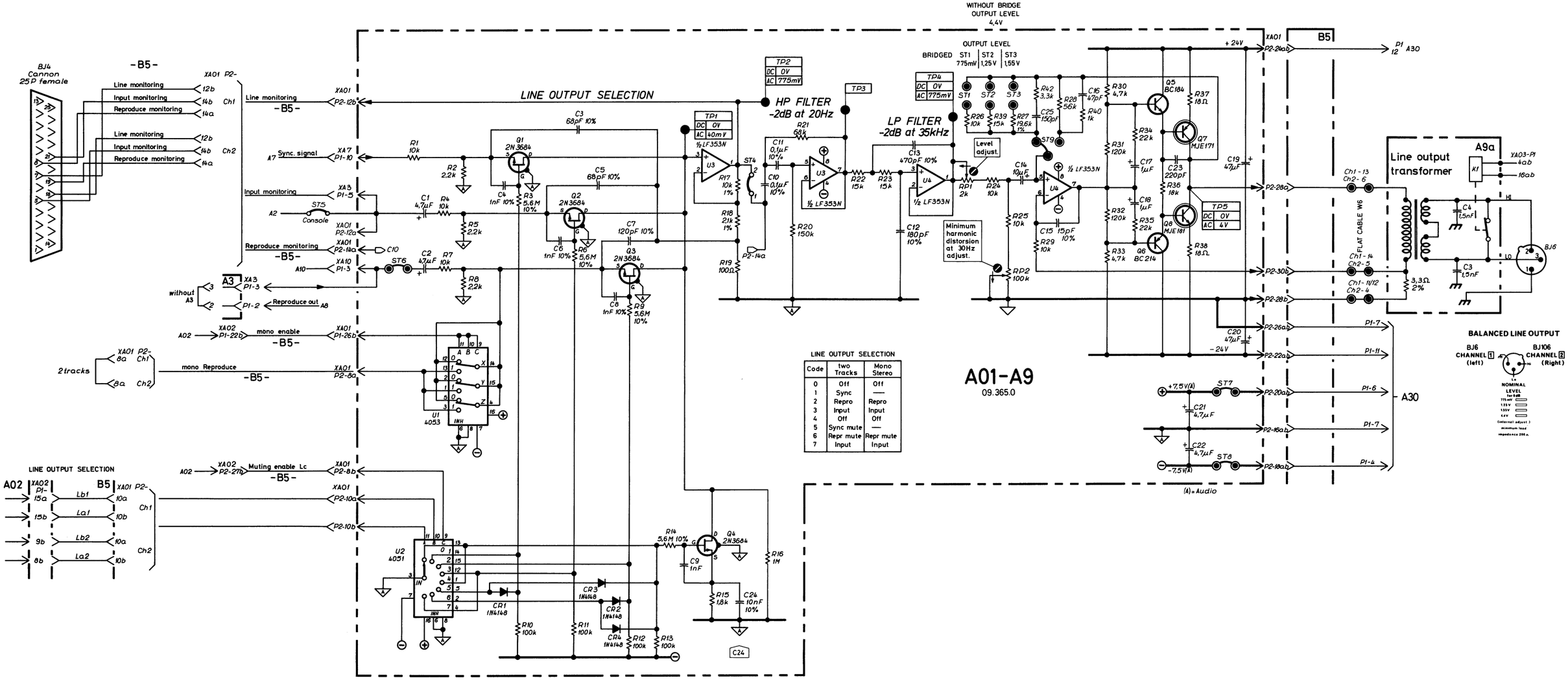
A02 MAIN CONTROL LOGIC
A3 OPTIONAL BOARD

A30 POWER SUPPLY
B1 HEADS INTERCONNECTION
B5 BOX INTERCONNECTION
BJ8 COPY OUTPUT PLUG
P1 POWER SUPPLY PLUG
H8 HEADS BLOCK

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10 036 19 West 44 th Street	A01-A8	0
NAGRA TA	4/5	09.09.365.0.00	19.11.81
REPRODUCE AMPLIFIER			

A9 LINE OUTPUT AMPLIFIER
09.365.0 index D





LINE OUTPUT SELECTION

Code	two Tracks	Mono Stereo
0	Off	Off
1	Sync	—
2	Repro	Repro
3	Input	Input
4	Off	Off
5	Sync mute	—
6	Repr mute	Repr mute
7	Input	Input

MALE / FEMALE CONTACT
EYELET
TEST-POINT
ARROW INDICATES SIGNAL FLOW
FRAME
AUDIO COMMON

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

UNLESS SPECIFIED
AC MEASUREMENT SHOULD BE MADE AT 1 kHz FOR 0dB LEVEL AND 4,4V OUT
VOLTAGES MAY VARY ±10 %

ALL RESISTORS METAL OXIDE 1/4W ±2%
ALL CAPACITORS ±20 %

ALL CONNECTORS VIEWED FROM THE OUTSIDE

A 01 AUDIO RECORD / REPRODUCE BOARD including
- A 2 Line input amplifier
- A 4 Record amplifier
- A 5 Record preemphasis
- A 6 Erase and bias
- A 7 Synchronizer reproduce
- A 8 Reproduce amplifier
- A 9 Line output amplifier
- A 10 Peak level indicator

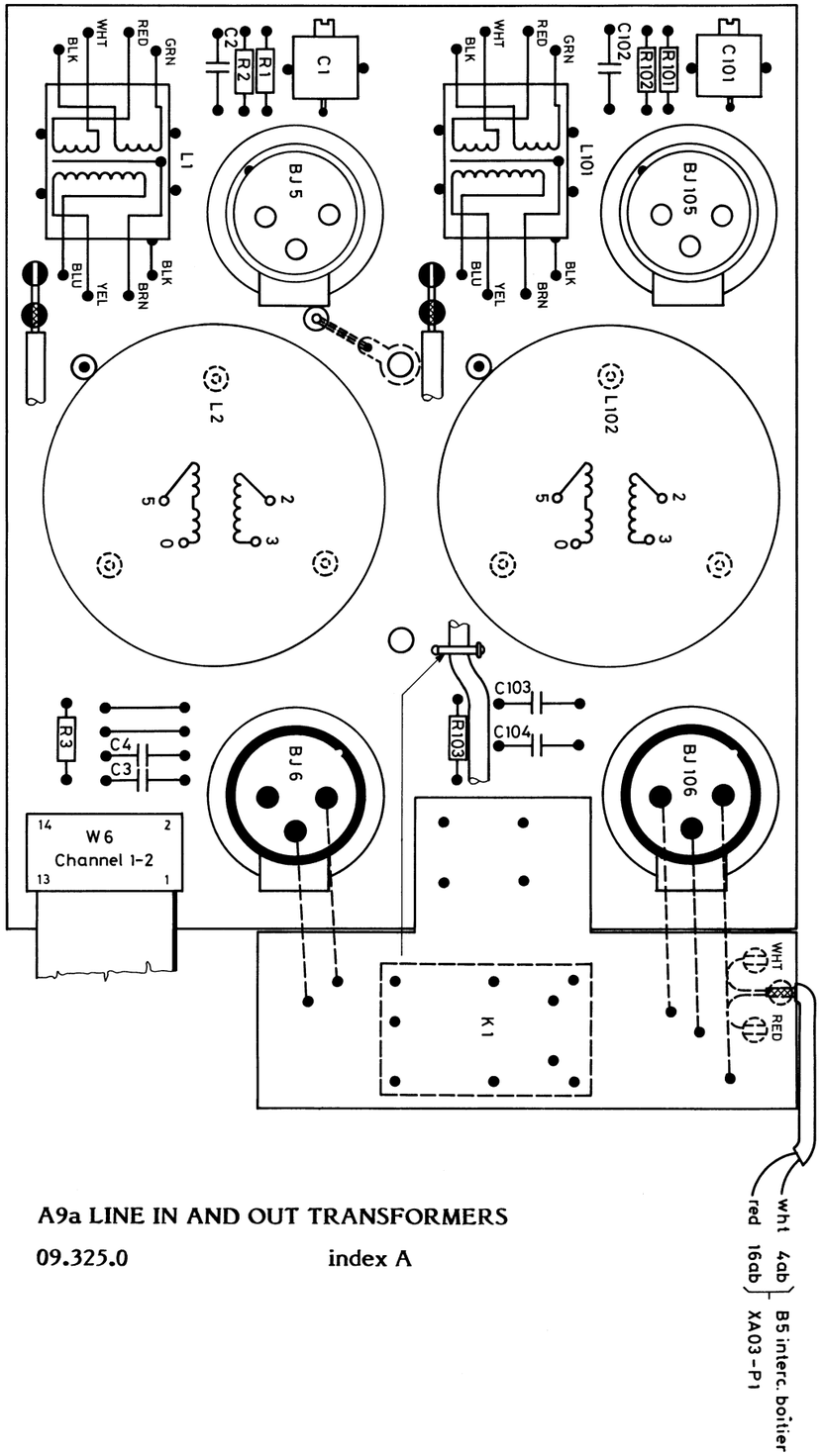
A02 MAIN CONTROL LOGIC
A3 OPTIONAL BOARD

A9a INPUT/OUTPUT–LINE TRANSF. BOARD

A30 POWER SUPPLY
B5 BOX INTERCONNECTION
BJ4 AUDIO MONITORING PLUG
BJ6 BALANCED LINE OUTPUT PLUG
BJ106 BALANCED LINE OUTPUT PLUG
P1 POWER SUPPLY PLUG

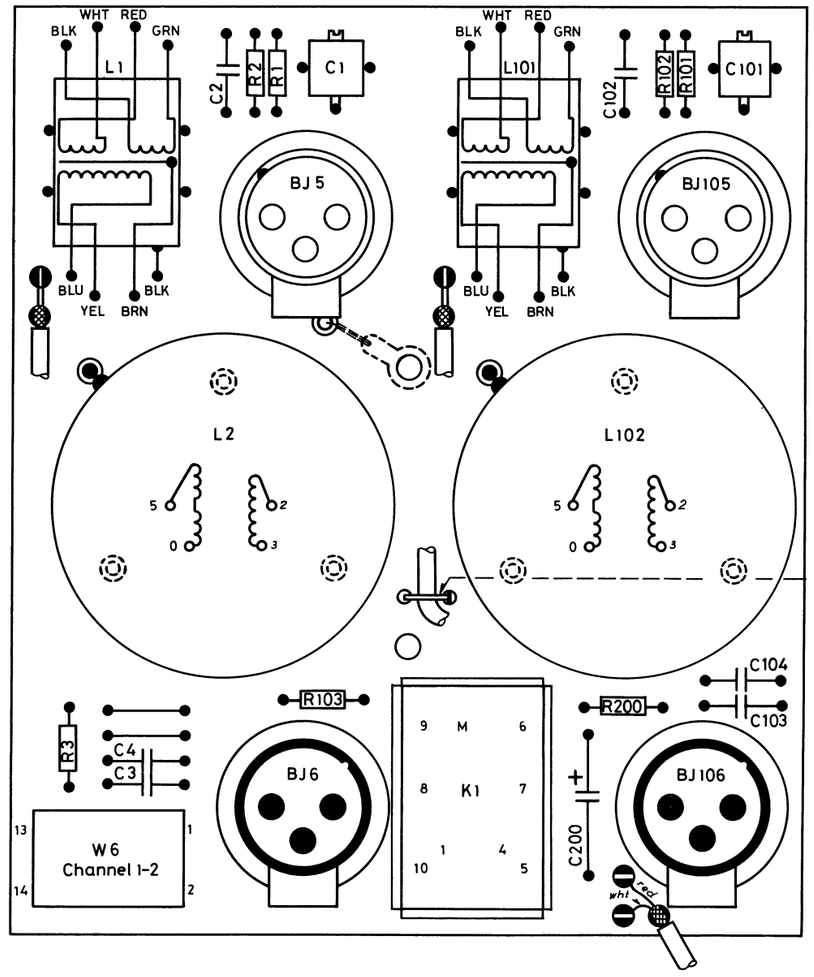
DELETED:
R41

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A01-A9 (D)
NAGRA TA	5/5	09.09.365.0.00 | 4.11.81
LINE OUTPUT AMPLIFIER		



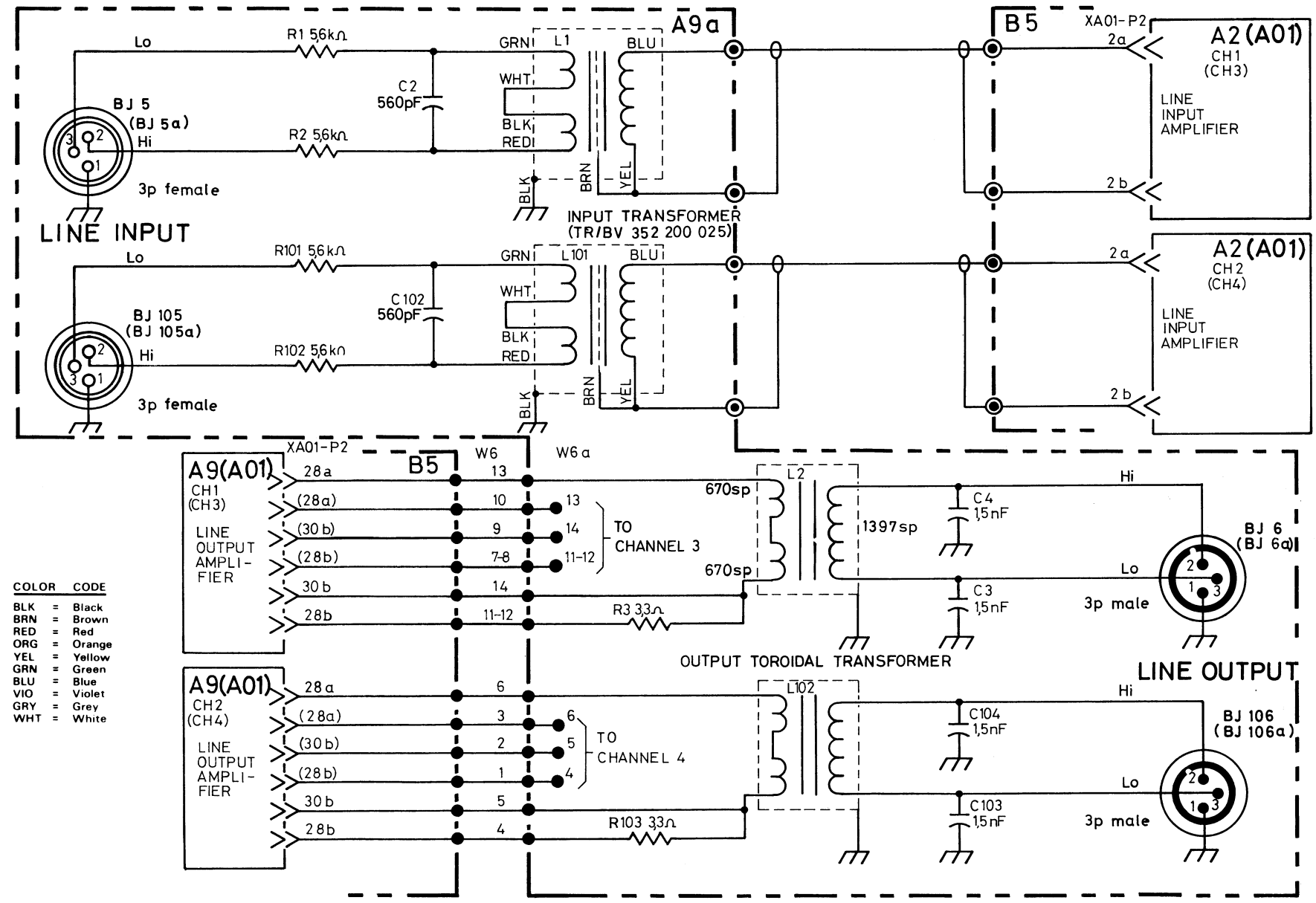
A9a LINE IN AND OUT TRANSFORMERS

09.325.0 index A



A9a LINE IN AND OUT TRANSFORMERS

09.326.0 index A



COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White

MALE
FEMALE
CONTACT
EYELET
FRAME

UNLESS SPECIFIED
ALL RESISTORS ± 2 % 1/4 W
ALL CAPACITORS ± 10 %

ALL CONNECTORS VIEWED FROM THE OUTSIDE

KUDELSKI S.A. Dept. NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 19 West 44 th. Street	A9a
NAGRA TA	09 09 325000	14 7 81
LINE IN AND OUT TRANSFORMERS		

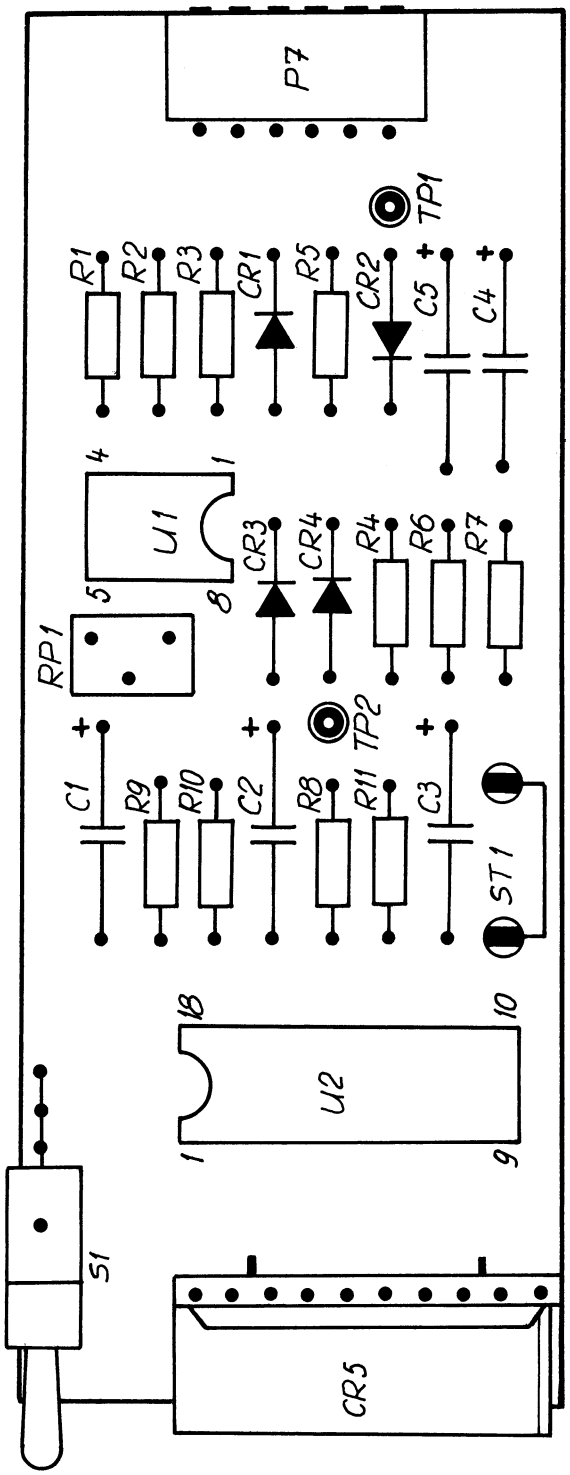
COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White

MALE
FEMALE
CONTACT
EYELET
FRAME

UNLESS SPECIFIED
ALL RESISTORS ± 2 % 1/4 W
ALL CAPACITORS ± 10 %

ALL CONNECTORS VIEWED FROM THE OUTSIDE

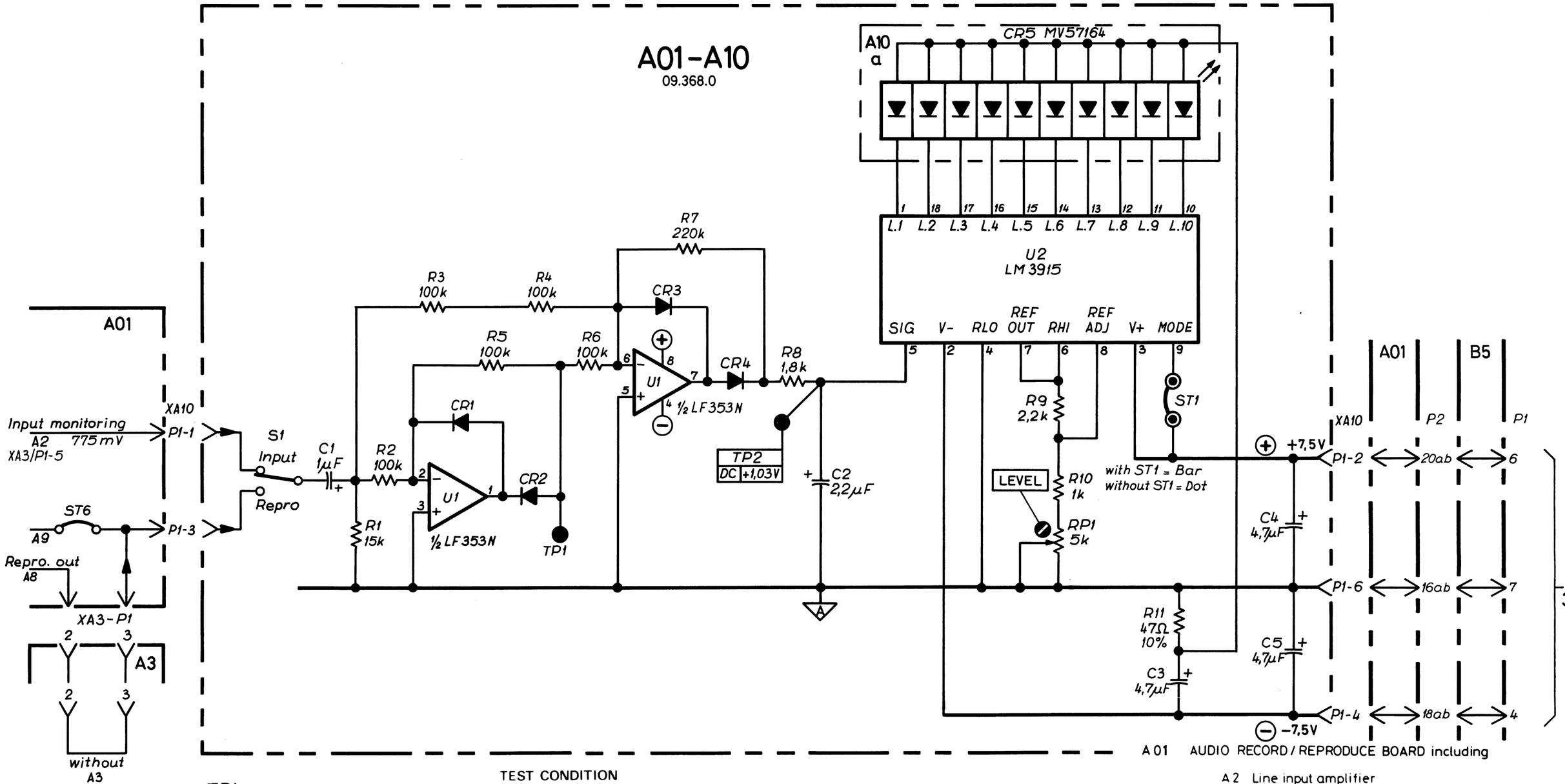
KUDELSKI S.A. Dept. NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 19 West 44 th. Street	A9a
NAGRA TA	09 09 326000	14 7 81
LINE IN AND OUT TRANSFORMERS		



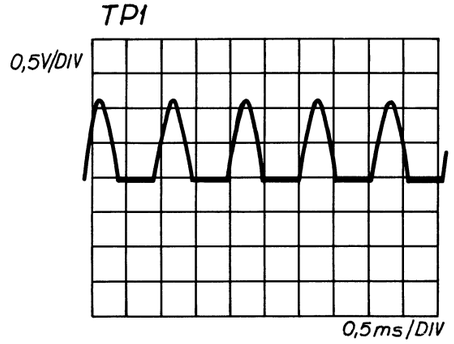
A10 PEAK LEVEL INDICATOR
09.368.0

A01-A10

09.368.0



TP1



TEST CONDITION

AC AND DC MEASUREMENT SHOULD BE MADE AT 0dB LEVEL

MEASURING INSTRUMENT

DC VOLTMETER 40 000 Ω / V

UNLESS SPECIFIED

VOLTAGES MAY VARY ± 10 %

ALL RESISTORS ¼W ± 2 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

ARROW INDICATES SIGNAL FLOW

A3 OPTIONAL BOARD

A30 POWER SUPPLY
P1 POWER SUPPLY PLUG

MALE
FEMALE
CONTACT
EYELET
TEST-POINT
AUDIO COMMON

A01 AUDIO RECORD / REPRODUCE BOARD including

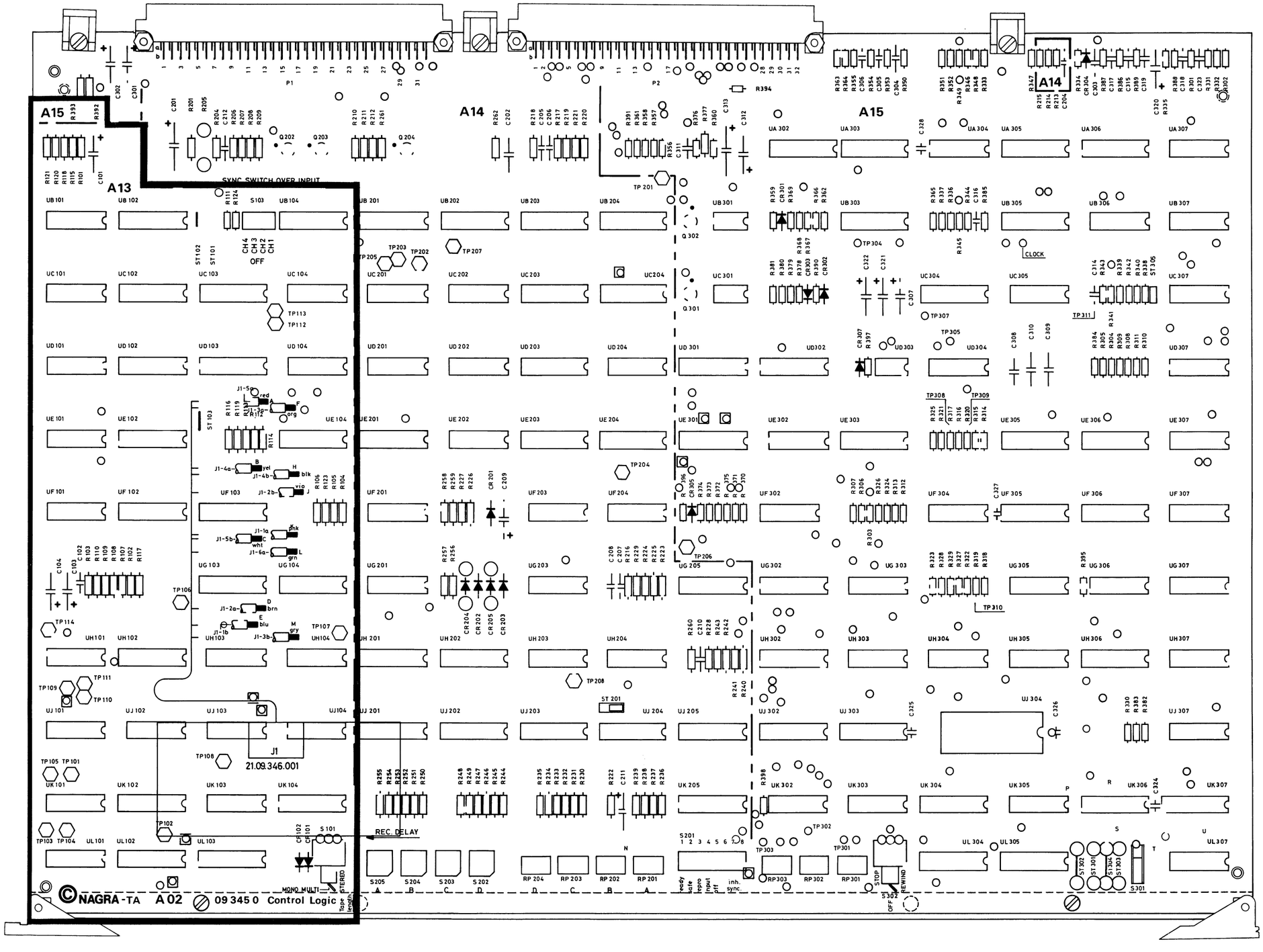
- A2 Line input amplifier
- A4 Record amplifier
- A5 Record preemphasis
- A6 Erase and bias
- A7 Synchronizer reproduce
- A8 Reproduce amplifier
- A9 Line output amplifier
- A10 Peak level indicator

3.86	REVISION

KUDELSKI S.A. Dept NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK N.Y. 10036 19 West 44th Street	A01-A10
NAGRA TA	09.09.368.0.00	27.10.81
PEAK LEVEL INDICATOR		

SECTION 8.4

A-02



A13 AUDIO CONTROL LOGIC

09.345.0 index E

A02 – A13

09.345.0

IC LIST

Comp.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	⊕	▽
UB101	H5	H5	H5	G5	-	-	14	7
UB102	H6	-	-	-	-	-	16	8
UB104	E6	-	-	-	-	-	16	8
UC101	G5	G5	F5	F5	-	-	14	7
UC102	G6	-	-	-	-	-	16	8
UC103	F6	-	-	-	-	-	16	8
UC104	E5	E5	F5	E5	-	-	14	7
UD101	F4	G4	H4	14	-	-	14	7
UD102	H-13	-	-	-	-	-	16	8
UD103	E-F3	-	-	-	-	-	16	8
UD104	E4	15	15	15	-	-	14	7
UE101	D-E4	H4	G4	F4	-	-	14	7
UE102	G3	-	-	-	-	-	16	8
UE104	D-E3	-	-	-	-	-	16	8
UF101	I2	H2	I2	-	-	-	14	7
UF102	G-H3	-	-	-	-	-	16	8
UF103	H-I2	-	-	-	-	-	16	8
UG103	F-G3	-	-	-	-	-	16	8
UG104	E3	-	-	-	-	-	16	8
UH101	B5	C3	-	-	-	-	14	7
UH102	B5	B5	C5	D3	D3	I4	14	7
UH103	G2	F2	F2	-	-	-	14	7
UH104	E-F2	E2	E2	-	-	-	14	7
UJ101	G3	H3	-	-	-	-	14	7
UJ102	H2	H2	G2	-	-	-	14	7
UJ103	B5	B6	C3	C3	-	-	14	7
UJ104	C6	H3-4	-	-	-	-	14	7
UK101	C-D2	D2	E2	D2	D2	D1	14	7
UK102	G-H2	-	-	-	-	-	16	8
UK103	E3	F3	-	-	-	-	14	7
UK104	E2	-	-	-	-	-	16	8
UL101	E2	D2	D1	E1	-	-	14	7
UL102	D2	-	-	-	-	-	16	8
UL103	F-G2	-	-	-	-	-	16	8

DISPLAY MULTIPLEXING

MUX 1	MUX 2	MUX 3	
Rec. 4	Safe 4	Repro 4	L 0
Ready 4	Sync 4	Input 4	L 1
Rec. 1	Rec. 2	Rec. 3	L 2
Ready 1	Ready 2	Ready 3	L 3
Safe 1	Safe 2	Safe 3	L 4
Sync. 1	Sync. 2	Sync. 3	L 5
Repro 1	Repro 2	Repro 3	L 6
Input 1	Input 2	Input 3	L 7

LINE OUT SELECTION

Lb	La	Function
0	0	Off
0	1	Sync.
1	0	Repro
1	1	Input

AUTOMATIC SWITCH – OVER FUNCTIONS

Sync - Rec. = Switch - over to Input or Off (selectable)

Sync. / Repro = Switch - over to Input in Stop, ≪, ≫, Loading . etc.

Sync. / Repro = Switch - over to Off if capstan speed not stabilized (only in bicapstan mode.)

Sync. / Repro / Off = Switch - over to Repro or Sync. in listen function.

