NAGRA T–AUDIO TIME CODE

INSTRUCTION MANUAL

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NAGRA Tape Recorder Manufacturer

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CHAPTER 1

INTRODUCTION

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1 - INTRODUCTION

1 - 1 THE NAGRA T-AUDIO

The NAGRA T-Audio is a transportable 1/4" (6.35 mm) studio recorder. It has two capstan motors and an inter-head tension sensor ensuring a very stable tape transportation. The servo controlled motors linked with this sensor also ensure almost unmeasurable wow and flutter.

The transport can take 5" or 7" reels with its lid in place, and up to 11.8" reels with the lid removed. Different types of spools can be fitted to the machine depending on the interchangeable hubs selected (Cine and NAB or AEG type reel holders are supplied as standard with all machines). The machine is equipped with an electronic counter, and wide band predistortion record circuits (TACAL) can be added to the audio boards, in the place of the TACAL-S circuits normally installed, giving exceptionally high recording levels without increased distortion. The size, weight and low power consumption of the T-Audio make it very practical for mobile applications. It can be delivered in various different standard versions and different accessories can be used, in order to make the machine fit perfectly into any application.

All versions have a possibility of four tape speeds 76, 38, 19 and 9.5 cm/s (30, 15, 7 1/2 and 3 3/4 ips) each of which can be calibrated to any tape type and equalization standard. (only two of these are fitted with recording equalization circuits as standard, the other two are optional). All audio inputs and outputs are of the 3-pole XLR type. All versions are also fitted with the TA-PPA connector for a second keyboard for remote control purposes.
The machine can be delivered in the following forms :

NTA.2S NAGRA T-AUDIO STEREO. The stereophonic version has two 2.75 mm tracks. This version has a full track erase head, and TACA-SM stereo keyboard which can be fitted with the TASC servo editing system.

NTA.2B NAGRA T-AUDIO BROADCAST. The broadcast version is a two track machine with two 2.00 mm tracks and is fitted with a two track erase head (2.75 mm track width available on special order). The machine has the TACA-BM keyboard which allows channel selection and editing functions as well as normal transport functions, and can be fitted with the TASC servo editing option.

1 - 2 TIME CODE VERSIONS

The T-Audio Time Code recorders contain all the options from the above machines but have two 2.00 mm audio channels and one 0.35 mm centre track. The machines have separate erase heads for audio and time code channels, and are fitted with two high speed time code readers (simultaneous reading of "off tape" and external time codes) and an internal time code generator. Also fitted as standard are amorphous metal long life heads. All the NTA.3 TC machines are fitted as standard with the TACA-TC2 keyboard and the TA-PPA second keyboard adapter (this will allow the connection of any additional keyboard, however small modifications and an additional cable is needed to fit an additional TACA-TC2 keyboard).
All the time code versions are fitted with the TASC servo editing option. Time code input and output is available on either XLR type connectors on the rear of the machine or a 5 pin LEMO connector on the front of the time code circuit.
The time code machine can be delivered in the following versions :

NTA.3 TCN NAGRA T-AUDIO Time Code (without synchronizer)

Basic time code model for use with an external time code synchronizer.

NTA.3 TCS NAGRA T-AUDIO Time Code (with synchronizer)

This version is as the NTA.3 TCN but includes an internal synchronizer which is capable of all chase synchronizing functions. This version is also fitted with the TASIM-2 self sync amplifiers allowing replay through the recording head.

NTA.3 TCR NAGRA T-AUDIO Time Code with synchronizer and serial remote control.

This version is as the NTA.3 TCS but is additionally fitted with the TA-RSA, RS-422 serial remote control interface, allowing control with SONY, AMPEX and MOSAIC protocols on RS-422 (see REMOTE).

CHAPTER 2

FIRST TIME OPERATION

2

2 - 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.

2 - 1 THREADING THE TAPE

Quick release adapters permit the use of tape reels having NAB, AEG or cinema type hubs. Each of the hub adapters is fitted with diametrically opposed spring loaded retaining catches which must be fully compressed before the adapter can be fitted onto the recorder.
The supply and take up reels have two alternative spindle positions to accommodate small reels up to 20 cm (8") diameter or large reels 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 on the LOAD key and thread tape as shown on page 146 according to the reel size being used. 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"). Once the tape is securely wrapped around the "take-up" spool then press the STOP key.

2 - 2 KEYBOARD

The NAGRA T-AUDIO TC is controlled by a TACA-TC2 keyboard, connected to the serial bus connector (BJ-1) on the right-hand side of the machine and to the RS-422 connector (BJ-13) located on the rear panel of the machine. In this case a TACA-TC keyboard, connected to the socket on the left-hand side of the machine, may be used as remote control.
The NAGRA T-AUDIO TC can also be controlled by either of the other two separate TACA keyboards connected to the socket on the side of the machine, as well as through the REMOTE CONTROL INPUT/OUTPUT socket on the rear of the machine to which any appropriate control device may be connected (additional keyboard (TASKR), parallel remote control (TAERP)...). The remote control possibilities of the machine depend on the version of the machine and the external accessories selected. (see REMOTE).

2 - 3 CONNECTION OF THE KEYBOARD

To use a TACA, TACA-TC keyboard on the NAGRA T-AUDIO, connect the cable to the socket on the right-hand (or left-hand) side of the machine. To use a TACA-TC2, connect the shorter cable as above, and also the longer cable to the RS-422 connector (BJ 13) located on the rear panel of the recorder.
If ERROR 10 message is displayed after connecting a TACA-TC2 keyboard, check the dil switches, located on the front edge of the time code circuit of the T-AUDIO, which must be set to the RS-422 position (Baud rate 19200 Bauds). Switches S3-1 to S3-3 should be in the OFF position. Check also that the machine is fitted with an NSC 858 communication IC on the time code circuit A 05.(TAIRS)

2 - 4 TACA-TC2 SOFTWARE

Using a TACA-TC2 keyboard requires at least software 2.X in the T-AUDIO. In the NTA. 3TC versions of the T-Audio there is only one software, instead of the previous four versions : NOSY, SYNC, RS and SYRS, and also one software in the TACA-TC2 (version 1.X). The type of software is now settled by a PAL (programmable array logic) located inside the TACA-TC2. For the whole system (T-AUDIO and TACA-TC2), there are three different PAL's, giving three different configurations.

These are as follows :

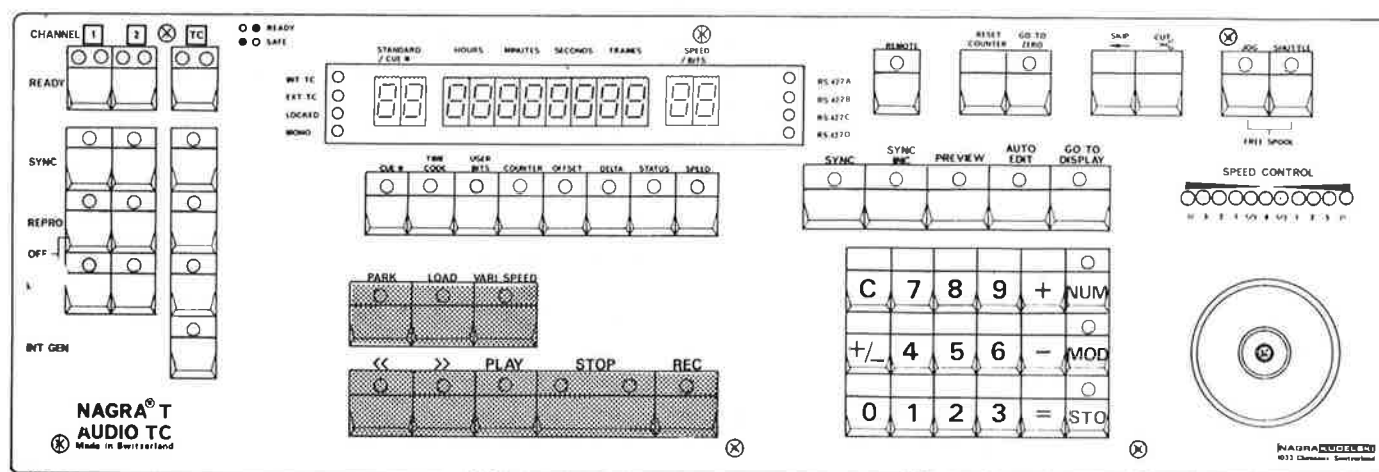| VERSION	PAL TYPE (Installed in TACA-TC2)	
NTA.3 TCN	NO SYNC	: Basic version without synchronizer or external RS-422 ports (TA-RSA).
NTA.3 TCS	SYNC	: With synchronizer but without external RS-422 ports (TA-RSA).
NTA.3 TCR	SYNC + 422	: Complete version with synchronizer and with the software required by the TA-RSA (RS-422 interface for the TACA-TC2). SONY and AMPEX protocols are both available, as well as a special SONY (SONY 2) software allowing the remote control of two machines in parallel, the NAGRA T-AUDIO TC and a VTR. Both are connected onto the same recorder port of the smaller video editors such as the BVE-900 that only allow one single recorder machine, thus allowing double system audio editing. The internal synchronizer of the T-AUDIO only works with SYNC (NTA.3 TCS) and SYNC + 422 (NTA.3 TCR) versions. It's presence is indicated by an "S" following the software version of the T-AUDIO (e.g. "tA 2.4 S") when looking at the status menu of the machine.

CHAPTER 3

KEYBOARD DESCRIPTION

3

TACA-TC2 KEYBOARD

3 - KEYBOARD DESCRIPTION

3 - 1 MAIN TRANSPORT FUNCTIONS

The leds inside the keys indicate that the selected function has been correctly executed by the T-AUDIO. No function will be accepted if either tensiometer is at its end stop position. (except for LOAD functions).

STOP

Pressing the STOP key overrides any transport function. This is the recommended position, prior to RECORD or PLAY.

This is the mode the machine should be in before PARK or LOAD keys are used, as they are not active in PLAY or RECORD modes, to protect against accidental access during normal use of the machine. The STOP function is also active when the machine is in any of the REMOTE modes to allow the operator to make an emergency stop if necessary.

PLAY

The PLAY key starts playback in twin capstan mode at nominal preselected speed (displayed on the two right-most digits in cm/s or in ips if numerical command 901 which will switch between the two indications is activated).

If VARI-SPEED mode is selected, the led in the VARI-SPEED key will light, then pressing the PLAY key starts playback in twin capstan mode at the preselected variable speed (about ± 12.7 %). (See page 19 for modification of the vari-speed percentage). By pressing the PLAY key, the machine may be made to exit record while remaining in the synchronization mode, and will not cancel the sync process.

Pressing either of the fast winding keys while holding the PLAY key will enable the "DEFEAT LIFTERS" mode. i.e. 76 cms (30 ips) in either direction while keeping the tape in contact with all the heads, allowing rapid location of a particular point on the tape.

FAST REWIND

<<   By pressing the FAST REWIND key, the tape will rewind at high speed
                          until the tape is either fully rewound or another key is pressed. The tape is
                          no longer kept in contact with the audio and time code heads. The
                          displayed time code is in this case updated by the pulses coming from the
                          counter roller assuming the UPDATE mode is selected, otherwise the time
                          code displayed will remain frozen at the last value read from the tape.
                          Pressing the REWIND key and PLAY simultaneously will activate the
                          DEFEAT LIFTERS mode (see FAST PLAY and DEFEAT LIFTERS), and
                          pressing the REWIND key while holding the LOAD key will activate the
                          right spool motor.(see LOAD)

FAST FORWARD

>>   Same function as < < but in the forward direction.

FAST PLAY AND DEFEAT LIFTERS

                          Pressing PLAY and > > will produce defeat lifters forwards. Pressing
                          PLAY and < < will produce defeat lifters backwards. These functions may
                          be activated in any mode, except RECORD or SYNC. Tape speed is 76
                          centimeters per second (30 ips) in either direction, and the tape will stay in
                          contact with all the heads. When the fast forward or rewind key is
                          released, then the machine will pass immediately into normal twin capstan
                          playback.

RECORD

                          Pressing PLAY and RECORD keys together starts the recording on
                          channels that have been selected to READY (RED led on) at the pre-
                          selected speed. To prevent recording on a particular channel, just select it
                          to the safe position (GREEN led on). When no channel is selected to
                          READY, the T-AUDIO is set to the PARK position, and the led in the
                          RECORD key will flash, thus indicating that RECORD is selected but has
                          not been executed. In this case, the recording will start as soon as one
                          channel is selected to READY. This includes the time code channel.
                          The machine will also be selected to PARK if the record inhibit switch
                          (S 301) on the right-hand side of main control logic board A02 is ON
                          (towards the rear of the machine) This will cause the two RED leds in the
                          channel status matrix to flash and the led in the record key to stay ON
                          permanently. Pressing PLAY and RECORD while in synchronization mode
                          will not cancel the sync process and the transport will remain locked to the
                          reference.

NOTE :   If the tape transport is in a synchronizing process and the time code channel is in
               the READY position (RED led ON), meaning that a new time code is to be
               recorded, then the machine will no longer be capable of synchronizing it's "off
               tape" time code to a reference as it cannot simultaneously playback and record a
               time code from/to the tape. However it will stay at the last speed that was issued
               to the synchronizer prior to entering the record mode.

NOTE :   All the manual editing functions are inhibited during record.

PARK

This mode is automatically selected on power up. This is the standby position with minimal power consumption. As brakes are applied to both reels, motors are not powered and tensiometers are inhibited. Always select PARK mode before power down. If the AUTO PARK feature is selected then the machine will automatically go into PARK mode after 3 minutes in STOP. This can be turned ON or OFF when in STATUS display mode (see MODIFY).

NOTE :   The PARK key has no action during PLAY, RECORD or SYNC. To activate PARK mode, press the STOP key first.

LOAD

The LOAD key is used when threading a tape. A light brake is applied to the reel motors and both tensiometers are inhibited thus allowing 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 either STOP or PARK.
Alternatively, when loading a full reel of tape from the left-hand side of the machine, press LOAD and then > > without releasing the LOAD button. The brakes on both tape reel hubs are initially released, permitting easy threading of the tape and attachment to the right-hand take up reel, however the moment that the left-hand tension arm leaves its "end stop" position the left-hand reel is powered in reverse to take up the slack. Once the tape is loaded, select STOP or PARK. When loading a full reel of tape from the right-hand side of the machine, press LOAD and then < < without releasing the LOAD key and proceed in the same way as above.
This feature makes one-handed loading possible.

NOTE :   These functions are inhibited during PLAY, RECORD or SYNC.

VARI-SPEED

This key is used to turn VARI-SPEED playback mode ON or OFF. When this mode is selected, the led inside the key is alight. PLAY commands will then be executed as VARI-SPEED PLAY. Vari-speed percentage may be set from the numerical keypad or trimmed using the control wheel, both of which can be effected while the machine is in playback mode. The value of VARI-SPEED can be seen by pressing the SPEED key, which must be selected before the vari-speed can be modified by means of the control wheel or the " + " and "–" keys. The maximum amount of VARI-SPEED is ± 12.7 %.

NOTE :   This is operative only if the toggle switch (S 1 on A03 A11) on the front edge of the speed stabilizer board is in the "synchronizer" position. Vari-speed record is only possible by first selecting the desired vari-speed, either in PLAYBACK or in STOP modes, and then playing back the tape and passing into RECORD "on the fly". The recording will then be made on the selected channels at the selected vari-speed. The VARI-SPEED cannot be altered while in RECORD.

3 - 2 DISPLAY SELECTION
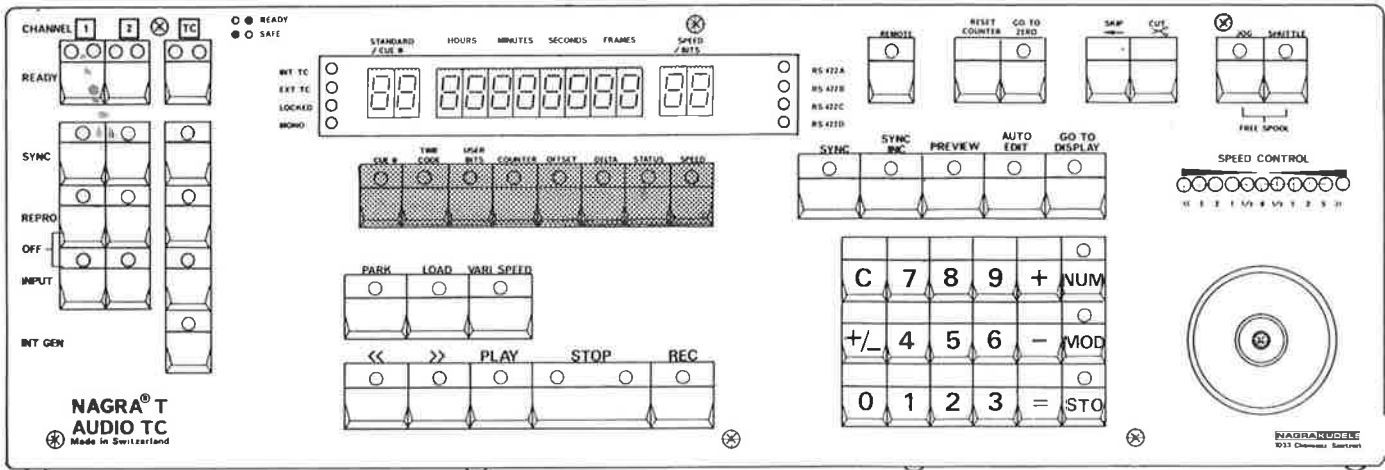
Eight keys are used to select the data to be displayed, these will in no way affect the mode of operation of the machine. They are located just below the display itself. Nominal playback standard is also displayed on the left-most digit as A, B, C, or D and on the two right-most digits in centimeters per second or in inches per second the selected tape speed is indicated, provided OFFSET, DELTA or one of the ten CUE points were not selected (use numerical command 901 to toggle between cm/s and ips). These keys are also used when storing a value. The function of each is described below.