A02 MAIN CONTROL LOGIC BOARD including
A13 Audio
A14 Serial bus multiplexer
A15 Tape transport

RECORD START CYCLE AT 19cm/s
(ON LINE AUDIO ERASE HEAD)
AUDIO REC ENABLE (TP111)
ERASE ENABLE (UE101 PIN 3 OR 11)
RECORD SIGNAL ENABLE (TP106)
BIAS ENABLE (TP107)
100ms/DIV
PUNCH IN DELAY (LINE ADJUST WITH RP1 ON A02-A17)
DELAY ~ 50ms

RECORD STOP CYCLE AT 19cm/s
(ON LINE AUDIO ERASE HEAD)
AUDIO REC ENABLE (TP111)
ERASE ENABLE (UE101 PIN 3 OR 11)
RECORD SIGNAL ENABLE (TP106)
BIAS ENABLE (TP107)
100ms/DIV
PUNCH IN DELAY (LINE ADJUST WITH RP2 ON A02-A17)
DELAY ~ 70ms

COLOR CODE
BLK = Black
BRN = Brown
RED = Red
ORG = Orange
YEL = Yellow
GRN = Green
BLU = Blue
VIO = Violet
GRY = Grey
WHT = White
PNK = Pink
TAN = Tan

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω / V

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS 1/4 W ± 10 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN
MALE CONTACT
FEMALE
EYELET
TEST – POINT
ARROW INDICATES SIGNAL FLOW
LOGIC COMMON

A01 AUDIO RECORD / REPRODUCE
A04 TAPE COUNTER AND THIRD TRACK
A05 SYNCHRONIZER
A14 SERIAL BUS MULTIPLEXER
A15 TAPE TRANSPORT CONTROL LOGIC
A30 POWER SUPPLY
B5 BOX INTERCONNECTION
BJ3 REMOTE CONTROL PLUG
BJ4 AUDIO MONITORING PLUG
BP1 POWER SUPPLY PLUG

ALL IC VDD ⊕ PIN 16 or 14
VSS ▽ PIN 8 or 7

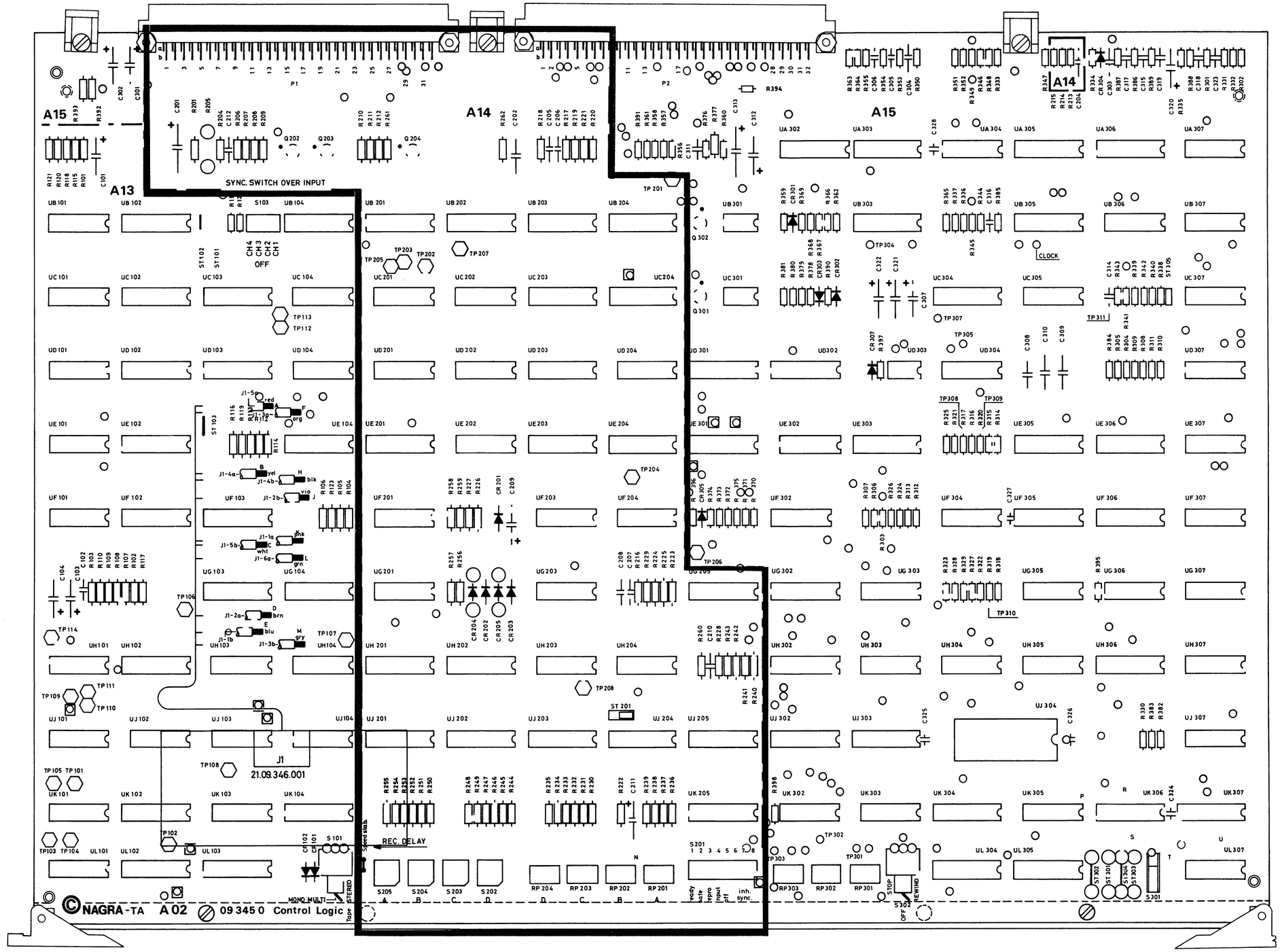
A02 – A17
09.346.0

LINE OUT SELECTION AND AUTOMATIC SWITCH – OVER

8.4-2

KUDELSKI S.A. Dept. NAGRA CH - 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th. Street
NAGRA TA	1/3 09 09 345 000 20.10.81
AUDIO CONTROL LOGIC	

A02-A13 E
A02-A17 △



A14 SERIAL BUS MULTIPLEXER

09.345.0 **index E**

A02-A14

09.345.0

DISPLAY/KEYBOARD SELECTOR

CLOCK GENERATION

SYNC. DETECTION

DISPLAY MUTIPLEXER

PRESSED KEY DETECTOR

SPEED std DISPLAY MULTIPLEXER

SYNC. INHIBITED

AUDIO FUNCTIONS INITIALIZATION

INITIALIZATION COUNTER

BUS DRIVERS

REPRODUCING SPEED std SELECTION

MODIFY COUNTER

BIAS REF. VOLTAGE ADJ.

SPEED std DISPLAY DECODER

SPEED STAB./COUNTER ENCODER

Serial bus = 128 positions
Total duration of one cycle = 125 µs x 128 = 16 ms

TP 203 10V/div.
TP 202 10V/div.
TP 206 10V/div.
Serial bus 1V /div.
125 µs
20µs /div.

Recording mode

UF 201-3 10V/div.
UF 201-4 10V/div.
UF 201-5 10V/div.
UF 201-6 10V/div.
1ms / div.

Initialization

TP 207 10V/div.
TP 208 10V/div.
10ms /div.

8.4-4

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS 1/8W ± 5 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

A01	AUDIO RECORD / REPRODUCE
A03	TAPE TRANSPORT CONTROL AND SPEED STAB.
A04	TAPE COUNTER AND THIRD TRACK
A06	SYNCHRONIZER
A13	AUDIO CONTROL LOGIC
A15	TAPE TRANSPORT CONTROL LOGIC
A30	POWER SUPPLY
B5	BOX INTERCONNECTION
BJ1	RIGHT KEYBOARD PLUG
BJ2	LEFT KEYBOARD PLUG (OPTION)
BJ3	REMOTE CONTROL PLUG
BJ4	AUDIO MONITORING PLUG
P1	POWER SUPPLY PLUG

REG. POWER SUPPLY COMMON
MAIN FRAME

ARROW INDICATES SIGNAL FLOW

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE / FEMALE CONTACT
EYELET
TEST-POINT
LOGIC COMMON

COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White

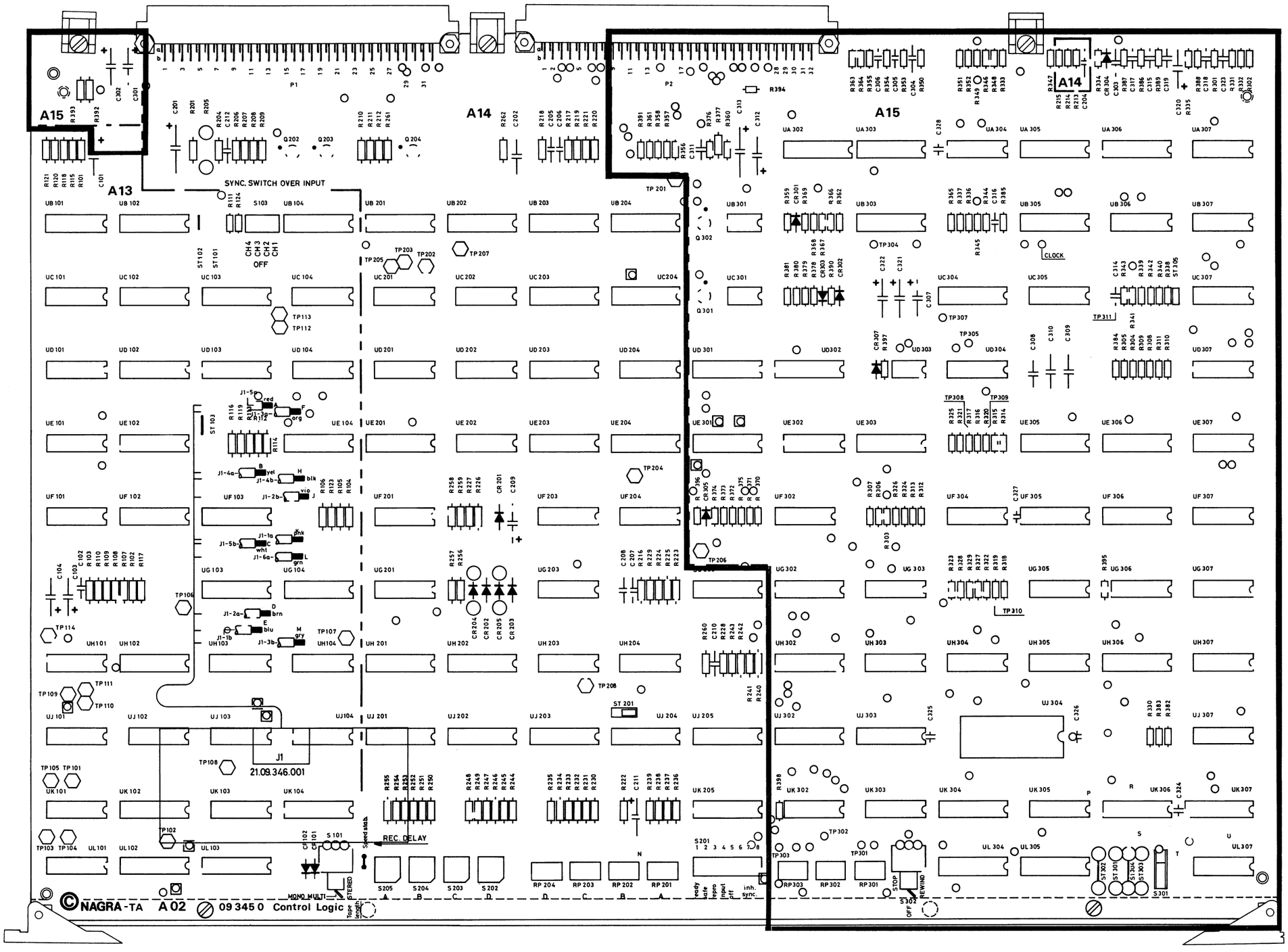
DELETED:
Q201
C203
R202 - R203

Repro selector	Effectiv speed (ips)	Speed code
0	3.34	0
1	7 1/2	1
2	15	2
3	30	3
4	7 1/2	1
5	15	2
6	15	2
7	30	3

IC LIST

Component	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	⊕	▽	⊖
UB 201	C2	-	-	-	-	-	16	8	-
UB 202	F6	-	-	-	-	-	16	8	-
UB 203	D3	-	-	-	-	-	16	8	-
UB 204	C3-4	-	-	-	-	-	16	8	-
UC 201	C3	C3	C3	C3	-	-	14	7	-
UC 202	D3	D-E5	-	-	-	-	14	7	-
UC 203	E4	-	-	-	-	-	16	8	-
UC 204	C5	-	-	-	-	-	16	8	-
UD 201	B3	C3	D6	A3	A3	D4	14	7	-
UD 202	D5	-	-	-	-	-	14	7	-
UD 203	E3	-	-	-	-	-	16	8	-
UD 204	D3	-	-	-	-	-	14	7	-
UE 201	C2	B-C2	-	-	-	-	16	8	-
UE 202	E5	E5-6	D5	C-D3	-	-	14	7	-
UE 203	E6	D3	G4	E5	E4	E4	14	7	-
UE 204	D2	-	-	-	-	-	16	8	-
UF 201	F2	D4	E4	-	-	-	14	7	-
UF 203	F4	E4	-	-	-	-	14	7	-
UF 204	C5	E5	F6	F5	-	-	14	7	-
UG 201	D4	E4	E3	E3	-	-	14	7	-
UG 203	F3	F3	-	-	-	-	14	7	-
UG 205	C4	C4	G2	F2	C4	C4	16	8	-
UH 201	H5	-	-	-	-	-	16	8	-
UH 202	I5	-	-	-	-	-	16	8	-
UH 203	C4	H6	H6	F4	-	-	14	7	-
UH 204	G5	F5	E4	-	-	-	14	7	-
UJ 201	I4	H-I4	-	-	-	-	16	8	-
UJ 202	H4	H4	-	-	-	-	16	8	-
UJ 203	G5	G5	-	-	-	-	16	8	-
UJ 204	F4	F4	-	-	-	-	16	8	-
UK 205	D6	-	F2	G2	F2	G2	16	8	-

KUDELSKI S.A. Dept. NAGRA	CH - 1033 CHESEAUX, Switzerland
NAGRA MAGNETIC RECORDERS INC.	NEW YORK, N.Y. 10 036, 19 West 44 th Street
A02 - A14	E
NAGRA TA	2/3 09 09 345 000 25.11.81
SERIAL BUS MULTIPLEXER	



A15 TRANSPORT CONTROL LOGIC

09.345.0 index E

A02-A15

09.345.0

8.4-6

A 01 AUDIO RECORD/REPRODUCE
A 03 TAPE TRANSPORT CONTROL AND SPEED STAB.
A 04 TAPE COUNTER AND THIRD TRACK
A 05 TIME CODE
A 5a COUNTER ENCODER
A 13 AUDIO CONTROL LOGIC
A 14 SERIAL BUS MULTIPLEXER
A 15b CLEAR TAPE DETECTOR
A 16a KEYBOARD
A 19 SERVO-EDITING
A 30 POWER SUPPLY
B 1 HEAD INTERCONNECTION
B 2 TAPE COUNTER ENCODER INTERC.
B 3 TAPE-DECK INTERCONNECTION
B 5 BOX INTERCONNECTION
BJ1 RIGT KEYBOARD PLUG
BJ2 LEFT KEYBOARD PLUG (OPTION)
BJ3 REMOTE CONTROL PLUG
BJ4 AUDIO MONITORING PLUG
P 1 POWER SUPPLY PLUG
HB HEAD BLOCK

SEE A 14 MULTIPLEXER

SPEED VARIATOR

spooling

Playback Speed %

Compon.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	⊕	▽	⊖
	302	E9	D6	D6	C9	-	-	14	7	-
	303	C6	C7	-	-	-	-	16	8	-
UA	304	C7	C6	C8-9	A5	-	-	3	12	-
	305	D-E9	E9	-	-	-	-	16	8	-
	306	E9	F9	-	-	-	-	16	8	-
	307	D3	E9	F9	-	-	-	14	7	-
	301	E8	-	-	-	-	-	8	4	-
	303	E8	E8	-	-	-	-	16	8	-
UB	305	F9	F9	F9	F9	F9	C9	16	8	-
	306	G7	E3	D9	D9	D9	C9	14	7	-
	307	D6	E7	D7	C8	-	-	14	7	-
	301	C8	B8-9	-	-	-	-	8	-	4
	304	E7	E7	-	-	-	-	16	8	-
UC	305	E6	E6	E6	E6	D9	D8	14	7	-
	307	D6	-	-	-	-	-	14	7	-
	301	E7	E8	F7	F9	-	-	16	8	-
	302	C8	-	-	-	-	-	16	8	-
UD	303	B8	-	-	-	-	-	8	4	-
	304	E3	E7	E7	F9	-	-	14	7	-
	307	F4	D6	D6	E6	-	-	14	7	-
	301	F8	-	-	-	-	-	16	8	7
	302	D7	E7	E8	E8	-	-	14	7	-
UE	303	B2	C2	C9	D3	F3	E3	1	8	-
	305	F2	-	-	-	-	-	16	8	-
	306	E5	-	-	-	-	-	16	8	-
	307	D5	D5	E5	F4	-	-	14	7	-

Compon.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	⊕	▽	⊖
	302	E7	-	-	-	-	-	16	8	-
	304	F5	F5	F5	F4	-	-	3	-	12
UF	305	E2	-	-	-	-	-	16	8	-
	306	D2	-	-	-	-	-	16	8	-
	307	D5	E5	E5	-	-	-	14	7	-
	302	C9	B5	D4	E7	E7	E4	1	8	-
	303	B2	B2	D4	D2	-	-	14	7	-
UG	305	D3	E2	E2	E3	-	-	14	7	-
	306	B5	-	-	-	-	-	14	7	-
	307	D5	D5	D5	D5	-	-	14	7	-
	302	C2	-	-	-	-	-	16	8	-
	303	B3	C3	C2-3	-	-	-	14	7	-
UH	304	F4	F4	E5	D4	-	-	14	7	-
	305	C2	D2	C-D3	C2	-	-	14	7	-
	306	E4-5	-	-	-	-	-	16	8	-
	307	D5	D5	D5	D4-5	-	-	14	7	-

Compon.	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	⊕	▽	⊖
	302	C-D2	-	-	-	-	-	16	8	-
UJ	303	B3	-	-	-	-	-	16	8	-
	304	C3	-	-	-	-	-	24	12	-
	307	D4	D3	D9	-	-	-	14	7	-
	302	F3	D2	F3	-	-	-	14	7	-
	303	E4	D2	-	-	-	-	14	7	-
UK	304	E4	E4	E4	F3	-	-	14	7	-
	305	C6	C6	-	-	-	-	14	7	-
	306	C-D3	-	-	-	-	-	16	8	-
	307	D4	D4	D5	D5	-	-	14	7	-
	304	E3	-	-	-	-	-	14	6	-
UL	306	E3-4	-	-	-	-	-	16	8	-
	307	D3	D3	D4	-	-	-	14	7	-

COLOR CODE

BLK	BLACK
BRN	BROWN
RED	RED
ORG	ORANGE
YEL	YELLOW
GRN	GREEN
BLU	BLUE
VIO	VIOLET
GRY	GREY
WHT	WHITE
PNK	PINK

MEASURING INSTRUMENT
DC VOLTMETER 40000 Ω/V

UNLESS SPECIFIED
VOLTAGES MAY VARY ±10%

ALL RESISTORS 1/4 W ± 2%
ALL CAPACITORS ±20%
ALL DIODES IN 4148

A 02 CONTROL LOGIC BOARD including
A 13 Audio
A 14 Serial bus multiplexer
A 15 Tape transport

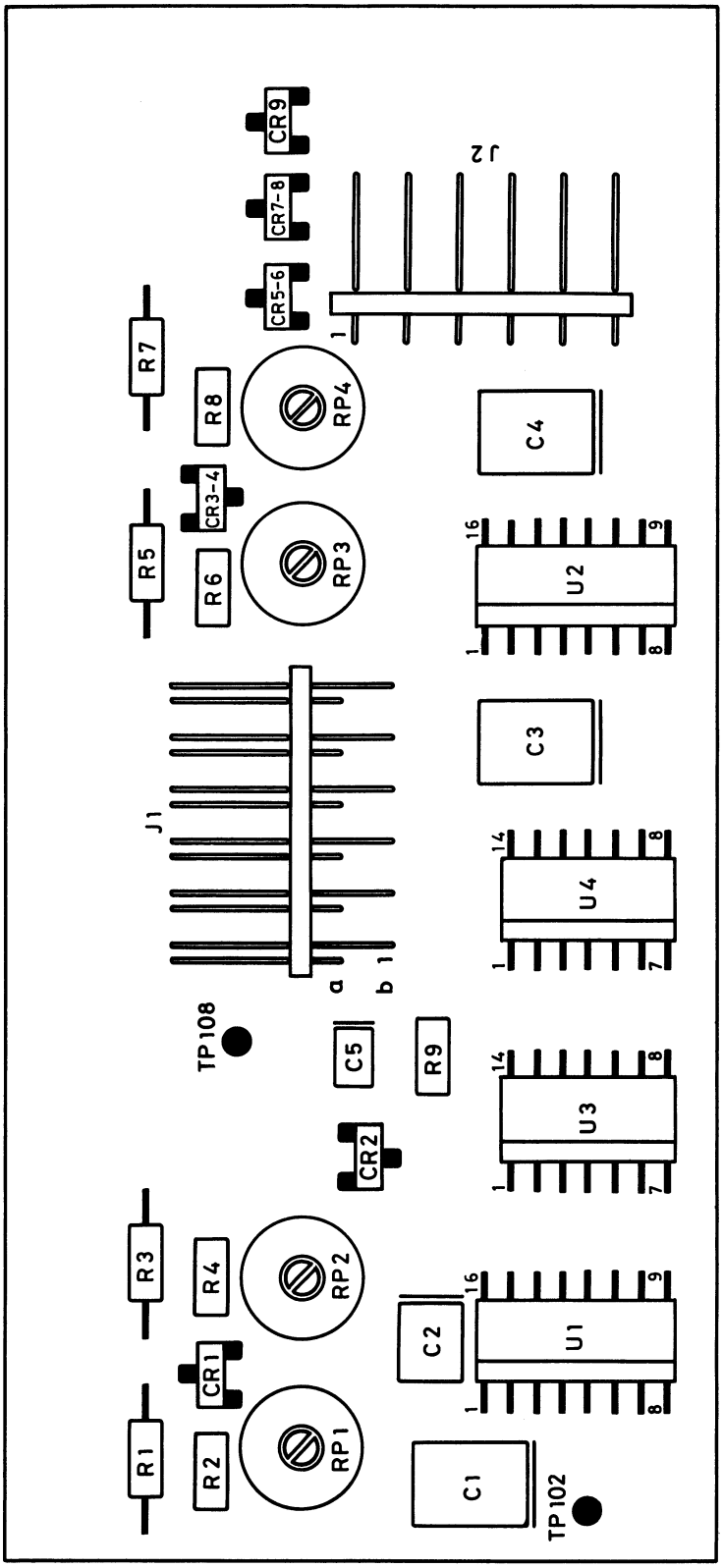
ARROW INDICATES SIGNAL FLOW
FEMALE
MALE
EYELET
TEST-POINT
OPTIMUM VALUE TO BE SELECTED TYPICAL VALUE SHOWN
UNREG COMMON
LOGIC COMMON
FRAME

KUDELSKI S.A. Dept. NAGRA
CH - 1033 CHEBEAUX
Switzerland

NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10 036
10 West 44 th Street

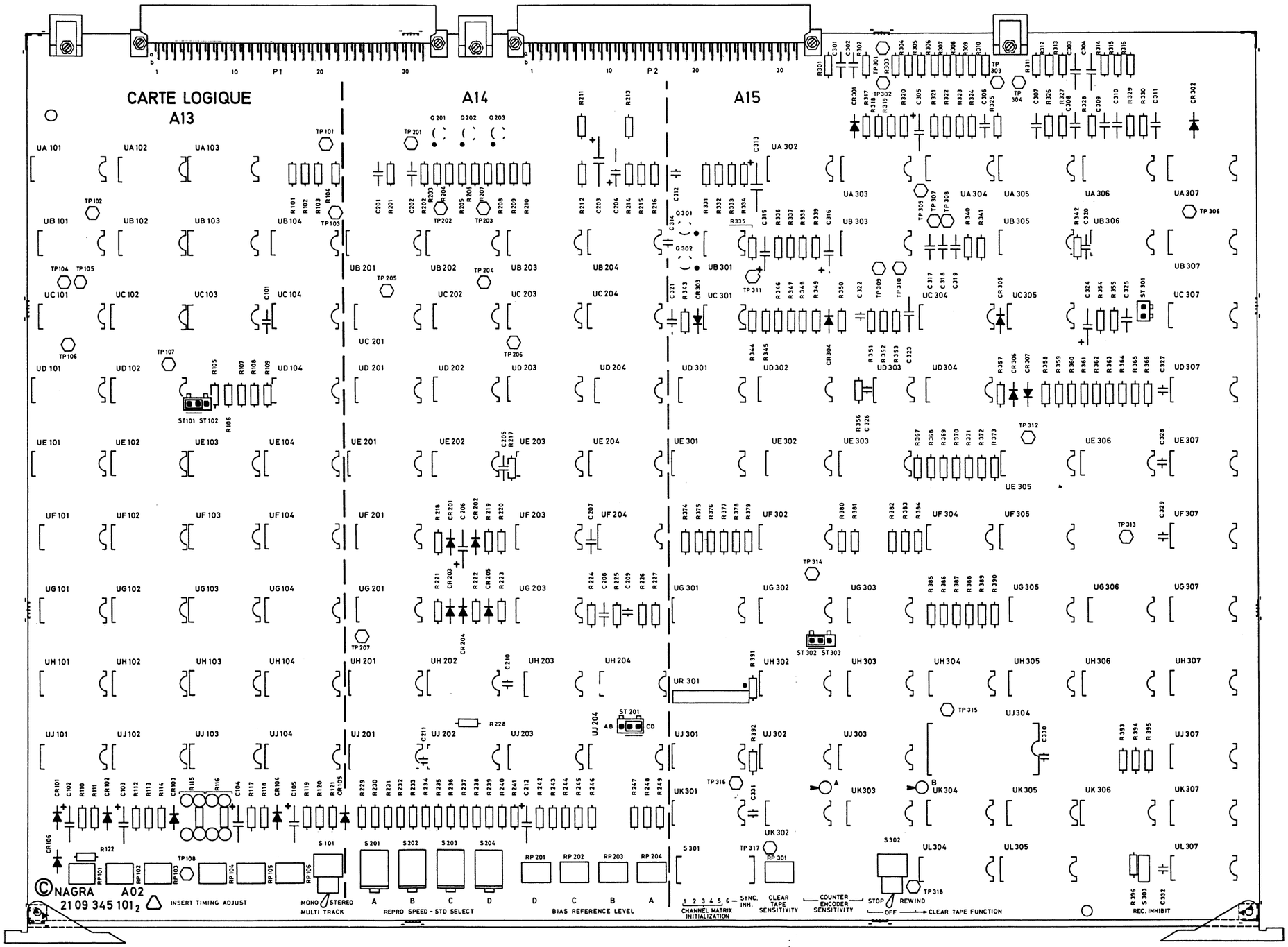
NAGRA TA | 3/3 | 09 09345 000 | 12.11.81. | A02-A15

TRANSPORT CONTROL LOGIC



A17 TEMPORISATION INSERT

09.346.0



LEGENDE

Point-test	01 04 765 103	(31x)
Pylône	01 04 109 106	(10x)
Douille	01 04 109 105	(10x)
Départ de fil		
Ecrou à river M2	01 09 365 007	

S 301. 6 SYNC INH.
7 SKIP DEFEAT
8 WINDING SLOW DOWN

A02 MAIN CONTROL LOGIC

A02-A13
09.345.1.
AUDIO CONTROL LOGIC

IC LIST

N°	Ref. design	Pos	Pos	Pos	Pos	Pos	Pos	⏚	▽L
UA 102	4071	A5	J5	J5	J5			14	7
UB101	4011	G6	G6	H6	H6			14	7
UB102	4069	G6	H6	J5	J6	J6	J6	14	7
UB103	4731 BP	B5	B5-6	C6	C-D6			16	7
UB104	4731 BP	B4	B4	C4-5	C-D5			16	7
UC 101	4001	E-F2	F2	F1-2	F2			14	7
UC 102	4028	E2						16	8
UC 103	4584	E1	E2	E2	F2	F2	D5	14	7
UC 104	4081	A4	B4	B5	B5			14	7
UD 101	4099	FG1-2						16	8
UD 102	4099	H1-2						16	8
UD 104	4071	D5	D6	I5	J6			14	7
UE 101	4099	I1-2						16	8
UE 102	4532	F-G5						16	8
UE 103	4081	F5	F5	H5	H5			14	7
UE 104	4532	G-H5						16	8
UF 101	4075	I2	I2	I2				14	7
UF 102	4043	I3						16	8
UF 103	4013	D2	H-I3					14	7
UF 104	4512	H-I4						16	8
UG101	4075	H2	H2	H2				14	7
UG102	4043	H3						16	8
UG103	4013	F3	G3					14	7
UG104	4512	G-H4						16	8
UH101	4075	F2	G2	G2				14	7
UH 102	4043	F-G3						16	8
UH103	4025	I-J3	J6	J6				14	7
UH104	4512	F4						16	8
UJ 101	4070	E5	E5	E6	E6			14	7
UJ 102	4538	D-E6	D-E7					16	8
UJ 103	4070	E4	E4	E6	E5			14	7
UJ 104	4538	D-E4	D-E5					16	8

B5

A01

A04 & A05

BJ3 Cannon 25p female

I/O BUS

XA01 P1

XA02 P2

XA04 & XA05 P1

XA04 & XA05 P2

To A14, A15

To A14

To A15

Mono enable

To A15

S101 MONO / MULTI TRACK

CR 101

CR 106

R122 47k

UC102 4028

UC 103 1/6 4584

UC 101 4x 1/4 4001

TP107

TP105

TP104

TP106

UD 101 4099

UD 102 4099

UE 101 4099

UH 101 3x 1/3 4075

UG 101 3x 1/3 4075

UF 101 3x 1/3 4075

UH 102 4043

UG 102 4043

UF 102 4043

UG103 1/2 4013

UF 103 1/2 4013

C104 100 pF 10%

R109 100k

R105 100k

R106 100k

R108 100k

R107 100k

Clock

256 kHz

Direct functions enable

Editing functions enable

Momentary functions enable

Ready 1

Ready 2

Ready tc

Sate 1

Sync 1

Repro 1

Input 1

Sate 2

Sync 2

Repro 2

Input 2

Sate tc

Sync tc

Repro tc

Input tc

A14

UD 201 1/6 4584

UH 103 1/3 4025

Record permitted

TP 101

RECORD START CYCLE at 19cm/s (ON LINE AUDIO ERASE HEAD)

RECORD STOP CYCLE at 19cm/s

Record enable UC 104.8

Erase enable P1-28b/P1-27b

Record signal enable P1-7ab/P1-10 ab

Bias enable P1-11ab/P1-12ab

426 ms

100 ms/DIV

delay 64 ms

Punch in delay (Line adjust with RP105/102)

Punch out delay (Line adjust with RP104/101)

CH 2

CH 1

Bias present 2

Bias present 1

Bias present tc

R104 1M

R102 1M

R101 1M

Count B

Count B (1 = 38 or 76 cm/s)

IN1 (38/19) ADJUST

IN1 (19) ADJUST

CR105

RP106 200k

R121 100k

C105 1µF

R115 100Ω

R120 56k

RP105 50k

UJ104 1/2 4538

AUDIO FUNCTIONS MULTIPLEXER UH 104 4512

UG 104 4512

UB 201 4512

Multiplexing code

MUX 3

MUX 2

MUX 1

Ready 1

CH.1

TP103

Erase 1

Record signal 1

Bias enable 1

Record signal 2

Bias enable 2

Erase 2

TP102

TP108 FRONTAL

DELAY = 32 ms

DELAY = 8.12 cm OF TAPE

DELAY = 64 ms

UB 104 1/4 4731 BP

UB 103 1/4 4731 BP

UC 104 1/4 4081

UA 102 1/4 4071

UD 104 1/4 4071

Tape delay pulses

ERASE / BIAS DELAY TIMING

CH.2

Record enable

Bicapstan enable

Tape forward sig

2 kHz

1 kHz

INSERT TIMING ADJUST CHANNEL 1

INSERT TIMING ADJUST CHANNEL 2

OUT 1 ADJUST

OUT 2 ADJUST

R116 Adj

R115 Adj

R118 10k

R117 10k

RP104 50k

RP103 50k

RP102 50k

RP101 50k

R113 56k

R111 10k

C104 1µF

C103 1µF

C102 1µF

UC 103 1/6 4584

UJ103 2x 1/4 4070

UJ101 2x 1/4 4070

UJ102 1/2 4538

UJ101 2x 1/4 4070

UJ104 1/2 4538

UJ103 2x 1/4 4070

UJ102 1/2 4538

SYNC. SWITCH-OVER TO INPUT

UE 103 1/4 4081

UE 104 1/4 4081

UE 102 4532

UD104 1/4 4071

R103 100k

ST101 SYNC

ST102 REPRO

UA 102 3 x 1/4 4071

UB 102 2 x 1/6 4069

UB 102 2 x 1/6 4069

UD 104 1/4 4071

UH 103 2 x 1/3 4025

UB 101 1/4 4011

UB K1 1/4 4011

Erase enable 1

Erase enable 2

Bias enable 1

Bias enable 2

Record signal enable 1

Record signal enable 2

Safe en 1

Safe en 2

Line out off

Listen enable

Rec 2

Rec 1

XA02-P1

XA01-P1

XA04-P1

W4

CH. 1

CH. 2

BJ 4

A05

UNLESS SPECIFIED

Voltages may vary ± 10%

All resistors 1/4 W ± 2%

All capacitors ± 20%

All diodes IN4148

All IC VDD ⊕ PIN 16 or 14

VSS ▽ PIN 8 or 7

MEASURING INSTRUMENT

DC Voltmeter 40000 Ω / V

Optimum value to be selected typical value shown

Male contact

Female contact

Arrow indicates signal flow

Eyelet

TP Test-Point

(TP) Test-Point (Automatic testing)

Logic common

DISPLAY MULTIPLEXING

MUX 1 MUX 2 MUX 3

Rec tc / Sate tc / Repro tc — L0

Ready 1 / Sync tc / Input tc — L1

Rec 1 / Rec 2 — L2

Ready 2 / Ready tc — L3

Sate 1 / Sate 2 — L4

Sync 1 / Sync 2 — L5

Repro 1 / Repro 2 — L6

Input 1 / Input 2 — L7

AUTOMATIC SWITCH-OVER FUNCTIONS

Sync + Rec = Switch-over to Input

Sync / Repro = Switch-over to Input in Stop ≪ ≫ Loading etc. (cf. SF 306 selected on A15)

Sync / Repro / Off = Switch-over to Off if capstan speed not stabilized (only in bicapstan mode)

Sync / Repro / Off = Switch-over to Repro or Sync in listen function (selectable by ST101/ ST102)

LINE OUT SELECTION

Lb	La	Function
0	0	Off
0	1	Sync
1	0	Repro
1	1	Input

COLOR CODE

BLK = Black
BRN = Brown
RED = Red
ORG = Orange
YEL = Yellow
GRN = Green
BLU = Blue
VIO = Violet
GRY = Grey
WHT = White
PNK = Pink
TAN = Tan

A13 CHANNEL 2 CHANNEL 1 S101

RP101 RP102 RP103 RP104 RP105 RP106

TP106

OUT IN(19) IN(38/19) OUT IN(19) IN(38/19)

MONO / STEREO MULTITRACK

CHANNEL 2 / CHANNEL 1 INSERT TIMING ADJUST

A01 AUDIO RECORD / REPRODUCE
A02 MAIN CONTROL LOGIC BOARD
A04 TAPE COUNTER
A05 TIME CODE

A13 AUDIO CONTROL LOGIC
A14 SERIAL BUS MULTIPLEXER
A15 TAPE TRANSPORT CONTROL LOGIC

B5 BOX INTERCONNECTION
BJ 3 REMOTE CONTROL PLUG
BJ 4 AUDIO MONITORING PLUG

MODIFICATIONS

KUDELSKI S.A. Dept NAGRA CH-1033 CHESEAUX Switzerland

NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 19 West 44 th Street

NAGRA-TA 1/3 09 09345 100 7.10.87. A02-A13

AUDIO CONTROL LOGIC

A02-A14
09.345.1.
SERIAL BUS MULTIPLEXER

RECORDING MODE

TP 203 10V/div
TP 202 10V/div
TP 206 10V/div
Serial bus 1V/div
125 µs — 20 µs/div
Serial bus = 128 positions
Total duration of one cycle = 125 µs x 128 = 16 ms

UF 201.3 10V/div
UF 201.4 10V/div
UF 201.5 10V/div
UF 201.6 10V/div
1ms/div

INITIALIZATION

TP 207 10V/div
TP 208 10V/div
10ms/div

REPRO SPEED - STD SELECTION

BIAS REFERENCE LEVEL

BUS DRIVERS — A15

DISPLAY / KEYBOARD SELECTOR

CLOCK GENERATION

SYNC. DETECT.

DISPLAY MULTIPLEXER

PRESSED KEY DETECTOR

SPEED std DISPLAY MULTIPLEXER

AUDIO FUNCTIONS INITIALIZATION

SPEED std DISPLAY DECODER

SPEED MODIFY COUNTER

INITIALIZATION COUNTER

SYNC INHIBITED

SPEED STAB / COUNT. ENCODER

REPRODUCING SPEED std. SELECTION

BIAS REF. VOLTAGE ADJ.

IC LIST — A14									
N°	Ref design	Pos.	Pos.	Pos.	Pos.	Pos.	+	▽	L
UB201	4040	B-C2					16	8	
UB202	4017	G5					16	8	
UB203	4028	D3-4					16	8	
UB204	4512	B-C4					16	8	
UC201	4081	C3	C3-4	C4	J3		14	7	
UC202	4072	E4	F5				14	7	
UC203	4040	G4					16	8	
UC204	4512	C6					16	8	
UD201	4584	B2	C3	B3-4	C4	E6	A13 J3	14	7
UD202	4013	G4	H4				14	7	
UD203	4028	DE3-4					16	8	
UD204	4078	C3-4					14	7	
UE201	4556	C2-3	J3				16	8	
UE202	4001	C3	F5	G4	G5		14	7	
UE203	4584	D4	F4	G4	F3	G4	J4	14	7
UE204	4040	C-D2					16	8	
UF201	4075	D3	E3	F4			14	7	
UF203	4013	D5	F3-4				14	7	
UF204	4093	C5	G5	G5	F4		14	7	
UG201	4081	E4	E4	E4	E5		14	7	

UG203	4013	D4	D4					14	7
UH201	4051	I7						16	8
UH202	4051	I7						16	8
UH203	4071	C4	G6	J5	J5			14	7
UH204	4073	F3	G5	J5				14	7
UJ201	4052	J6	J6					16	8
UJ202	4052	I6	I6					16	8
UJ203	4052	F-J6	I3					16	8
UU204	4510	G-H6						16	8

IC LIST — A15									
N°	Ref design	Pos.	Pos.	Pos.	Pos.	Pos.	Pos.	+	▽	L
UA304	3302	B5						3	12	
UG301	4503	C5	J4	J4-5	J5			16	8	
UJ301	4503	G2	G2	G2	G3	G3	G3	16	8	
UK301	4051	E6						16	8	

Repro select	Effective speed (ips)	Speed code
0	3 3/4	0
1	7 1/2	1
2	15	2
3	30	3
4	7 1/2	1
5	15	2
6	15	2
7	30	3

A 01 AUDIO RECORD / REPRODUCE BOARD
A 02 MAIN CONTROL LOGIC
A 03 TAPE TRANSPORT CONTROL AND SPEED STAB
A 04 TAPE COUNTER
A 05 TIME CODE
A 13 AUDIO CONTROL LOGIC
A 14 SERIAL BUS MULTIPLEXER
A 15 TAPE TRANSPORT CONTROL LOGIC
A 30 POWER SUPPLY
B 5 BOX INTERCONNECTION
BJ 1 RIGHT KEYBOARD PLUG
BJ 2 LEFT KEYBOARD PLUG (OPTION)
BJ 3 REMOTE CONTROL PLUG
BJ 4 AUDIO MONITORING PLUG

UNLESS SPECIFIED
Voltages may vary ± 10%
All resistors 1/4W ± 2%
All capacitors ± 20%
All diodes 1N 4148

MEASURING INSTRUMENT
DC Voltmeter 40 000 Ω / V

TP● Use resistor wire as TP
Optimum value to be selected typical value shown
Male contact
Female contact
Arrow indicates signal flow
Eyelet
TP Test - Point
(TP) Test - Point (Automatic testing)
Logic common

S 301 — 1 2 3 4 5 6 7 8
Ready, Safe, Repro, Input, Off, Sync. inh., Skip defect, Winding, Slow down
CHANNEL MATRIX INITIALIZATION

COLOR CODE
BLK = Black
RED = Red

DATE	MODIFICATIONS

KUDELSKI SA Dept NAGRA CH-1033 CHESEAUX Switzerland
NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 * Made at Nagra

NAGRA-TA | 2/3 | 09 09 345100 | 5.11.87. | A02-A14

SERIAL BUS MULTIPLEXER

A01 AUDIO RECORD/REPRODUCE
A02 MAIN CONTROL LOGIC BOARD
A03 TAPE TRANSPORT CONTROL AND SPEED STAB.
A04 TAPE COUNTER
A05 TIME CODE

A5a COUNTER ENCODER
A13 AUDIO CONTROL LOGIC
A14 SERIAL BUS MULTIPLEXER
A15 TAPE TRANSPORT CONTROL LOGIC
A15b CLEAR TAPE DETECTOR
A16a KEYBOARD
A19 SERVO-EDITING
A30 POWER SUPPLY

B1 HEAD INTERCONNECTION
B2 TAPE COUNTER ENCODER INTERC.
B3 TAPE-DECK INTERCONNECTION
B5 BOX INTERCONNECTION

BJ1 RIGHT KEYBOARD PLUG
BJ2 LEFT KEYBOARD PLUG (OPTION)
BJ3 REMOTE CONTROL PLUG
BJ4 AUDIO MONITORING PLUG

P1 POWER SUPPLY PLUG
HB HEAD BLOCK

A02-A15
09.345.1.
TAPE TRANSPORT CONTROL LOGIC

IC LIST

N°	Ref design	Pos	Pos	Pos	Pos	Pos	Pos	+	▽L	−
UA302	4011	D7	D7	C11	E11			14	7	
UA303	4538	C-D8	C-D8					16	8	
UA304	3302	C7	C8	C8	D9			3	12	
UA305	4538	E11	F11					16	8	
UA306	4538	F11	G11					16	8	
UA307	4073	D4	F11	F-G11				14	7	
UB301	40107	F6						8	4	
UB303	4538	E10	E10					16	8	
UB305	4503	C11	G11	G11	G11	G11	G12	16	8	
UB306	4584	F3	G9	C11	D11	D11	E11	14	7	
UB307	4071	E7	E9	F9	D10			14	7	
UC301	LF353N	C9	B10					8		4
UC304	4538	E8	F8					16	8	
UC305	4584	F7	F7	F7	E10	D11		14	7	
UC307	4078	E8						14	7	
UD301	4081	F9	F9	G9	F-G11			14	7	
UD302	4017	C10						16	8	
UD303	40107	B10						8	4	
UD304	4081	F3	E8	E9	G10			14	7	
UD307	4081	G4	E7	E7	E7			14	7	
UE301	4051	G9-10						16	8	7
UE302	4011	D8	E9	F9	F10			14	7	
UE303	4049	B2	C3	E3	G3	F3	C-D11	1	8	
UE305	4512	G2						16	8	
UE306	4512	F2						16	8	
UE307	4071	G5	E6	F6	E7			14	7	
UF302	4040	F9						16	8	
UF304	3302	G5	G6	G6	G6			3		12
UF305	4042	E6						16	8	
UF307	4075	E6	F6	F6				14	7	
UG302	4049	B5	D5	F5	E9	E9	C-D11	1	8	
UG303	4081	B-C2	B-C3	E2	E5			14	7	
UG305	4071	E-F2	E-F2	F3	E4			14	7	
UG306	4078	B5						14	7	
UG307	4071	E6	E6	E6	E6			14	7	
UH302	40174	C2						16	8	
UH303	4075	C3	C3	D3				14	7	
UH304	4071	E4	G4	G4	F6			14	7	
UH305	4071	C2	C2	E2	D4			14	7	
UH306	4532	E5-6						16	8	
UH307	4081	E5	E5	E6	E6			14	7	
UJ302	40174	D2						16	8	
UJ303	4028	B3						16	8	
UJ304	4514	C3						24	12	
UJ307	4075	E4	E4	E11				14	7	
UK302	4025	D2	G3	G3				14	7	
UK303	4082	E2	F4-5					14	7	
UK304	4077	F4	F4	F4	G4			14	7	
UK305	4072	D7	D7					14	7	
UK306	4028	D3						16	8	
UK307	4071	E4	E5	E5	E5-6			14	7	
UL304	4042	F3-4						16	8	
UL305	4532	E4						16	8	
UL307	4075	E4	E4	E4				14	7	

TP ● Use resistor wire as TP
Optimum value to be selected typical value shown
Male contact
Female contact
Arrow indicates sign flow
Eyelet
TP Test-Point
(TP) Test-Point (Automatic testing)
Logic common
Unreg common
Frame

SPEED VARIATOR
Playback Speed %
spooling

UNLESS SPECIFIED
Voltages may vary ± 10 %.
All resistors 1/4 W ± 2 %.
All capacitors ± 20 %.
All diodes 1N4148

MEASURING INSTRUMENT
DC Voltmeter 40 000 Ω/V

COLOR CODE
YEL = Yellow
GRN = Green
BLU = Blue
VIO = Violet
BLK = Black
BRN = Brown
RED = Red
ORG = Orange
GRY = Grey
WHT = White
PNK = Pink
TAN = Tan

DATE	MODIFICATIONS
12 87	OME 09-115
1 88	OME 09-110

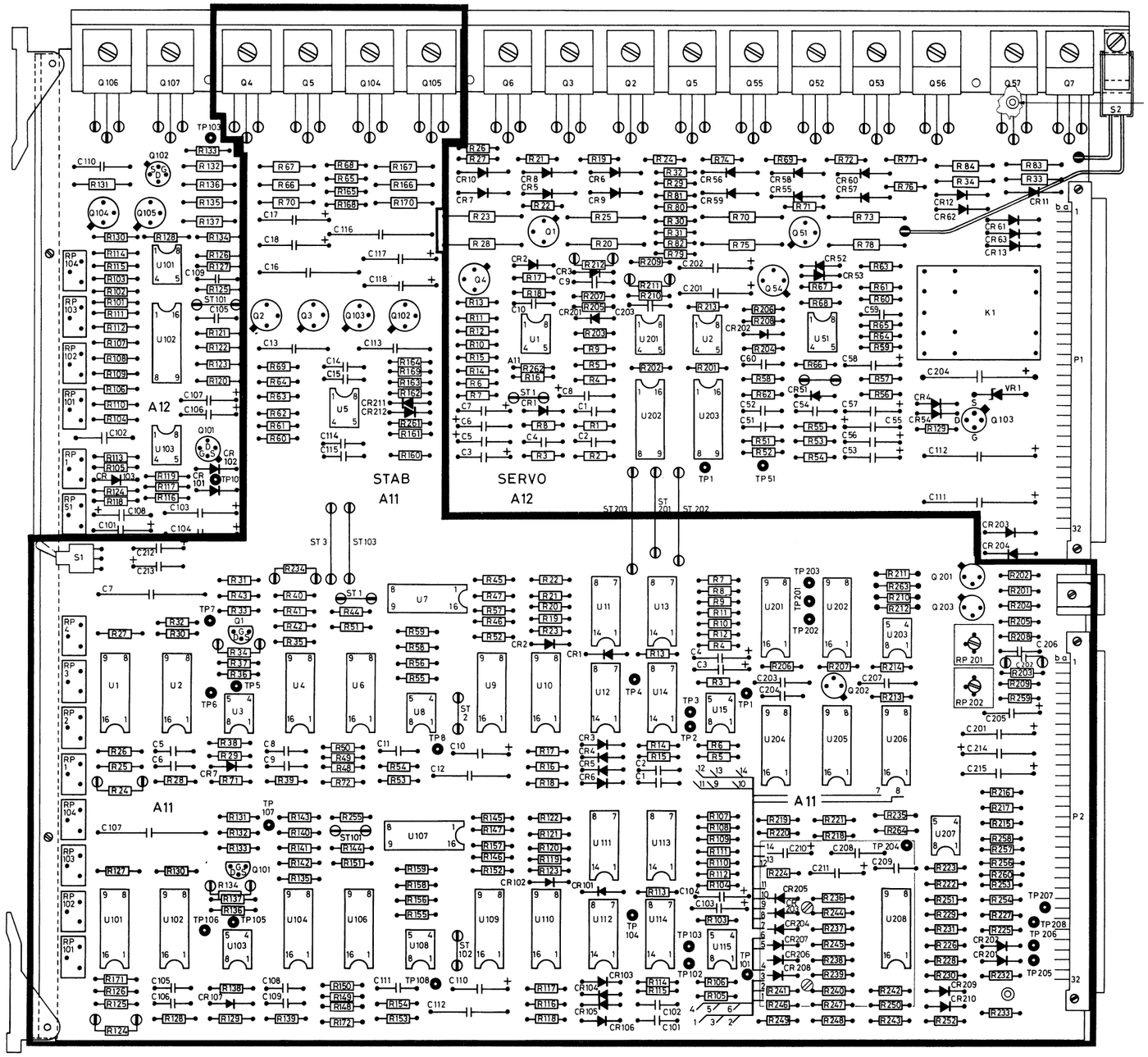
AUDEL SKI SA Dept NAGRA CH 1033 CHESEAUX Switzerland
NAGRA MAGNETIC MEASUREMENTS INC. NEW YORK N.Y. 10036

A02-A15 6
NAGRA-TA 3/3 09 09 345 100 25 11 87
TAPE TRANSPORT CONTROL LOGIC

1470 x 1039.5

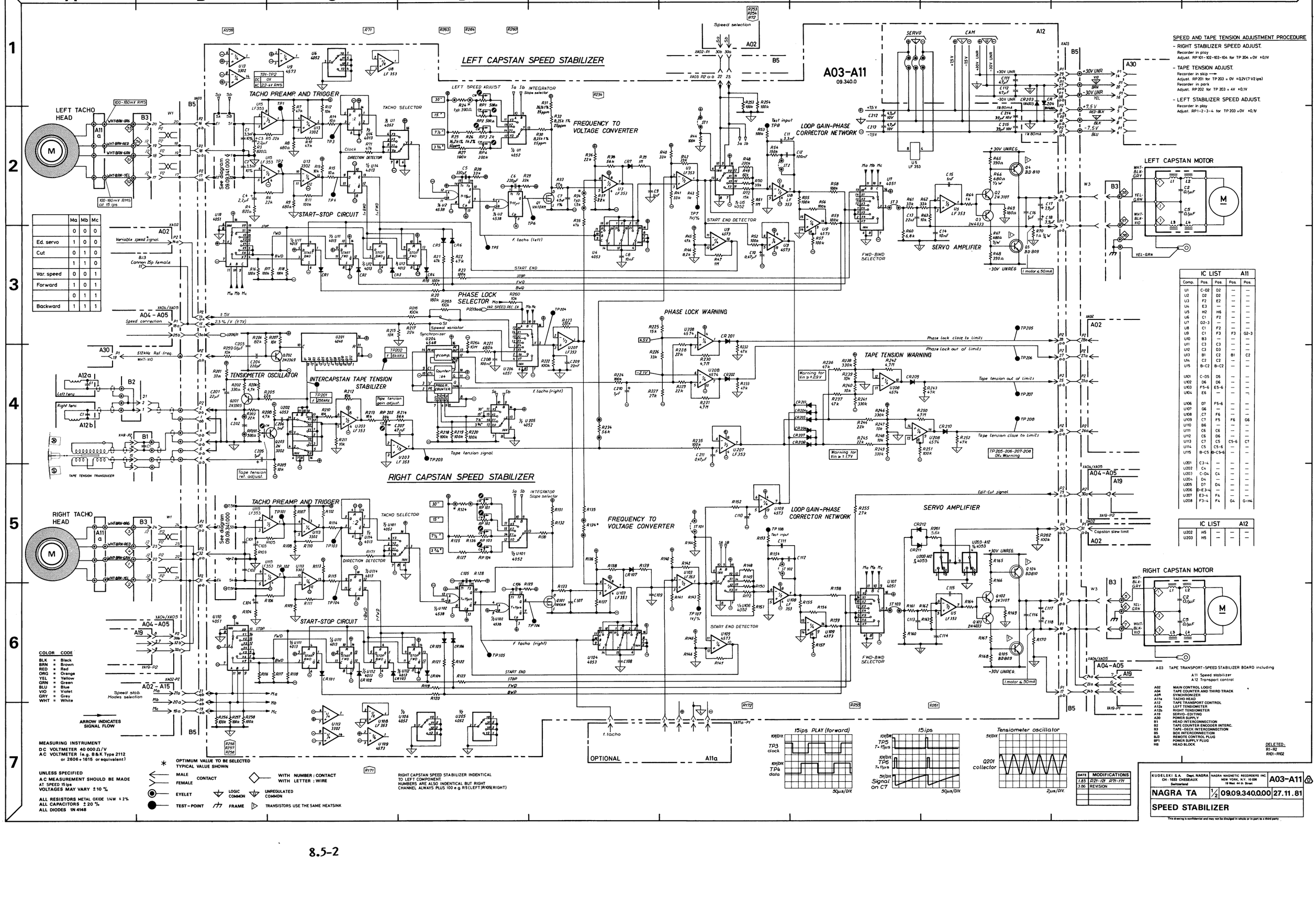
A-03

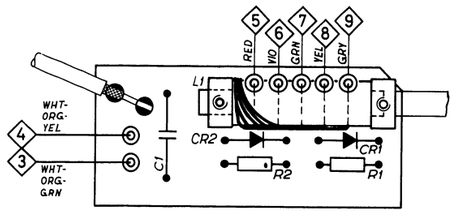
SECTION 8.5



A11 SPEED STABILIZER

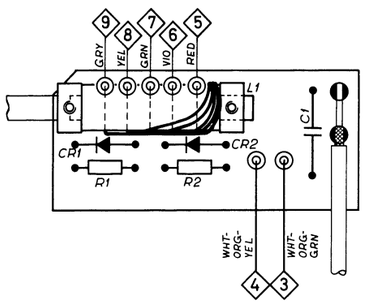
09.340.0 index D


A03-A11
09.340.0
LEFT CAPSTAN SPEED STABILIZER
RIGHT CAPSTAN SPEED STABILIZER
TACHO PREAMP AND TRIGGER
TACHO SELECTOR
FREQUENCY TO VOLTAGE CONVERTER
START-STOP CIRCUIT
START END DETECTOR
PHASE LOCK SELECTOR
PHASE LOCK WARNING
LOOP GAIN-PHASE CORRECTOR NETWORK
FWD-BWD SELECTOR
TENSIOMETER OSCILLATOR
INTERCAPSTAN TAPE TENSION STABILIZER
TAPE TENSION WARNING
SERVO AMPLIFIER
SERVO
CAM
LEFT TACHO HEAD
RIGHT TACHO HEAD
LEFT CAPSTAN MOTOR
RIGHT CAPSTAN MOTOR
TAPE TENSION TRANSDUCER
SPEED AND TAPE TENSION ADJUSTMENT PROCEDURE
- RIGHT STABILIZER SPEED ADJUST.
Recorder in play
Adjust. RP 101 - 102 - 103 - 104 for TP 204 = 0V ±0.1V
- TAPE TENSION ADJUST.
Recorder in skip ⟶
Adjust. RP 201 for TP 203 = 0V ±0.2V (7 1/2 ips)
Recorder in park
Adjust. RP 202 for TP 203 = 4V ±0.1V
- LEFT STABILIZER SPEED ADJUST.
Recorder in play
Adjust. RP1-2-3-4 for TP 203 = 0V ±0.1V
Ma Mb Mc
Ed. servo
Cut
Var. speed
Forward
Backward
Variable speed signal
Speed correction
Speed stab. Modes selection
Tape tension ref. adjust.
Tape tension gain adjust.
Tape tension signal
f. tacho (left)
f. tacho (right)
Edit-Cut signal
Capstan slew limit
Phase lock close to limit
Phase lock out of limit
Tape tension out of limits
Tape tension close to limits
Warning for Vin ≥ ±2.9V
Warning for Vin ≥ ±1.7V
TP205-206-207-208 0V= Warning
15ips PLAY (forward)
15ips
Tensiometer oscillator
Q201 collector
OPTIONAL
ARROW INDICATES SIGNAL FLOW
COLOR CODE
BLK = Black
BRN = Brown
RED = Red
ORG = Orange
YEL = Yellow
GRN = Green
BLU = Blue
VIO = Violet
GRY = Grey
WHT = White
MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606 + 1615 or equivalent)
UNLESS SPECIFIED
A C MEASUREMENT SHOULD BE MADE AT SPEED 15 ips
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS METAL OXIDE 1/4W ± 2%
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148
OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN
MALE
FEMALE
EYELET
TEST-POINT
CONTACT
LOGIC COMMON
FRAME
WITH NUMBER : CONTACT
WITH LETTER : WIRE
UNREGULATED COMMON
TRANSISTORS USE THE SAME HEATSINK
RIGHT CAPSTAN SPEED STABILIZER INDENTICAL TO LEFT COMPONENT. NUMBERS ARE ALSO INDENTICAL BUT RIGHT CHANNEL ALWAYS PLUS 100 e.g. R5 (LEFT) R105 (RIGHT)
A03 TAPE TRANSPORT-SPEED STABILIZER BOARD including
A11 Speed stabilizer
A12 Transport control
A02 MAIN CONTROL LOGIC
A04 TAPE COUNTER AND THIRD TRACK
A04 SYNCHRONIZER
A11a TACHO HEAD
A12 TAPE TRANSPORT CONTROL
A12a LEFT TENSIOMETER
A12b RIGHT TENSIOMETER
A19 SERVO-EDITING
A30 POWER SUPPLY
B1 HEAD INTERCONNECTION
B2 TAPE COUNTER ENCODER INTERC.
B3 TAPE-DECK INTERCONNECTION
B5 BOX INTERCONNECTION
BJ3 REMOTE CONTROL PLUG
BP1 POWER SUPPLY PLUG
HB HEAD BLOCK
DELETED:
R1-R2
R101-R102
IC LIST A11
IC LIST A12
KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland
NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street
NAGRA TA
09.09.340.0.00
27.11.81
SPEED STABILIZER
A03-A11
This drawing is confidential and may not be divulged in whole or in part to a third party



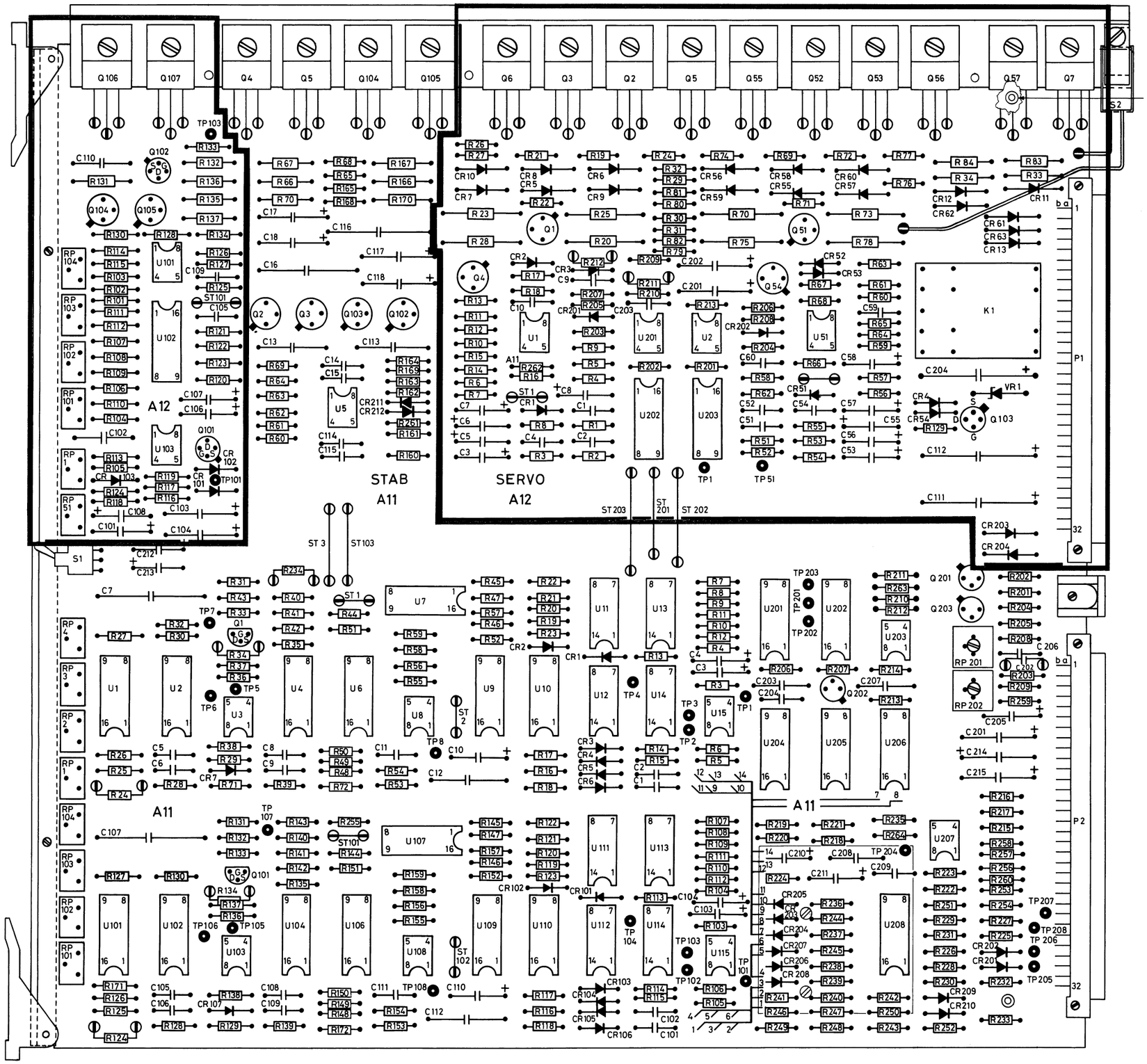
A12a LEFT TENSIOMETER

09.285.0



A12b RIGHT TENSIOMETER

09.286.0



A12 TRANSPORT CONTROL

09.340.0 index D

A03-A12

09.340.0

LEFT REEL MOTOR SERVO AMPLIFIER

FAST WINDING SPEED STABILIZER

RIGHT REEL MOTOR SERVO AMPLIFIER

CAM MOTOR SERVO AMPLIFIER

Function	Half 5" spool	Half 7" spool	Half 30cm spool	
Play 15ips	330	380	460	mA
≪ or ≫	380	430	520	mA

Tensiometer position	TP1 TP51	TP2 TP52
Released	0,8V	6,7V
Pulled	-0,8V	-6V
Normal (Stop)	-0V	0,8V

CAM pos.	TP101	TP102
Bicapstan	5,9V	-5,9V
Right	5,3V	-5,3V
Stop	5V	-5V
Listen	3,3V	-3,3V
Park	0V	0V
Load	0,44V	-0,44V
Brakes rel.	0,88V	-0,88V

IC LIST		
Comp.	Pos.	Pos.
U1	E2	E1
U2	D1	D4
U51	E4	E4
U101	F5	F5
U102	D5-6	—
U103	E5	E-F5
U201	F3	E3
U202	D-E3	—
U203	D3	—

DATE	MODIFICATIONS
L83	S2-Q6-C55-R211-212
	REVISION

TAPE OXYDE POSITION

INSIDE — TAKE UP REEL: OUTSIDE, SUPPLY REEL: INSIDE

OUTSIDE — TAKE UP REEL: INSIDE, SUPPLY REEL: OUTSIDE

TAPE OXYDE POSITION

OUTSIDE INSIDE

TEST CONDITION
AC AND DC MEASUREMENT SHOULD BE MADE AT SPEED 15 ips

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS ¼W ± 2 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

2V/DIV, TP102, 1V/DIV, TP103, 200ms/DIV
TRANSITION FROM PARK TO SKIP →

COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White

* OPTIMUM VALUE TO BE SELECTED, TYPICAL VALUE SHOWN

▷ TRANSISTORS USE THE SAME HEATSINK

MALE CONTACT / FEMALE

EYELET / TEST-POINT

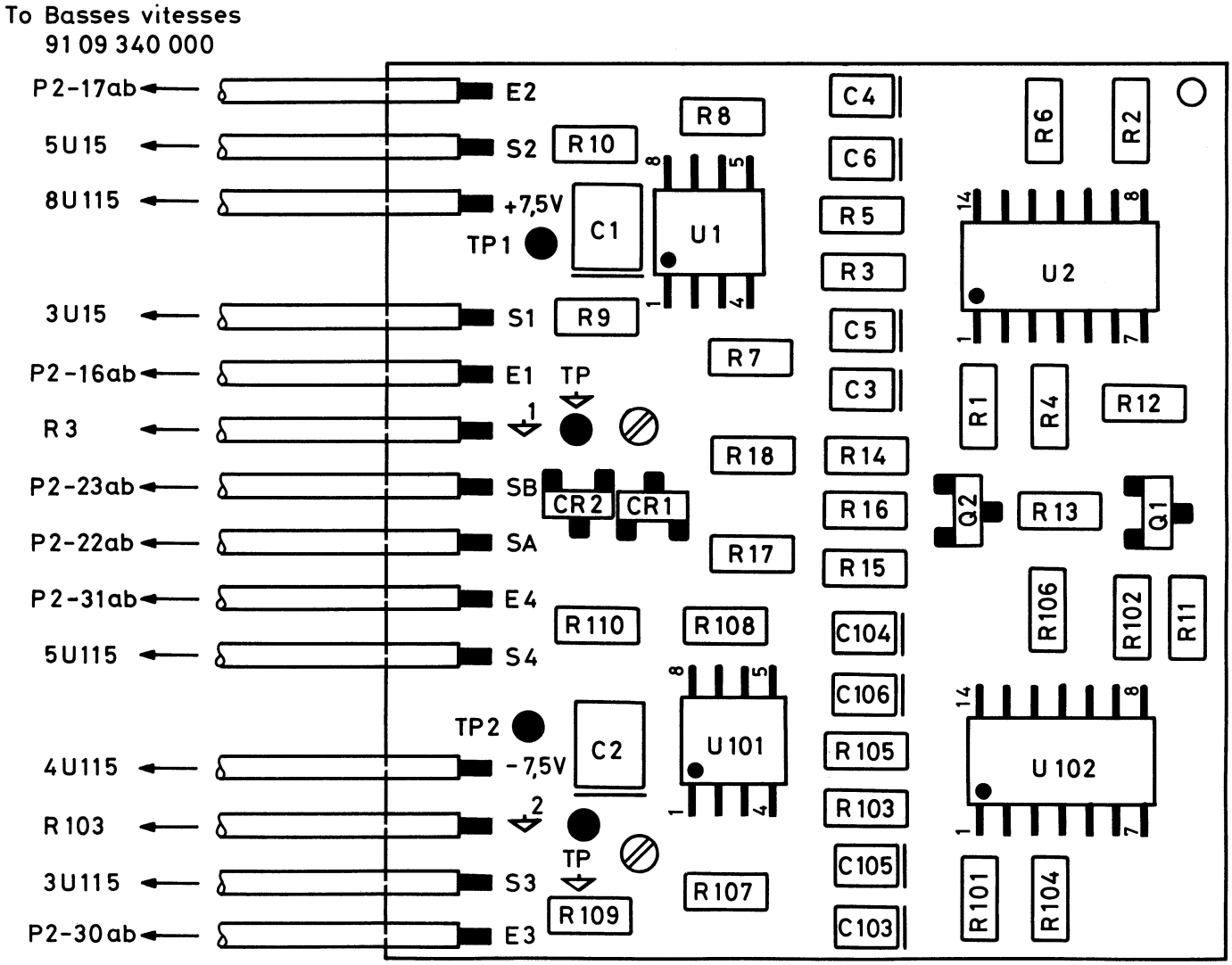
LOGIC COMMON / UNREGULATED COMMON / FRAME

ARROW INDICATES SIGNAL FLOW

A03 TAPE TRANSPORT-SPEED STABILIZER BOARD including
A11 Speed stabilizer
A12 Transport control

A02 MAIN CONTROL LOGIC
A3c REEL MOTOR
A12a LEFT TENSIOMETER
A12b RIGHT TENSIOMETER
A30 POWER SUPPLY
B2 TAPE COUNTER ENCODER INTERC.
B3 TAPE-DECK INTERCONNECTION
B5 BOX INTERCONNECTION
P1 POWER SUPPLY PLUG