TIME CODE

Time code is displayed according to the time code channel status (page 23). If the time code channel is selected to REPRO or OFF, the displayed value is shifted (delayed) as if it were being read through the audio playback head. If the time code channel is selected to SYNC, the displayed value is shifted as if it were being read through the audio record head. Selecting the time code channel to INPUT displays the external time code fed to the T-AUDIO, either via the XLR connector on the rear of the machine or the five pin LEMO connector on the front of the time code circuit. Selecting the time code channel to INT GEN causes the internal time code generator to be displayed. Time code values are always displayed with decimal points between the hours. minutes. seconds. frames.

USER BITS

User bits will be displayed, according to the time code channel status (page 23). If the time code channel is selected to REPRO, SYNC or OFF, the off tape value is displayed. Selecting the time code channel to INPUT displays the external user bits fed to the T-AUDIO, via either of the two external time code connectors. Selecting the time code channel to INT GEN causes the internal generator's user bits to be displayed. User bits are displayed without decimal points between the digits.

COUNTER

Selecting COUNTER will cause the tape timer to be displayed, regardless of the time code channel status. Values are displayed from 00:00:00:00 to 23:59:59:2X. Thus the counter counts in the time code style. Although the counter is not necessarily being displayed all the time it still takes into account all tape movements, and RESET COUNTER will memorize a point and GO TO ZERO will go to this point when making a counter search. (see GO TO ZERO). If a counter value is frozen on the display as a result of pressing the STO key and a GO TO DISPLAY is then attempted, this value will be considered as a time code and the machine will search for this value on the tape, unless the time code channel is switched to OFF by pressing INPUT and REPRO simultaneously on the time code channel matrix. If this is done then a counter search may be performed.

OFFSET

Pressing the OFFSET key displays the programmed offset in extended format, with bits on the two right-most digits of the display. These last two digits will count from 0 to 79.
This value can be modified bit by bit either using the numerical keypad or the control wheel (see MOD). The value in the OFFSET register is always stored when the power is switched off (see note below), and is always taken into account when the SYNC key is pressed. Values of offset can be stored in the 10 CUE memories if necessary as these also store values in the extended format.

NOTE : The software can be configured to reset to ZERO the offset register at each power down/up to avoid mistakes when various different operators work with the machine. This can be turned ON and OFF when in the status display mode see (MODIFY).

DELTA

This shows the calculated "distance" between off tape time code and external time code, taking the programmed OFFSET into account. DELTA is displayed in the extended format, which includes bits on the two right-most digits. As DELTA values are always automatically calculated by the microprocessor, it is impossible to set its value from the keyboard.
During synchronization, the DELTA will decrease as the transport approaches the sync point and the LOCKED led will light when the DELTA is less than 65 bits during 16 consecutive frames.

STATUS

This key is used to display the internal status of the T-AUDIO. Pressing the STATUS key consecutively or the + or − key will move in the corresponding direction to display the next status through the entire menu. Some status may be modified with the dil switches located on the front edge of time code circuit A05 and the rest by pressing the MOD key when the status to be modified is selected to the display.
Numerical commands may also be used. (see page 47 for list of status and their explanation)

SPEED

Pressing this key causes the VARI-SPEED percentage to be displayed. Pressing rapidly twice on the SPEED key causes the speed to change between the 4 (or 2) preselectable speeds of the machine without changing the displayed information. Pressing SPEED and then " + " or "–" without releasing the SPEED key also causes the speed to change between the 4 (or 2) preselectable speeds of the machine but in this case the display turns to speed display mode. The actual preselected speed of the machine is shown permanently by the two right-most digits of the display except when displaying DELTA, OFFSET or CUE values.

CUE

Pressing the CUE key and then one of the ten numerical keys (0-9) without releasing CUE , causes the value of the selected CUE memory to be displayed.
CUE 1 is reserved for the edit "IN" point, thus, if a GO TO DISPLAY is made using the CUE 1 as the point to be located, the tape will actually stop at the preset preroll time before this value (This can be programmed using numerical command 010).
CUE 2 is likewise reserved for the edit "OUT" point. Other CUE memories are general purpose registers and may be used to store a point to be located, an OFFSET, or anything else. As CUE points may be used to store an OFFSET, they are always displayed in the extended format, including bits on the two right-most digits.

3 - 3 CHANNELS STATUS
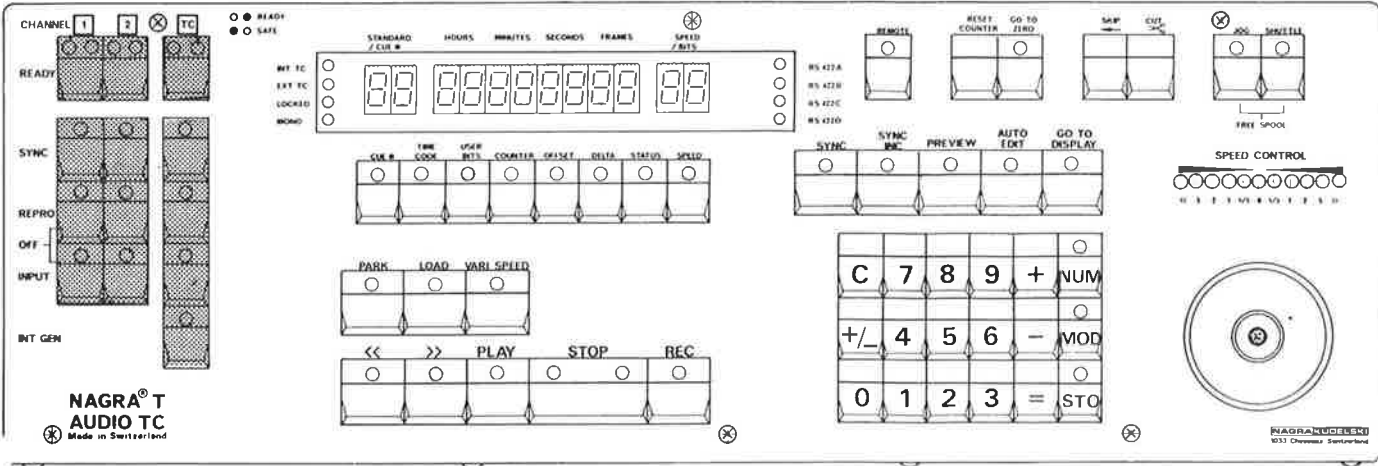
Channel status related keys are designed as a key matrix of which each column corresponds to a given channel, Audio 1, Audio 2, or time code. Time code channel behavior is different from that of the audio channels, although the function names are similar. (See TIME CODE for more details). On power up, the indicated status will depend on the position of the initialization switches. These switches are located on MAIN CONTROL LOGIC board A02 (see page 129).

READY

These keys are used to toggle between two positions :

READY to record position   (RED led on)
SAFE   from record position   (GREEN led on)

When recording is selected on a given channel and bias is not present, the selected channel's RED led will flash. This also happens when erasing the time code track.

REPRO

For the audio channels the line output is directly connected to the playback amplifier.
For the time code channel the off tape time code is shifted, as if read from the audio playback head.

SYNC

For the audio channels the line output is directly connected to the record head. For this feature to work, it is necessary to have TASIM-2 circuits installed on each audio circuit. Thus in this position the audio is replayed through the record head.
For the time code channel the off tape time code is shifted, as if it were being read from the audio record head.

NOTE :

Switching between REPRO and SYNC of the time code channel will have no effect as long as the tape is not moving.

INPUT

> The line output is connected to the line input amplifier (EE). The time code output is connected to the time code input if the time code channel is in READY.

OFF

> When pressing simultaneously on REPRO and INPUT, the selected channel output is switched off. For the time code channel this will put the machine into COUNTER mode.

NOTE : TIME CODE or USER BITS may always be displayed, even if the time code channel is set to the OFF position. To perform COUNTER SEARCH or SYNC functions, select the TC channel to the OFF position.

INT GEN (internal time code generator)

> Only available for the time code channel. This key selects the internal time code generator to be used and eventually recorded. It is not dependent upon the time code READY / SAFE status.

NOTE : For the TIME CODE channel only, the displayed time code and user bits correspond to the time code channel status (SYNC, REPRO, INPUT or INT GEN). However, in the OFF position, the off tape value is displayed. The COUNTER (tape timer) can be displayed, regardless of the time code channel status.

SET FROM EXTERNAL

> Time code set from external is performed by selecting the time code channel to INPUT and then pressing the STORE key without releasing the INPUT TC key while time code is selected on the display. The time code channel status should then switch to INT GEN thus indicating that the setting has been performed. In a similar way to set the user bits from an external generator, first select the user bits on the display. Then press INPUT TC and STORE without releasing the INPUT TC key. As when setting time code, the time code channel matrix will then switch to INT GEN thus indicating that the setting has been performed.

NOTE : For a time code setting to be performed correctly, the input time code must be running. Any attempt with a stopped external time code generator (HOLD mode) may give unpredictable results.

3 - 4 EDITING
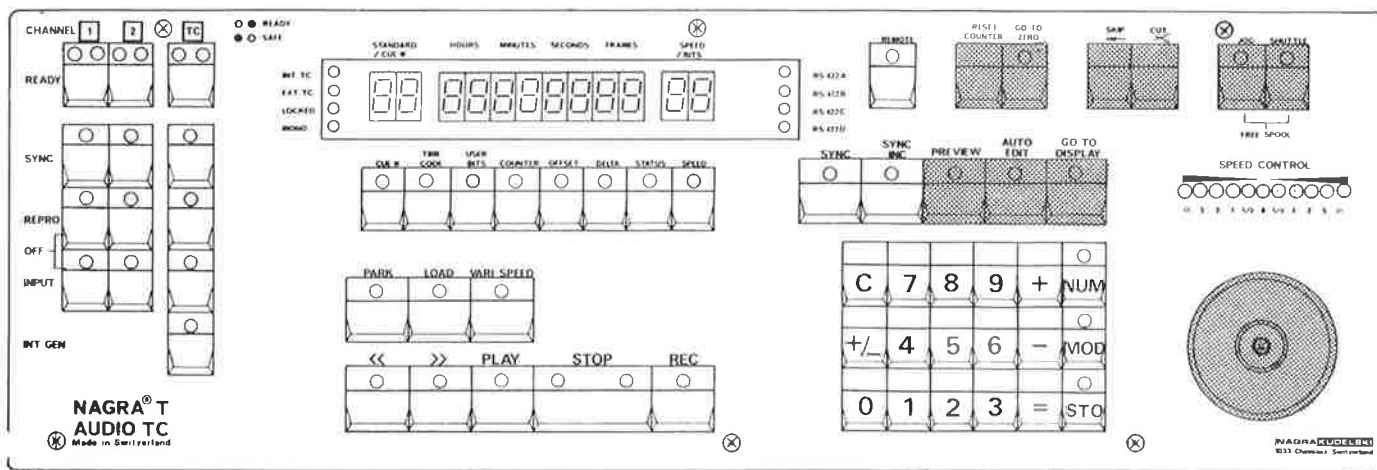
JOG

When the JOG mode is selected the tape is directed by the control wheel in both direction and speed. The tape speed is directly proportional to the rotational speed of the control wheel but is limited to a maximum of 38 cm/s (15 i.p.s). For this function to work, the TASC option must be installed on the time code circuit. JOG is inhibited during RECORD.

SHUTTLE

When SHUTTLE is selected the tape speed is directly set by the angular position of the control wheel. Both direction and speed are indicated by a row of leds marked "SPEED CONTROL" which are located above the control wheel.

When pressing SHUTTLE for the first time, the speed is controlled between maximum reverse speed and maximum forward speed, always keeping the tape close to the time code head, thus allowing a correct reading of the "off tape" time code in the event of a time code discontinuity. This mode is indicated by the SHUTTLE led being permanently ON.

Pressing SHUTTLE again gives "slow speed" control, with maximum speed limited to ± 38 cm/s (15 i.p.s.) and always keeping the tape in contact with the audio and time code heads. This mode is shown by the fast flashing of the SHUTTLE led. When pressing the SHUTTLE key a third time, the SHUTTLE mode will return to normal.

Pressing the SHUTTLE key while in PLAY, > > or < < enters the SHUTTLE mode and the tape keeps its former speed as close as possible. Shuttle sensitivity may be adjusted by means of numerical command 900 (see page 47 Numerical Commands). Available values are from 0 to 5, 0 corresponding to the smallest rotational angle.

FREESPOOL

This is not a direct access function. It can be selected by pressing simultaneously the SHUTTLE and JOG keys. Both leds will come ON to indicate that the FREESPOOL mode is selected. This mode allows manual editing. Brakes on both tape reels are released and tensiometers blocked allowing the reels to be turned by hand, in either direction. To return to normal operation of the machine, simply press the STOP key.

RESET COUNTER

Resets the tape timer and starts the count again from zero. This feature will operate irrespective of the display mode selected.

GO TO ZERO

This function returns the tape to the zero point (of the tape counter). It is not active in RECORD. While the tape is returning, or advancing the GO TO 0 led blinks. It comes permanently "ON" as soon as the zero point is located.

GO TO DISPLAY

This is the TIME CODE or COUNTER search key. The T-AUDIO will shuttle to the time code value displayed at the moment the key is pressed, providing the time code channel is not in the OFF position.

To perform the COUNTER search function, select the time code channel to the OFF position. The value to be searched may be directly entered from the numeric keypad, recalled from one of the ten CUE memories or stored on the fly. If a counter value is frozen on the display as a result of pressing the STO key and a GO TO DISPLAY is then attempted, this value will be considered as a time code and the machine will search for this value on the tape, unless the time code channel is switched off by pressing INPUT and REPRO simultaneously on the time code channel matrix. If this is done then a counter search may be performed. The led inside the key blinks during the search process. It will stay ON permanently as soon as the search is completed. When CUE 1 is searched for, programmed pre-roll time is taken into account. Pre-roll time to CUE 1 may be displayed and modified by means of the numerical command 010.

This feature is not operational while recording. If the value to be located does not have the time code format, ERROR 02 message will be displayed. In case the value to be located does not exist on the tape, due to a discontinuity, ERROR 05 message will be displayed, and the transport will park as close as possible to the interruption.

NOTE : As the difference between the actual position of the tape and the target position is computed "modulo 24 hours", if the value obtained is bigger than ± 12 hours then the DELTA calculation will calculate the other way round (the closest value through midnight) for example:

Tape position	:	01:43:27:12
Target position	:	22:17:19:12
Tape - Target	:	−20:33:52:00
Modulo 24 Hours	:	+ 24:00:00:00
Value after Modulo		+ 03:26:00:00

Thus in this case a GO TO DISPLAY command will start the tape in the backwards direction rather than try to advance it to a code 20 hours further down the tape.

CUT

Pressing the CUT key moves the tape that is presently directly in front of the gap in the audio playback head to a position directly above the scissors which are mounted on the deck plate. While the tape is moving, the JOG led will flash, and it will remain on once the tape has stopped. The transport will remain in the JOG mode. After cutting the tape, unwanted tape may be "dumped" using the control wheel. This mode is not operational while recording. To operate the scissors, turn the black push-button to unlock them, and then press vertically downwards. The cut angle is 30 degrees. Ensure that TASC option is fitted for the CUT feature to work.

SKIP <–

Pressing the SKIP key causes the tape to move backwards at nominal speed until the key is released. This function is inhibited in RECORD and SYNC modes. When the key is released the machine will return to the mode that it was in at the moment the key was pressed.

PREVIEW

A preview (rehearsal) of an edit can be performed by setting the selected channels to READY and rolling the T-AUDIO TC across the loaded edit "IN" and "OUT" points in any synchronizer or playback mode. When the T-AUDIO reaches CUE 1 (edit "IN" point), the selected channels are switched to INPUT. They are returned to their initial position at CUE 2 (edit "OUT" point). To activate the automatic editor in the PREVIEW mode, just press the PREVIEW key. The green led will be ON. To cancel the rehearse mode press the PREVIEW key again. The preview may be performed with all channels in SYNC or REPRO.

Execute numerical command 009 for SYNC (rEh.SYnC) and numerical command 008 for REPRO (rEh.rEP.) depending upon where the time code is to be referenced during the rehearsal. The time code channel will be set the same way as the audio channels in order to synchronize the tape on the selected audio head.