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th. Street	A03-A12	D
NAGRA TA	2/2	09.09.340.0.00	4.12.81
TRANSPORT CONTROL			



TACHY FILTER
09.341.0

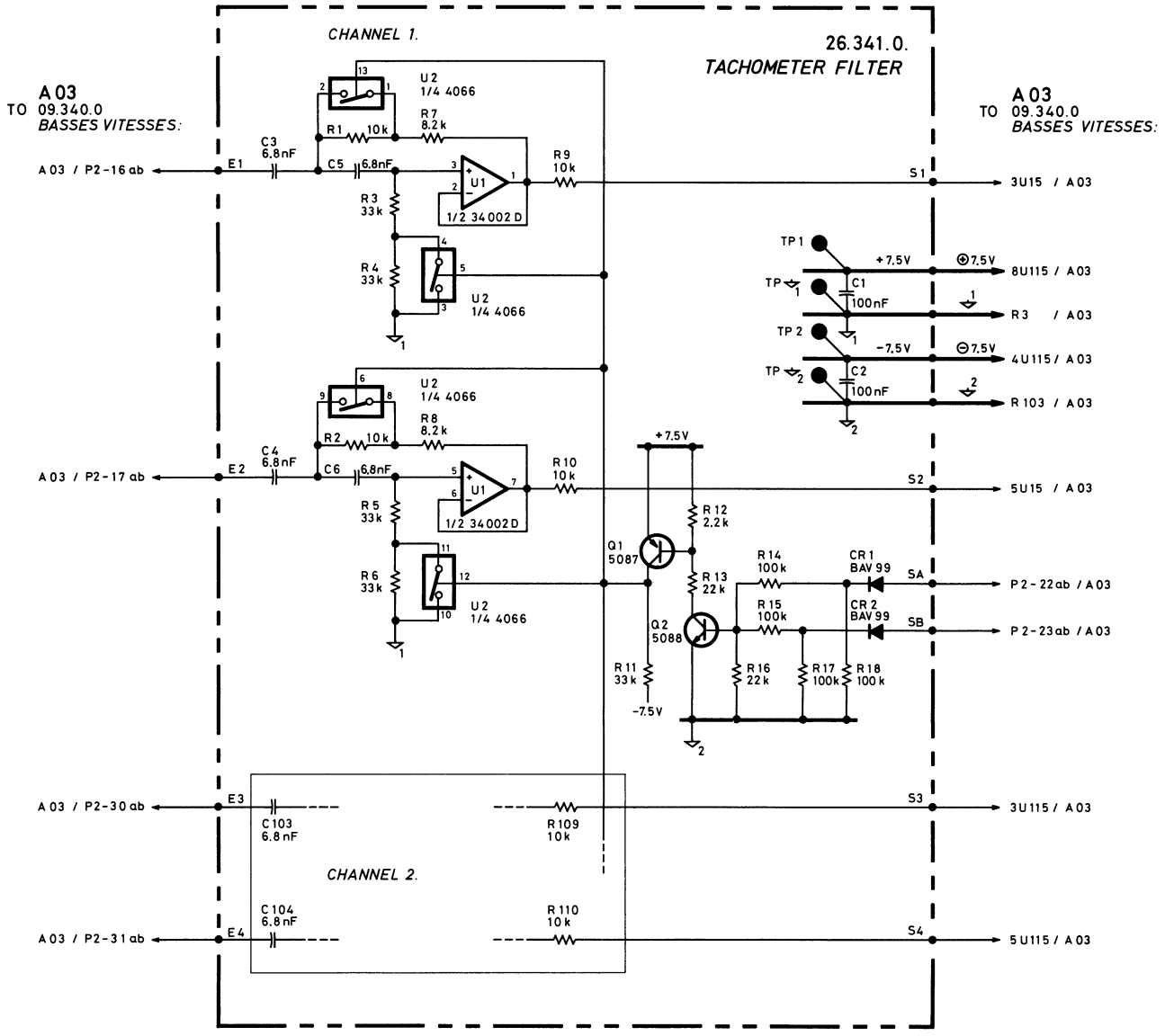
IC LIST			
N°	Ref.design.	⊕7.5V	⊖7.5V
CHANNEL 1			
U1	34002D	8	4
U2	4066	14	7
CHANNEL 2			
U101	34002D	8	4
U102	4066	14	7

SCHEMATIC DIAGRAM NOTES

Circuit assembly borderline

Test Point

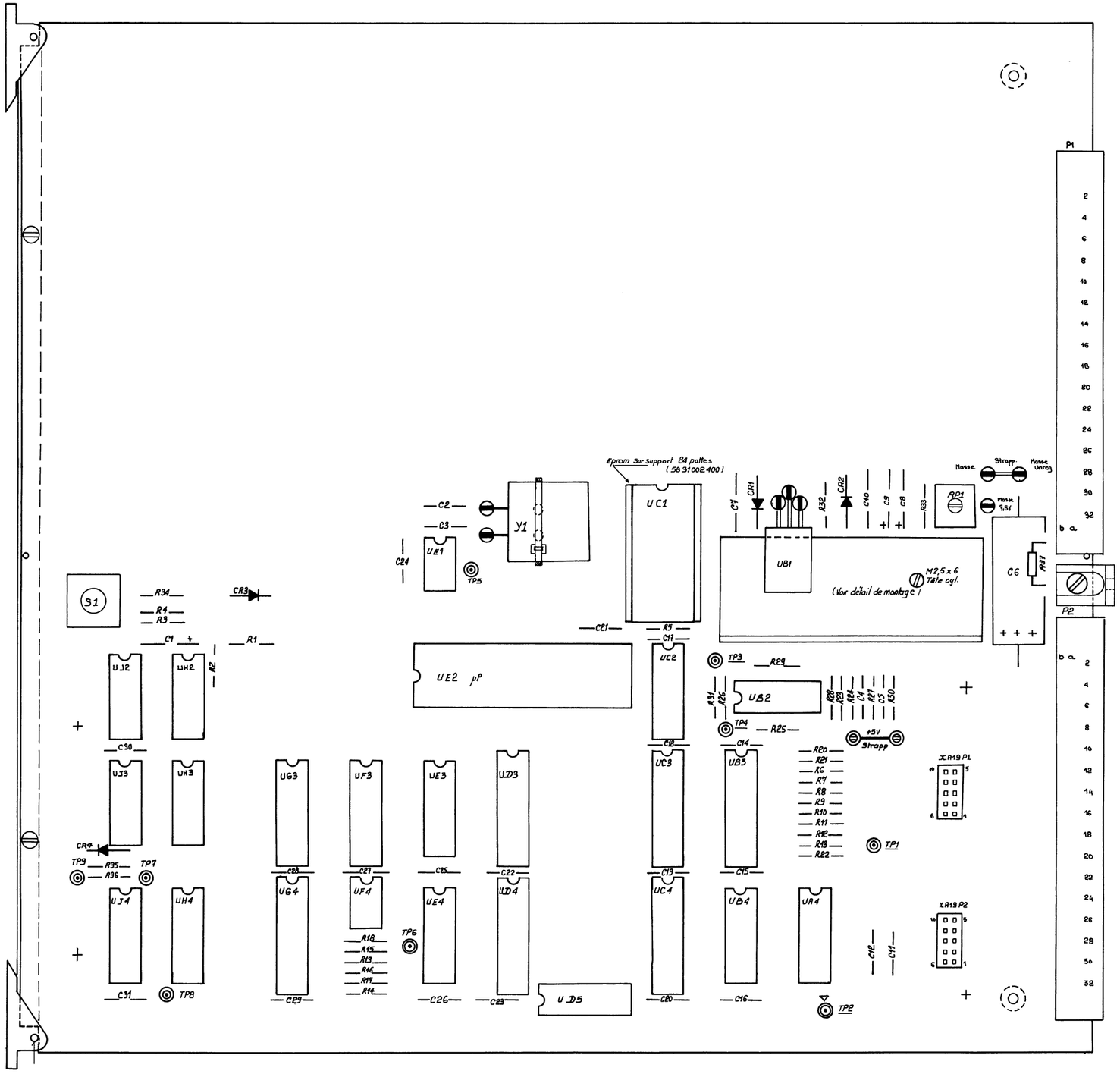
Common connections



KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A
T-AUDIO	09 09 341 000	19.3.86.
TACHOMETER FILTER		

A-04

SECTION 8.6



P1	
b	a
Erase	1
Time Code Head	2
	3
Gnd Audio	4
Input monitor	5
- 7.5 Audio	6
+ 7.5 Audio	7
0V (24) Record Audio	8
+24V " "	9
nc	10
TC Play	11
Tc Clock	12
TC DATA	13
TC out	14
	15
Video	16
+5V	17
Audio Record	18
Tc Présent	19
CNT Max	20
	21
Counter A	22
	23
Serial bus	24
	25
+13V Unreg	26
	27
0V Unreg	28
	29
Tape BW Sig.	30
Line out off	32

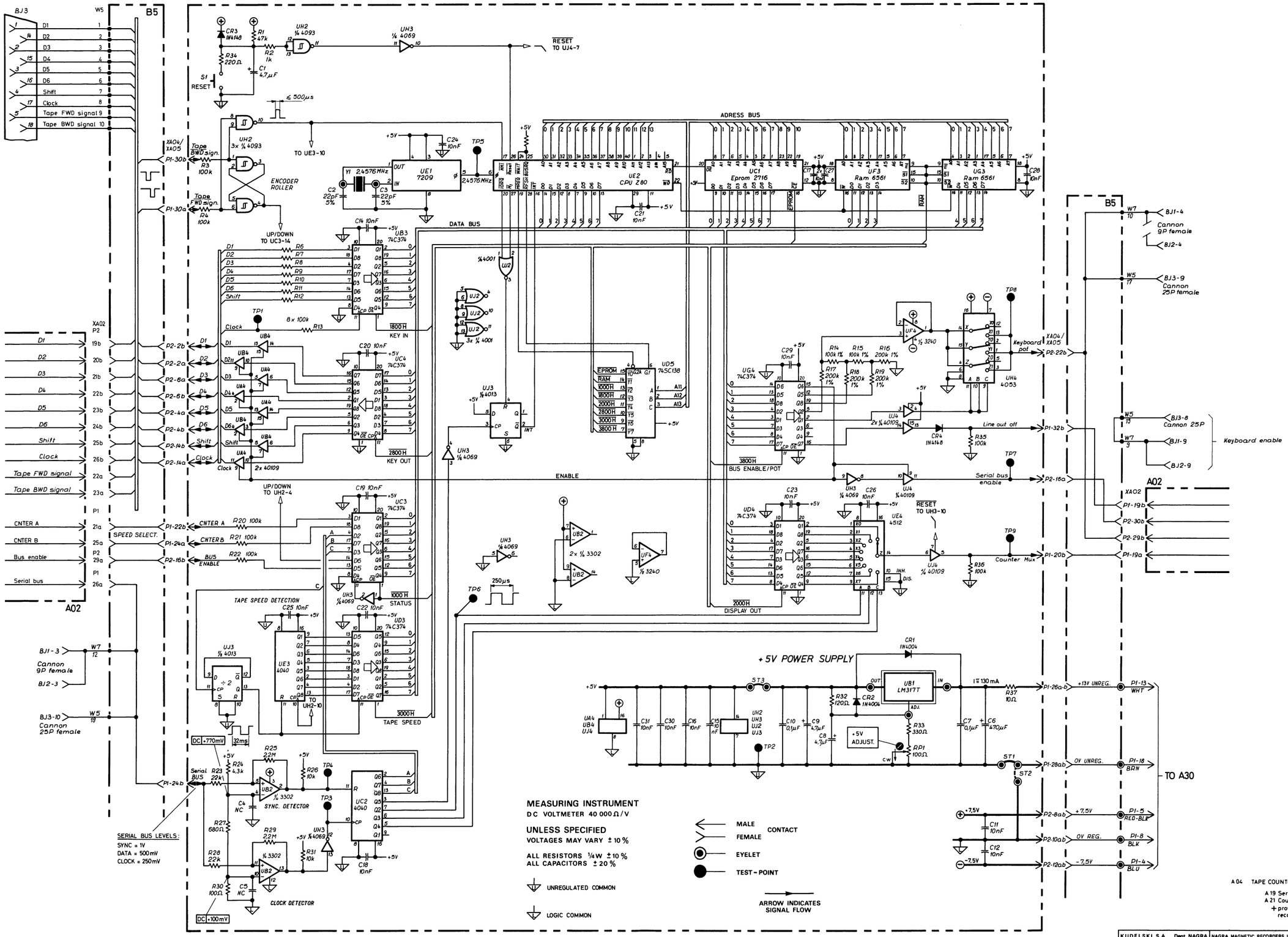
Erase
Gnd Audio
2e Head
Repro monitor
- 7.5 Audio
+ 7.5 Audio
0V Record
+24 V
nc
Entrée CUE
Sortie CUE
Tc Master
TC In
SET (clap)
X Tal (48 KHz)
+5V
TC Record
Bias Level
Counter perm
512 KHz
Counter B
+13V Unreg
0V Unreg
Tape FW Sig
Led Synch oe
Slow down enable

P2	
b	a
D1	2
D6	4
D4	6
+ 7.5V Log	8
0V Log	10
- 7.5V Log	12
Shift	14
Cnt. bus enable	16
Zero detect	18
Mb	20
Pot	22
U ref motor R.	24
FW Input	26
Editing encoder B	28
Tachy Right	30
Tachy left	32

D2
D5
D3
+ 7.5V Log
0V Log
- 7.5V Log
Clock
Keyboard enable
Mc
Ma
Right motor +
Right motor -
BW Input
Editing encoder A
Edit. Cut signal
Tachy right

A21 COUNTER

09.350.0


BJ3
W5
B5
D1
D2
D3
D4
D5
D6
Shift
Clock
Tape FWD signal 9
Tape BWD signal 10
CR3 1N4148
R1 47k
R2 1k
UH2 ¼ 4093
UH3 ¼ 4069
RESET TO UJ4-7
R34 220Ω
C1 4,7µF
S1 RESET
≤ 300µs
UH2 3x ¼ 4093
TO UE3-10
XA04/ XA05
Tape BWD sign.
P1-30b
R3 100k
ENCODER ROLLER
Tape FWD sign.
P1-30a
R4 100k
Y1 24576MHz
C2 22pF 5%
C3 22pF 5%
UE1 7209
C24 10nF
TP5
24576MHz
UE2 CPU Z80
C21 10nF
ADRESS BUS
DATA BUS
UC1 Eprom 2716
UF3 Ram 6561
UG3 Ram 6561
C17 C27 C28 10nF
UP/DOWN TO UC3-14
C14 10nF
UB3 74C374
R6 R7 R8 R9 R10 R11 R12
8x 100k R13
TP1
Clock
1800H KEY IN
UJ4001
UJ2 3x ¼ 4001
UJ3 ¼ 4013
UH3 ¼ 4069
UB4
UA4 2x 40109
C20 10nF
UC4 74C374
2800H KEY OUT
UD5 74SC138
EPROM
RAM
1000H
1800H
2000H
2800H
3000H
3800H
UG4 74C374
C29 10nF
R14 100k 1%
R15 100k 1%
R16 200k 1%
R17 200k 1%
R18 200k 1%
R19 200k 1%
UF4 ½ 3240
UH4 4053
TP8
Keyboard pot
XA04/ XA05
P2-22b
UJ4 2x ¼ 40109
CR4 1N4148
R35 100k
Line out off
P1-32b
3800H BUS ENABLE/POT
ENABLE
TP7
Serial bus enable
P2-16a
UD4 74C374
C23 10nF
UH3 ¼ 4069
C26 10nF
UA4 ¼ 40109
RESET TO UH3-10
UE4 4512
R36 100k
TP9
Counter Mux
P1-20b
2000H DISPLAY OUT
XA02 P2
D1 19b
D2 20b
D3 21b
D4 22b
D5 23b
D6 24b
Shift 25b
Clock 26b
Tape FWD signal 22a
Tape BWD signal 23a
P1
CNTER A 21a
CNTER B 25a
Bus enable 29a
Serial bus 26a
A02
P2-2b
P2-2a
P2-6a
P2-6b
P2-4a
P2-4b
P2-14b
P2-14a
P1-22b
P1-24a
P2-16b
SPEED SELECT.
CNTER A R20 100k
CNTER B R21 100k
BUS ENABLE R22 100k
UP/DOWN TO UH2-4
C19 10nF
UC3 74C374
1000H STATUS
TAPE SPEED DETECTION
C25 10nF
C22 10nF
UD3 74C374
UJ3 ¼ 4013
UE3 4040
TO UH2-10
3000H TAPE SPEED
DC •770mV
32ms
DC •100mV
R25 2,2M
R24 4,3k
R26 10k
TP4
UB2 ½ 3302
SYNC. DETECTOR
TP3
UC2 4040
C18 10nF
R27 680Ω
R29 2,2M
R31 10k
R28 22k
R30 100Ω
C5 NC
CLOCK DETECTOR
Serial BUS R23 22k
P1-24b
SERIAL BUS LEVELS:
SYNC = 1V
DATA = 500mV
CLOCK = 250mV
UH3 ¼ 4069
2x ½ 3302
UF4 ½ 3240
250µs
TP6
BJ1-3 W7 12
Cannon 9P female
BJ2-3
BJ3-10 W5 19
Cannon 25P female
+5V POWER SUPPLY
CR1 1N4004
UB1 LM317T
I ≅ 130 mA
R37 10Ω
ST3
R32 120Ω
CR2 1N4004
R33 330Ω
RP1 100Ω
+5V ADJUST.
C31 10nF
C30 10nF
C16 10nF
C15 10 nF
C10 0,1µF
C9 4,7µF
C8 4,7µF
C7 0,1µF
C6 470µF
TP2
ST1
ST2
P1-26a-b
+13V UNREG.
P1-13 WHT
P1-28ab
0V UNREG.
P1-18 BRN
TO A30
+7,5V
C11 10nF
C12 10nF
-7,5V
P2-8ab
P2-10ab
P2-12ab
+7,5V
0V REG.
-7,5V
P1-5 RED-BLK
P1-8 BLK
P1-4 BLU
W7 10
BJ1-4
Cannon 9P female
BJ2-4
W5 17
BJ3-9
Cannon 25P female
W5 15
W7 9
BJ3-8 Cannon 25P
BJ1-9
BJ2-9
Keyboard enable
A02
XA02
P1-19b
P2-30b
P2-29b
P1-19a
MEASURING INSTRUMENT
DC VOLTMETER 40 000Ω/V
UNLESS SPECIFIED
VOLTAGES MAY VARY ±10%
ALL RESISTORS ¼W ±10%
ALL CAPACITORS ±20%
UNREGULATED COMMON
LOGIC COMMON
MALE CONTACT
FEMALE
EYELET
TEST-POINT
ARROW INDICATES SIGNAL FLOW
A04 TAPE COUNTER BOARD including
A19 Servo editing
A21 Counter
+provision for third track record / reproduce
A02 MAIN CONTROL LOGIC
A08 SYNCHRONIZER
A30 POWER SUPPLY
B5 HEAD INTERCONNECTION
BJ1 RIGHT KEYBOARD PLUG
BJ2 LEFT KEYBOARD PLUG (OPTION)
BJ3 REMOTE CONTROL PLUG
BJ4 AUDIO MONITORING PLUG
P1 POWER SUPPLY PLUG
COLOR CODE
BLK = Black
BRN = Brown
RED = Red
ORG = Orange
YEL = Yellow
GRN = Green
BLU = Blue
VIO = Violet
GRY = Grey
WHT = White
KUDELSKI S.A. Dept. NAGRA
CH-1033 CHESEAUX
Switzerland
NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10036
19 West 44 th Street
A04-A21
NAGRA TA
09.09.350.0.00
21.10.81
COUNTER
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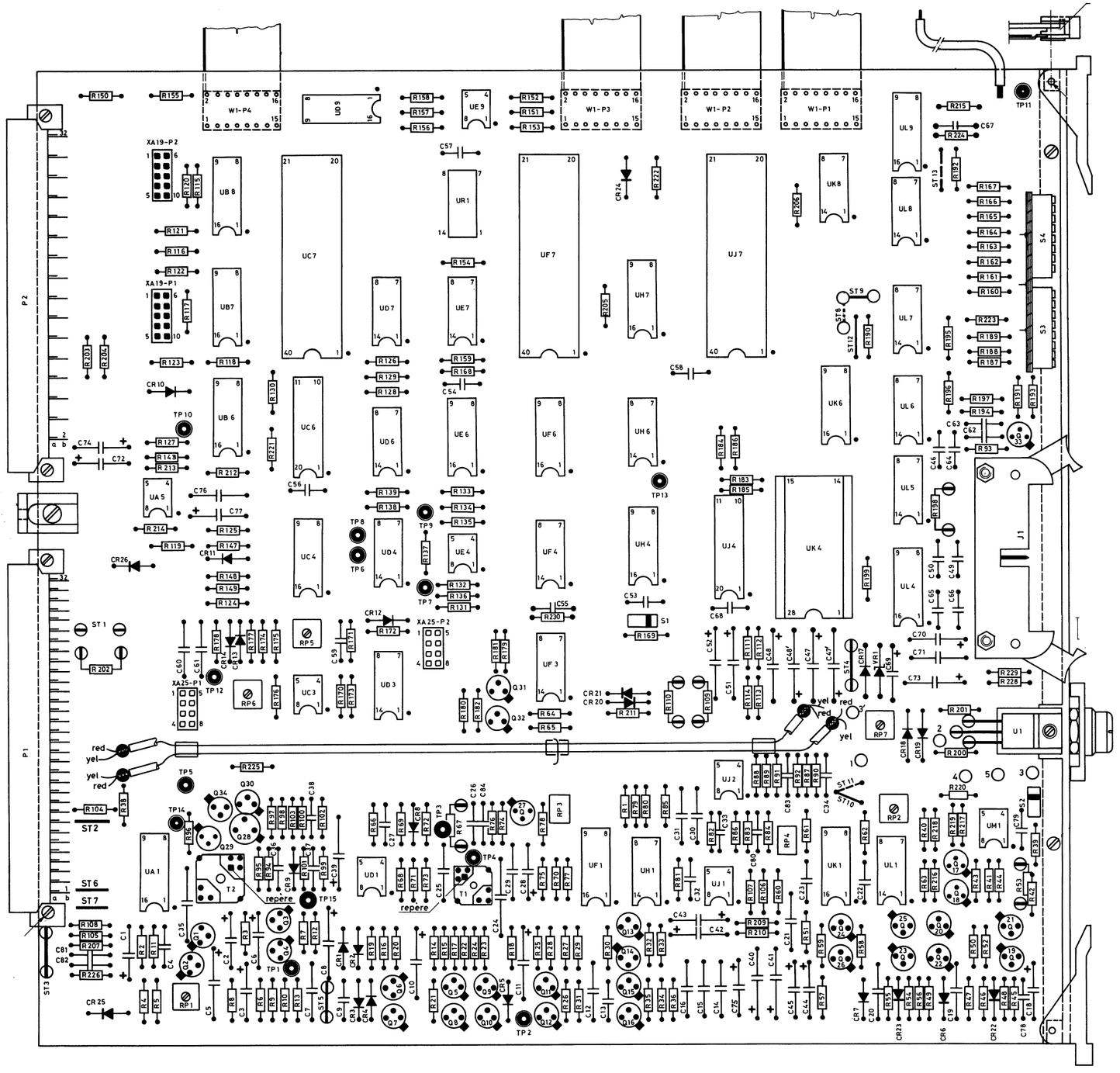
A-05

SECTION 8.7



A22 TC MAIN BOARD

09.361.0 **index D**

A05-A22

09.361.0

IC LIST

Nr.	Ref. design.	⇒7,5V	⇒7,5R	+5V	⇔	⇔	-7,5R	-7,5V	
UA1	4053	-	16	-	8	-	-	-	⇔ 6
UD1	3240	-	8	-	4	-	-	-	
UF1	4035	-	16	-	8	-	-	-	
UF3	4071	-	-	14	-	7	-	-	+5V 12-13
UH1	74HC74	-	-	-	-	-	-	-	⇔ 6,5R 14 1-4-10-13
UH7	40109	-	16	-	-	-	-	-	+5V 1-15 ⇔ L 8
UJ1	34002	-	8	-	-	-	4	-	
UJ2	LF2903	-	8	-	-	-	4	-	+7,5R 5 -7,5R 6
UK1	HEF4528	16	-	-	-	-	-	8	-7,5V 1-15/ +7,5V 3-13
UL1	4013	14	-	-	-	-	-	7	-7,5V 8-9-10-11
UL4	DS3692N	-	-	1	-	8	-	-	⇔ 4
UL5	DS88C20N	-	-	14	-	7	-	-	+5V 4-10
UL9	4053	-	-	16	-	8	-	-	⇔ 1-2-6-7-10
UM1	34002	8	-	-	-	-	-	4	

DERIVATED PLAY TC ON TP2

(30 fr/s at nominal speed)

1V/DIV

0V

500µs/DIV

ADAPTIVE TRIGGERING & BI-PHASE RECONSTRUCTION

(30 fr/s at nominal speed)

(BASE OF Q20)
POS. ADAPTIVE THRESHOLD
(BASE OF Q21)
PLAY TC
(COLLECTOR OF Q22)
POS. COMPARATOR OUT.
(PIN 1 OF UL1)
LOGICAL BI-PHASE
RECONSTRUCTED

0V
-2V
-4V
-6V
15V p-p
15V p-p
"0" "0" "1" "1" "0"
200µs/DIV

TC RECORD START & STOP CYCLE AT 19cm/s

AUDIO REC ENABLE
(TP111 ON A02)
TC ERASE ENABLE
(PIN 5 OF UH7)
TC PLAY / $\overline{REC}$
(PIN11 OF UH7)
(AUDIO BIAS SIGNAL ON HEAD)

DELAY ≅ 28 ROLLER PULSES
DELAY ≅ 57 ROLLER PULSES

100ms/DIV

RECORD SIGNALS

5V/DIV
BIAS (TP3)
2nd HARMONIC OF BIAS (TP4)
RECORD SIGNAL (TP5)
2µs/DIV

ERASE SIGNALS

20V/DIV
TP14
ST7
ST6
2µs/DIV

TC RECORD / PLAYBACK HEAD

TC ERASE HEAD

BJ14

BALANCED TC INPUT (100mV to 24V p-p max) (Zin>5kΩ) BJ9

TC OUTPUT (2V p-p) (Zout = 300Ω) BJ10

A30

DELETED:
C17
R37

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A05-A22 D
NAGRA TA	1/2 09.09.361.0.00	3.4.85
TIME CODE PLAYBACK, RECORD & ERASE		

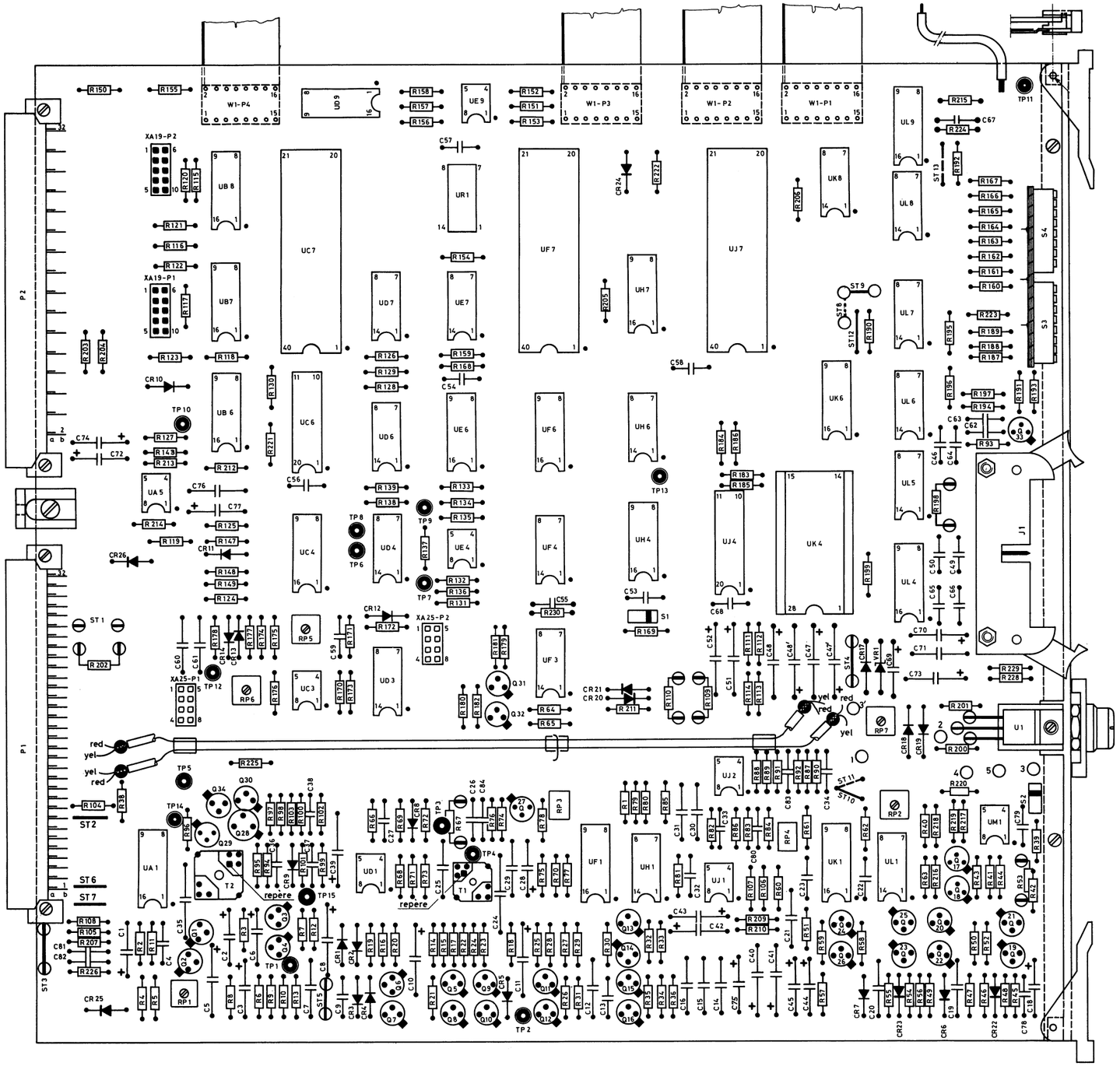
TEST CONDITION
AC AND DC MEASUREMENT SHOULD BE MADE AT SPEED 7½ ips

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606 + 1615 or equivalent)

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS ¼W ± 10 %
ALL CAPACITORS ± 20 %

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE CONTACT
FEMALE
EYELET
TEST-POINT
COMMON



A23 TC MAIN BOARD

09.361.0 **index D**

IC LIST				
Comp.	Pos.	Pos.	Pos.	Pos.
UA5	B5	-	-	-
UB6	B3	B4-5	B7	-
UB7	B2	-	-	-
UB8	B1-2	-	-	-
UC3	G2	-	-	-
UC4	B5-6	-	-	-
UC6	C5-6	-	-	-
UC7	C2-3	-	-	-
UD3	F4	-	-	-
UD4	D2 3	-	-	-

UD6	B3	C3	C4	-
UD7	C3	C-D3	D4	-
UD9	B5	B7	-	-
UE4	B3-4	-	-	-
UE6	C3-4	-	-	-
UE7	B-C6-7	D4	-	-
UE9	B6-7	-	-	-
UF3	E4	G3	-	-
UF4	E4	-	-	-
UF6	E4	H2	-	-
UF7	F-F2-3	-	-	-
UH4	B-C4-5	-	-	-
UH6	F4	G3	-	-

UH7	D6	-	-	-
UJ4	C4-5	-	-	-
UJ7	D-E2	-	-	-
UK4	FG3-4	-	-	-
UK6	H3-4	-	-	-
UK8	D5	-	-	-
UL4	15	-	-	-
UL5	15	-	-	-
UL6	14	-	-	-
UL7	13-4	-	-	-
UL8	C-D6	E1	F1	H5
UL9	D6	-	-	-

IC LIST							
Nr	Ref. design.	⊕7.5VL	+5V	-L		⊖7.5VL	
UA5	3240	8	-	4	-	-	L 5
UB6	40109	16	-	8	-	-	+5V 1-7
UB7	40109	16	-	8	-	-	+5V 1
UB8	40109	16	-	8	-	-	5V 1

UC3	34002	8	-	-	-	4	
UC4	4504	16	-	8	-	-	+5V 1 -L 13
UC6	40374	-	20	-	10	-	+5V 1
UC7	NSC 810NI	-	40	-		-	
UD3	4013	-	14	-	7	-	+5V 8-9-10-11 4-6
UD4	4093	-	14	-	7	-	+5V 5-6
UD6	4069	-	14	-	7	-	
UD7	4081	-	14	-	7	-	

UD9	4053	16	-	8	-	7	-L 5-6-12
UE4	LM2903	8	-	4	-	-	
UE6	4040	-	16	-	8	-	
UE7	4013	-	14	-	7	-	+5V 9 4-6-8
UE9	LM2903	8	-	4	-	-	
UF3	4071	-	14	-	7	-	
UF4	4013	-	14	-	7	-	+5V 5-9 6-8
UF6	4053	-	16	-	8	7	6

UF7	NSC 810 NI	-	40	-	20	-	
UH4	4512	-	16	-	8	-	10-15
UH6	4013	-	14	-	7	-	6-9-11
UH7	40109	16	-	8	-	-	+5V 1-15
UJ4	40374	-	20	-	10	-	1
UJ7	NSC 810 NI	-	40	-	20	-	
UK4	NSC 858 N	-	28	-	14	-	+5V 17
UK6	4053	-	16	-	8	-	6-7

UK8	4013	-	14	-	7	-	+5V 9 3-4-5-6-8
UL4	DS 3692 N	-	1	-	8	-	4
UL5	DS 8820 N	-	14	-	7	-	+5V 4-10
UL6	1489	-	14	-	7	-	9-10-12-13
UL7	1488	14	-	7	-	-	L 9-10-12-13
UL8	NJM 4004	-	14	-	7	-	+5V 1
UL9	4053	-	16	-	8	-	+5V 5

CHIP SELECTS

HIGH ORDER ADDRESS BUS

CONTROL & CLOCKS

DATA BUS

CONNECTOR BUS

A05-A23

09.361.0

A02

A03

A19

A22

A25

B5

B6

B14

BJ3

A05-A24

OPTIONAL UART

FM PILOT AND NEOPILOT OPTION

Synchronizer range adjust

Synchronizer offset adjust

PILOT SPEED COR.