AUTO EDIT

An automatic edit pass will be performed when AUTO EDIT is selected, and the tape passes the "IN" point locked to the reference. The RED led will be ON. To cancel AUTO EDIT mode, press AUTO EDIT again. The machine will drop into RECORD on the channels selected to READY at CUE 1 (edit "IN" point) and will return to playback at CUE 2 (edit "OUT" point). Since it results in an inaudible, miniature cross fade, there is no objection to fixing an edit IN point and an edit OUT point in the middle of the program material. Be sure to allow enough pre-roll time before the "IN" point, as the editor will only work correctly when the edit "IN" point is reached at nominal speed in LOCKED state. Numerical command 010 will give access to see and modify the pre-roll time.

NOTE :

If in the "REHEARSE REPRO" mode the audio outputs are kept in REPRO during the edit pass to allow an off tape confidence monitoring on the edit switching. Consequently, the sound is not synchronous with the picture because the synchronizer is set to synchronize the tape on the record head during editing.

If in the "REHEARSE SYNC" mode the audio outputs are switched to INPUT during the edit pass. No confidence monitoring is then available but audio events are synchronous with the picture.

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3 - 5 SYNCHRONIZATION
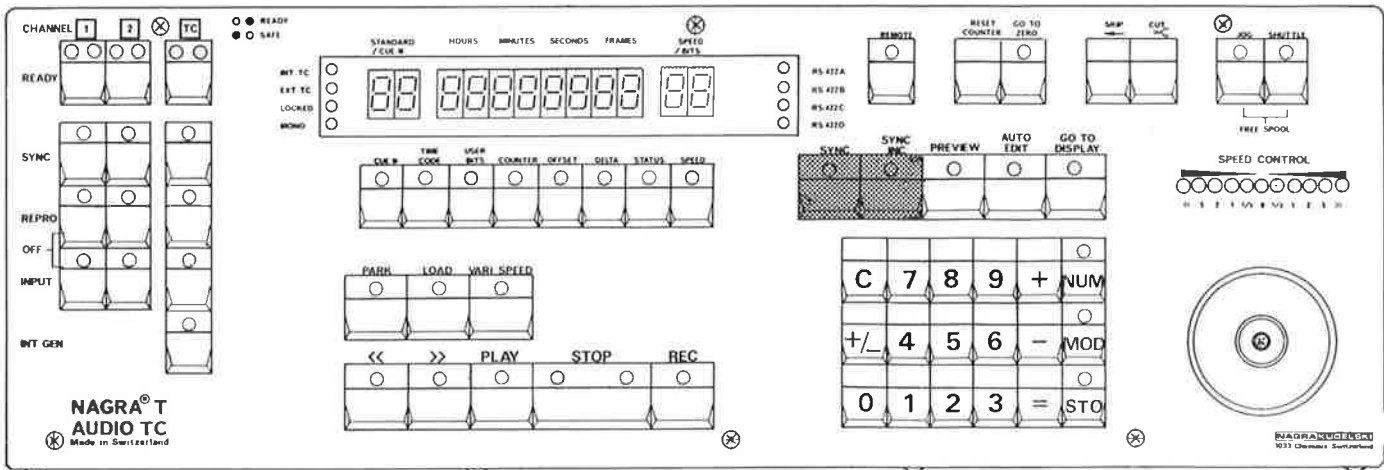
Two modes of synchronization are available with the TACA-TC2 keyboard. One mode is data dependent, using the pre-programmed offset value. The other is data independent, re-calculating a new offset as soon as this mode is entered. Synchronization on the tape timer may also be achieved by selecting the time code channel to OFF.

SYNC

This is the standard (data dependent) mode for 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 lock very accurately and the LOCKED led will come ON as soon as DELTA is measured to be less than 65 bits during 16 consecutive frames. In this mode, the T-AUDIO will not react immediately on speed variations of the master.

A reaction time (initially set to 15 frames) is applied, thus preventing wow and flutter from the master being copied by the T-AUDIO TC and providing protection against dropouts (Numerical command 012 gives access to the reaction time). SYNC mode can be cancelled by pressing on the key again. The T-AUDIO will then keep its former speed.

SYNC INCREMENTAL

This data independent mode is identical to SYNC as far as the tape transport behaviour is concerned. Additionally, automatic OFFSET adjustment is performed at the moment the SYNC INC key is pressed. When a discontinuity is encountered on either master or off tape time code, and with the T-AUDIO locked at nominal speed, the same will be added spontaneously to the offset register. SYNC INC mode can be cancelled by pressing on the key again. The T-AUDIO will then keep its former speed.

3 - 6 NUMERICAL KEYPAD
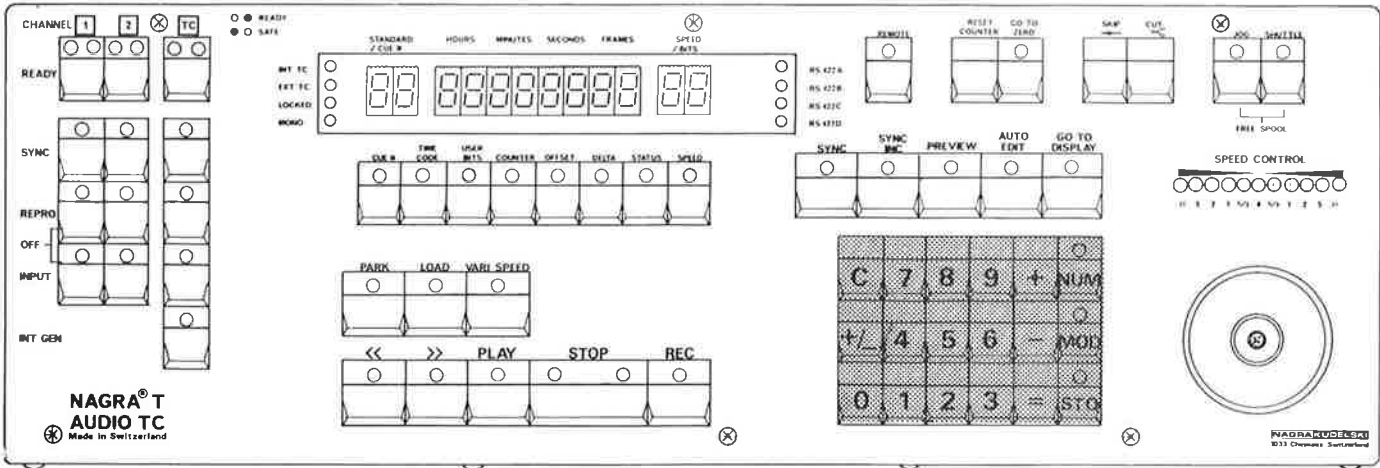
Values can be entered, modified, trimmed and stored in any of the 10 memories by the numerical keypad. Once one of the numerical keys is pressed, the display turns to the "SCRATCHPAD DISPLAY" mode. The calculator is a time code calculator, allowing additions or subtractions on time code values according to the selected frame rate (24, 25, 29.97 or 30 f.p.s.) with or without drop frame. It may also be used to program USER BITS or execute a NUMERICAL COMMAND.

CLEAR

This key clears the display and resets the time code calculator irrespective of the mode of the machine or what is on the display.

+ /-

This is the CHANGE SIGN key, used for example to set the offset to a negative value.

STORE

When in "SCRATCHPAD DISPLAY" mode, pressing this key makes a STORE request and causes the STO led to flash. The next "DISPLAY SELECTION" key (see page 20) will then indicate in which memory the value will be stored. If either TIME CODE or USER BITS keys are pressed, then the corresponding memory (INPUT, REPRO or INT GEN) depending on time code channel status will be updated. To store a value in one of the ten CUE memories, it is necessary to press, the STORE key once upon which the led will flash, followed by the CUE key and then the desired memory number without releasing the CUE key. Store requests, indicated by the flashing of the STORE led, may be cancelled by pressing the STORE key again. The STORE key may also be used to take other data (time code, offset, delta...) "on the fly", when not in "SCRATCHPAD DISPLAY" mode. The values taken on fly may then be edited or stored in one of the memories by pressing the STORE key again. After the first pressing of the STORE key the number on the display is frozen. When pressed a second time the STORE led will start to flash and is then ready to be stored in one of the memories.

NUM

This key is used to execute a numerical command. Type the command number and then press the NUM key. The command will be executed. If the selected command does not exist, ERROR 01 message is displayed. When entering a numerical command leading "0"s are not necessary. Numerical commands are special features that are not used frequently and do not have a dedicated key. They are three digit numbers and are listed on page 47)

CALCULATING

The built-in calculator is a time code oriented calculator. It means that values must match a time code format (hours, minutes, seconds, frames according to the frame rate). Negative values may be used as . However the result is always time code formatted which means it is a positive value between 00:00:00:00 and 23:59:59:2X. Operands may be typed on the keyboard or recalled from one of the various memories (offset, delta, cue point ...) as well. Whenever an operand does not have the required format, ERROR 02 message is displayed.

3 - 7 EDITING OF DISPLAYED INFORMATION

Pressing the MODIFY key allows the user to trim the value of some features, such as OFFSET or VARI-SPEED.

MODIFY

This key is used to switch the "DISPLAY EDIT" feature "ON" and "OFF" allowing trimming, incrementing or decrementing of the displayed value. It is also used to change the currently displayed status. Whenever this mode is selected, it is indicated by the MODIFY led being lit. In this case, the following possibilities are available :

- Trim the displayed value using the control wheel.
- Increment the displayed value by one unit using the " + " key.
- Decrement the displayed value by one unit using the "–" key.
- Modification of the machine's internal status.

OFFSET DISPLAY MODE

Pressing the MODIFY key allows real time offset trimming. In this case, one unit corresponds to 1 bit.

SCRATCHPAD DISPLAY MODE

Pressing the MODIFY key allows time code values to be trimmed. One unit is equivalent to 1 frame. If the initial value is not a time code, then attempting to modify it will cause ERROR 02 message to be displayed. When typing a value with the numerical keypad and "MOD" mode is selected, the keys 0 to 5 will produce the hexadecimal digits A to F, useful when storing the user bits.

SPEED DISPLAY MODE

Pressing the MODIFY key when in SPEED DISPLAY mode or in any other mode while the tape transport is in vari-speed playback, enables the operator to trim the vari-speed percentage. One unit corresponds to 0.1 percent of variation. If vari-speed is selected, the modification is immediately taken into account. Obviously, it is possible to set the vari-speed to a certain value when the T-AUDIO is stopped and then to start the vari-speed playback with the selected speed variation. Vari-speed values may also be directly set from the keyboard, by typing the value, positive or negative, and then by pressing on the STORE key followed by the SPEED key.

NOTE :   "DISPLAY EDIT" mode is inhibited or cancelled if the tape transport status is SHUTTLE or SERVO, as in these cases the control wheel is reserved for transport control.

3 - 8 REMOTE CONTROL
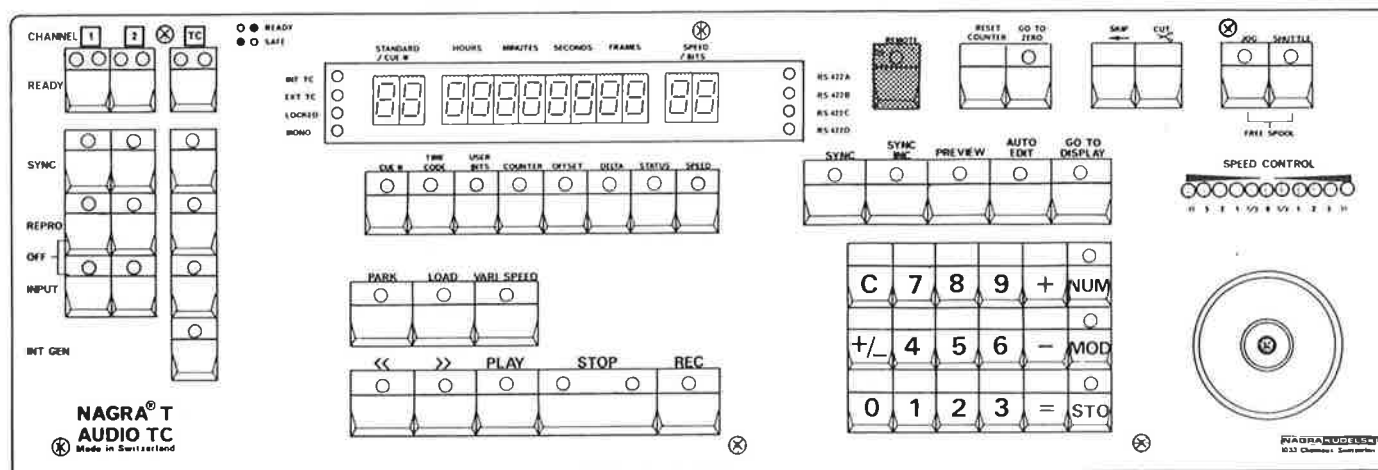
The REMOTE key is used to select one of three modes of operation for the TACA-TC2 :

> REMOTE
> LOCAL
> REMOTE and LOCAL

The current remote status may be displayed in the status menu. The function of the REMOTE key may be selected by remote mode status. 3 modes are available :

DISPLAY	EXPLANATION
rEM Std :	Standard mode of operation. Pressing the REMOTE key toggles between LOCAL and REMOTE. Press twice rapidly on the key to get REMOTE + LOCAL. Display is updated to show the selected mode.
rEM l-r :	In this mode the REMOTE key toggles between LOCAL and REMOTE modes without modifying the displayed data.
rEM l-rl :	In this mode the REMOTE key toggles between LOCAL and REMOTE + LOCAL modes without any change on the display.

The selected mode may be changed when it is displayed by pressing the MOD key.
The REMOTE led is a warning led which is ON every time remote control is possible, this does not mean that ONLY remote control is possible. The selected position is stored in a permanent memory. Default function of this key is rEM Std.

LOCAL

In this mode, all the keys of the TACA-TC2 are active (except certain functions that are automatically inhibited in RECORD, PLAY or SYNC modes). Remote control through the optional TA-RSA, RS-422 interface, is inhibited. This mode is indicated by the REMOTE led being OFF.

REMOTE

In this mode, all the keys that affect the operation of the machine are inactive, except STOP for emergency cases. All the "DISPLAY SELECTION" keys that allow internal status and synchronization accuracy to be monitored, are permanently active. Remote control from an optional TACA-TC or through a TA-RSA is not inhibited. This mode is indicated by the REMOTE led being ON.

REMOTE + LOCAL

This special mode allows both LOCAL (by TACA-TC2) and REMOTE (TACA-TC2 or TA-RSA) controls. It is indicated by the REMOTE led being ON.

3 - 9 OTHER LEDS

STANDARD /CUE#	HOURS MINUTES SECONDS FRAMES	SPEED /BITS

INT TC   ○   ○   RS 422 A
EXT TC   ○   ○   RS 422 B
LOCKED   ○   ○   RS 422 C
MONO   ○   ○   RS 422 D
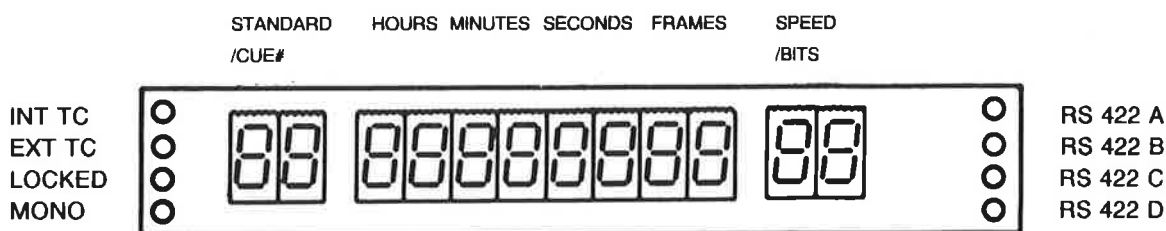
This section describes the functions of the remaining leds shown in the drawing above.

INTERNAL TIME CODE

When alight, this led shows that the off tape time code is being successfully read and decoded and is available for display.

In any pilot mode (Neopilot or FM), this led shows that a pilot signal is at the correct frequency (± 8% around 50 or 60 Hz depending on the programmed frame rate) and is being read from the tape.

NOTE : In time code mode this acts as a very useful way of describing the "quality" of the time code read from the tape (it is a much more powerful indication than a simple level meter) as it will flash "OFF" each time any of the following parameters are not correct :

- Time code word is not 80 bits long.
- Time code sync word does not have the correct pattern.
- Reverse of direction.
- The new time code value is more than two frames bigger (or smaller in the reverse direction) than the previous one (discontinuous or wrong time code detected)
- The new time code value is not compatible with the direction of the tape. (ie smaller value in the forward direction or greater value in the reverse direction).
- Time code missing during more than 1½ frames (detected by the tape timer pulses) thus indicating a drop-out of "off tape" time code.

EXTERNAL TIME CODE

This led is ON each time the external time code, or the external reference, fed to the T-AUDIO is successfully decoded.

LOCKED

This led shows that the T-AUDIO is locked to an external reference (time code, frame pulse or bi-phase), depending on the selected mode of operation of the machine at nominal speed and that DELTA has decreased to less than 65 bits during more than 16 consecutive frames.