TC SPEED COR.

SERIAL I/O OPTION

EXT. ROLLER FWD/BWD

PILOT REFERENCE SELECTION

BAUD RATE

RS 232/422

NEOPILOT HEAD

TEST CONDITION

AC AND DC MEASUREMENT SHOULD BE MADE AT SPEED 7½ ips

MEASURING INSTRUMENT

D.C. VOLTMETER 40 000 Ω/V
A.C. VOLTMETER (e.g. B & K Type 2112 or 2605+1615 or equivalent)

UNLESS SPECIFIED

VOLTAGES MAY VARY ± 10 %

ALL RESISTORS ¼W ± 10 %
ALL CAPACITORS ± 20 %

OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE CONTACT
FEMALE
EYELET
TEST-POINT
COMMON

ARROW INDICATES SIGNAL FLOW

DELETED:
CR15-CR16
R140-R141-R142
R144-R145-R146
R208-R227

8.7-4

KUDELSKI S.A. Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10036
19 West 44 th Street

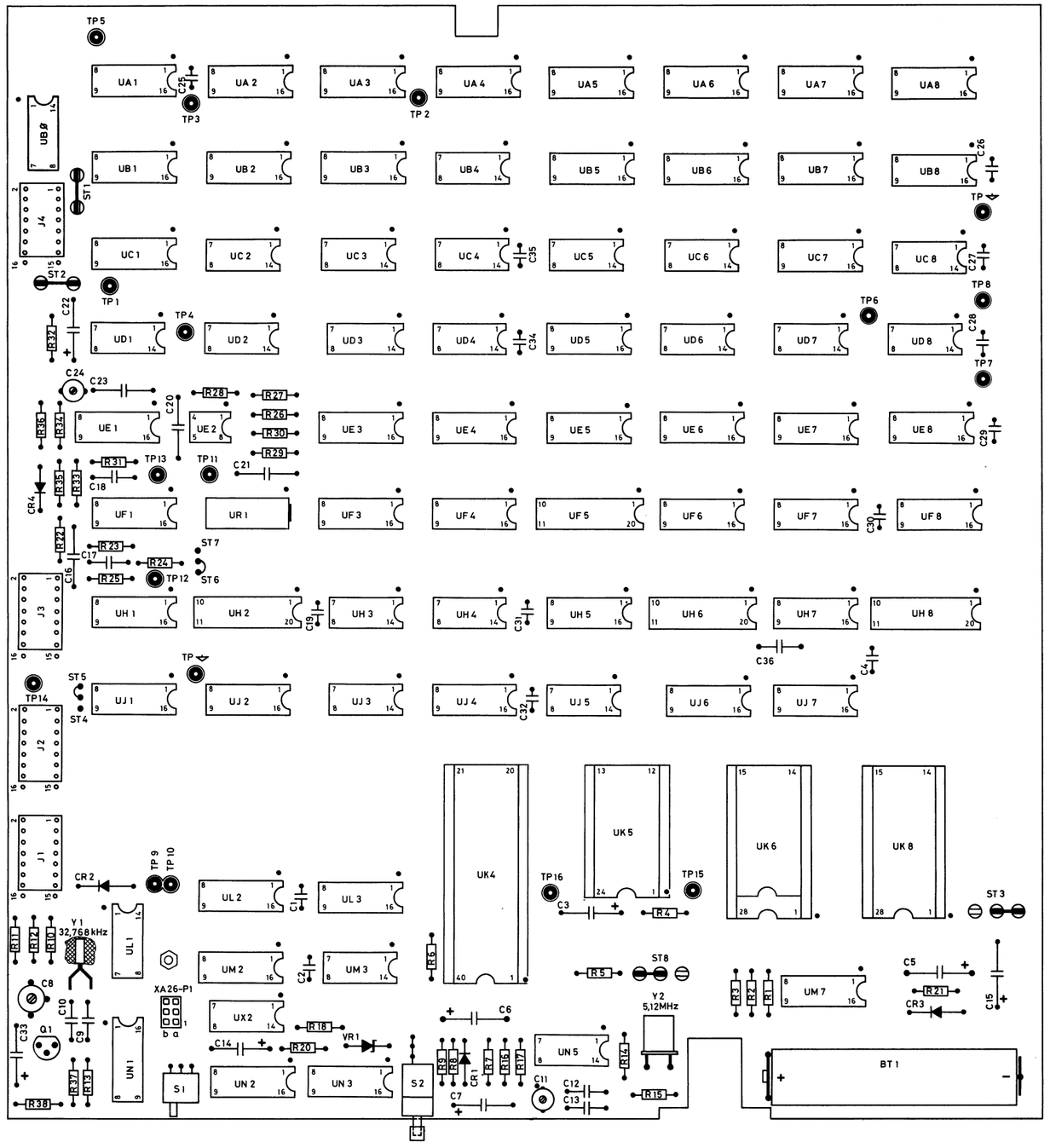
NAGRA TA

TIME CODE

MACHINE INTERFACE & SYNCHRONIZER

A05-A23 A

2/2 09.09.361.0.00 3.4.85



A24 TIME CODE COUNTER

09.362.0 **index D**

A05-A24

09.362.0

IC LIST

Comp.	Pos.	Pos.	Pos.	Pos.
UA1	B4	-	-	
UA2	C4	-	-	
UA3	C4	-	-	
UA4	C4	-	-	
UA5	C6	-	-	
UA6	C6	-	-	
UA7	C6	-	-	
UA8	B6	-	-	
UB0	D5-6	J4	-	
UB1	B5	D-E5	-	
UB2	C5	-	-	
UB3	C5	-	-	
UB4	D6	D7	-	
UB5	H4-5	-	-	
UB6	C6-7	-	-	
UB7	C7	-	-	
UB8	B6-7	D-E6	-	
UC1	B5	D-E5	-	
UC2	C5	-	-	
UC3	B5	B7	G5-8	
UC4	H4-5	14-5	-	
UC5	14-5	-	-	
UC6	J4	-	-	
UC7	B7	D-E7	-	
UC8	C7	-	-	
UD1	F6	-	-	
UD2	E-F5	E6	-	
UD3	D4	-	-	
UD4	F5-7	14	-	
UD5	H4	-	-	
UD6	J-J4	-	-	
UD7	E-F8	-	-	
UD8	F6	-	-	
UE1	G3	-	-	
UE2	G3	-	-	
UE3	G5	-	-	
UE4	F5	-	-	
UE5	G5-8	-	-	
UE6	G6-7	-	-	
UE7	G7	-	-	
UE8	F7	-	-	
UF1	G1	-	-	
UF3	E4	-	-	
UF4	F4	-	-	
UF5	G5-8	-	-	
UF8	E7	-	-	
UF7	F7	-	-	
UF8	H6-7	-	-	
UH1	H2	-	-	
UH2	F-G2	-	-	
UH3	G2	H2	H4	13-4
UH4	G2	-	-	
UH5	F-G2	-	-	
UH6	H3	-	-	
UH7	E2	F2	-	
UH8	D2-3	-	-	
UJ1	H1-2	-	-	
UJ2	F-G2	-	-	
UJ3	G2	-	-	
UJ4	H-13	-	-	
UJ5	G2	13	-	
UJ6	H3	-	-	
UJ7	B1	H7	-	
UK4	E1-2-3	-	-	
UK5	C2-3	-	-	
UK6	B-C2-3	-	-	
UK8	D2-3	-	-	
UL1	B-C3	-	-	
UL2	B1-2	-	-	
UL3	C-D4	-	-	
UM2	B2-3	-	-	
UM3	B2	C1	C2	G2
UM7	C1	G1	-	
UN1	B3-4	-	-	
UN2	E-F3-4	-	-	
UN3	E4	-	-	
UN5	B2	D3	E2	F3 14
UX2	C1	-	-	

IC LIST

ALL IC VDD 5V PIN 14 or 16
VSS PIN 7 or 8

EXEPT

Nr	Ref. design.	+7,5V	+5V	BACK-UP	
UB0	74HCU04	-	14	-	7	+5V 9 5 3-5
UC6	HEF 4013	-	14	-	7	3-4-5-6
UD4	HEF 4081	-	14	-	7	+5V 8-9
UE2	3240	8	-	-	4	5
UF5	HEF40373	-	20	-	10	
UH3	HEF4069	-	14	-	7	11
UH5	HEF4053	-	16	-	8	6-7
UH6	HEF40373	-	20	-	10	
UH7	HEF 4053	-	-	16	8	6-7-11-12-13
UL1	4011	-	-	14	7	
UL3	74HC4520	-	16	-	8	9-10-15
UN1	HEF4040	-	-	16	8	BACK-UP 12
UN2	40109	16	1	-	8	
UN3	HEF4518	-	-	-	8	9-10-15
UX2	74HC11	-	14	-	7	+5V 1-2-9-10-11-12-13-14

TEST CONDITION
AC AND DC MEASUREMENT SHOULD BE MADE AT SPEED 7T0 tps

MEASURING INSTRUMENT
D.C. VOLTMETER 40 000 Ω/V
A.C. VOLTMETER (e.g. B&K Type 2112 or 2608 + 1615 or equivalent)

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS ¼W ± 10 %
ALL CAPACITORS ± 20 %

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

MALE / FEMALE CONTACT
EYELET — COMMON
TEST-POINT

DELETED:
R19-R39

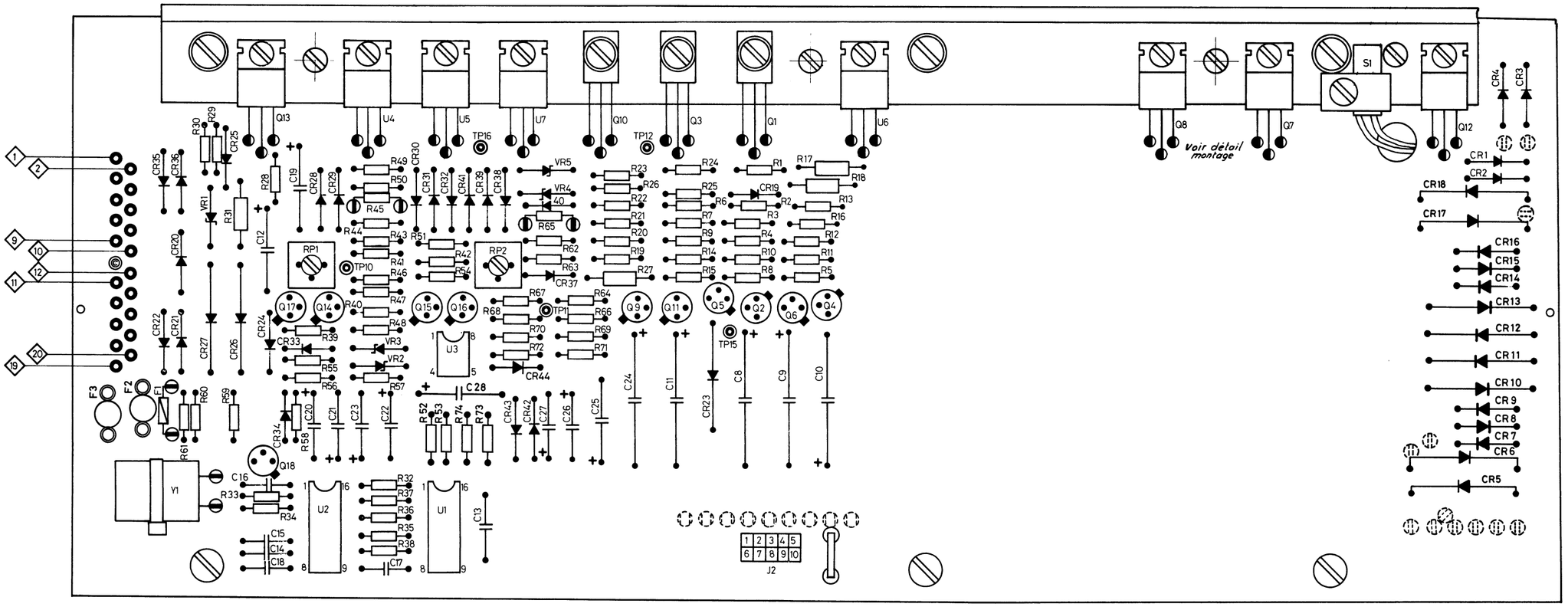
KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th. Street	A05-A24 ⚠
NAGRA TA	09.09.362.0.00	3.3.85
TIME CODE	CPU, DECODER & GENERATOR	

This drawing is confidential and may not be divulged in whole or in part to a third party

POWER SUPPLY

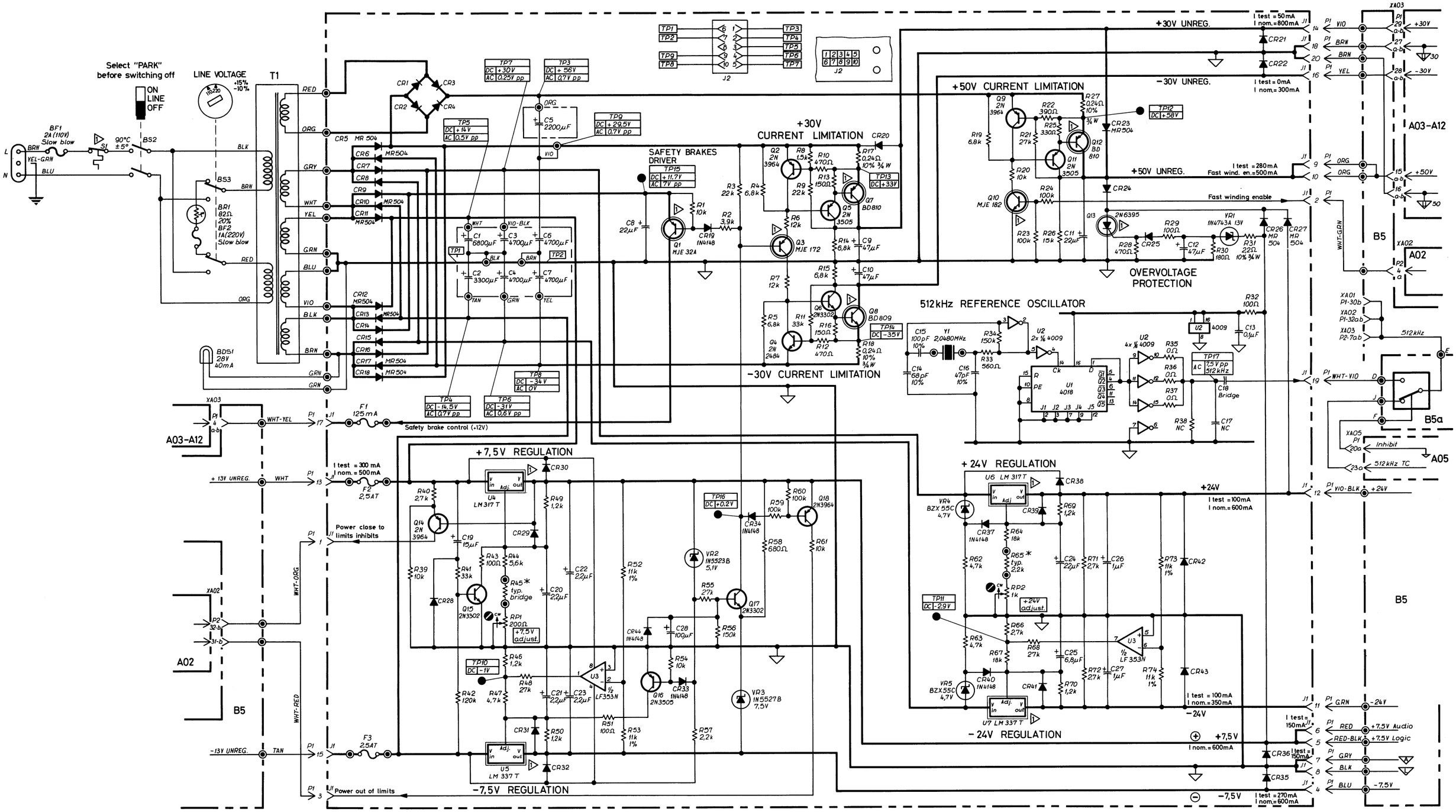
09 09 300 000	A30	MAIN POWER SUPPLY	8.8-2

SECTION 8.8



A30 POWER SUPPLY

09.300.0 **index D**



COLOR	CODE
BLK	= Black
BRN	= Brown
RED	= Red
ORG	= Orange
YEL	= Yellow
GRN	= Green
BLU	= Blue
VIO	= Violet
GRY	= Grey
WHT	= White
PNK	= Pink
TAN	= Tan

8.8-2

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

TRANSISTORS AND INTEGRATED CIRCUITS USE THE SAME HEATSINK

CONTACT: MALE, FEMALE, EYELET, TEST-POINT

ARROW INDICATES SIGNAL FLOW

COMMON
UNREGULATED COMMON
AUDIO COMMON
LOGIC COMMON

UNLESS SPECIFIED
VOLTAGES MAY VARY ±10%
ALL RESISTORS METAL OXIDE 1/4W ±2%
ALL CAPACITORS ±20%
ALL DIODES 1N 4003

MEASURING INSTRUMENT
DC VOLTMETER 40 000Ω/V
AC VOLTMETER (e.g. B & K Type 2112 or 2606 + 1615 or equivalent)

TEST CONDITIONS
Measurement should be made with 220V line voltage and loading by NAGRA TA, stereo version (stop selected)

A02 MAIN CONTROL LOGIC
A03–A12 TRANSPORT CONTROL
B5 BOX INTERCONNECTION

KUDELSKI S.A. Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10036
19 West 44 th Street

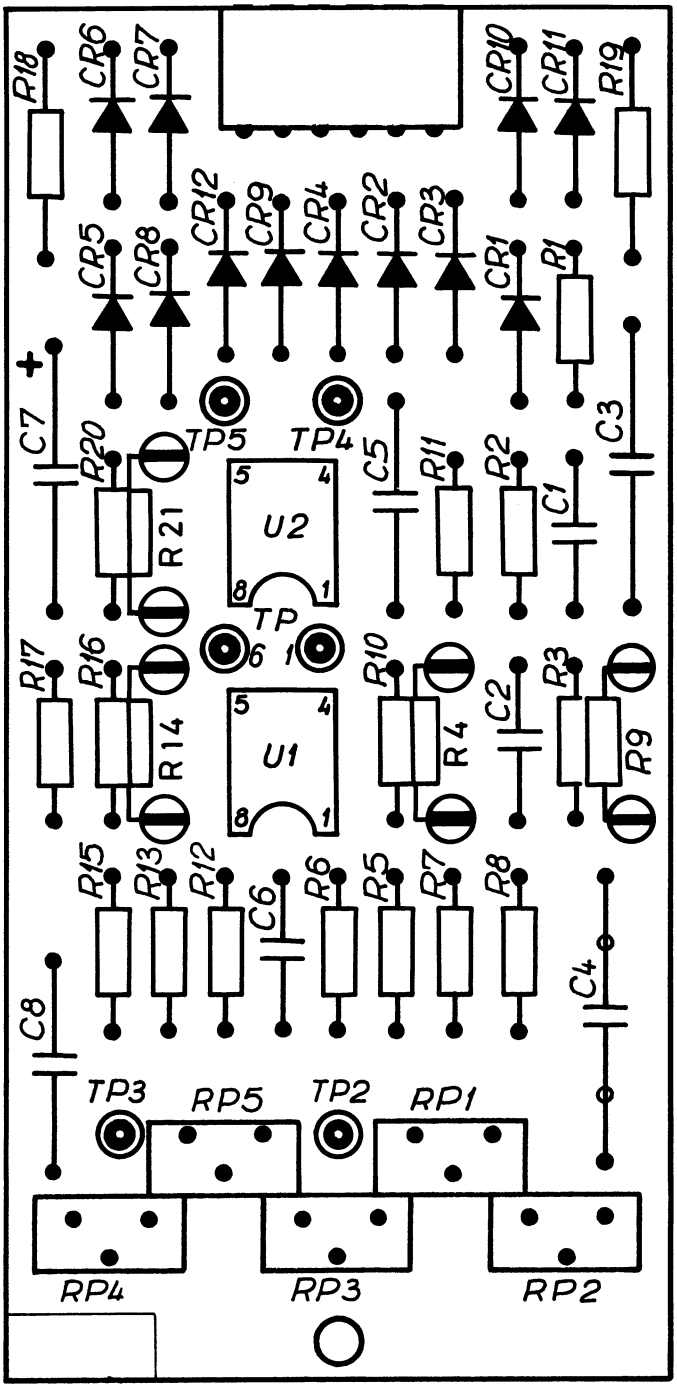
A30 (D)

TAPS | 09.09.300.0.00 | 26.10.81

MAINS POWER SUPPLY for NAGRA TA

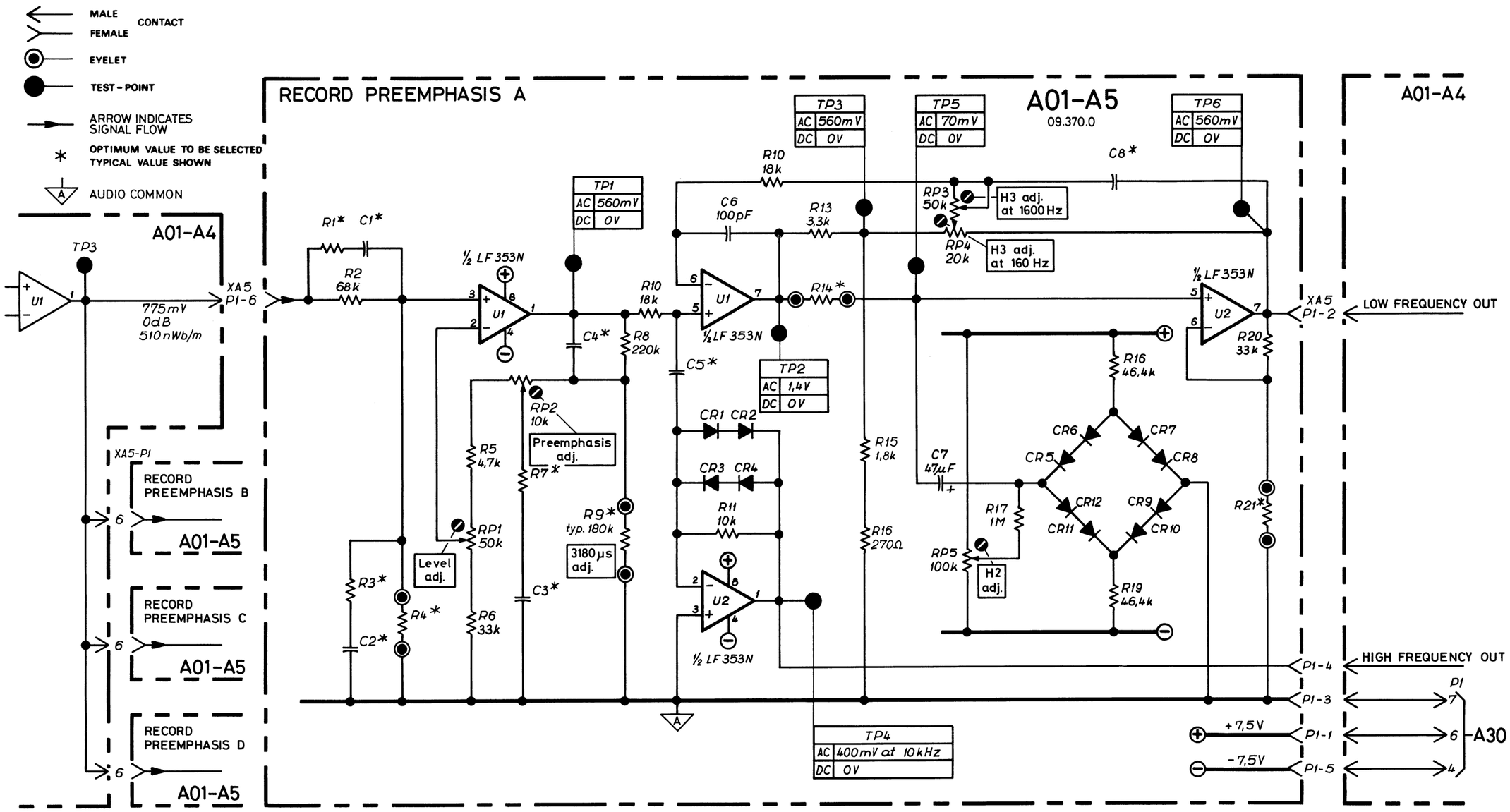
OPTIONS

SECTION 8.9



A5 TACAL/RECORD PREEMPHASIS
WITH PREDISTORTION

09.370.0 index A



A 01 AUDIO RECORD / REPRODUCE BOARD including

- A 2 Line input amplifier
- A 4 Record amplifier
- A 5 Record preemphasis
- A 6 Erase and bias
- A 7 Synchronizer reproduce
- A 8 Reproduce amplifier
- A 9 Line output amplifier
- A 10 Peak level indicator

A30 POWER SUPPLY
P1 POWER SUPPLY PLUG

TEST CONDITION

AC AND DC MEASUREMENT SHOULD BE MADE AT SPEED 7 1/2 ips CCIR AND 500 Hz FOR 0dB LEVEL = 510 nWb / m

MEASURING INSTRUMENT

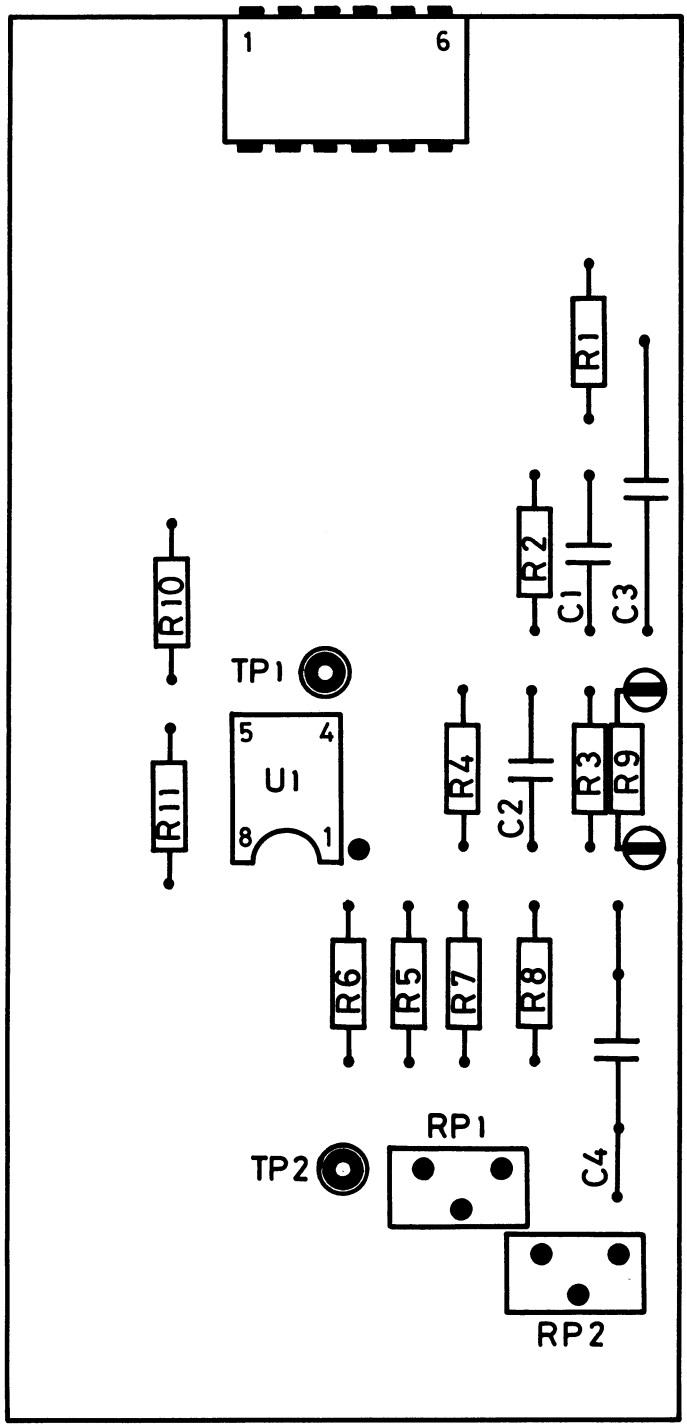
DC VOLTMETER 40000 Ω / V
AC VOLTMETER (e.g. B.&K Type 2112 or 2606 + 1615 or equivalent)

UNLESS SPECIFIED

VOLTAGES MAY VARY ± 10 %
ALL RESISTORS METAL OXIDE 1/4 W ± 2 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

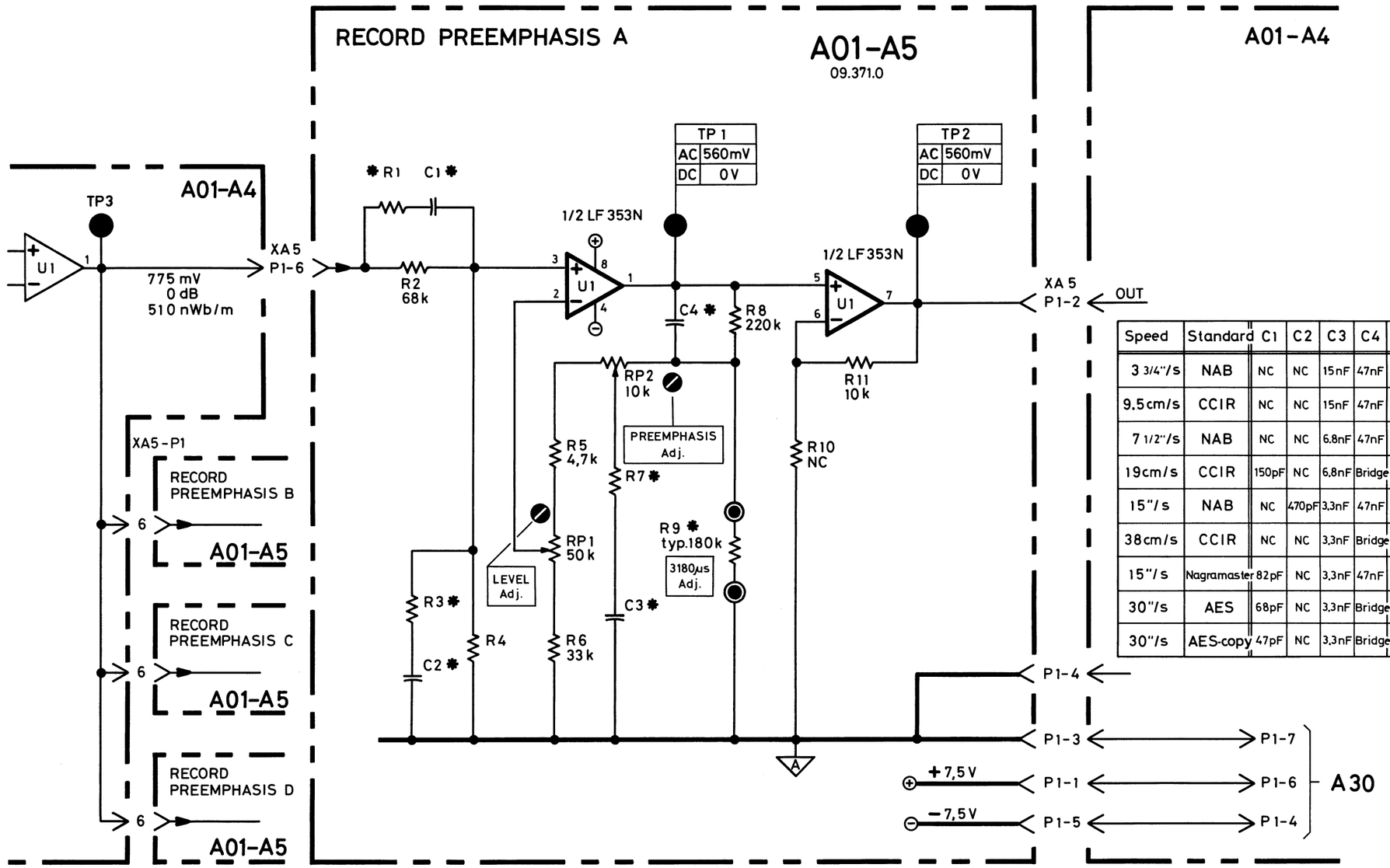
Speed	Standard	C1	C2	C3	C4	C5	C8	R1	R3	R4	R7	R9	R14	R21
3 3/4 "/s	NAB/CCIR	adj.	adj.	15nF	47nF	2,2nF	1,5nF	adj.	adj.	18k	1k	adj.	18k	8,2k
7 1/2 "/s	NAB	adj.	adj.	6,8nF	47nF	1,5nF	1nF	adj.	adj.	27k	1,5k	adj. typ. 180k	18k	6,8k
7 1/2 "/s	CCIR	150pF	adj.	6,8nF	Bridge	1,5nF	1nF	22k	adj.	27k	1,5k	adj.	18k	6,8k
15 "/s	NAB	adj.	470pF	3,3nF	47nF	1nF	1nF	adj.	56k	27k	2,2k	adj.	18k	6,8k
15 "/s	CCIR	adj	adj.	3,3nF	Bridge	1nF	1nF	adj.	adj.	27k	2,2k	adj.	27k	4,7k
15 "/s	NAGRA MASTER	82pF	adj.	3,3nF	47nF	1nF	1nF	22k	adj.	27k	1,5k	adj.	27k	4,7k
30 "/s	AES	68pF	adj	3,3nF	Bridge	1nF	1nF	27k	adj.	27k	3,3k	adj.	27k	4,7k
30 "/s	AES Copy	47pF	adj.	820pF	Bridge	1nF	1nF	18k	adj.	27k	820Ω	adj.	18k	6,8k