MONO

This led is ON whenever the T-AUDIO is set to MONO mode. To select the mode MONO, STEREO or MULTITRACK, just move the switch located on the front of main control logic board A02.

3

RS-422 PORTS

Four leds are located on the right hand side of the display. They indicate when one or more of the four available ports is working.

RS-422 port A

This led indicates communications between the TACA-TC2 and the T-AUDIO, and should always stay on. When it is permanently off, check the connection between the T-AUDIO and the keyboard, or the settings inside the T-AUDIO (RS-422, 19200 Baud) located on the leading edge of time code circuit A 05.

RS-422 port B

This led indicates the communication between the NAGRA T-AUDIO TC and an external controller (remote keyboard, TAERS, video editor or computer) using the NAGRA protocol. The led goes on each time a command is correctly received and decoded by the NAGRA T-AUDIO TC.

RS-422 port C

The C port is reserved for remote control from an editor using an AMPEX, SONY or MOSAIC protocol. This led goes on each time a command is successfully decoded by the T-Audio. If it stays permanently off, check the connection with the editor and the settings of the T-Audio (see REMOTE).

RS-422 port D

The D port is reserved for remote control of a video machine for double audio recording system when using the smaller type 3 or 4 editors based on the SONY protocol which only have the possibility to control 1 recorder. The led goes on each time an answer is correctly received from the VTR. If it stays off, check the connection with the VTR or the protocol mode which should be set to SONY-2. Check that a correct video reference signal is being supplied to the TA-RSA (Without this, no time code or status requests are sent to the VTR). Also check that the VTR is in the correct remote control mode. (for further information see REMOTE)

3 - 10 T-AUDIO INTERNAL STATUS

When pressing the STATUS key the first line of the status display menu is displayed. This information is user definable depending upon the required mode of operation of the machine. Certain status lines are automatically modified depending upon alternative selections made. Some of the internal status of the machine are modified using the row of dil switches on the front edge of time code circuit A05, (or the toggle switches on the TACO-D2RS if fitted) and the remainder is modified directly via the TACA-TC2 keyboard. This is done either by pressing the MOD key when the relevant line is on display or by means of numerical commands using the numerical keypad.

The section below shows the different status lines of the machine and the different indications of the display. The indication marked in **BOLD TYPE** is the default value on a machine leaving the factory or after a reset (NUM 317) has been performed.

NOTE : Some of these STATUS displays are changed by the dil switches on the front of the time code circuit and will not change with NUM 317.

tc 25/ tc 29.97 / tc 29.97 df / tc 30 / tc 30 df / tc 24 / PIlot / FMPI

This is the first line of the menu which shows two pieces of information. Firstly it indicates the mode of the machine, being time code (tc), Neopilot (PILot) or Nagrasync FM pilot (FM PI). The number to the right is the frame rate when in time code mode (24, 25, 29.97, 29.97 df, 30 and 30 df) or the pilot frequency when the machine is in the pilot mode (50 or 60). Both of these modes of operation and the frame rate / frequency can be modified by means of the dil switches located on the front of time code circuit A05, or by means of the automatic tape analysis mode, once the correct format has been found (NUM 001). The selection between NAGRA FM pilot and STELLA pilot is made by means of the switch on the TAPFM pilot amplifier mounted on the time code circuit. This does not change the display on the keyboard.

DATE Ub / FREE Ub

This line indicates the format of the internal time code generator's user bits. In the date mode (DatE Ub) the user bits must conform to the DD MM YY ?? calendar format. The other possible mode of operation is the free user bits mode (FrEE Ub), where they can be any value from 0 to F in hexadecimal. Changing between these modes is done by means of dil switch S4-4 on the front of the time code card. The position of this switch does not matter when in any of the pilot modes.

SLOW DOWN ON / SLOW DOWN OFF

This line of the status menu indicates whether or not the shuttle speed of the transport has been limited. (SLo . on) indicates that the speed of the transport has been limited to a maximum of 60 times nominal speed (for frame rates of 24 and 25 fps and 50 times nominal speed for frame rates of 29.97 and 30 fps) to ensure the accurate reading and decoding of the time code from the tape. When the speed is not limited the display indication is (SLo . oFF) and the spooling will occur at maximum speed but will not guarantee perfect time code reading. This selection is made with dil switch S4-7 on the front of the time code circuit.

ROLLER UPDATE ON / ROLLER UPDATE OFF

Normally the off tape time code is updated using pulses from the counter roller and in this case the display will show (UPdAtE). If this function is inhibited then the time code is shown directly from the tape and makes drop out detection possible. The other position of dil switch S4-8 will inhibit the roller update and the display then indicates (UPdA.OFF)

AUDIO MUTE DURING SYNC UP ON / AUDIO MUTE OFF

This status indicates whether or not the audio outputs are automatically muted when the transport is not in the LOCKED state while the machine is synchronizing. If MUTE ON is selected then the display will show (MUtE on). The second possibility is (MUtE oFF) meaning that the automatic audio muting is turned off and that there will be an audio output even if the machine is not locked to the reference signal. These two selections may be changed by selecting this line of the status menu to the display. By pressing the MOD key, the status will then switch from one to the other in turn.

REFERENCE TIME CODE / BI-PHASE / COLOUR FRAMED / FRAME PULSE

This line shows the external reference expected by the time code circuit, and is the reference that the machine will use to synchronize to. Reference time code (rEF .tc) is the normal mode of operation. Other choices are reference bi-phase (rEF.blPh) which is the reference delivered from a telecine type transport, and is only used if the machine is equipped with the TACO-D2R option. Colour framed reference (rEF .CF) means that the synchronizer will round up the offset to multiples of 4 frames (PAL) or 2 frames (NTSC) whenever a new offset is entered either manually, or the SYNC INC mode is selected, therefore allowing the off tape time code to be correctly colour framed with respect to the incoming "master" time code in synchronous operation. Frame pulse reference (rEF.Fr.P) means that the machine expects a video reference such as a black burst. All these can be modified using the MOD key when they are selected onto the display, and will toggle from one to the next in turn.

REHEARSE MODE REPRO / REHEARSE SYNC

When (rEh.rEP) is selected this indicates that the audio channels will be in the REPRO position on the channel status matrix during an edit rehearsal. The other possibility is to have the audio channels in SYNC position during the edit rehearsal in which case the display will show (rEh .SYnC). This is switched by selecting this line to the display and then pressing the MOD key.

AUTO PARK ON / OFF

This display allows the selection of automatic parking of the pinchwheel carriage and application of parking brakes to the reel motors, after the machine has been stationary in the stop mode for 3 minutes. If selected, the display will show (PArC on). This mode can be switched off using the MOD key when this line is on the display, the display will then show (PArC oFF).

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CHANNEL SWITCHING OFF / ON

This line indicates the mode of the automatic channel switching. The default display is (ChAn oFF), and if MOD is pressed then the display will show (ChAn on). If channel switching is selected then depending on the commands sent to the machine the output of the audio channels will switch from SYNC to INPUT.

STOP, RECORD, REWIND, FAST FORWARD, LOAD and PARK will cause this switching from SYNC to INPUT.

PLAY, FREESPOOL, CUT, SKIP, SHUTTLE, JOG, GO TO LEADER, GO TO DISPLAY and GO TO ZERO will cause the audio channels outputs to switch from INPUT back to SYNC.

OFFSET RESET OFF / ON

When the display is in the default mode (rESo oFF) then the offset register will not be reset when the machine is powered down, and the previous value stored will be recalled from the memory. When this mode is on then an automatic reset of the OFFSET register will be made when the machine is switched on, in this mode the display will show (rESo on).

AUDIO MUTE DURING LOCATE OFF / ON

If (LoCM OFF) is selected then the audio outputs will not be muted during the LOCATOR function and audio will be heard on the audio outputs. The other possible selection is (LoCM on) which means that the muting feature is active and the audio will not be heard on the outputs during LOCATE functions (in order to garantee full muting during all the phases of the LOCATE process, the following status "Tape lifter during locate" should be set to ON too).

TAPE LIFTER DURING LOCATE OFF / ON

This allows the selection of whether or not the tape lifter is active during LOCATE functions. If (LIFt oFF) is selected then the tape will remain in contact with the heads white SEARCHING. The other option is (LIFt on) and in this case the tape will be kept away from the heads and is implemented in order to preserve head life for those machines that are used frequently in LOCATOR modes.

DISCONTINUITY HANDLING OFF / ON

This feature, useful when the T-Audio is controlled from a Sony protocol based editor, allows the T-Audio to synchronize to a master that does not have continuous time code on it (or if the tape on the T-Audio is not continuous). If this mode is enabled, the display will show (dISC on) and the machine will switch from SYNC to SYNC INC mode as soon as the transport is locked to the reference, and likewise switches back when the transport is no longer synchronous. Upon returning to SYNC the software recalls the initial offset value at the beginning of the SYNC process so as to avoid cumulative errors, during each rehearse or edit. This will also handle a discontinuity of the form : 10, 11, 12, 13, 13, 13, 14, 15 etc. as a new offset is calculated at the discontinuous point. In the default mode the display will show (dISC oFF).

TIME CODE GENERATOR RUN /HOLD

This indicates the status of the internal time code generator. In the mode (tc run) the internal time code generator is running and will continue to count time, even if the power is disconnected. In the mode (tc hoLd) the internal time code generator is stopped and will hold its value until recording of time code is initiated. When the recording is stopped, the internal generator will return to the "hold" mode keeping the last recorded value in the memory.This will allow recording "CONTINUOUS" time code on the tape (as a matter of fact small discontinuities will be recorded on tape as this is not a true "Assembly" mode).

TIME CODE GENERATOR PROTECTED / UNPROTECTED

This indicates whether or not the internal generator is protected from being modified either from the keyboard or from an external source. In the default setting the display is (Prot oFF) thus there is no protection. If MOD is pressed the display will switch to (ProtECt) and then the internal generator is protected against any modification. If an attempt is made to change the internal generator when in "protect" the message ERROR 04 will be displayed.

TIME CODE OUTPUT NORMAL / MUTED

The display (tco norM) indicates that the time code PLAYBACK output is in the normal mode and will give an output at all times. If MOD is pressed (tco MUtE) is displayed. Then the time code output is muted at all times except when the machine is at nominal speed.This mode is intended for applications where the T-Audio is under control of an external synchronizer (Adams-Smith, Q-Lock) through the TAERP

SPARE-2 INPUT OFF / PLAY / RECORD / LOAD / PLAY TOGGLE / REC TOGGLE

This shows the operational mode of the spare 2 general purpose input on the third track input / output connector on the rear panel of the machine. The default display (SP2 oFF), indicates that it is set to have no function. There are several programming possibilities for this input, and are stepped through using the MOD key, and are as follows : (SP2 PLAY) indicates that a constant 5V signal on the spare 2 input will put the machine into playback, for as long as the signal is present. (SP2 rEC) is as above but the channels selected to READY will pass from playback to record.
If (SP2 LoAd) is selected an active signal on the input will put the machine into the LOAD mode, and back to STOP when inactive again. The (SP2 P to) position will put the machine into playback upon receiving a pulse, and then return it to stop upon receiving the following pulse, thus toggling from one mode to the other. The (SP2 r to) position will toggle the selected channels of the machine between playback and record as above.

RS-422 19200 BAUDS

The display (422 19.2) indicates the serial mode of the machine i.e. : RS-422 at a Baud rate of 19.2 kBauds. This must be the case if the TACA-TC2 keyboard is being used. If the TACA-TC keyboard is being used then the dil switches on the front edge of the time code circuit may be changed to allow RS-232 communication at various different Baud rates.

T-AUDIO SOFTWARE VERSION 2.4 (NTAS.TCN) 2.4S (NTA3.TCS/R)

The display (tA 2.4 S) shows the version of software in the machine. It indicates the "S" if the machine is equipped with the internal time code synchronizer. If the internal synchronizer option is not installed then simply tA 2.4 is displayed.

KEYBOARD SOFTWARE VERSION 1.4

The display (CP 1.4) indicates the version of software in the control panel or keyboard, in this case version 1.4. This will only be displayed on the TACA-TC2

LOCAL / REMOTE / LOCAL + REMOTE

In this line of the status the possible mode(s) of control of the machine are indicated. The default display is (LoCAL). Other possibilities are (rEMotE), allowing only remote control and (rEM-LoC) allowing both forms. These are selected by pressing the REMOTE key.

NOTE :   The third position (rEMotE + LoCAL) is achieved by pressing twice rapidly on the remote key.

REMOTE STANDARD / LOCAL,REMOTE / LOCAL,REMOTE + LOCAL

This shows the program setting of the remote / local switch. The position (rEM Std) means it is set to standard remote functions of remote, local and a double click of the switch to get remote and local together.
(rEM L-r) means that each depression of the remote switch will toggle between remote and local control.
(rEM L-rL) will toggle between remote and remote with local control. These selections are made by pressing the MOD key.

NOTE :   The following status lines in the menu will only appear if the machine is fitted with the RS-422 option TA-RSA.

SONY / SONY-2 / AMPEX (PROTOCOL SELECTION)

This line of the menu allows the selection of RS-422 protocol for serial communication with a video editor. The default setting (SonY) corresponds to the normal SONY protocol and should be used when the machine has a dedicated port on the editor. (SonY-2) is the second option and this is a special adapted version of the SONY protocol to allow a T-Audio and a SONY VTR to be connected simultaneously on one recorder port of a small 3 or 4 machine editor. (AMPE) is the final selection and corresponds to the AMPEX protocol and allows the T-Audio to communicate with AMPEX based video editors. These choices are made by pressing the MOD key.

NOTE :   Depending upon the selection of the above protocol the following lines in the status display menu are different. They are therefore listed in the order SONY, SONY 2, AMPEX.

MACHINE SELECTION BVU 800 / BVH 2000 / BETACAM / T-AUDIO

This line shows the type of VTR machine that the T-Audio is emulating. The default value is (bvU 800) and this represents a U-Matic and covers all SONY U-Matic transports. For the benefit of the editor it is recommended to set this line in the T-Audio to be the same type of machine as all the other machines connected to the video editor. The second possibility is (bvh 2000) selection which covers all SONY one inch "C" format vtr's. The third choice is (bEtACAM) and this covers all Betacam machines. The final choice is (t-AudIo) and allows the T-Audio to have its own specific identification number for editors that have the possibility to select a T-Audio. These selections are the same for PAL and NTSC machines. They are selected with the MOD key.

STANDARD PLAY / SYNC PLAY

The default selection (Std PLAY) means that every playback command received by the T-Audio from the editor is understood as a normal non-sync playback. The other choice is (SYnc PLAY) and when this is selected all play commands received by the T-Audio from the editor are understood as play locked synchronously to the house reference. The SYNC PLAY mode is to be used whenever the default mode does not work well with the video editor. This is selected with the MOD key.

SPEED FAST / SPEED LIMITED

The default setting (SPd FASt) means that the shuttle speed of the T-Audio is not limited and any fast forward or fast rewind commands are interpreted normally and the pinchwheel carriage will move away from the heads and the time code on the display will be updated from the counter roller. If MOD is pressed then the display will show (SPd Ltd) and in this case the shuttle speed is limited and the tape will always remain in contact with the time code head so that discontinuities and drop outs in the time code can be detected and accounted for.

The following depression of the STATUS key will return to the first line of the status display menu.

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When SONY-2 is selected the three following lines of the menu are the same as for the normal SONY protocol. The lines listed below follow the shuttle speed selection line.

TRANSPORT SELECTION BOTH / T-AUDIO / VTR

The default setting (tSP both) indicates that when two recorder machines are connected to one single RS-422 port of the editor, then the editor will control both machines simultaneously. If the MOD key is pressed then (tSP t-A) will be displayed showing that the commands sent from the editor will be acted upon by the T-Audio only and the VTR will remain stationary. The final selection shows (tSP vtr) and this indicates that the commands fed from the editor will be passed directly by the T-Audio to the VTR and the T-Audio will not move.

AUDIO RECORD BOTH / T-AUDIO / VTR

This selection determines the destination of the audio to be recorded. The default display is (ArECboth) and means that the audio will be recorded on both transports provided that the TRANSPORT BOTH mode above is selected first. In this case the audio during an edit would be recorded on the T-Audio and also on the audio channels of the VTR, thus giving a total of four audio channels. If MOD is pressed the display will show (ArEC t-A) and this means that the audio will be recorded on the T-audio only. If MOD is pressed again then the display shows (ArEC vtr) and this indicates that the audio will be recorded on the two audio channels of the VTR only.

The following depression of the status key will return to the first line of the status display menu.

MACHINE IDENTIFICATION T-AUDIO TC / VPR-3

This allows the selection of the identification given by the T-Audio to the video editor. The default value (Id tA-tC) means that the T-Audio identifies itself as a T-Audio transport for editors that recognize the T-Audio. The other choice, made by pressing the MOD key is (Id VPr-3) and in this case the T-Audio identifies itself to the editor as an AMPEX VPR-3 machine. This is for any Ampex based editor that does not directly recognize the T-Audio as a specific transport.

NOTE : In order to handle correctly a "Non standard speed" edit with the T-Audio, the Ampex Ace requires receiving the VPR-3 identification (for the time being).

TIME CODE DELAY 0 / 1 FRAME

This indicates that the time code from the T-Audio is not delayed when sent back to the editor (0 Fr dLY). Upon pressing the MOD key the display shows (1 Fr dLY) meaning that the time code will be delayed by one frame.
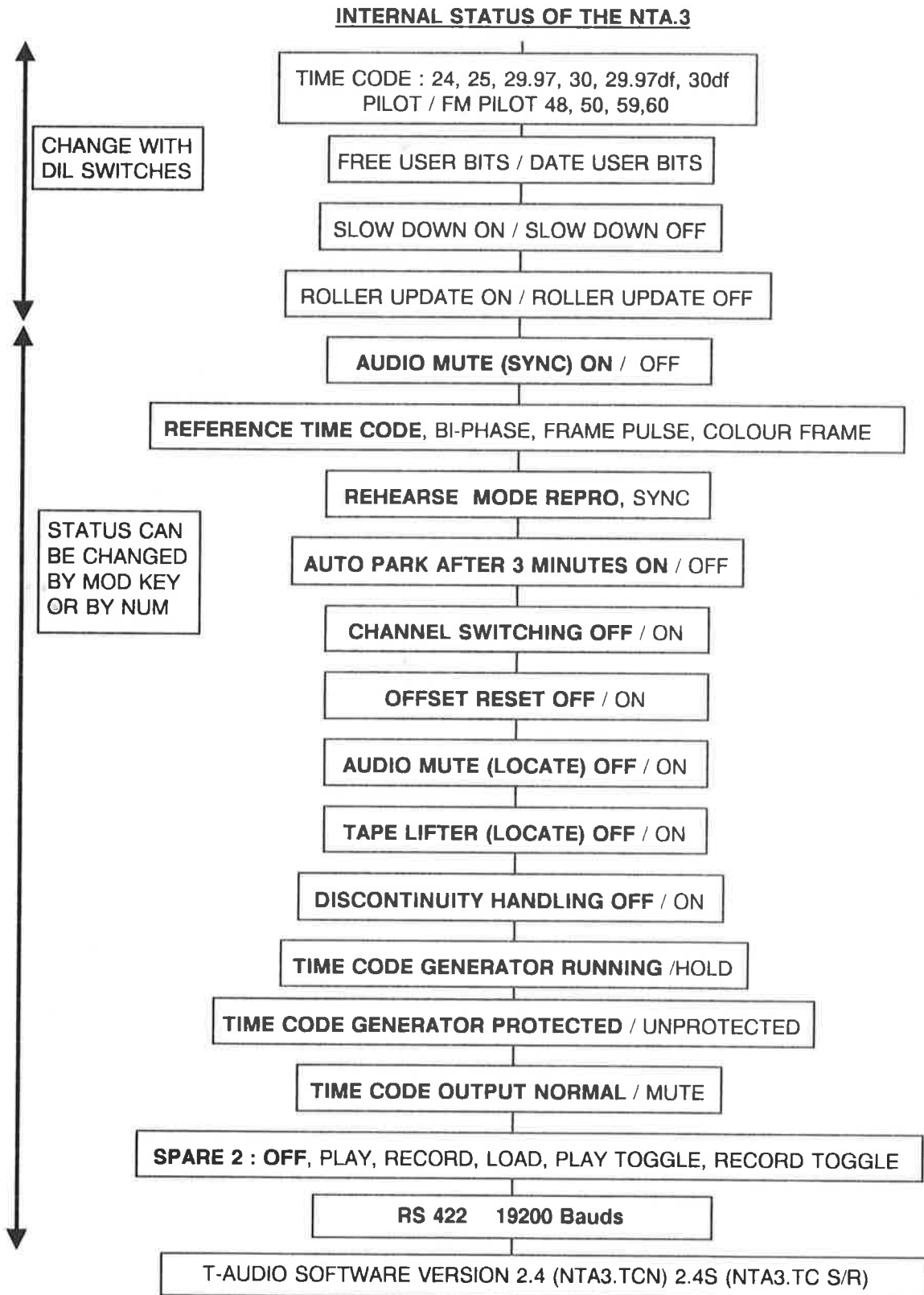
SPEED FAST / SPEED LIMITED

The default setting (SPd FASt) means that the shuttle speed of the T-Audio is not limited and any fast forward or fast rewind commands are interpreted normally and the pinchwheel carriage will move away from the heads and the time code on the display will be updated from the counter roller. If MOD is pressed then the display will show (SPd Ltd) and in this case the shuttle speed is limited and the tape will always remain in contact with the time code head so that discontinuities and drop outs in the time code can be detected and accounted for.
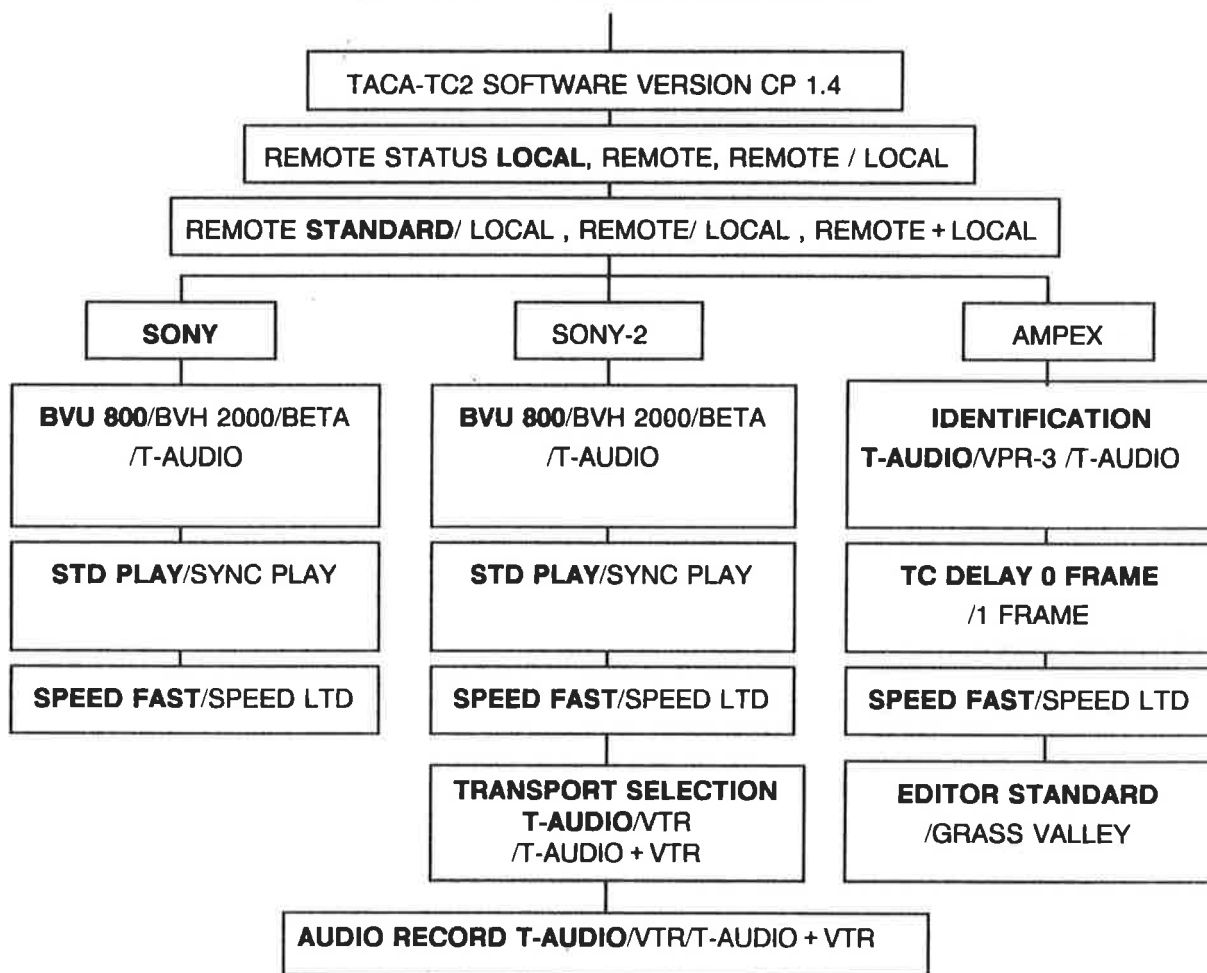
EDITOR SELECTION STANDARD / GRASS VALLEY

The default selection is (Std Edlt) which indicates that a standard type Ampex based editor is selected. As Grass Valley do not use the principle of time line, a special selection is needed. (GrASS vY) will be displayed when pressing MOD.

The next depression of the STATUS key will return to the first line of the status display menu.

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INTERNAL STATUS OF THE NTA.3

CHANGE WITH DIL SWITCHES

TIME CODE : 24, 25, 29.97, 30, 29.97df, 30df
PILOT / FM PILOT 48, 50, 59,60

FREE USER BITS / DATE USER BITS

SLOW DOWN ON / SLOW DOWN OFF

ROLLER UPDATE ON / ROLLER UPDATE OFF

AUDIO MUTE (SYNC) ON / OFF

REFERENCE TIME CODE, BI-PHASE, FRAME PULSE, COLOUR FRAME

STATUS CAN BE CHANGED BY MOD KEY OR BY NUM

REHEARSE MODE REPRO, SYNC

AUTO PARK AFTER 3 MINUTES ON / OFF

CHANNEL SWITCHING OFF / ON

OFFSET RESET OFF / ON

AUDIO MUTE (LOCATE) OFF / ON

TAPE LIFTER (LOCATE) OFF / ON

DISCONTINUITY HANDLING OFF / ON

TIME CODE GENERATOR RUNNING /HOLD

TIME CODE GENERATOR PROTECTED / UNPROTECTED

TIME CODE OUTPUT NORMAL / MUTE

SPARE 2 : OFF, PLAY, RECORD, LOAD, PLAY TOGGLE, RECORD TOGGLE

RS 422   19200 Bauds

T-AUDIO SOFTWARE VERSION 2.4 (NTA3.TCN) 2.4S (NTA3.TC S/R)

3

BOLD INDICATES DEFAULT VALUES

TACA-TC2 KEYBOARD INTERNAL STATUS

TACA-TC2 SOFTWARE VERSION CP 1.4

REMOTE STATUS **LOCAL**, REMOTE, REMOTE / LOCAL

REMOTE **STANDARD**/ LOCAL , REMOTE/ LOCAL , REMOTE + LOCAL

SONY	SONY-2	AMPEX
BVU 800/BVH 2000/BETA /T-AUDIO	**BVU 800**/BVH 2000/BETA /T-AUDIO	**IDENTIFICATION T-AUDIO**/VPR-3 /T-AUDIO
STD PLAY/SYNC PLAY	**STD PLAY**/SYNC PLAY	**TC DELAY 0 FRAME** /1 FRAME
SPEED FAST/SPEED LTD	**SPEED FAST**/SPEED LTD	**SPEED FAST**/SPEED LTD
	TRANSPORT SELECTION T-AUDIO/VTR /T-AUDIO + VTR	**EDITOR STANDARD** /GRASS VALLEY

AUDIO RECORD T-AUDIO/VTR/T-AUDIO + VTR

BOLD INDICATES THE DEFAULT VALUES

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3 - 11 NUMERICAL COMMANDS

To execute a numerical command, just type its number (leading 0's are not necessary) and then press on the NUM key. The display will then be updated according to the selected command. Underlined are the ex-factory settings. Remember that all the displayed status may be changed either by moving one or more of the dil switches on the front of the T-AUDIO or by using the MOD key.

SYNCHRONIZER COMMANDS

000 :   Sets the display to the first line of the status menu. Same effect as pressing the STATUS key.

001 :   Automatic tape analysis request. This means that a tape of any time code or pilot format will be read by the T-Audio and the display will then display the format of the tape. (for further explanation see page 57)

002 :   Automatic muting of the audio outputs when the synchronizer goes out of locked state when in synchronization mode.
       Display : MUtE on

003 :   Inhibition of automatic muting.
       Display : MUtE oFF

004 :   Sets the time code synchronizer to resolver mode. Allows synchronization on an external reference at the frame pulse rate. If switch S1 on the time code board is set to internal, this mode lets the T-AUDIO synchronize on its own internal generator.
       Display : rEF.Fr.P

005 :   Normal operating mode for the time code synchronizer.
       Display : rEF. tc

006 :   Selects the bi-phase synchronizer mode. Bi-phase signals are processed in the TACO-R option and fed to the T-AUDIO through the Ext. ref. input and FWD or BWD Ext. roll. inputs on the THIRD TRACK INPUT/OUTPUT connector.
       Display : rEF.blPh

007 :   Select the color framed synchronizer mode. Each time an offset is programmed, it is internally tuned to match the color framing of the external time code.
       Display : rEF. CF

008 :   Preview edit pass with audio channels set to REPRO. This mode will automatically be selected when in AMPEX protocol and the editor is connected to the TA-RSA.
       Display : rEh.rEP.

009 :   Preview edit pass with audio channels set to SYNC. This mode is automatically selected when in SONY or SONY-2 protocols and the editor is connected to the TA-RSA.
       Display : rEh.SYnC

010 :   Access to pre-roll time to CUE 1. To modify the pre-roll duration, just type the new value on the numerical keyboard and press then STORE. The display will then show the new value. Only seconds and frames are taken into account.
       Display : PrE 05.00

011 :   Access to post-roll time to CUE 2. To modify the post-roll duration, proceed the same way as for pre-roll duration (NUM 010).
          Display : PoSt07.00

012 :   Access to synchronizer reaction time. To modify its value, process the same way as for pre-roll duration (NUM 010).
          Display : rEAC00.15

014 :   Switch on the auto park mode. When no command is typed on the keyboard for more than three minutes and the T-AUDIO is in stop mode, the command PARK is sent.
          Display : PArC on

015 :   Inhibition of the auto park mode.
          Display : PArC oFF

016 :   Sync/input channel switching ON. Depending on the commands sent to the machine then the output of the audio channels will switch from SYNC to INPUT.
          STOP, RECORD, REWIND, FAST FORWARD, LOAD and PARK will cause this switching.
          PLAY, FREE SPOOL, CUT, SKIP ,SHUTTLE, JOG, GO TO LEADER, GO TO DISPLAY and GO TO ZERO will cause the audio channels outputs to switch from INPUT back to SYNC.
          Display : chAn on

017 :   Sync/input channel switching OFF
          Display : chAn oFF

018 :   Offset reset during power up. Resets the offset register of the internal time code generator to zero when the machine is powered up.
          Display : rES0. on

019 :   No offset reset during power up. The offset register of the internal time code synchronizer is not reset to zero.
          Display : rES0. oFF

020 :   Audio mute during locate function enabled.
          Audio channels will be muted during the locate procedure.
          Display : LoCM. on

021 :   Audio mute during locate function disabled.
          No audio muting during the locate procedure.
          Display : LoCM. oFF

022 :   Tape lifter during locate function enabled.
          Tape will not remain in contact with the time code head during locate features.
          Display : LIFT. on

023 :   Tape lifter during locate function disabled.
          Tape will always remain in contact with the time code head.
          Display : LIFT. oFF

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024 :   Discontinuity handling ON. This feature allows the T-Audio to synchronize to a master that does not have continuous time code on it (or if the tape on the T-Audio is not continuous). The machine will switch from SYNC to SYNC INC mode as soon as the transport is locked to the reference, and likewise switches back when the transport is no longer synchronous. Upon returning to SYNC the software recalls the initial offset value at the beginning of the SYNC process so as to avoid cumulative errors, during each rehearse or edit. This will also handle a discontinuity of the form: 10, 11, 12, 13, 13, 13, 14, 15 etc. as a new offset is calculated at the discontinuous point.
Display : diSC. on

025 :   Discontinuity handling OFF.
Display : diSC. oFF

INTERNAL GENERATOR COMMANDS

100 :   Stops internal time code generator.
Display : tc hOLd

101 :   Starts internal time code generator.
Display : tc run

102 :   Protection of internal time code generator from accidental modification.
Display : ProtECt.

103 :   No protection of the internal time code generator against accidental settings.
Display :Prot.oFF

104 :   Time code 24/25 frames conversion. This alters the frequency of the internal generator at either 24 or 25 frames per second. For instance when the T-Audio is at 25 fps this command will slow down the generator from its nominal speed of 2000 bits per second to 1920 bits per second which corresponds to a frame rate of 24 fps. Likewise if the machine is at 24 fps this command will speed up the internal generator in the reverse manner. This is used to speed up or slow down the tape by 4 % (at the ratio of 24 to 25). This may be done as follows: Resolve the original tape on the IV-STC or T-Audio while making a copy of the tape on a T-Audio which is in this mode, and recording its internal generator. The copied tape will have a time code, recorded in such a way that any future synchronization playback will be done at the converted speed.

SERIAL INTERFACE COMMANDS

200 :   Access to machine identification number. To change it, just type the new value and press STORE.
Display :   MACh 01

202 :   Single frame step forward, test function.

203 :   Single frame step backward, test function.