KUDELSKI S.A. Dept. NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK N.Y. 10036 19 West 44 th Street	A01-A5 Ⓐ
TACAL	09.09.370.0.00	5.11.81
RECORD PREEMPHASIS FOR NAGRA TA		



A5 TACAL-S/RECORD PREEMPHASIS WITHOUT PREDISTORTION

09.371.0 index A



Speed	Standard	C1	C2	C3	C4	R1	R4	R3	R7	R9	R10
3 3/4"/s	NAB	NC	NC	15nF	47nF	NC	18k	NC	1 k	Adj.	NC
9.5cm/s	CCIR	NC	NC	15nF	47nF	NC	18k	NC	1 k	Adj.	NC
7 1/2"/s	NAB	NC	NC	6.8nF	47nF	NC	27k	NC	1.5 k	Adj. ~180k	NC
19cm/s	CCIR	150pF	NC	6,8nF	Bridge	22k	27k	NC	1.5 k	NC	NC
15"/s	NAB	NC	470pF	3,3nF	47nF	NC	27k	56 k	2.2 k	Adj.	NC
38cm/s	CCIR	NC	NC	3,3nF	Bridge	NC	27k	NC	2.2 k	NC	NC
15"/s	Nagramaster	82pF	NC	3,3nF	47nF	22k	27k	NC	1,5 k	Adj.	NC
30"/s	AES	68pF	NC	3,3nF	Bridge	27k	27k	NC	3,3 k	NC	NC
30"/s	AES-copy	47pF	NC	3,3nF	Bridge	18k	27k	NC	820Ω	NC	NC

A01 AUDIO RECORD / REPRODUCE BOARD including

- A2 Line input amplifier
- A4 Record amplifier
- A5 Record preemphasis
- A6 Erase and bias
- A7 Synchronizer reproduce
- A8 Reproduce amplifier
- A9 Line output amplifier
- A10 Peak level indicator

A30 POWER SUPPLY
P1 POWER SUPPLY PLUG

TEST CONDITION
AC AND DC MEASUREMENT SHOULD BE MADE AT SPEED 7½ ips CCIR
AND 500 Hz FOR 0dB LEVEL = 510 nWb/m

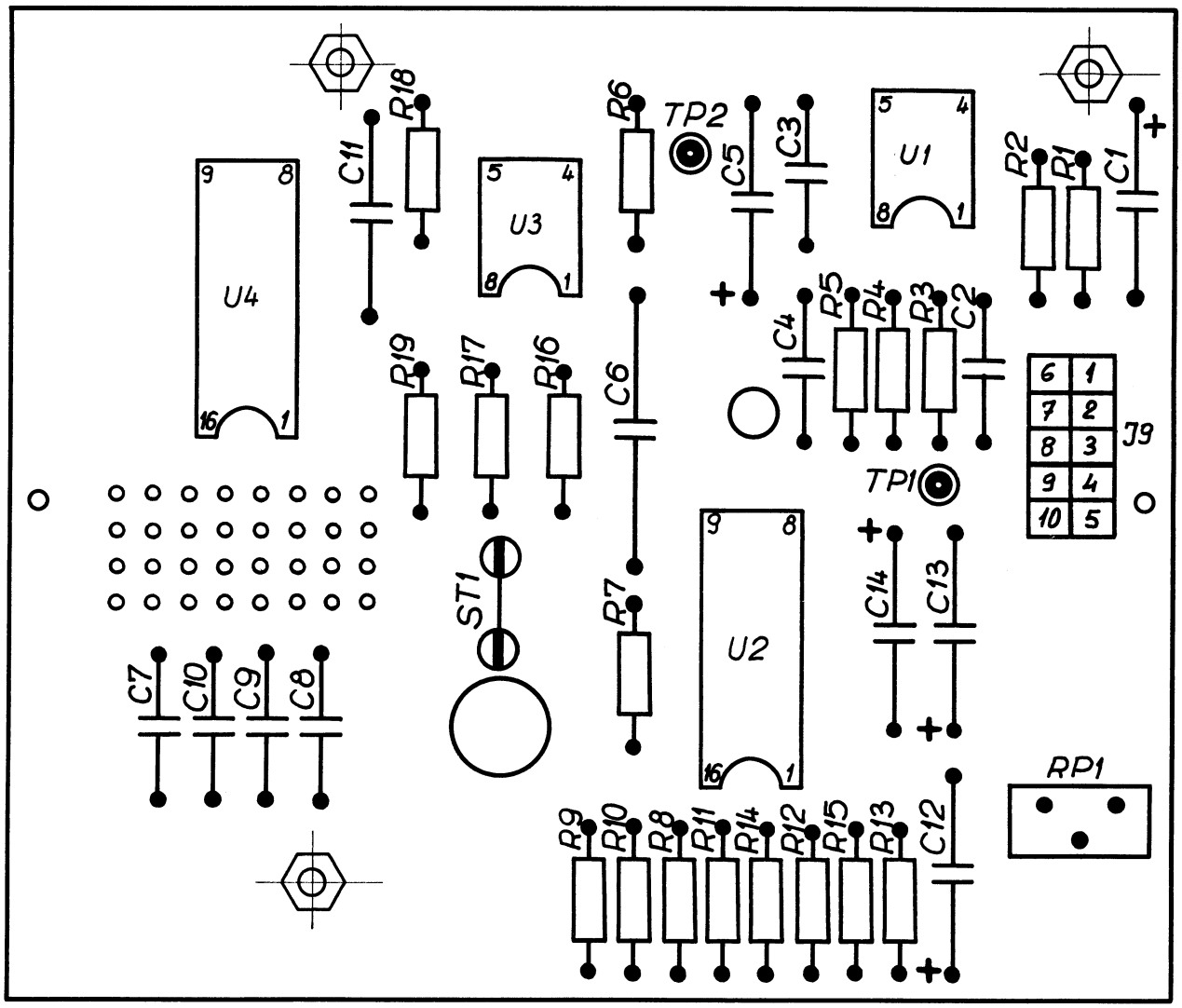
MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606 + 1615 or equivalent)

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %

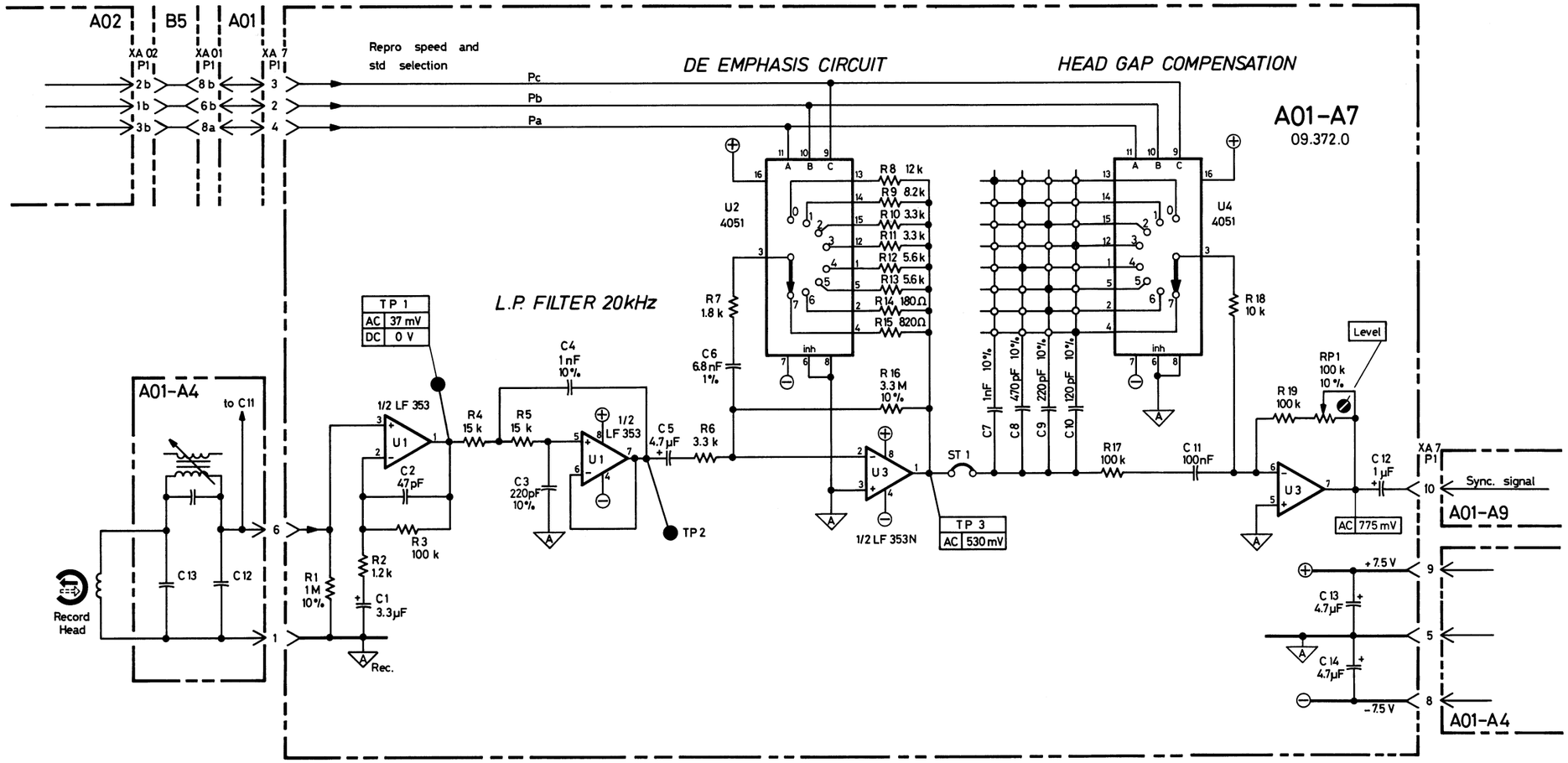
ALL RESISTORS ¼W ± 2% METAL OXIDE
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

MALE CONTACT
FEMALE
EYELET
TEST-POINT
ARROW INDICATES SIGNAL FLOW
AUDIO COMMON
OPTIMUM VALUE TO BE SELECTED TYPICAL VALUE SHOWN

KUDELSKI S.A. Dept. NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK, N.Y. 10036 19 West 44 th Street	A01-A5 (A)
TACAL-S	0909371000	12.4.84
RECORD PREEMPHASIS for NTA (without predistortion)		



A7 SELF-SYNC REPRODUCE TASIM
09.372.0



Speed code	Speed ips	Standard	Deemphasis Time constant Hi-freq.	Lo-freq.	
0	3 3/4	CCIR-NAB	90µs	3180µs	
1	7 1/2	CCIR	70	∞	
2	15	CCIR	35	∞	
3	30	CCIR	35	∞	Normal or Copy 30ips
4	7 1/2	NAB	50	3180	
5	15	NAB	50	3180	
6	15	Nagra Master	13,5	3180	
7	30	AES	17,5	∞	Normal or Copy 30ips

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %

ALL RESISTORS 1/4W ± 2 %
ALL CAPACITORS ± 20 %

MALE / FEMALE CONTACT
TEST-POINT
ARROW INDICATES SIGNAL FLOW
AUDIO COMMON

A01 AUDIO RECORD / REPRODUCE BOARD including
- A2 Line input amplifier
- A4 Record amplifier
- A5 Record preemphasis
- A6 Erase and bias
- A7 Synchronizer reproduce
- A8 Reproduce amplifier
- A9 Line output amplifier
- A10 Peak level indicator

A02 MAIN CONTROL LOGIC
B5 BOX INTERCONNECTION

DATE	MODIFICATIONS
3.86	REVISION

KUDELSKI S.A. Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10 036
19 West 44 th Street

A01-A7 △

TASIM | 09.09.372.0.00 | 9.2.82

SELF-SYNC REPRODUCE FOR NAGRA TA

1008374-0012 A

A7

R12 R10 C5 C6 R8 R15 R16 R11 R36 R18 R17 R19 R20 R14 C7 R21 C8 C9 C17 C10 C11 R22 R23 R32 R28 R26 R30 R25 R24 R27 R31 R29 C4 C3 R2 R4 R7 R3 R9 R6 R5 R35 C12 C13 C14 C15 R33 R34 C19 C16 R37 C1 C2 R1 R13 C18

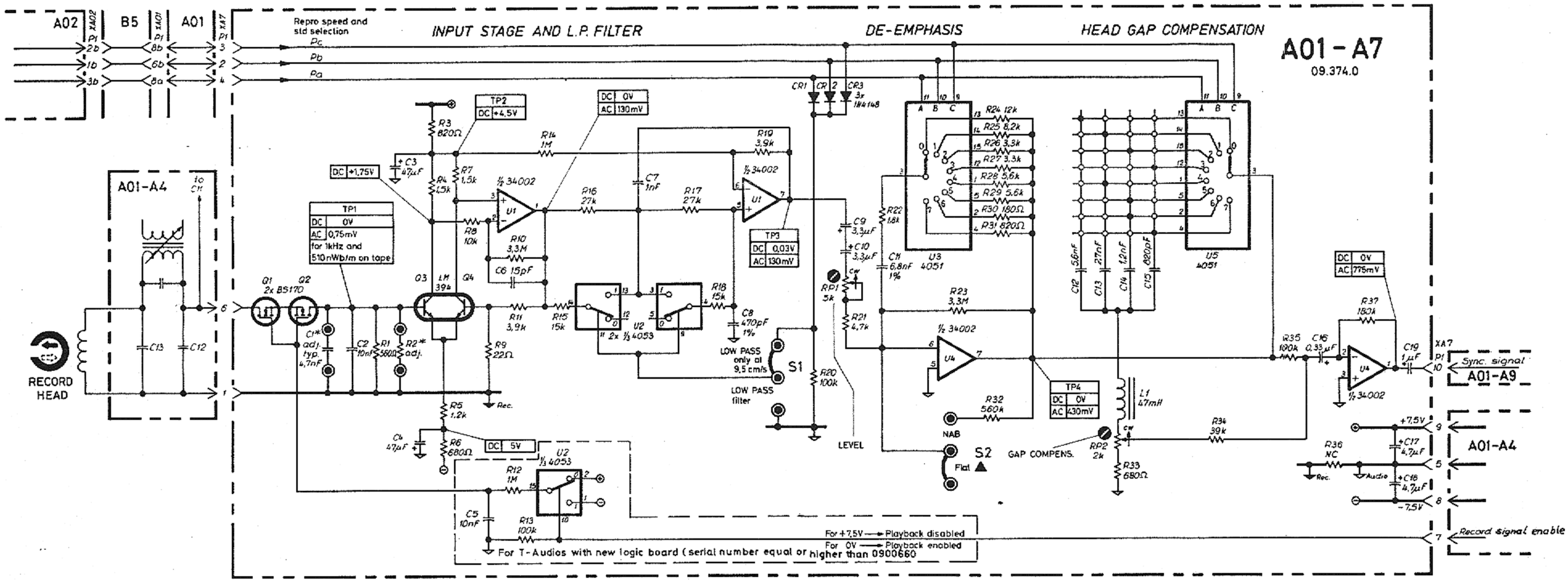
U2 U1 U5 U3 U4 Q2

ST1 ST2 TP1 TP2 TP3 LP CR1 CR2 CR3

J1 J4

L1

RP2 RP1



Speed code	Speed ips	Standard	Deemphasis Time constant ▲
0	3 3/4	CCIR - NAB	90µs
1	7 1/2	CCIR	70µs
2	15	CCIR	35µs
3	30	CCIR	35µs
4	7 1/2	NAB	50µs
5	15	NAB	50µs
6	15	Nagra Master	13,5µs
7	30	AES	17,5µs

▲The low frequency equalization (3180µs) can by enabled (NAB and Nagra Master positions) or disabled, with the S2 switch, at all speeds and standards.

MEASURING INSTRUMENT

DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

UNLESS SPECIFIED

VOLTAGES MAY VARY ± 10 %

ALL RESISTORS ¼W ± 2 %
ALL CAPACITORS ± 20 %

EYELET

ARROW INDICATES SIGNAL FLOW

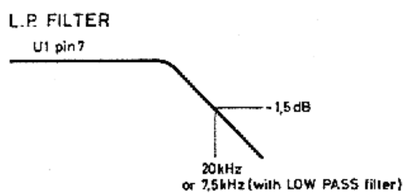
* OPTIMUM VALUE TO BE SELECTED TYPICAL VALUE SHOWN

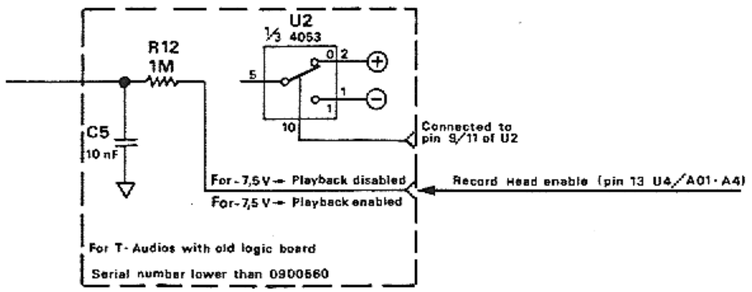
MALE / FEMALE CONTACT

Audio Common

Rec. Record Common

L.P. FILTER





	RECORD HEAD GAP	
	10 µ *	20 µ
C 12	5,6 nF	10 nF
C 13	2,7 nF	6,8 nF
C 14	1,2 nF	2,7 nF
C 15	820 pF	820 pF

* ex factory

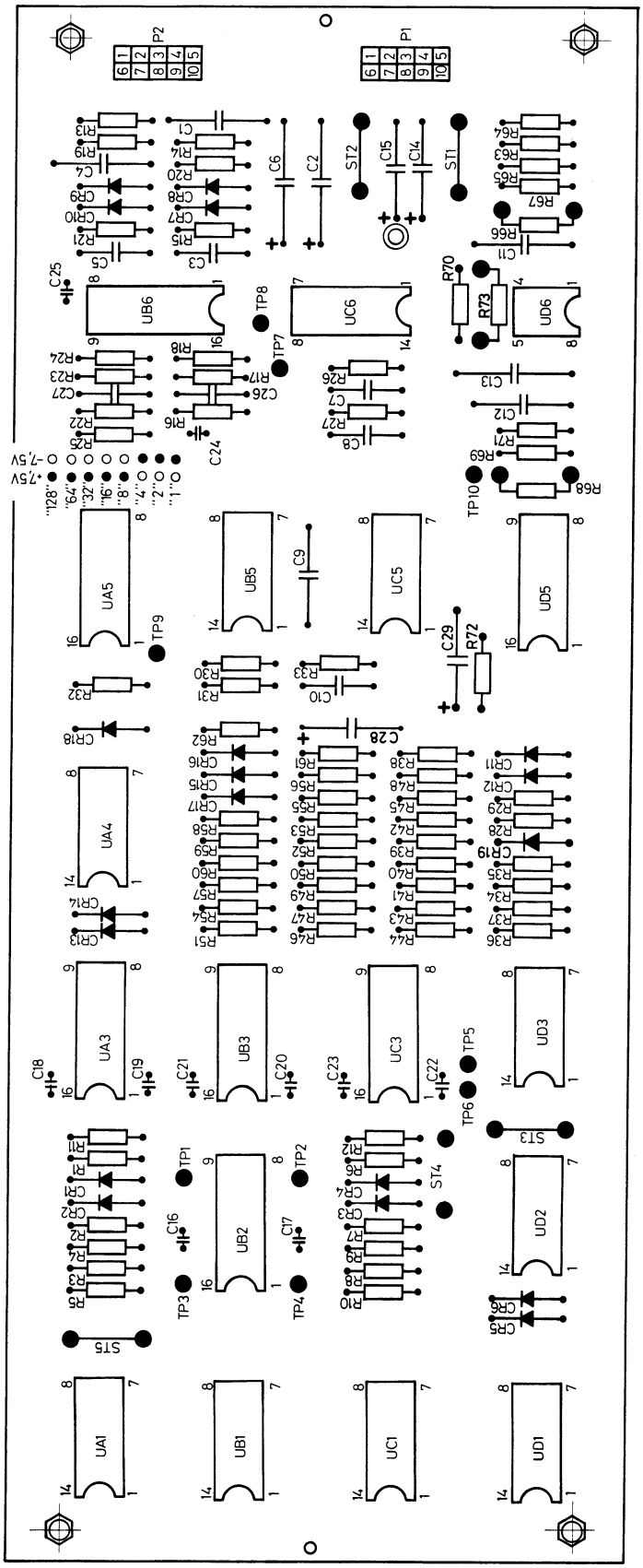
IC LIST

Nr	Ref. design.	+7,5V	⏚	-7,5V
U1	34002	8	-	4
U2	4053	16	6 - 8	7
U3	4051	16	6 - 8	7
U4	34002	8	-	4
U5	4051	16	6 - 8	7

A01 AUDIO RECORD / REPRODUCE BOARD including

- A2 Line input amplifier
- A4 Record amplifier
- A5 Record preemphasis
- A6 Erase and bias
- A7 Synchronizer reproduce
- A8 Reproduce amplifier
- A9 Line output amplifier
- A10 Peak level indicator

KUDELSKI SA Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A01-A7 Ⓐ
TASIM-2	09.09.374.0.00	6 . 2 . 87
SELF - SYNC REPRODUCE FOR NTA		



A19 TASC/SERVO-EDITING

09.353.0 **index B**

A04-A19

09.353.0

A16b — SERVO-ENCODER

MLED 71 — TIL 100 — +7,5V

SERVO-EDIT A — P2-1

SERVO-EDIT B — P2-6

ENCODER FWD

A = TP1

B = TP2

+7,5V

-7,5V

TP1 TP2 TP3 TP4

A

B

$\overline{A}$

$\overline{B}$

UA1 4013 FWD BWD

UB1 4013 FWD BWD

UC1 4013 FWD BWD

UD1 4013 FWD BWD

ST3

ST4

CR5 CR6

UD2 2x ¼4012

DATA = TP7

RIGHT CAPSTAN FORWARD

CLOCK = TP8

RIGHT TACHO HEAD

P2-8

P2-2 P2-7

P2-9

UB6 ¼4575

DATA

CLOCK

UC6 4013 FWD BWD

FWD EXECUTED

BWD EXECUTED

CUT PULSES

TP6 FWD PULSES

TP5 BWD PULSES

UD3 2x ½4002

ST5

UC3 40193

UB3 40193

UA3 40193

2x ½4023

⅓4023

TP10

23x 33,2k 1%

BWD INPUT

FWD INPUT

+MOTOR

-MOTOR

REF. MOTOR

TEST CONDITION: CUT FUNCTION AFTER SERVO EDITING

TP10 2V/DIV.

I motor P1-6 1V/DIV.

100ms/DIV.

"ADVANCE TO CUT" OSCILLATOR

TAPE LENGHT COUNTER

SPEED STAB. MODES SELECTION

P1-3 Ma

P1-4 Mb

P1-9 Mc

UD5 4051

ADVANCE TO CUT

SERVO EDIT

UB5 4047 Astable Osc. out

UC5 4013 ÷2

UA5 40103 Matrix

ZERO DETECTION P1-5

TEST INPUT

GENERATOR ON TEST INPUT
FREQ. = 1Hz AMPL. ± 7,5 V
(UD5 PIN15 AT +7,5V)

TP9 test input 10V/DIV.

TP10 2V/DIV.

200ms/DIV.

ST1 I=15mA P2-4

ST2 I=10mA P2-10

P2-5

UA1-4 UB1 UC1-5-6 UD1-2-3

8x 100nF

CR19 C29 R72

XA19 P1 — XA04 P2

BWD INPUT 26a

FWD INPUT 26b

ZERO DETECT. 18b

Ma 20a

Mb 20b

Mc 18a

SERVO-EDIT B 28b

SERVO-EDIT A 28a

SERVO ENABLE

2 x ⅓ 4053

+MOTOR 24a

REF. MOTOR 24b

-MOTOR 22a

RIGHT TACHO 32b

EDITION-CUT SIGN. 30a

+7,5V 8a-b

0V 10a-b

RIGHT TACHO 30b

RIGHT TACHO 32a

-7,5V 12a-b

XA02 P2 — XA03 P2

A02

A03

BJ1 BJ2 BJ3

A19 — A04/05 — B5

BWD INPUT — FWD INPUT — FOR FREQUENCY = 1kHz, SPEED 3 3/4 ips; " " = 2kHz, SPEED 7 1/2 ips; MAXIMUM FREQUENCY ≅ 4kHz

RIGHT CAPSTAN MOTOR

A04 A05 — B5 — B3

WHT-BLK-GRY

YEL-GRN

WHT-BLK-VIO

L1 L2 L3 L4 C2 0,1µF C5 0,1µF

A03

SPEED STABILIZER

Q104 Q105

C116 C117 C118 R170

MEASURING INSTRUMENT

DC VOLTMETER 40 000 Ω/V

UNLESS SPECIFIED

VOLTAGES MAY VARY ± 10 %

ALL RESISTORS ¼W ± 10 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

ARROW INDICATES SIGNAL FLOW

MALE
FEMALE
CONTACT
EYELET
TEST-POINT

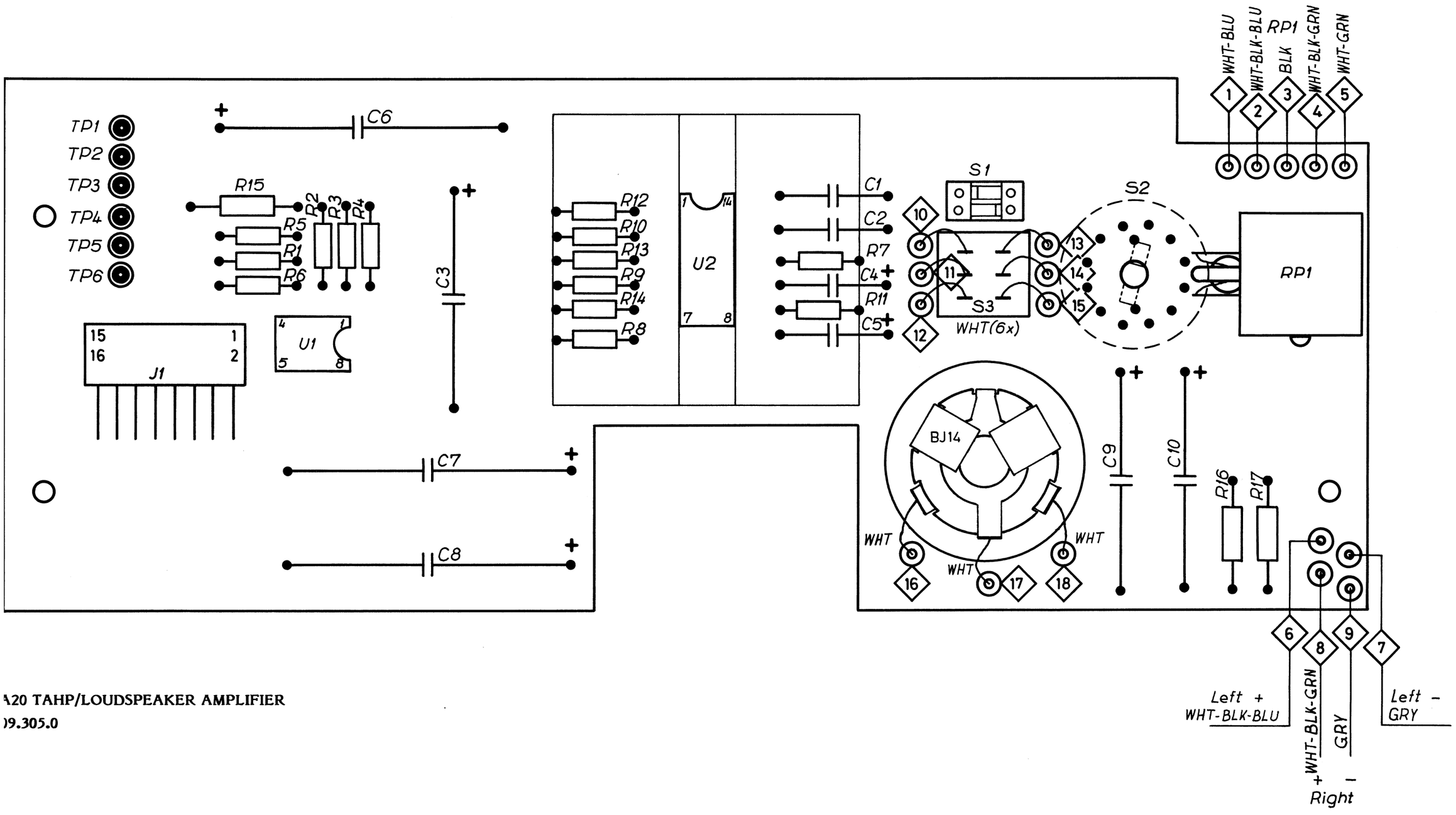
TACHO HEAD COMMON
LOGIC COMMON
UNREGULATED COMMON

A02 MAIN CONTROL LOGIC
A03 TAPE TRANSPORT CONTROL AND SPEED STAB.
A04 SYNCHRONIZER
A014 TAPE COUNTER AND THIRD TRACK
A16b SERVO-ENCODER
B5 BOX INTERCONNECTION
BJ1 RIGHT KEYBOARD PLUG
BJ2 LEFT KEYBOARD PLUG (OPTION)
BJ3 REMOTE CONTROL PLUG

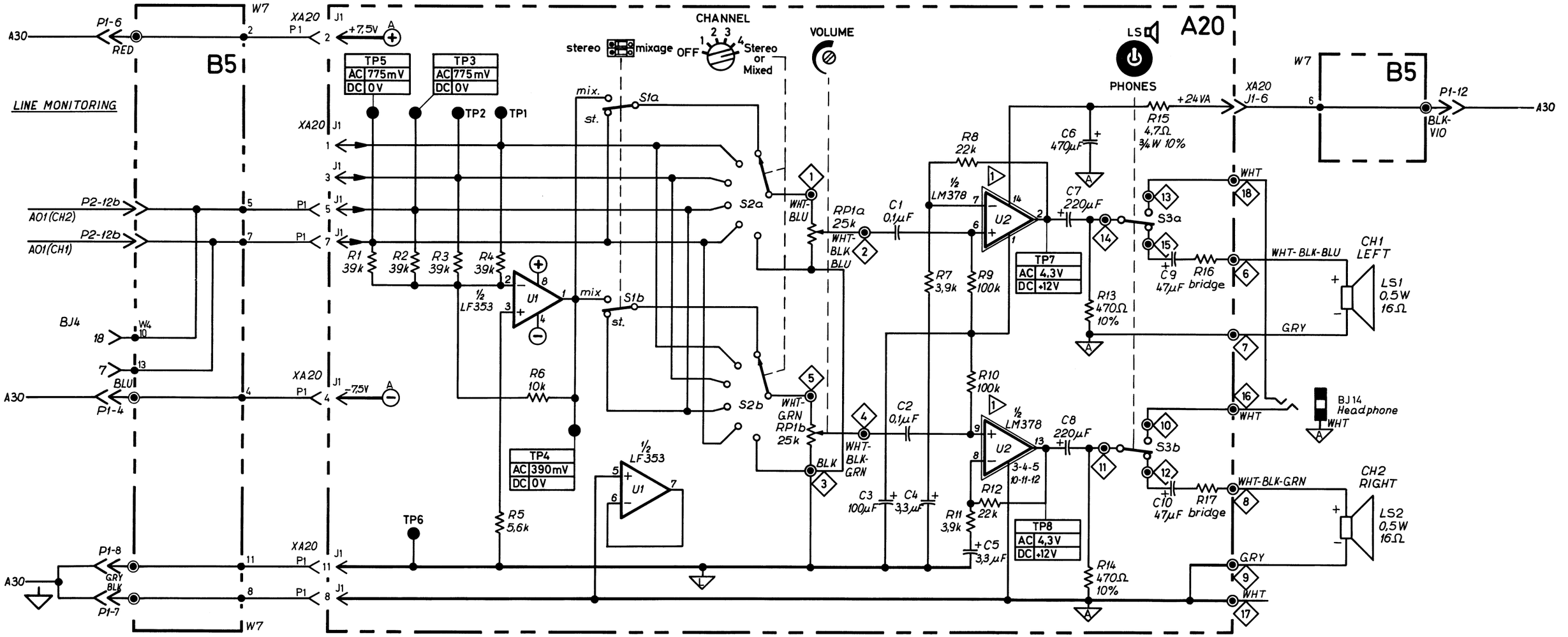
A04 TAPE COUNTER BOARD including
A19 Servo editing
A21 Counter

DELETED:
C28

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street	A04-A19 (B)
TASC	09.09.353.000	12.10.81
SERVO-EDITING for NAGRA TA		



A20 TAHP/LOUDSPEAKER AMPLIFIER
09.305.0



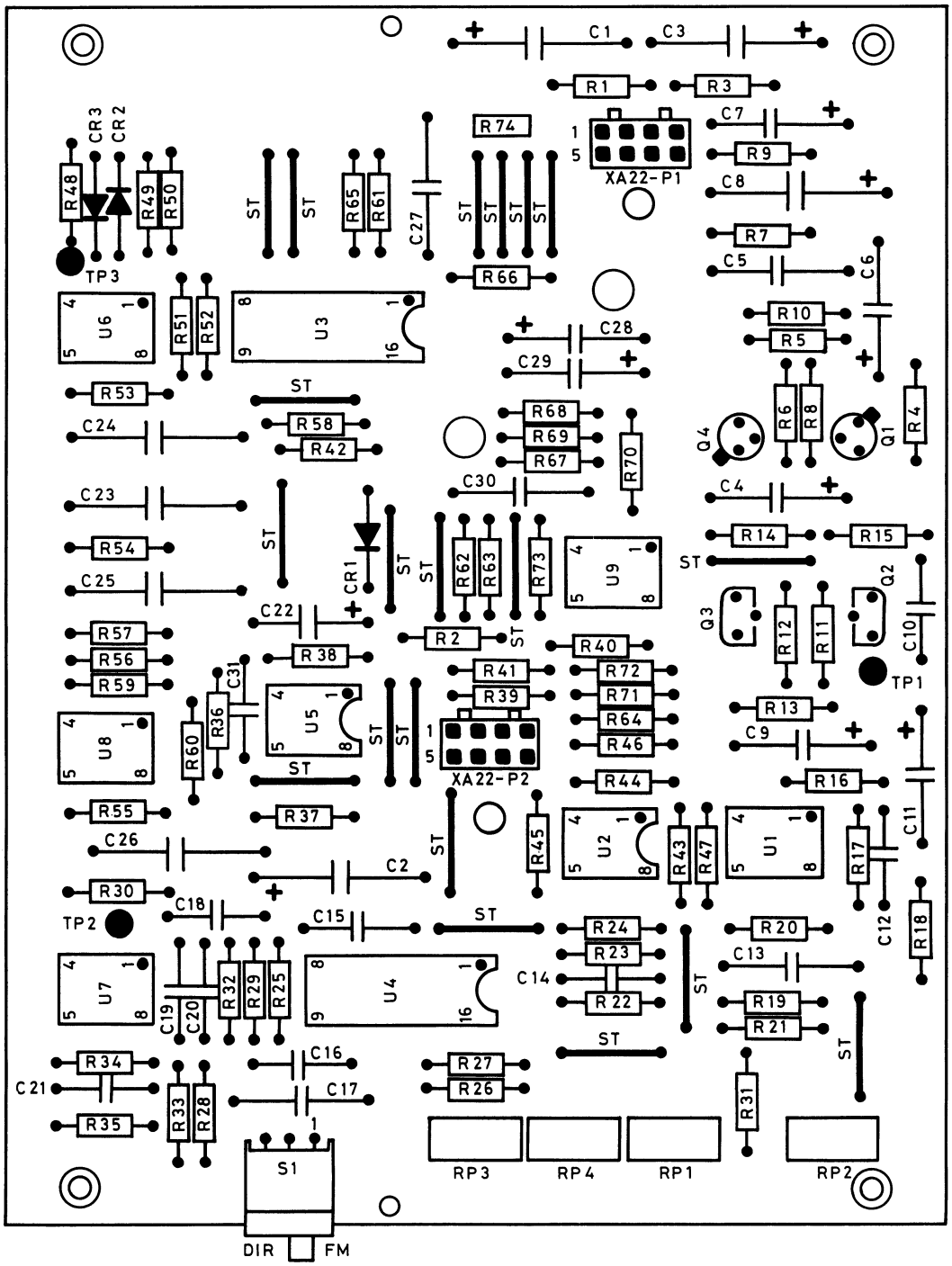
MEASURING INSTRUMENT
DC VOLTMETER 40000Ω/V
AC VOLTMETER (e.g. B & K Type 2112 or 2606+1615 or equivalent)
UNLESS SPECIFIED
AC MEASUREMENT SHOULD BE MADE AT 1kHz FOR 0dB LEVEL
ALL RESISTORS METAL OXIDE 1/4W ± 2%
ALL CAPACITORS ±20%

MALE / FEMALE — CONTACT
EYELET
TEST-POINT
LOGIC COMMON
AUDIO COMMON
INTEGRATED CIRCUIT
USE HEATSINK
ARROW INDICATES SIGNAL FLOW

A01	AUDIO–RECORD REPRODUCE
A30	POWER SUPPLY
B5	BOX INTERCONNECTION

COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White

KUDELSKI S.A. Dept NAGRA CH 1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC NEW YORK N.Y. 10036 19 West 44th Street	A20
TAHP	09.09.305.0.00	29.9.81
L.S. AMPLIFIER for NAGRA TA		



A25 TAPFM/PILOT FM AND NEOPILOT

09.375.0 index B

A05
09.361.0

A25
09.375.0
FM. PILOT AND NEOPILOT OPTION

3rd Track Ext.ref. — BJ11 — B6 — XA05 J1 P1 — XA22 J2 P2

Ext.ref. in — +7.5VL — R1 22Ω — C1 6.8µF — DC +6.8V — Audio — C2 6.8µF — R2 22Ω — −7.5VL — DC −6.8V

0VL

Pilot ref.