204 :   T-AUDIO TC identifies itself as T-AUDIO, code 1D. Not available with SONY editors.
Display : (AMPEX only) Id tA-tC

205 :   T-AUDIO TC identifies itself as VPR 3, code 09. Not available with SONY editors.
Display : (AMPEX only) Id vPr 3

206 :   The time code output is permanently on.
Display : tco norM

207 :   The time code output is muted each time the T-AUDIO is not at nominal speed. This mode has to be used with some external synchronizers which are using tape counter pulses when no time code output is available.
Display : tco MutE

AUXILIARY CONTROL COMMANDS

<u>300</u> :   Spare 2 input inhibited.
Display : SP2 oFF

301:              Spare 2 input used for fader start.
Display : SP2 PLAY

302 :   Spare 2 input used for record switching.
Display : SP2 rEC

303 :   Spare 2 input is used for switching between LOAD and STOP.
Display : SP2 LoAD

305 :   Toggle pulse on Spare 2 to switch between STOP and PLAY.
Display : SP2 P to

306 :   Toggle pulse on Spare 2 to switch between PLAY and RECORD.
Display : SP2 r to

317 :   This command restores all the default values.
Display : Error 07

KEYBOARD RELATED COMMANDS

900 : Access to Shuttle control sensitivity constant. To change it, just type the new value on the keyboard and press STORE. Allowed range : 0 to 5. The programmed value is stored in the permanent memory. This changes the rotational angle of the control wheel needed to change the speed and direction of SHUTTLE.
Display : ShtL-S 0

901 : Use this command to toggle speed display between centimeters per second and inches per second.
No display (except that the value changes)

920 : VTR record advance (in SONY-2 mode only). This numerical command is automatically executed when a VTR is selected in the STATUS menu. This value can still be modified if necessary and will remain unchanged until another VTR is selected. The settings are as follows :

> 3 frames for BVU series
> 5 frames for BVW series
> 6 frames for BVH series.

Display : rECAd 00

990 : Performs the keyboard self test. Eprom, timer 0, serial bus and ram are checked. A successful check is displayed by the two letters "Gd" for good. An unsuccessful test by the two letters "bd" for bad. To pass from one step to the next one just press on any key.

991 : Performs the RS-422 loop through test. The full test requires the presence of a TA-RSA. Without TA-RSA (NTA3-TCN and NTA3-TCS) only the keyboard RS-422 port A is checked. To perform this test, it is first necessary to build a connector linking RA to TA and RB to TB so that the emitted data can also be received on port A. Press on any key to pass from one step to the next. On machines equipped with TA-RSA (NTA3-TCR) then performing this test on a keyboard with a TA-RSA option only requires to link RS-422 port A (going to the T-AUDIO) with port B and port C with port D with conventional RS-422 cables. The leds corresponding to each RS-422 port on the keyboard will light if each is functioning correctly.

992 : Performs the control wheel test. Press on any key to start the test. The control wheel position is displayed in hexadecimal values. Check that the number is incrementing when turning to the right and decrementing when turning to the left. Press on any key to continue.

993 : Performs the keys and leds test. Press on any key to start the test. First all the segments of the display are switched on to detect a possible short circuit between two segments. After this is completed when you press on a key, the corresponding led should switch on and then off again when the same key is pressed again. If not, check the key or the led. To stop the test press on STOP key, once the two STOP leds are ON.

3 - 12 ERROR MESSAGES

This section describes the meaning of all the error codes that may appear on the display.

ERROR 01 :   Non existent numerical command has been executed. No action is undertaken.

ERROR 02 :   Invalid time code. The value used for a setting is not correct, check the frame rate.

ERROR 03 :   Invalid date in user bits. The user bits generator has been set with dil switches to calendar mode. A set from external or a manual set has been attempted with user bits of which the format is not a date. The setting has not been performed. Correct the value or set the UB generator to FREE mode.

ERROR 04 :   Internal generator setting not allowed. The modifications of the internal generator are inhibited. In spite of that, a setting has been attempted. Execute numerical command 103 to authorize the setting.

ERROR 05 :   Time code not found. This message may appear in synchronizer mode or during a "GO TO DISPLAY" function. This error message means that the time code was not found on the tape due to a discontinuity.

ERROR 06 :   Unavailable function. In some operational modes, certain functions are inhibited. For example SYNC when the machine is set to pilot operation.

ERROR 07 :   Permanent memory lost. The contents of the memory has been lost. This may occur when the backup battery is flat, after an eprom change or after NUM 317 has been performed (reset to default values).

ERROR 08 :   Invalid external reference. May appear when the machine is used in the resolver mode and the frame pulse reference signal is not present or unstable. Also indicates problems in the time line synchronization when the T-AUDIO is controlled from an editor.

ERROR 09 :   The microprocessor failed an attempt to set the real time clock during an internal generator setting.

ERROR 10 :   RS-422 error. This message may occur when the RS-422 communication between the TACA-TC2 and the T-AUDIO is not correct. Check the cables or the dil switches in the front of the T-AUDIO which have to be set to RS-422, 19200 Bauds position.

ERROR 11 :   Invalid parameter. The programmed value (shuttle sensitivity, machine number...) is not in the allowed range.

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ERROR 12 : TACA-TC2 time line error. This error message may occur when controlling the T-AUDIO from a SONY editor. It means that the command buffer is full.

ERROR 13 : This indicates that no recognized tape format was found on the tape during analysis mode. (NUM 001)

3

CHAPTER 4

TIME CODE

4

4 - TIME CODE

4 - 1 GENERAL

All time code versions of the NAGRA T-Audio are fitted with two time code readers, for simultaneous reading of off tape and external time code, and an internal time code generator and the necessary electronics to allow the recording and reproduction of centre-track time code according to the SMPTE / EBU 80 bits format. Other time code features depend upon the options chosen for the machine. The time code system in the NAGRA T-Audio is a software based system that makes it very flexible and allows it to operate at extremely high speed. The time code circuit is fitted with a lithium battery which will keep information stored in the RAM such as offset values, cue values, time code and user information even when the machine is not powered. The internal time code generator will continue to run even if the time code circuit is removed from the machine. As the T-Audio is a five head machine the time code and audio are not recorded by the same head. There is therefore an offset which is internally calculated by the microprocessor, to compensate for the delay / advance of the time code when recording or replaying a tape, depending on the selected tape speed. This is done so that according to the time code format all time code and corresponding audio are coincident on the tape and at the time code outputs. This ensures compatibility between different manufacturers of machines.

All the features of the time code system and software options will be covered in full in this section. All operations concerning the internal generator, synchronizer and time code in general will be explained. All practical applications will be explained later.

AUTOMATIC TAPE ANALYSIS

A special feature has been incorporated in the T-Audio time code and this allows the operator to place any tape onto the machine and determine its recorded format. This is done by activating numerical code 001 upon which the machine will automatically start in playback at the preselected speed and simultaneously select the display to tc 24. This is the first mode of the tape analysis, after 5 seconds it will change to tc 25 (without the need for the operator to change the dil switches located on the front of time code circuit A 05). After a further 5 seconds the machine will pass to the following frame rate, followed by all PILOT modes. This will continue until all modes have been tested or the machine has found the proper mode of operation according to the type of tape. Once located this setting will remain (irrespective of the position of the dil switches, on the time code circuit or the TACO-D2RS) until the machine is switched OFF, or another mode is specially selected. The order of the internal tests is as follows : tc 24, tc 25, tc df 29, tc ff 30, fm pi 50, fm pi 60, pilot 50, pilot 60. If no compatible format is recovered from the tape then the machine will display the ERROR 13 message.

NOTE :   The last two positions cannot be tested unless the operator has put the FM/NEO switch (S4-6) into the NEO position (OFF) before the start of the test.

As the time code circuit of the machine has no access to change the playback speed itself, the user should manually change the speed testing all possibilities. This manual speed scrolling is only necessary if the machine is fitted with the TACA-TC keyboard. Machines fitted with the TACA-TC2 keyboard perform this automatically. At the end of the test the format of tape will be displayed on the keyboard and the machine will remain in this mode.

4 - 2 INTERNAL GENERATOR

The T-Audio time code machines are fitted with an internal generator allowing the machine to pre-stripe tapes for use in editing, without the need for a "House" time code generator or any other equipment in the studio. It also allows the T-Audio (when fitted with the TA-HSX high stability time base) to be used as a master clock, either in the studio or on location in a mobile capacity. It can also be used as a resolver reference for transfer and playback recording applications on the set. The internal generator of the machine is also used when recording an external time code to regenerate the time code and compensate for poor signal level and drop-outs in the incoming signal. This means that time code recorded on the T-Audio is always free from drop-outs and jitter. The internal time code generator (both time and user information) can be set either from an external source or from the TACA-TC2 keyboard, and will keep this information even if the power to the machine is cut off. The internal generator can accurately generate all standard frame rates for film and television applications in both PAL and NTSC standards, including drop frame modes at both 29.97 and 30 frames per second, assuming the TA-HSX option is fitted. A special feature of the internal generator is that if selected to the HOLD mode then the internal generator starts running again as soon as the time code channel of the machine is put into RECORD. This means that the internal generator may be pre-set to a specific value and will start to record as soon as the time code channel starts to record. The internal generator will then stop again as soon as the recording is finished.

EXTERNAL REFERENCE

Depending upon the mode of operation of the T-Audio there can be one of four different external references fed to the internal generator. The reference should be fed to pin 5 of THIRD TRACK IN / OUT connector BJ-11 or to pin 3 of RS-422 connector BJ-13, both located on the rear panel of the machine. If the optional TAPFM pilot resolver circuit is fitted to the time code circuit the reference will pass through an automatic level compensation circuit which allows the external reference to be of any shape and any level between 0.8 V to 14 V. Without the TAPFM the reference must be a 5 V logic square wave. In this case pins 1 and 8 of connector XA25-P2 on time code circuit A 05 must be bridged.

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

The machine must be set to expect the correct type of reference according to the mode. This is selected in the STATUS mode and is changed by pressing the MOD key.

In normal operation the machine will be in the time code mode and in this case connection to the master is simple. The decoder of the external time code reader can decode a signal at speeds varying from 0.02 times nominal speed up to approximately 70 times nominal speed (60 times nominal speed for frame rates of 29.97 and 30 fps.) The time code signal level may be anything from 100 mV pp to 24 Vpp and in most cases the signal does not need to be reshaped before being fed to the T-Audio TC. A time code reference should be fed either to the XLR time code input on the rear panel of the machine or to the five pin LEMO connector on the front of time code circuit A 05.

4

SETTING THE INTERNAL GENERATOR (time code and user bits)

1 : FROM THE TACA-TC2 KEYBOARD

To set the internal generator time code from the keyboard, firstly select the internal generator to the display by pressing the INT GEN key followed by the time code display select key under the display. Then enter the time according to the format HH.MM.SS.FF (Hours.Minutes.Seconds. Frames) in the twenty four hour clock format, using the numerical keypad. When the desired time is on the display press the STO (store) key followed by the TIME CODE key in the selection keys below the display. This will store the time code in the internal generator which will immediately start counting from this value, providing the internal generator is not on HOLD (see STATUS displays). If this is the case then the value will be stored but the internal generator will not start to count until the time code channel is put into RECORD. ERROR 02 will appear on the display if the time code entered does not conform to a valid time. If this happens, re-enter the correct time value on the numerical keypad, and re-store it. Error 04 will appear if an attempt is made to set the generator when setting is prohibited. To allow setting select status, move to the fifteenth line of the menu, press MOD and the display will show Prot. oFF. Then set the generator again as above. To reset the internal generator to zero, set it as above but enter a zero to the display before pressing STO.

The internal generator may also be modified in the following manner. Select the internal generator to the display and then press the STO key which will freeze the display. Then press MOD and the led will light. Turning the control wheel will now modify the time code. Once the modification is complete press STO followed by TIME CODE, and the internal generator will continue from this new value.

Setting the USER BITS only from the keyboard is done in exactly the same way as above except the display selection key must be USER BITS after STO is pressed. The user bits must conform to one of two standards (DATE or FREE).

If the user bits are in the date mode then they must be in the DD.MM:YY.xx format. If an attempt to set them is made and they do not conform to the correct format then ERROR 03 will be displayed. If the USER BITS are set to FREE mode then each of the positions can be set to any value between 0 and F (hex). The letters A,B,C,D,E and F are programmed by first pressing MOD and then the numbers 0-5 which correspond to the letters A-F respectively. Changing the mode of the USER BITS from DATE to FREE is done by means of the dil switch on the leading edge of time code circuit A 05.

2 : FROM AN EXTERNAL SOURCE (time code and user bits)

To set the internal generator from an external source, first make sure that a time code signal is present at the time code input either on the LEMO connector on the front of the time code circuit or on the 3-pin XLR connector on the rear panel of the machine. Then ensure that the frame rate of the internal generator of the machine is set to the same frame rate as the external signal. Setting of the time code is then effected as follows. Select the time code channel status matrix to INPUT and then select TIME CODE on the display. Check that the external time code is correctly arriving on the display and that the EXT TC led to the left of the display is lit. Then while pressing the INPUT key on the channel matrix press the STO key. The time code channel will switch to internal generator and continue counting. If an ERROR message should occur check the status menu of the machine to ensure the setting is not inhibited. Setting the time code from external in this manner will only set the time portion of the code. To set the user bits proceed in the same manner as above but select USER BITS to the display before pressing input and STO.

Once the setting has been made the cable can be removed and the internal generator will continue from the set value. The user bits when in DATE mode will automatically be incremented when the internal generator passes midnight.

STRIPING A TAPE WITH TIME CODE

In order to carry out insert editing it is necessary to have a time coded tape. As the T-Audio is fitted with an internal generator, it is therefore possible to leave the T-Audio to stripe a tape without affecting the operation of any of the other machines in the studio. In order to do this proceed as follows :
Put a new tape onto the T-Audio and select the machine to time code operation at the desired frame rate (The TA-HSX high stability time base option must be fitted if 29.97 fps is to be recorded). Then select INT GEN and time code to the display. The generator may be set to a desired value if necessary. Then select the time code channel matrix to READY, press PLAY and RECORD and the machine will start to record.

JAM SYNC FROM TAPE

The internal generator can also make a jam sync off tape, which makes it possible to continue a time code recording that stops in the middle of a tape, without causing any numerical discontinuities. The old and the new code will be perfectly sequential, however one complete time code word will be lost (drop out) at the point where the new code is recorded. This is done by moving the transport back a short way to a point on the tape where the original time code is still present. Then set the time code channel matrix to READY and REPRO. Press PLAY and once the tape speed has stabilized press PLAY and RECORD. At that point the machine will start to record a new time code track. Ensure that the time code led lights up. If the machine passes into PARK check the position of the record inhibit switch on the right-hand side of the main logic circuit. The machine will continue to record time code until another transport key is pressed or the time code channel is switched to SAFE. However, in order to make a clean exit from recording it is recommended to press PLAY followed by STOP.

4

4 - 3 SYNCHRONIZATION

INTERNAL SYNCHRONIZER

The internal time code chase synchronizer cannot be recognized as a hardware circuit in the T-Audio's time code electronics. Time code circuit A 05, essentially contains a micro-processor with peripheral hardware controlling the time code functions. The internal synchronizer itself therefore is entirely software which coupled with the low inertia twin capstan transport makes the system very fast at synchronizing and extremely flexible. If the machine is fitted with the software including the internal synchronizer then the status display menu will show a letter S after the software version.

Once the synchronizer has been activated the T-Audio will park within 1 frame of the master should the master stop. During shuttle the T-Audio will use vari-speed shuttle in order to keep as close to the master as possible. The typical lock up time from standstill to nominal speed and locked to the reference is 2.5 sec. The LOCKED status is reached when the DELTA between the time code on the tape and the external reference falls below 65 bits during 16 consecutive frames, and this is indicated by means of the led on the left-hand side of the display.

The synchronizer can also lock the transport to the time code reference in reverse at nominal speed.

Chasing is done using the numerical values of the two separate time code signals until the locked state is reached, and then phase resolving is done between the two bit streams to ensure exact phase stable synchronization.

The internal synchronizer is not disturbed by having the audio channels of the machine in RECORD. Thus synchronized insert editing is possible.

Two different modes of synchronization of the T-Audio are available with the TACA-TC2 keyboard. One mode is data dependent, taking into account the pre-programmed offset value stored in the offset register. The other one is data independent, re-calculating a new offset as soon as the mode is entered. Synchronization on the tape timer may also be achieved by selecting the time code channel to OFF:

SYNC

This is the standard mode (data dependent) for the synchronizer. The T-Audio will try to stay as close as possible to the connected master at any speed and in either direction. When the master is at nominal speed, the T-Audio will lock very accurately and the LOCKED led will light up as soon as DELTA has decreased to less than 65 bits during 16 consecutive frames. Once locked, the T-Audio will not react immediately on speed variations of the master. A reaction time (initially set to 15 frames) is applied, thus providing protection against dropouts. SYNC mode can be cancelled by pressing on the key again. The T-Audio will then keep its former speed. Numerical command 012 gives access to the reaction time. Changing the offset manually using the control wheel or the numerical keypad is described under DISPLAY SELECTION OFFSET KEY on page 21.

SYNC INCREMENTAL

This mode (data independent) is identical to SYNC as far as the tape transport behavior is concerned. Additionally, automatic OFFSET adjustment is performed at the moment the SYNC INC key is pressed. When a discontinuity is encountered in either master or off tape time code, with the T-Audio locked at nominal speed, the same will be added spontaneously to the value in the offset register. SYNC INC mode can be cancelled by pressing on the key again. The T-Audio will then keep its former speed.

If the master stops the T-Audio will continue for the reaction time while in either of the above synchronization modes. Upon reaching this it will stop then reverse to the same time code value as the master.

nagra

4 - 4 RESOLVING OF TIME CODE TAPES

Thanks to the fact that the time code signal contains clocking information in addition to numerical position information, it can be used as a pilot frequency (speed reference) allowing simple resolving. The resolving is performed by the internal time code synchronizer which means that the pilot resolver TAPFM is not necessary for time code resolving. To set the internal synchronizer to the resolver mode select the reference selection line of the status display onto the display and press MOD until the frame pulse reference is on display (rEF Fr P). However when the external reference is a time code, the display must be set to reference time code.

EXTERNAL TIME CODE REFERENCE

The machine may be left in the normal time code chaser mode for this operation. Feed the time code reference to either the time code input XLR connector on the rear panel of the machine, or to the LEMO connector on the front of the time code circuit. Verify the reception of this signal by setting the time code channel status matrix to INPUT : the incoming time code should be displayed. Be sure that the frame rate of the reference is the same as the frame rate on the tape. To start resolving simply press SYNC INC.

EXTERNAL PILOT REFERENCE (machine not fitted with TACO-D2R or D2RS)

Set the machine into resolver mode by selecting the reference selection line of the status display menu to the display and then press the MOD key until the display shows REFERENCE FRAME PULSE (rEF Fr P). Feed the reference signal of 25 Hz (for 25 FPS time code on the tape) to pin 2 of the THIRD TRACK INPUT/OUTPUT connector on the rear of the machine. Check that the S 1· reference switch on the center of the time code circuit is set to the EXTERNAL position (towards the front of the machine). Verify that the EXT TC led to the left of the display is alight and then press the SYNC INC key. The tape will start to move and after a short time the TC LOCKED led will light.

4

EXTERNAL PILOT REFERENCE (machine fitted with TACO-D2R or D2RS)

If the machine is fitted with either the TACO-D2R or the TACO-D2RS then there are two possibilities of resolving to an external pilot signal. They are as follows :

1)   **Reference the same frame rate as the time code**

Set the machine into resolver mode by selecting the reference selection line of the status display menu to the display and then press the MOD key until the display shows REFERENCE FRAME PULSE (rEF Fr P). Feed the reference signal of 25 Hz (for 25 FPS time code on the tape or 30 Hz for 30 fps time code) to pin 2 of the THIRD TRACK INPUT/OUTPUT connector on the rear of the TACO-D2R (this is a parallel socket as the socket on the machine is already occupied by the TACO-M1). Set the reference selector of the TACO-D2R to the EXTERNAL position. Set the frame rate selector of the TACO-D2R to the PILOT 1/1 position. Check that reference switch S 1 on the center of the time code circuit is set to the EXTERNAL position (towards the front of the machine). Verify that the EXT TC led to the left of the display is alight and then press the SYNC INC key. The tape will start to move and after a short time the TC LOCKED led will light.

2)   **50/60 Hz reference**

Set the machine in exactly the same way as above except select the frame rate selector on the TACO-D2R to the PILOT 1/2 position and connect a reference of 50 (or 60 Hz depending the frame rate of the time code on the tape) to the reference input.

nagra

RESOLVING AGAINST THE INTERNAL GENERATOR

Select the internal time code generator by pressing INT GEN. Set the machine into the normal time code mode by selecting the reference selection line of the status display menu to the display and then press the MOD key until the display shows REFERENCE TIME CODE (rEF tc). Use of the optional high stability time base TAHSX is strongly recommended for this operation. Ensure that the machine is set to the same frame rate as the time code on the tape. Put a loop between the time code input and the time code output on the XLR connectors on the rear of the machine, or between pins 2 and 5 of the LEMO connector on the front panel of the time code circuit. Press SYNC INC and the machine will then start to self resolve. The TC LOCKED led will light up as soon as the resolved play speed is reached.

NOTE :   It is possible to switch one or both of the audio channels into record as soon as the transport is locked and the TC LOCKED led is alight, in any of the above modes. This allows the resolved recording of sound onto a tape that was previously recorded with time code.

4 - 5 EDITING

This section explains the internal editing possibilities of the T-Audio TC itself. Control of the T-Audio from an external video editor is explained in the section REMOTE CONTROL.

All three channels of the NAGRA T-Audio time code are completely independent, and it is therefore possible to record a time code onto an audio tape that already has the audio portion recorded without any detrimental effects to the original audio. It is also possible to read an already recorded time code from the centre track while recording audio on one or both of the audio channels. This means that the internal synchronizer can use this time code to lock the tape transport to an external reference while recording audio, and hence make synchronized recordings. For almost all editing operations the audio tape must be pre-striped with time code. This can be done either from an external source or from the internal generator.

The switching between RECORD and PLAY during editing will not result in an audible "click" in the sound track. This is because the bias, erase and record amplifiers are controlled in such a way, that a miniature cross-fade occurs during the switching. The timing circuits take into account the relationship between the tape speed and the erase head and the record head. In order to ensure correct timing the tape needs to be at nominal speed. If the T-Audio is started in record directly from stop, or manually stopped when in record, clicks may be recorded onto the tape. When in automatic editing, the record function will be automatically switched off if the synchronizer detects a speed change of the reference which may result in an audible effect.

MANUAL EDITING

When the transport is either LOCKED to the reference or in non-sync playback, manual "punch in" and "punch out" editing may be made on either of the two audio channels, that have previously been selected to READY. This may result in a click on the monitoring output, however this will not be recorded onto the tape.

NON-SYNCHRONOUS

Select the desired channel(s) to be recorded to READY and stop the T-Audio at a point sufficiently ahead of the point where the punch in is to be made. Then press PLAY on the keyboard and then at the desired punch in point press PLAY + REC together. To exit cleanly from record press PLAY at the desired punch-out point first, followed by STOP.

SYNCHRONOUS

Select the desired channel(s) to be recorded to READY and then select the time code channel matrix to SYNC. This will reference the time code to the record head rather than the replay head. Make sure that there is a valid time code reference being fed to the time code input, and that it corresponds to the frame rate of the machine. Activate the internal synchronizer in either SYNC or SYNC INC mode and then park the machines sufficiently ahead of the point where the punch "IN" point is to be, so as to allow enough pre-roll time. This pre-roll time may be very short as the T-Audio has a very low inertia transport, however 5 seconds is a generally accepted pre-roll time. Start the master in play and then put the T-Audio into record by pressing PLAY + REC at the desired moment. Make sure that the LOCKED led is alight before the T-Audio is put into record. If this is not the case then incorrect switching of the audio channels may occur. At the punch "OUT" point press PLAY on the T-Audio to exit from record followed by STOP, to avoid clicks being recorded.

AUTOMATIC EDITING (using cue memories)

There are 10 cue memories (0-9) in the TACA-TC2. CUE 1 is reserved principally for the edit "IN" point when making automatic editing, and CUE 2 is reserved for the edit "OUT" point. Storing a cue value may be done either by entering the value using the numerical keypad followed by STO and then CUE and the number 1 or 2 (IN or OUT point), or alternatively by pressing STO while the tape is in playback followed by the CUE and the number, thus storing a value from the tape "on the fly". Once both the edit "IN" and "OUT" points have been entered into the cue memories, they can be modified if necessary (see MOD).

REHEARSAL OF THE EDIT

Rehearsal of the edit can be made with the audio channels in either the SYNC position or in the repro position depending on the selection made in the status display menu.
Put the desired audio channels of the machine into READY and select CUE 1 to the display using the CUE and "1" keys together and then press GO TO DISPLAY. The T-Audio will automatically locate a point at the preselected pre-roll time ahead of this "IN" point and stop (this pre-roll is programmable using NUM 010 followed by storing the desired pre-roll time). Then press PREVIEW thus activating the editor. Make sure that there is a valid time code reference being fed to the time code input, and that it corresponds to the frame rate of the machine. Press SYNC INC and the transport will start in playback locked to the external reference. At CUE 1 the selected audio channels will switch to INPUT and the signal at the input can be monitored. Upon arrival at CUE 2 the channel(s) being edited will return to REPRO. A preview of an edit may be made with the audio channels switching from SYNC to INPUT and back if required and this is selected in the status menu and toggled from one to the other using the MOD key. When the operator is satisfied with the "preview" the edit can then be performed.

MAKING THE EDIT

The procedure for actually making the insert edit is the same as for the preview above except the AUTO EDIT key is pressed instead of the PREVIEW key. When the edit IN point is reached then the selected audio channel(s) will pass from SYNC to INPUT and then return to SYNC at the "OUT" point. Also at the IN point the machine will put the selected channel(s) into record and the REC led in the REC key will light up.

FOLLOW ON EDITING

After the first edit has been made it may be necessary to make the IN point of the following edit at the "OUT" point of the previous edit and build up the finished product in this way. The easiest way to do this is to select CUE 2 onto the display and then press the STO key TWICE so that the led in the STO key is flashing. Then select CUE 1 and the old "OUT" point will be entered into the CUE 1 memory thus becoming the new "IN" point.

To switch off the PREVIEW or AUTO EDIT modes simply press the relevant key again and the led will go out.

4 - 6 REMOTE CONTROL

There are various different means of remote controlling a T-Audio, these being :

> KEYBOARD
> PARALLEL
> SPARE
> SERIAL

KEYBOARD

The **NTA. 3**TC can be controlled by means of any additional TACA keyboard without any form of modification to the machine. It is simply connected to the second TA-PPA keyboard connector on the left-hand side of the machine. If a second TACA-TC2 keyboard is to be connected then some modifications will be needed, and extension cables will be necessary.

Remoting of the following :

4 - 7 SECOND KEYBOARD CONNECTION

A : EXISTING TACA-TC2 ON MACHINES NOT FITTED WITH TA-RSA

Two extension cables are required when remoting a TACA-TC2 keyboard. The first cable (TAC4R-14 n° 09659) is an RS-422 extension cable which connects between the RS-422 (9-pin connector) of the keyboard to the RS-422 connector (BJ 13) on the right-hand side rear panel of the machine. The second cable is a serial bus and powering cable TATCC-14 (09500) which connects between the shorter cable of the keyboard and the serial bus connector on the right-hand side of the machine.
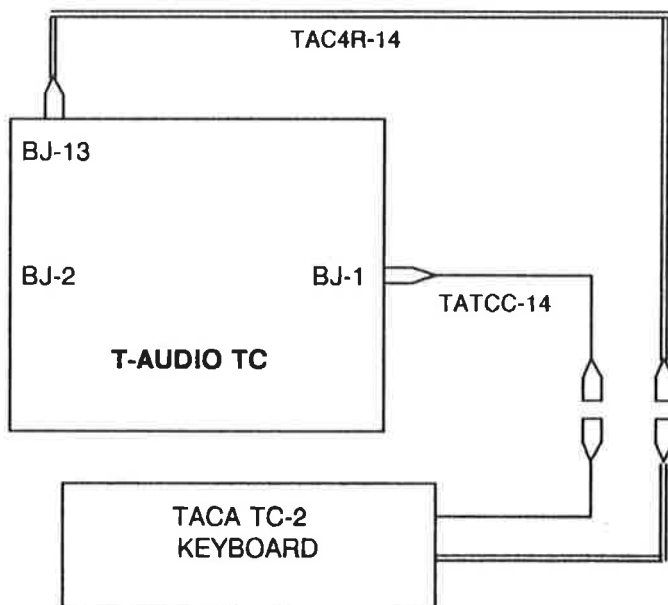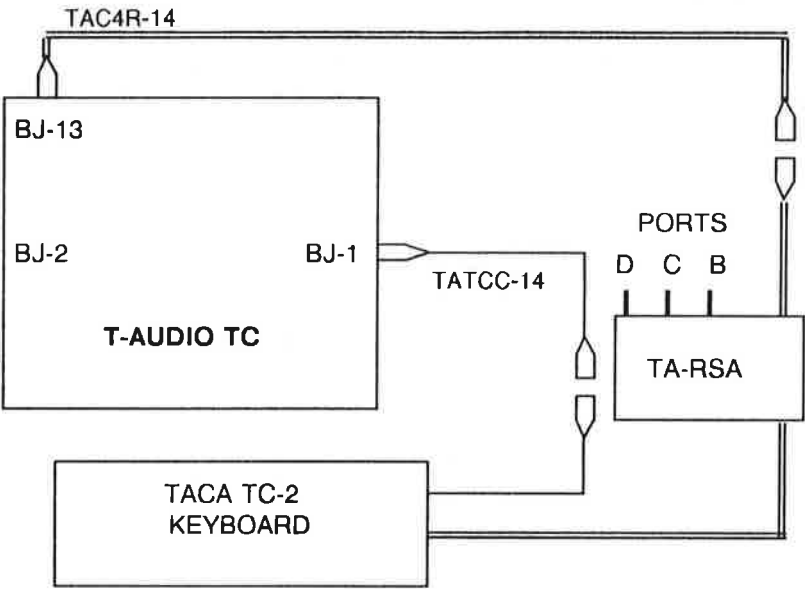
SCHEMATIC

B : <u>EXISTING TACA-TC2 ON MACHINES FITTED WITH TA-RSA</u>

Connection is as above except the TAC4R-14 connects onto the cable coming from the TA-RSA as opposed to the keyboard directly.
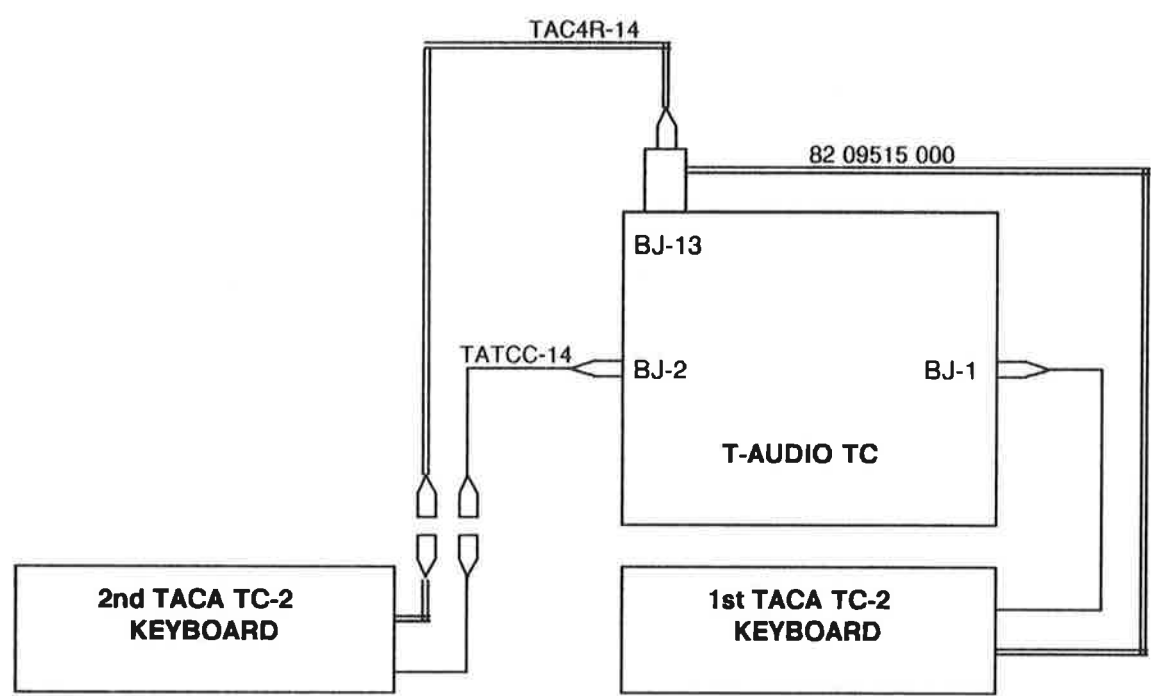
SCHEMATIC

C : A SECOND TACA-TC2 ON MACHINES NOT FITTED WITH TA-RSA

NOTE : A MODIFICATION IS NEEDED TO USE TWO TACA-TC2 KEYBOARDS SIMULTANEOUSLY ON A T-AUDIO TC.(SEE PAGE 71)

To connect a second TACA-TC2 to a machine not fitted with a TA-RSA the cable from the existing keyboard must be fitted with the special "T" cable (P/N 82 09515 000) between the keyboard and the machine. The RS-422 extension cable connects between this "T" type connector (which is in turn plugged directly into the machine) and into the second keyboard. This cable must be used in conjunction with the TATCC-14 (09500) serial bus and powering extension cable, which in this case must be connected to the second keyboard adapter on the left-hand side of the machine.

SCHEMATIC

D : <u>SECOND TACA-TC2 ON MACHINES FITTED WITH A TA-RSA</u>

NOTE :   A MODIFICATION IS NEEDED TO USE TWO TACA-TC2 KEYBOARDS SIMULTANEOUSLY ON A T-AUDIO TC.(SEE END)

In this case the existing TACA-TC2 is left as normal and the second is connected using the extension cable into the TA-RSA port B on the rear panel of the machine. The other end of the cable connects to the RS-422 connector on the second keyboard. This is also used in conjunction with the TATCC-14 (09500) serial bus extension cable.