FM/NEOPILOT

NEOPILOT AMPLIFIER — CR1 1N4148 — +6.7V — R3 680Ω — C3 39µF — R4 220k — R5 6.8k — Q1 2N3964 — Q2 BC214 — DC 4.3V — DC 3.4V AC 21mVRMS — C4 1.5µF — C5 0.1µF — R7 120k — R6 220k — Q4 2N2484 — C6 1µF — R9 10Ω — C7 6.8µF — R8 68k — R11 150k — C9 6.8µF — R13 1k — R12 100k — R10 47Ω — C8 100µF — R14 1k — DC 0.9V — Audio

NEOPILOT PLAYBACK HEAD — B5 — XA05 P1 J1 — 4a — 2a — − 17µV RMS

NEOPILOT LEVEL ADJUST — R17 220k — RP2 200k — C12 3.3nF — C11 0.33µF — R16 47k — C10 22nF — R15 1k — TP1

U1 1/2 34002B — AC 130mVRMS — R18 470Ω — R48 10k — U3 1/3 4053 — 2x1N4148 — CR2 — CR3 — TP3 — DC 0V AC 130mVRMS — R49 NC — R50 10k

U5 1/2 LM2903 — R38 220k — R39 18k — R40 18k — R41 47k — C22 2.2µF — C31 10nF — R36 47k — R37 12k — R42 1M

U2 1/2 LM2903 — R43 39k — R44 220k — R45 22k — R46 22k

U6 1/2 34002B — C23 22nF — C24 22nF — R53 1.5M — R54 127k — R51 120k — R52 10k — C25 27nF — C26 27nF — R55 11k — 63Hz FILTER — 48Hz FILTER

63Hz + 48Hz FILTER PASSBAND RESPONSE — 0 dB — −6 dB — −12 dB — 50Hz — 60Hz

PILOT RESOLVER — R47 22k — R57 47k — R56 47k — U8 1/2 34002B — R58 1k — U3 1/3 4053 — R61 1k — R65 100k — C28 2x0.22µF — C29 — R68 560k — R69 1.5M — C30 47nF — R66 470k — C27 0.1µF — R67 560k — U9 1/2 34002B — R70 100Ω — R60 470Ω — R74 NC — R62 10k — R72 22k — R71 18k — R73 27k — Hysteresis ±500mV — R63 10k — R64 150k

AC 1.7±0.1V RMS

XA22 P2 J2 — Ext.ref.out 5V 0V — Speed correction — Pilot out — Pilot comp. 5V 0V

XA05 P1 J1 — B6 — BJ11 — 3rd Track Pilot out

DIRECT LEVEL ADJUST — RP1 20k — R20 22k — R19 4.7k — C13 47nF — TC.Play — U1 1/2 34002B — AC 4.0V P-P (FM) AC 0.4V P-P (DIRECT)

DIRECT PILOT — FM PILOT — S1 — R31 3.9k — RP4 5k — FM LEVEL ADJUST — R32 33k

FM DEMODULATOR — U4 4046 HEF — R21 100k — U2 1/2 LM2903 — R24 22k — R23 330k — C14 100pF — R22 4.7k — R25 12k — C15 3nF — R26 39k — R27 120k — RP3 100k — DEMODULATOR CENTER FREQU. ADJUST.

R29 180k — R30 180k — C16 6.8nF — R28 18k — C17 0.1µF — C18 560pF — U7 1/2 34002B — C19 270pF — DC 0V AC 3.3V±0.3V P-P 50Hz FM-PILOT — TP2

U7 1/2 34002B — C20 10nF — C21 10nF — R33 39k — R34 82k — R35 470Ω — AC 1.2V RMS for ±20% modulation — 280Hz CUE FILTER

XA22 P2 J2 — CUE out — XA05 P1 J1 — B6 — BJ11 — 3rd Track CUE out

IC LIST

N°	Ref.design.	NB.	+7,5V	−7,5V	GND
U1	34002B	2/2	8	4	
U2	LM 2903	2/2	8	4	
U3	4053	2/3	16	7	6-8-11
U4	4046 HEF	1	16	8	
U5	LM 2903	1/2	8-5	4-6	

IC LIST

N°	Ref.design.	NB.	+7,5V	−7,5V	GND
U6	34002B	2/2	8	4	
U7	34002B	2/2	8	4	
U8	34002B	2/2	8	4	
U9	34002B	2/2	8	4	

SCHEMATIC DIAGRAM NOTES
- * Asterisk denotes a factory adjusted value
- Value shown is typical
- Circuit assembly borderline
- Arrows indicate signal flow
- A conducting connection to a chassis or frame
- Common connections
- Male Contact / Female Contact
- Test Point
- Tool aided adjustement
- All connectors viewed from the outside

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω/V
AC VOLTMETER (e.g. B&K Type 2112 or 2606+1615 or equivalent)

UNLESS SPECIFIED
A C MEASUREMENT SHOULD BE MADE AT 1kHz FOR 0dB LEVEL
VOLTAGES MAY VARY ±10 %

ALL RESISTORS 1/4W±10%
ALL CAPACITORS ±20 %

ALL CONNECTORS VIEWED FROM THE OUTSIDE

POWER SUPPLY VOLTAGE DESIGNATION
L = Logic

KUDELSKI SA Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

NAGRA MAGNETIC RECORDERS INC.
NEW YORK, N.Y. 10036
19 West 44 th Street

A25 A

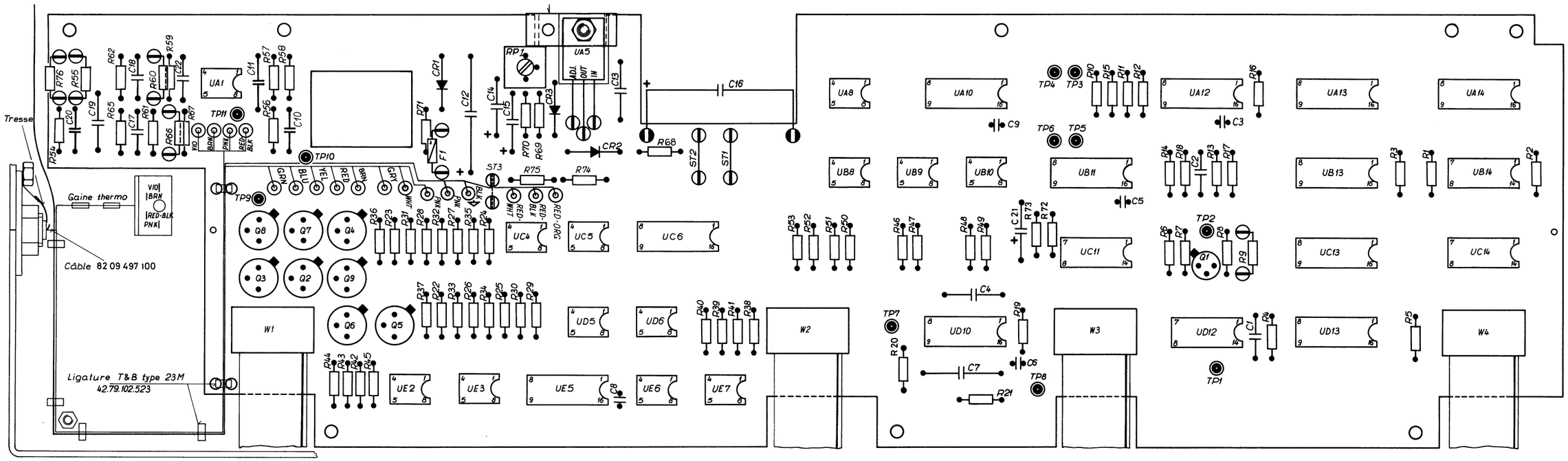
TAPFM | 09 09 375 000 | 17.10.85

FM PILOT AND NEOPILOT OPTION

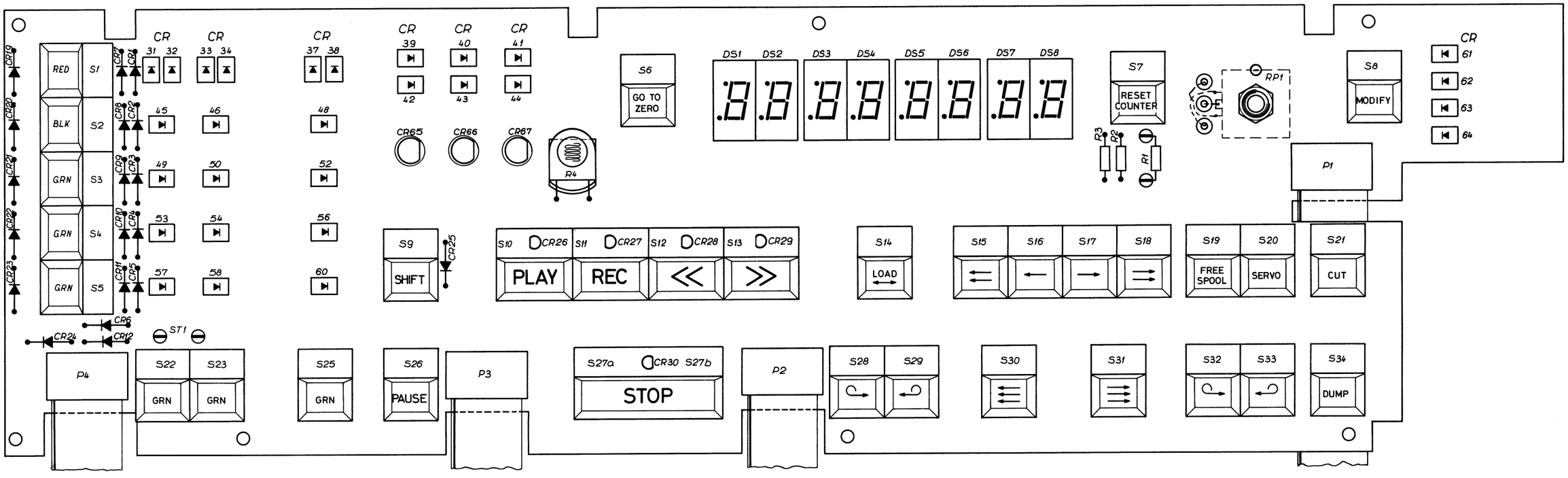
KEYBOARD

SECTION 8.10

June 1988



A16 INFERIOR KEYBOARD TACA-TC
09.425.0 index C



A16a SUPERIOR KEYBOARD TACA-TC
09.431.0

A16
09.425.0 C

A16a
09.430.0 Δ

A16b
09.435.0 A

SERVO-ENCODER

	Y0	Y1	Y2	Y3
0	STOP	EDIT FREE SPOOL	PAUSE	
1	PLAY	EDIT SERVO	GOTO ZERO	
2	≪	EDIT ←○	MODIFY ϕ	
3	≫	EDIT ○→	RESET COUNTER	←
4	RECORD	LOAD ←	SHIFT	→
5		LOAD ←○		
6		LOAD ○→		
7		✂		

With STOP key pressed

TP2 Serial bus 0,5V/DIV.
TP3 Reset 10V/DIV.
TP4 Data 10V/DIV.
TP5 Clock 10V/DIV.
20µs/DIV.

With STOP key pressed

TP2 Serial bus 0,5V/DIV.
TP1 Keyboard clock 10V/DIV.
TP6 Display clock 10V/DIV.
20µs/DIV.

CR 26 to CR 67
light emitting diodes
CR 26 - 30 MV 5074
CR 31 - 64 MV 57124
CR 65 - 67 HP 4693
all LED RED

DS 1 - DS 8
MAN 3620 A
ORANGE

COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White
PNK	Pink

MEASURING INSTRUMENT
DC VOLTMETER 40 000 Ω / V

UNLESS SPECIFIED
VOLTAGES MAY VARY ± 10 %
ALL RESISTORS ¼W ± 10 %
ALL CAPACITORS ± 20 %
ALL DIODES 1N 4148

* OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN

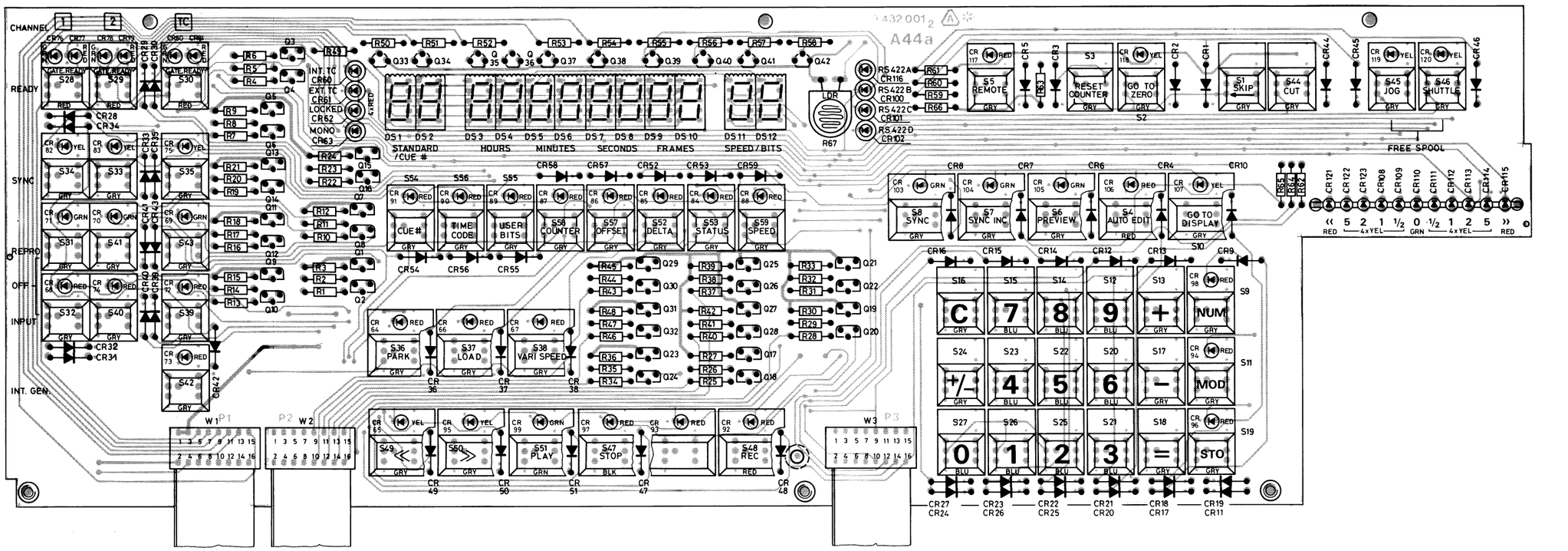
WITH NUMBER : WIRE
MALE CONTACT
FEMALE CONTACT
EYELET
TEST-POINT
LOGIC COMMON
UNREG. COMMON

ARROW INDICATES SIGNAL FLOW

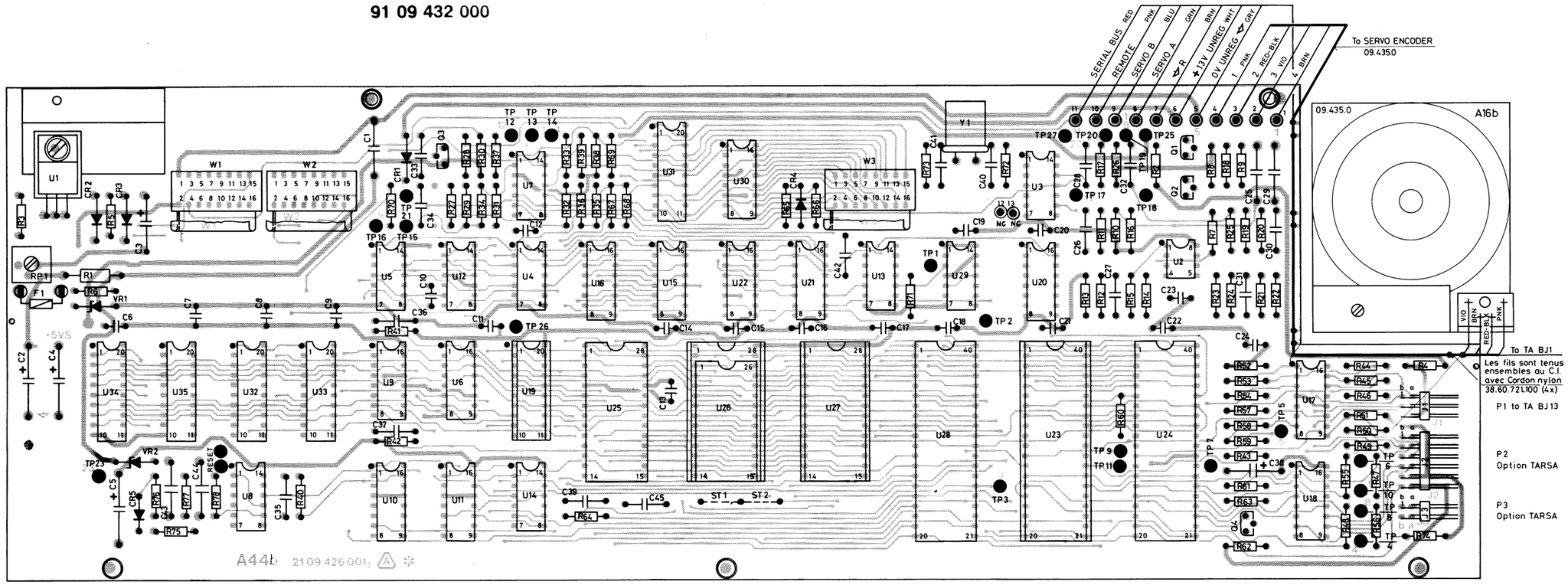
DELETED:
R63-R64

A02	MAIN CONTROL LOGIC
A04	TAPE COUNTER AND THIRD TRACK
A05	SYNCHRONIZER
A19	SERVO-EDITING
A30	POWER SUPPLY
BJ1	RIGHT KEYBOARD PLUG
BJ2	LEFT KEYBOARD PLUG (OPTION)
BJ3	REMOTE CONTROL PLUG
BJ4	AUDIO MONITORING PLUG

KUDELSKI S.A. Dept. NAGRA CH-1033 CHESEAUX Switzerland	NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th. Street
A 16	
TACA	09 09 239 000 12.10.81
KEYBOARD ENCODER FOR NAGRA TA	



A44a SUPERIOR KEYBOARD TACA-TC2 Index A
91 09 432 000



8.10-3 **A44b INFERIOR KEYBOARD TACA-TC2 Index A**
91 09 426 000

A44b
09.426.0

POWER SUPPLY

CONTROL WHEEL ENCODER

A16b SERVO-ENCODER

SERIAL BUS DECODER

I IO DECODER

MEMORY DECODER

RESET GENERATOR

WHEN STOP KEY PRESSED

5,0V/DIV TP27 Serial Bus
5,0V/DIV TP12 Bus Reset
5,0V/DIV TP13 Bus Data
5,0V/DIV TP14 Bus Clock
5,0V/DIV TP15 KBCK

20µS/div

IC LIST

N°	Ref. design.		+ 5 V
U2	LM393N	4	8
U3	74HC74	7	14
U4	74HCU04	7	14
U5	4071	7	14
U6	4021	8	16
U7	LM2901	12	3
U8	4093	7	14
U9	4538	8	16
U10	4516	8	16
U11	4516	8	16
U12	74HC74	7	14
U13	74HCU04	7	14
U14	4066	7	14
U15	4094	8	16
U16	4094	8	16
U17	DS34C86	8	4,12,16
U18	DS34C87	8	(16)
U19	PAL C-16R4-25	10	20
U20	74HC138	8	6
U21	74HC138	8	16
U22	74HC138	8	16
U23	Z84C40AP-6	31	9
U24	Z84C40AP-6	31	9
U25	Z84C30AP-6	5	24
U26	HM6116 LP-3	12	24
U27	27C256	14	28
U28	Z84C00AP-6	29	11
U29	74HC74	7	14
U30	74HC138	8	16
U31	74HC244	10	20
U32	74HC374	10	20
U33	74HC374	10	20
U34	74HC374	10	20
U35	74HC374	10	20

BJ1 (BJ2 option)
cannon 9p male

OPTIMUM VALUE TO BE SELECTED
TYPICAL VALUE SHOWN
WITH NUMBER : CONTACT
WITH LETTER : WIRE
MALE
FEMALE
CONTACT
EYELET
TEST-POINT
COMMON
LOGIC COMMON

UNLESS SPECIFIED
Voltages may vary ± 10%
All resistors 1/4W ± 2%
All capacitors ± 20%

MEASURING INSTRUMENT
DC Voltmeter 40 000 Ω / V

A44a Keyboard buttons and leds
A44b Keyboard electronics
A16b Servo encoder

COLOR	CODE
BLK	Black
BRN	Brown
RED	Red
ORG	Orange
YEL	Yellow
GRN	Green
BLU	Blue
VIO	Violet
GRY	Grey
WHT	White
PNK	Pink
TAN	Tan

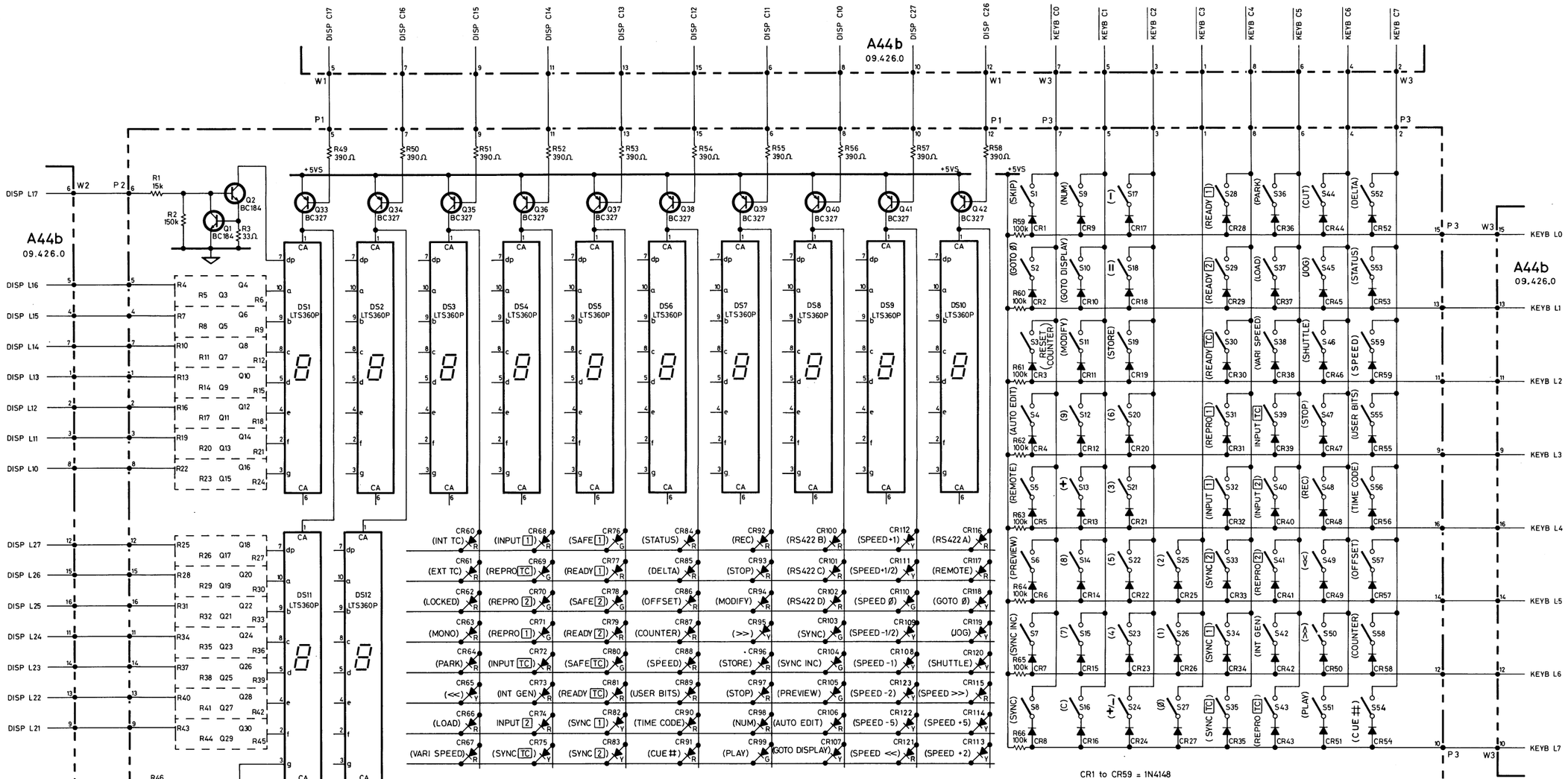
DATE	MODIFICATIONS

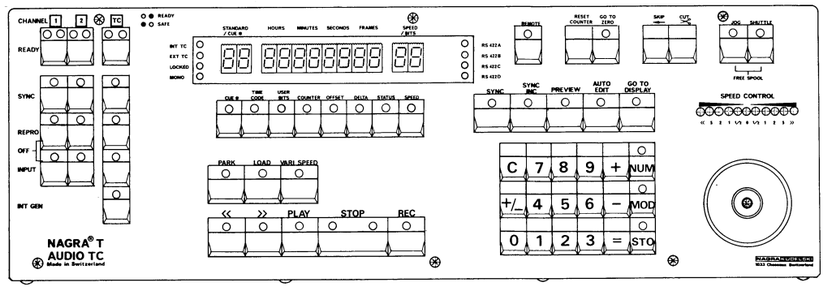
KUDELSKI SA CH-1033 CHESEAUX Switzerland
Dept. NAGRA
NAGRA MAGNETIC RECORDERS INC. NEW YORK, N.Y. 10036 19 West 44 th Street

TACA - TC2 | 09.09.426.0.00 | 2.12.87

KEYBOARD ELECTRONICS

A16b
A44b





COLOR	CODE
BLK	= Black
BRN	= Brown
RED	= Red
ORG	= Orange
YEL	= Yellow
GRN	= Green
BLU	= Blue
VIO	= Violet
GRY	= Grey
WHT	= White
PNK	= Pink
TAN	= Tan

MEASURING INSTRUMENT
DC VOLTMETER 40000 Ω/V

UNLESS SPECIFIED
VOLTAGES MAY VARY ±10%
ALL RESISTORS 1/4W ±10%
UNREG. COMMON

A44a Keyboard buttons and leds
A44b Keyboard electronics

DATE	MODIFICATIONS

KUDELSKI SA Dept. NAGRA
CH-1033 CHESEAUX
Switzerland

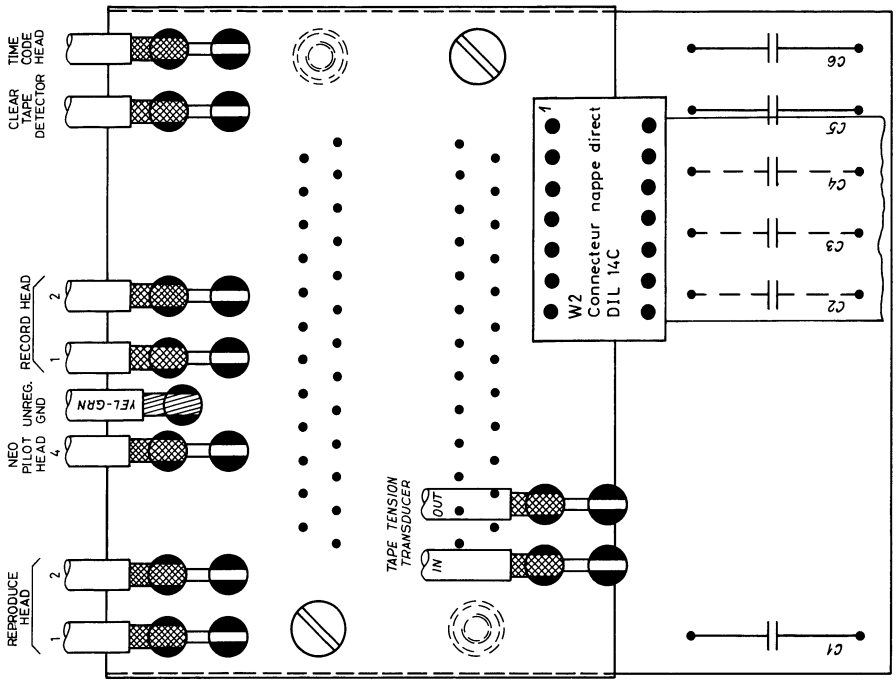
NAGRA MAGNETIC RECORDERS INC
NEW YORK, N.Y. 10036
19 West 44 th Street

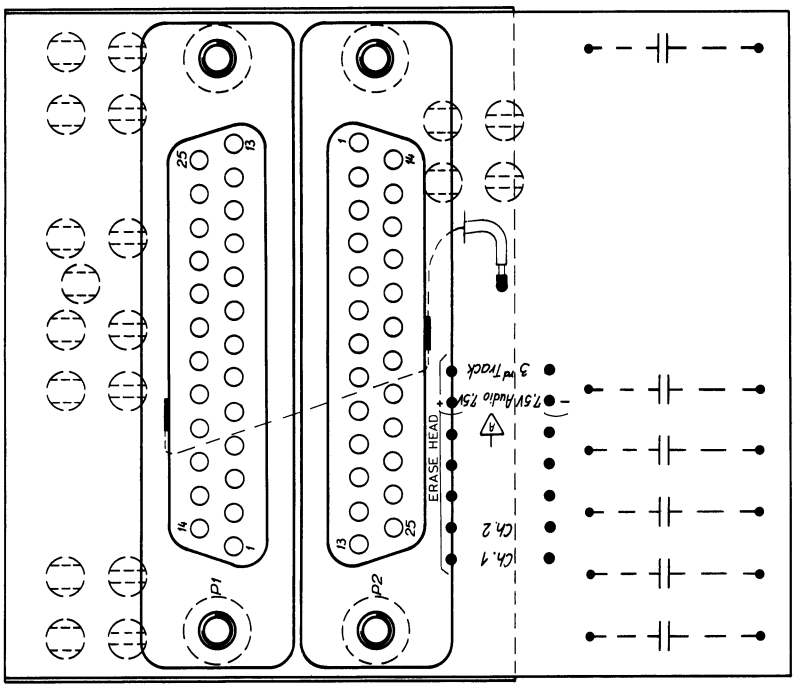
A44a ⚠

TACA -TC2 | 09.09.432.0.00 | 2.12.87

KEYBOARD BUTTONS AND LEDS

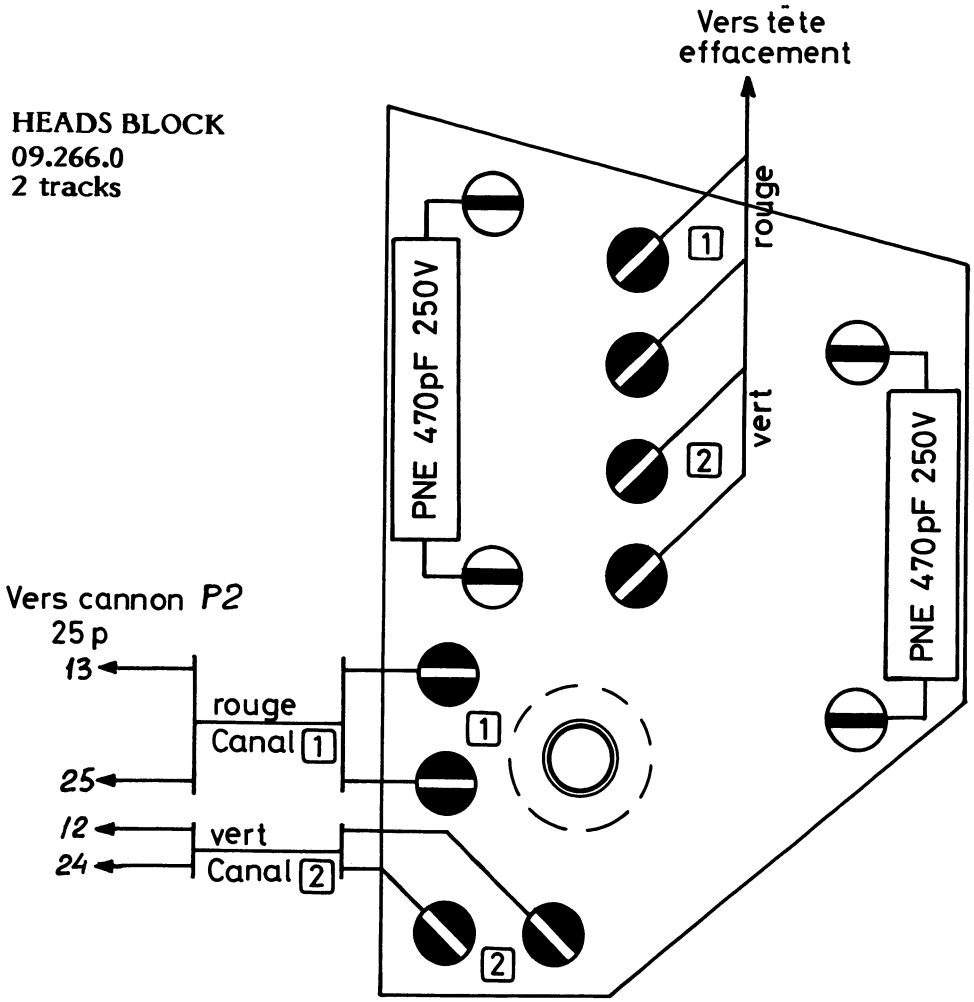
INTERCONNECTIONS

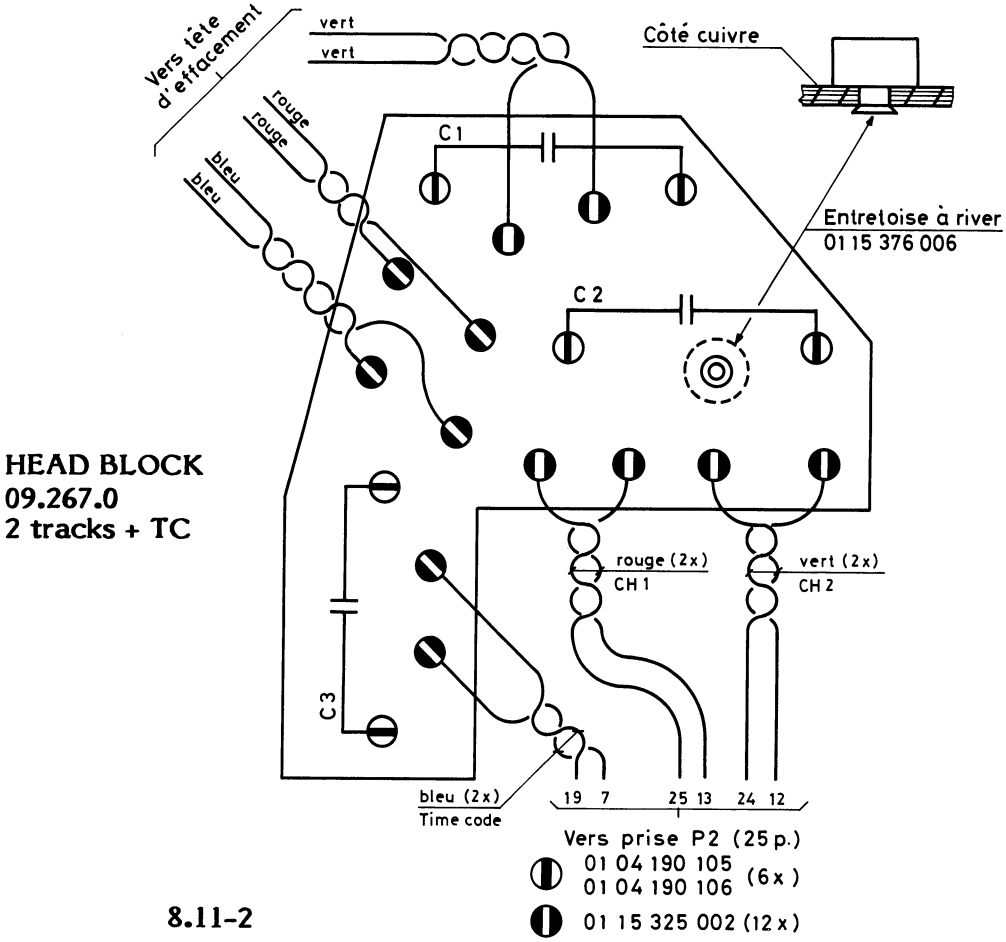




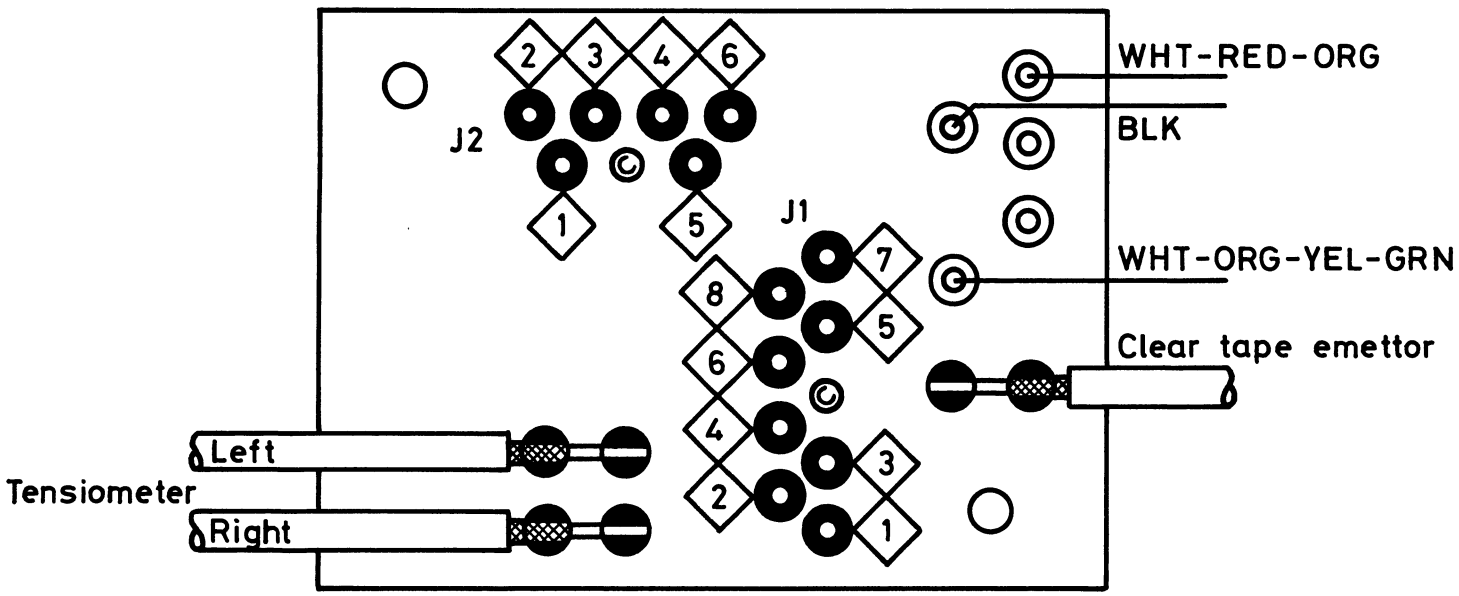
B1 HEADS INTERCONNECTION

09.250.0 **index A**





HEAD BLOCK
09.267.0
2 tracks + TC

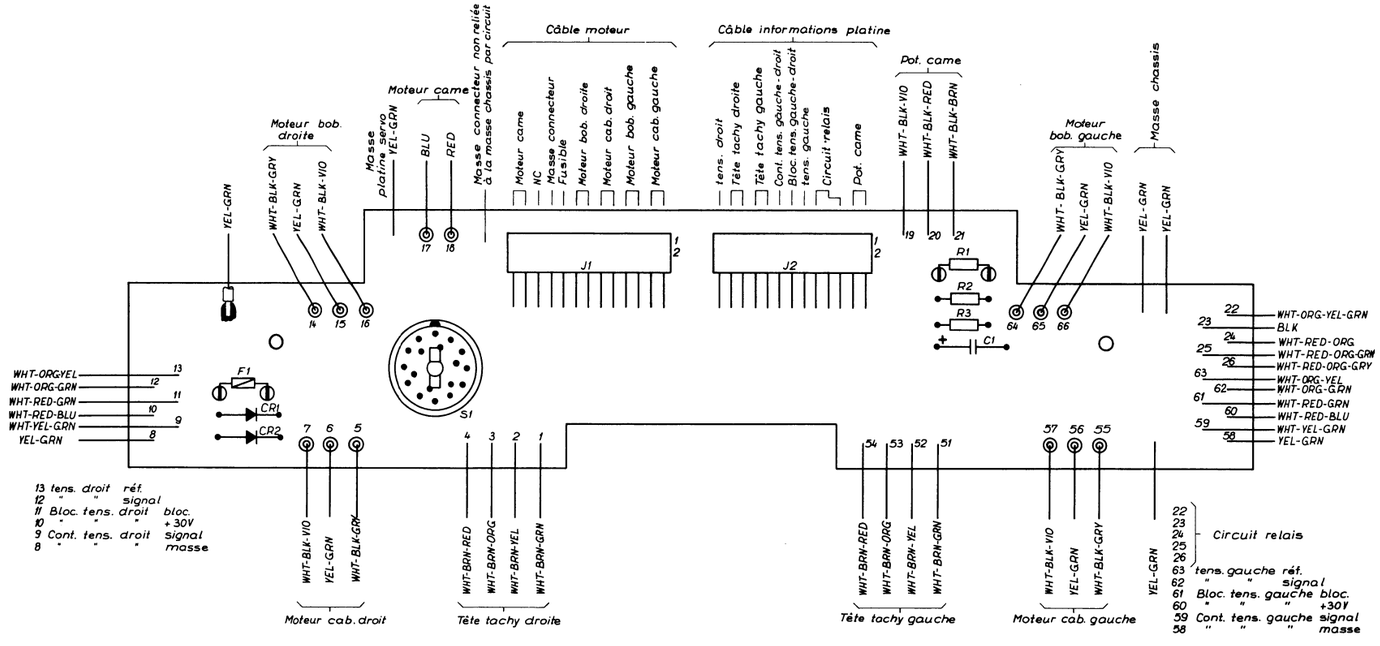


B2 HF ENCODER INTERCONNECTION

09.255.0 index A

B3 TAPE DECK INTERCONNECTION

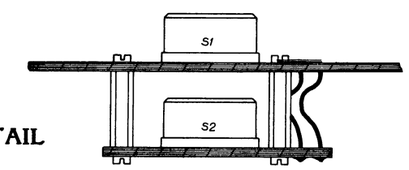
09.260.000

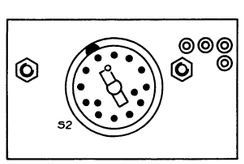


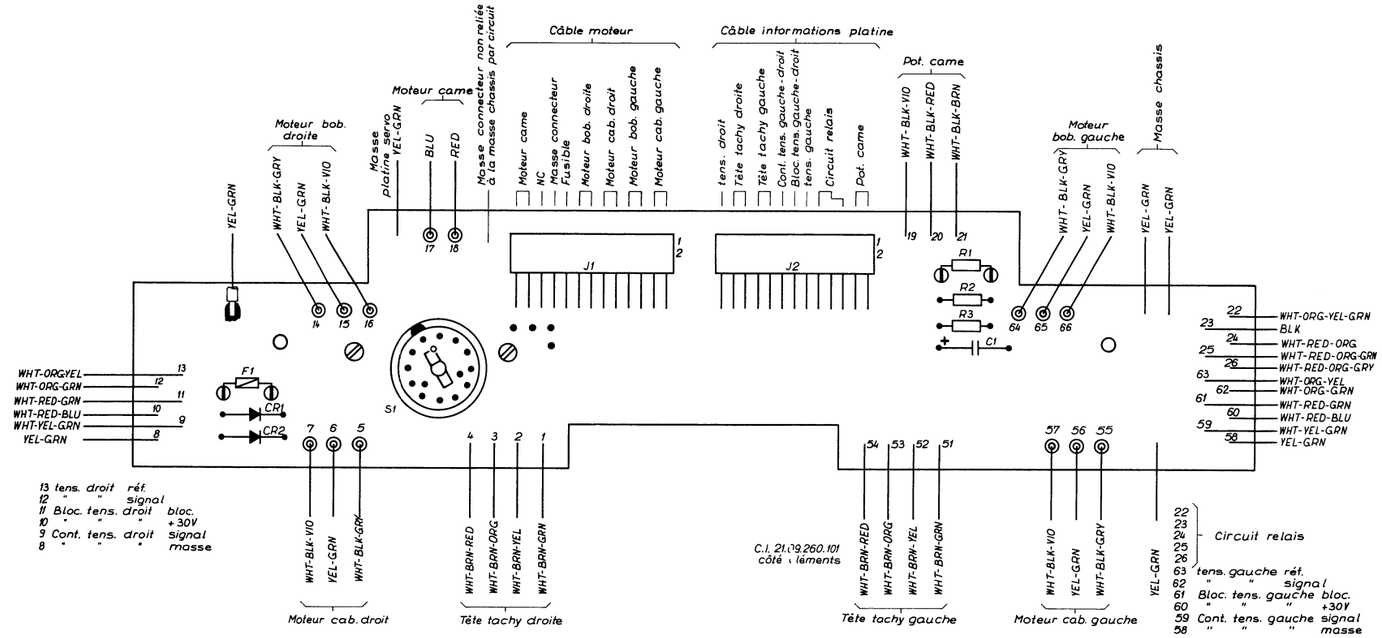
B3 TAPE DECK INTERCONNECTION

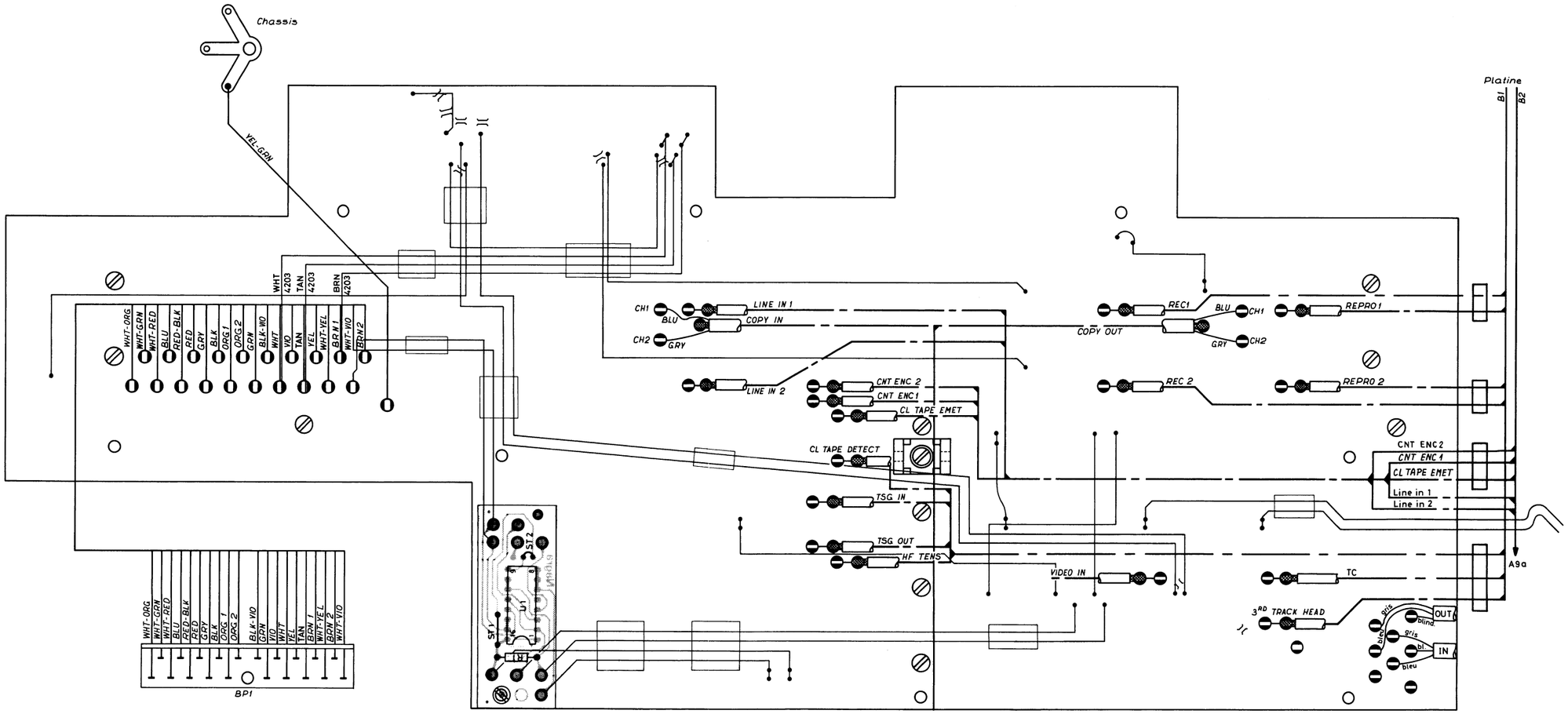
09.260.100

S1/S2 DETAIL









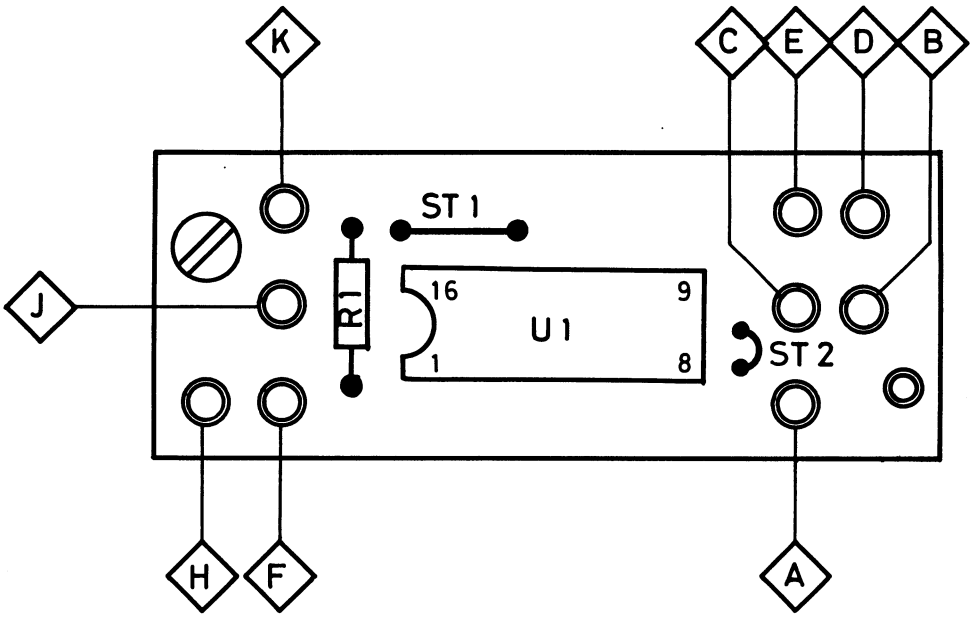
B5 BOX INTERCONNECTION

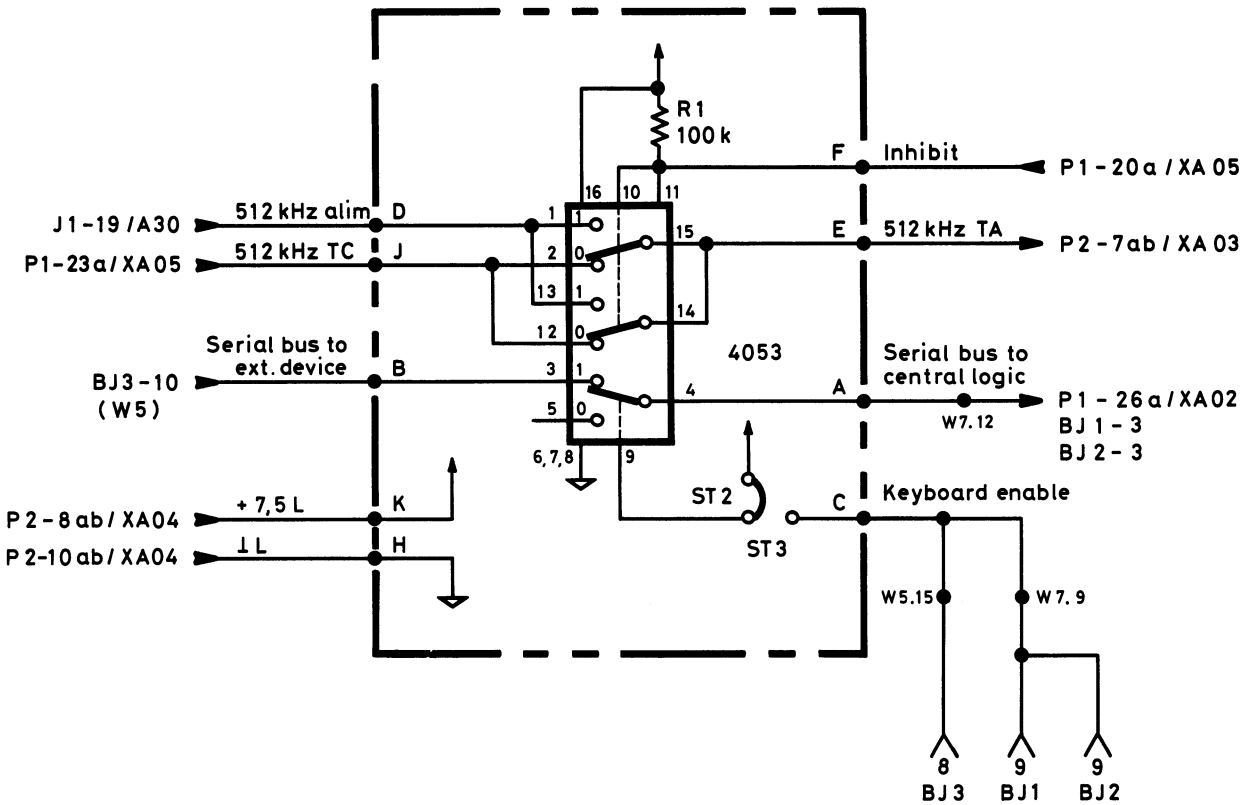
09.321 1/2
(soldering side)

B5 BOX INTERCONNECTION

09.321.0 2/2

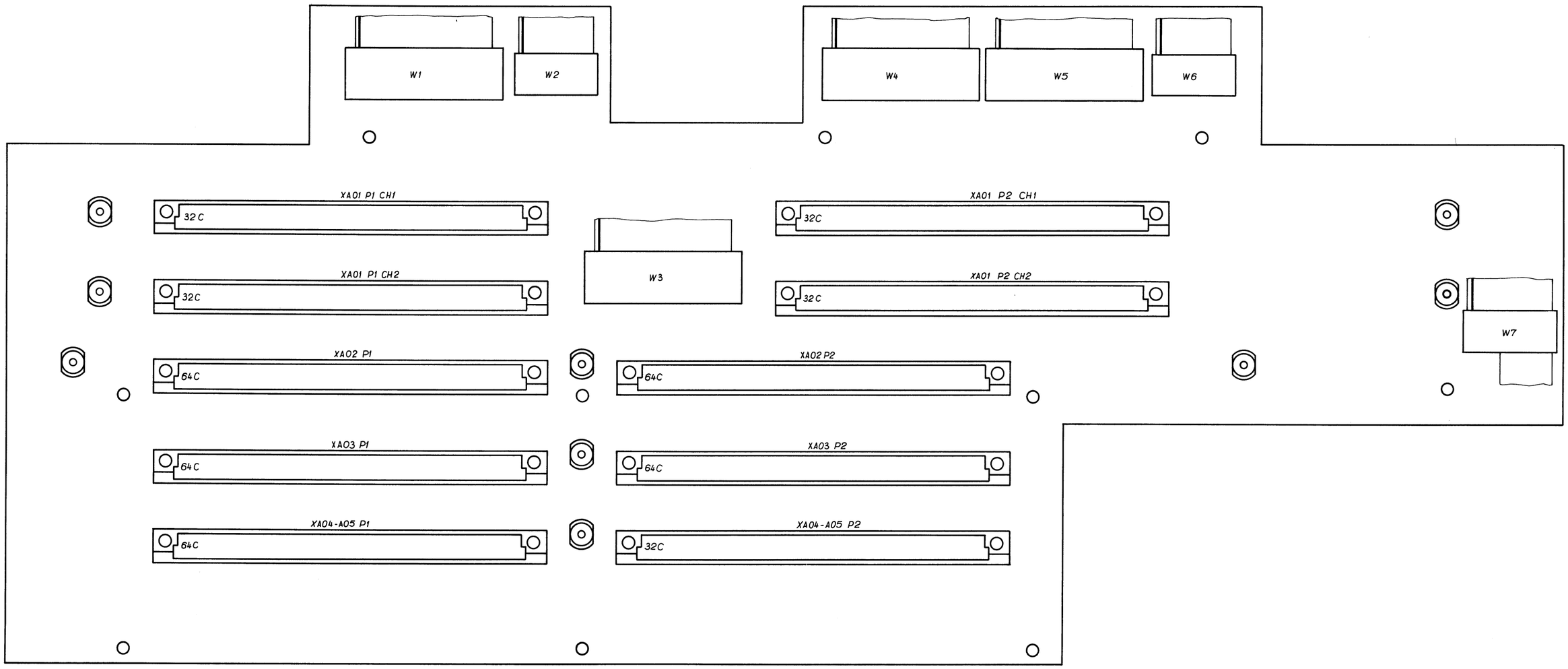
(ONLY FOR TIME CODE VERSION)





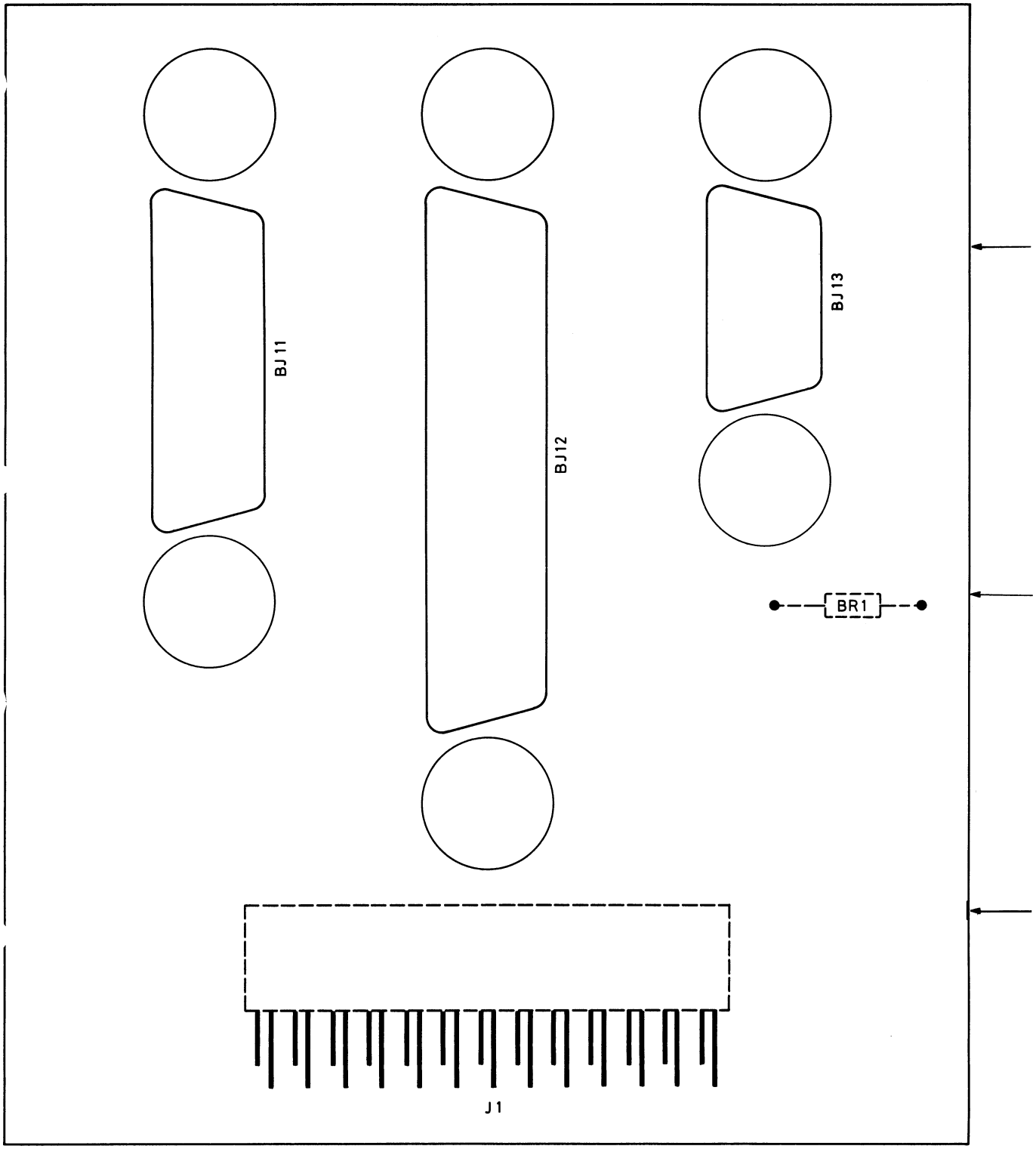
B5a 512 kHz COMMUTATION

09.323.0



B5 BOX INTERCONNECTION

09.321.0 2/2
(connectors side)



B6 THIRD TRACK CONNECTORS
09.200.172

Article No.	DESCRIPTION
71 04058 000	Oil Isoflex PDP38, 50 ccm
39 80210 222	Loctite 222, weak glue for threaded parts (50 ccm)
39 80210 601	Loctite 601, strong glue for adjusted parts (50 ccm)
39 80221 106	Glue, epoxy resin with hardener, Araldite AW 106 (2 tubes of 20 ccm)
	Fuses/Lamps
41 81321 100	Fuse, 1 A, 6 x 32 , FST slow-blow
41 81321 200	Fuse, 2 A, 6 x 32 , FST slow-blow
41 11528 000	Lamp 28 V, 40 mA, MIDGET TI 3/4
41 81551 250	Fuse 2.5 A, 2.4 X 7, with connection wires, fast-blow
41 81551 100	Fuse 1A, 2.4 x 7, with connection wires , fast blow
41 81550 250	Fuse 250 mA, 2.4 X 7, with connection wires, fast-blow
41 81550 125	Fuse 125 mA, 2.4 x 7, with connection wires, fast-blow
41 81611 250	Fuse 2.5 A, TR5-T, with connection wires , slow blow