SCHEMATIC
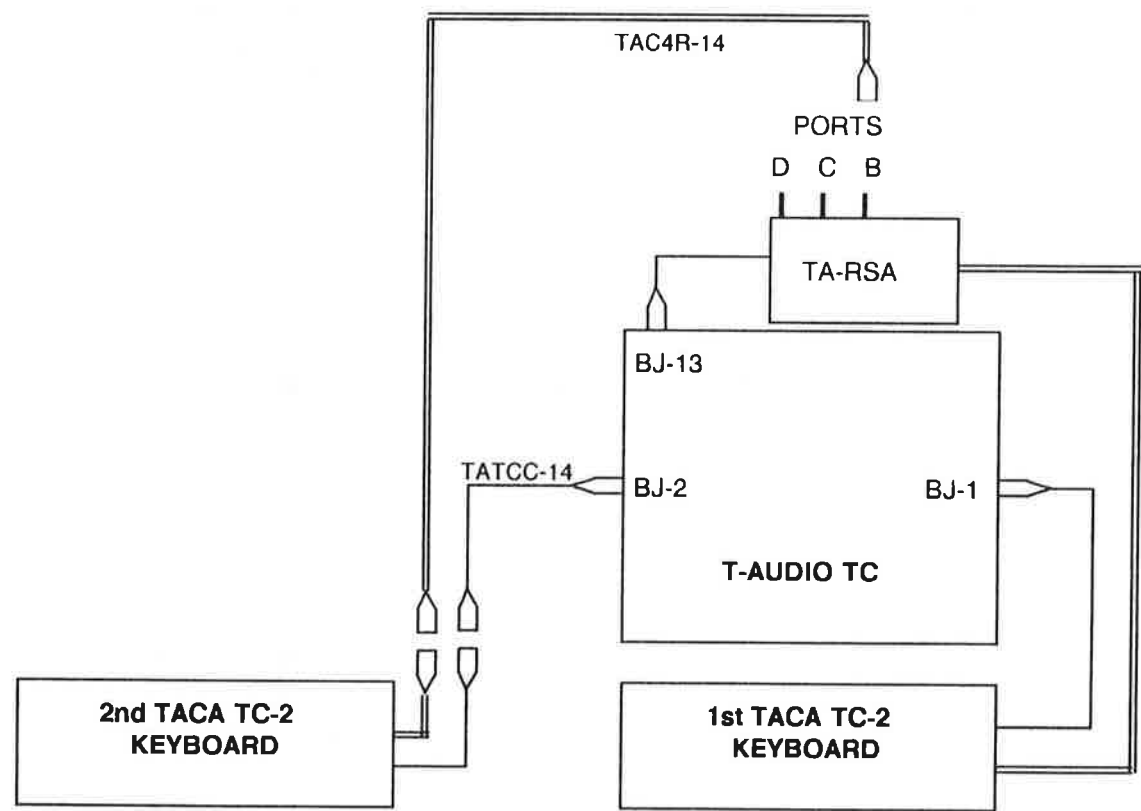
MODIFICATION NEEDED TO RUN TWO TACA-TC2 KEYBOARDS SIMULTANEOUSLY

When two TACA-TC2 keyboards are fitted to one T-Audio TC the two functions JOG and SHUTTLE interfere with each other. In order to prevent this it is necessary to disable these two functions in one of the two keyboards, as follows :

On one of the two keyboards, un-solder and carefully insulate the two wires 8 and 9 marked servo A and servo B (green and blue respectively) located by TP 19 and TP 20 on main circuit A44b (91 09426 000). This will disable the JOG function from this keyboard. Then remove the small brown 4-pin connector on the servo wheel circuit which is done by first loosening the fixing screw and then removing the connector completely. This will stop any interaction of the two keyboards in the SHUTTLE mode.
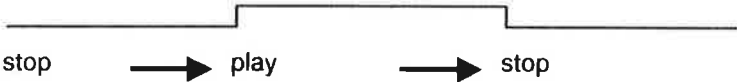
PARALLEL REMOTE CONTROL

Parallel remote control of the T-Audio is only possible through the TAERP parallel interface. A full description of the commands used by this external interface is given in the service manual under the section EXTERNAL ACCESSORIES.
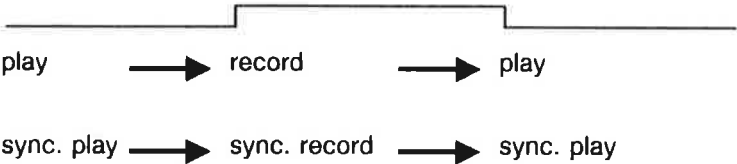
SPARE 2

The SPARE 2 input on the THIRD TRACK INPUT / OUTPUT CONNECTOR on the rear panel of the machine can be set to have several different programmed functions. These are stepped through using the MOD key when in the status display mode, the initial setting of which is SP2 oFF. SP2 PLAY indicates that a constant 5V signal on the spare 2 input will put the machine into playback, for as long as the signal is present. SP2 rEC is as above but the selected channels will pass into record. SP2 LoAd will put the machine into LOAD. SP2 P to will put the machine into playback upon receiving a pulse and then return it to stop upon receiving the following pulse, thus toggling. SP2 r to will toggle the selected channels of the machine between playback and record as above.

This allows simple remote control possibilities.

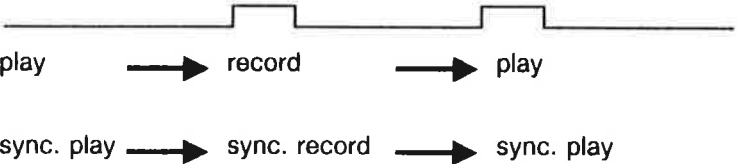Spare 2 programmed play (Numerical code 301)

stop ➤ play ➤ stop

Spare 2 programmed play/rec (Numerical code 302)

play ➤ record ➤ play

sync. play ➤ sync. record ➤ sync. play

Spare 2 programmed toggle play (Numerical code 305)

150 ms (minimum)

stop ➤ play ➤ stop

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

play ➤ record ➤ play

sync. play ➤ sync. record ➤ sync. play

SERIAL REMOTE CONTROL THROUGH RS-422

The T-Audio may be remote controlled using RS-422 if the TA-RSA option is fitted to the machine. The TA-RSA in conjunction with the hardware in the TACA-TC2 allows the machine to communicate serially at 19'200 Bauds using the NAGRA protocol via port B. It can also communicate with a video editor using either SONY or AMPEX protocols via port C at the standard rate of 38'400 Bauds and can use the port D to control a second recorder machine when used on a small video editor having a single recorder possibility.

REMOTE CONTROL THROUGH THE TA-RSA

HARDWARE DESCRIPTION

The TA-RSA is a small square adapter that mounts onto the rear panel of the T-Audio TC. One end is hard wired to the TACA-TC2 keyboard, and the other is fitted with a standard RS-422 9-pin connector. This RS-422 connector plugs into BJ 13 (RS-422 IN/OUT INTERFACE) connector on the rear panel of the machine. The other three remaining RS-422 sockets are used for connection to video edit controllers, parallel VTR recorder, TAERS, computers etc.
The TA-RSA is also fitted with two BNC type connectors. These are connected together to allow a loop through, and are used to receive a PAL or NTSC "HOUSE" video signal allowing correct synchronization when the machine is being used in video editing situations. A 75 Ohm termination can be switched in and out of circuit if necessary.

NOTE : The TA-RSA includes the necessary electronics to extract a square reference signal from the video reference signal. The reference signal is sent to the TACA-TC2 keyboard where it is mainly used to synchronize the RS-422 communication with the video recorder connected to port D when in the Sony-2 mode of operation. The reference signal is also sent to the internal synchronizer of the T-Audio which it will use as the external speed reference whenever it is in the mode REFERENCE FRAME PULSE. In order to ensure that this synchronization is done with perfect phase accuracy (and not one video field too late) it is necessary to place a resistor bridge in one of the two following positions in the TA-RSA :

220 Ω resistor in position :

1)   R18 (default ex-factory position) if there is no TAPFM pilot resolver installed on the time code circuit or if the TAPFM is installed and its switch is in the position "TACO-R" (BI-PHASE).

2)   R19 position if the TAPFM is installed and the switch is in the position "NORMAL"

4 - 8 PROTOCOLS

The term protocols can best be understood as "languages". This is because at present there are two main protocols used by video edit controllers. The first being the AMPEX protocol used by the ACE series of editors, the second being the SONY protocol as used by all BVE series editors. Most other editors such as CMX, PALTEX, GRASS VALLEY etc can use either of these protocols. The TA-RSA has been designed in conjunction with the TACA-TC2 keyboard to allow remote control of the T-Audio time code with either of these protocols, and to therefore emulate either an Ampex or one of three Sony video recorders as closely as possible. The third protocol accepted by the T-Audio time code is the NAGRA protocol.

The machine can be controlled by any of these protocols as long as the keyboard is set to either REMOTE or REMOTE + LOCAL.

PORT A   This is the cable that leaves the TA-RSA and connects directly to BJ-13 on the rear panel of the machine. This is the RS-422 communication between the TACA-TC2 and the time code circuit of the machine. This port cannot be used by the operator, for any other purpose.

PORT B   This is reserved for remote control using the NAGRA protocol. This port would be used to control the machine from a second keyboard, a computer or from a TAERS for example and communicates according to the following standard :
Baud rate 19.2 kBauds, parity : even, stop bits : two

PORT C   This port is used to connect the T-Audio to a video editor, using either the Ampex or Sony protocols, and communicates according to the following standard :
Baud rate 38.4 kBauds, parity : odd, stop bits : one

PORT D   This is used in conjunction with port C when using the Sony-2 protocol to connect a VTR (BVH, BVU or BVW) as a recorder simultaneously with the T-Audio, in order to allow true double system editing. This port communicates according to the same standard as port C.

The communication protocol to be used by ports C and D can be selected via the STATUS mode of the TACA-TC2. The choices available are as follows :

SONY	- One machine control (source or recorder)
SONY-2	- Two machine control (recorder)
AMPEX	- One machine control (source or recorder)
NAGRA	- Always available via port B

All these will be explained in turn.

4 - 9 SONY PROTOCOL

The Sony selection is only made when the machine is connected to its own dedicated port of the editor, as either a SOURCE or a RECORDER machine, according to the Sony protocol.

The Sony protocol in the NAGRA T-Audio has been designed in such a way as to emulate a Sony BVU 800 U-Matic VTR as closely as possible. However emulation of either a BVH 2000 or a BETACAM is also possible depending on the video editor. The software in the T-Audio allows the operator to control the machine in exactly the same way as he controls a video recorder. That is to say that all the transport controls and edit IN/OUT markings can be used in exactly the same way as they would be used for a VTR.

As stated earlier there are two different uses for the Sony protocol, referred to as SONY and SONY-2. Communication errors between the video editor and the T-Audio are indicated by the RS-422 C led flashing OFF. If there is no communication between the editor and the T-Audio then this led will remain OFF.

SONY (one machine control as a source or recorder)

Connect PORT C on the TA-RSA to the desired port of the editor using a 9-pin RS-422 cable. The "House reference" (either PAL or NTSC) must be fed to one of the BNC connectors also on the TA-RSA. There is a 75 Ω line termination, which may be switched in or out of circuit according to requirements.

Important note : The Record advance in the video editor must be set to 15 frames, if the machine is to be used as a recorder.

4

SCHEMATIC
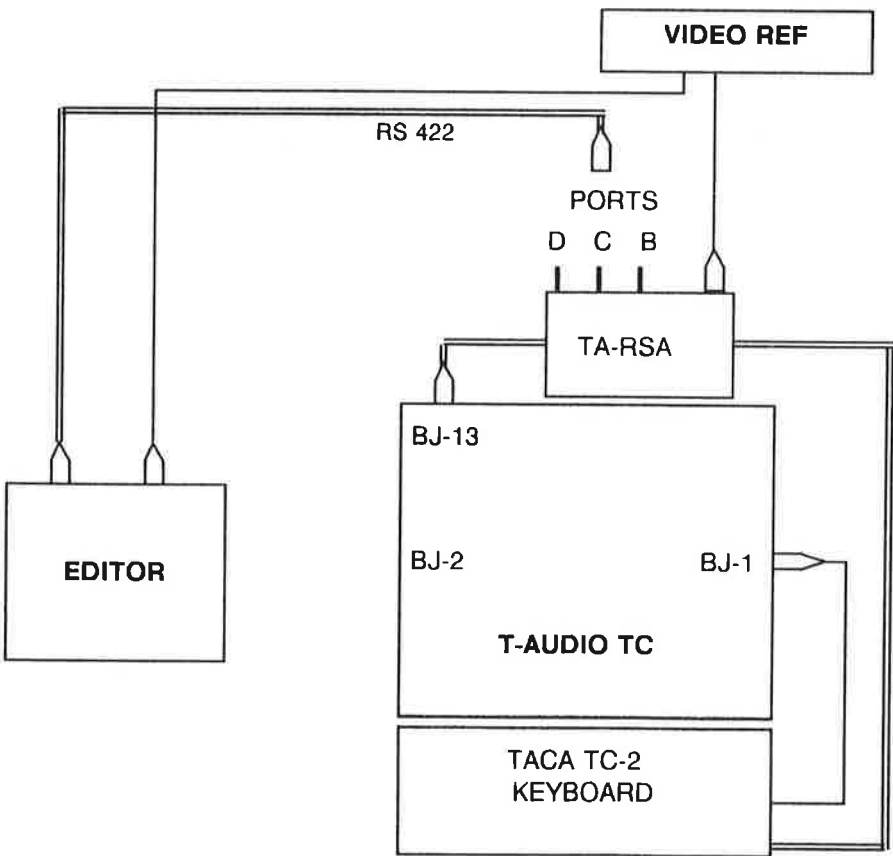
SYSTEM SET UP

In order to correctly emulate a SONY VTR there are certain settings needed to configure the T-Audio according to the requirements of the video editor. To access these set up features press the STATUS key on the TACA-TC2 and then scroll through the status menu using the " + " and "–" keys located on the numerical keypad. When the correct status position is located, its setting can be changed simply by pressing the MOD key. All such settings are stored in the permanent memory of the T-Audio itself and will not be lost on power down. Therefore they only need to be set once, when a different editor or VTR is being used. The STATUS listed below are the values that need to be changed according to the system. For additional status see "T-Audio status display"

NOTE : The features which are underlined are the default values.

BVU 800 /BVH 2000 / BETACAM / T-AUDIO

Set this to the chosen VTR to be emulated. The only difference between these settings is the device type answer to the editor. The answers to all other commands do not depend on the type of machine emulation selected. The software in the T-Audio has been designed to emulate a BVU 800, however some editors respond better when controlling another machine. The setting BETACAM on the TACA-TC2 is the position used to emulate a BVW-40. The position T-AUDIO is designed for video editors which can recognize the T-Audio, for example to set the edit advance to 15 frames with a PALTEX edit controller.

Identification :   id TA PAL   = 11 EO
                   id TA NTSC = 10 EO

STANDARD PLAY / SYNC PLAY

STANDARD play means non-synchronous playback except during editing. This mode should be selected whenever it is possible. SYNC play means that all play commands are interpreted by the T-Audio as play synchronously, and the machine is synchronized to the external video reference. This mode should only be selected when the STANDARD play mode does not cause synchronized playback during edits.

SPEED FAST / SPEED LTD

This is active only in the FAST FORWARD and FAST REWIND modes of the machine. When SPEED FAST mode is selected, then the tape is normally moved completely away from all the heads and time code can no longer be read from the tape. When SPEED LTD (limited) is selected then all FAST FORWARD and FAST REWIND commands are interpreted as maximum speed spooling commands, this is to say that the machine will go into SHUTTLE mode and the tape will remain in contact with the heads and the correct time code from the tape, instead of the counter roller, will be sent to the editor even at high speed. The maximum speed in this mode is naturally not as fast as in wind mode.
After the above selections have been made there are certain other settings that must be done on the T-Audio.

REFERENCE SELECTION

Using the STATUS key select the line of the status menu that determines the type of external reference that the T-Audio is expecting to receive. This can be changed by pressing the MOD key. The reference should be set to FRAME PULSE and this is shown on the display as rEF.Fr.P. However the reference mode is automatically selected when the Sony or Sony-2 protocols are selected (reference tc for Sony-2 mode) as soon as the editor is connected to the TA-RSA.
To be sure that the reference is being received by the T-Audio check that the led marked EXT TC is on without interruption. This also indicates if the external frame pulse reference is correct providing the correct reference setting is made in the STATUS of the machine.

EDIT REHEARSE MODE

When using the Sony protocol, the rehearse mode must be set to SYNC, this is shown as rEh SYnc on the display when the correct line of the STATUS menu is put onto the display. This position will give the correct synchronization between the time code on the tape and the audio.

NOTE :   The recommended mode of this selection is automatically selected when the editor is connected to the TA-RSA. However it may be changed as explained above if required.

4

SONY 2

This special use of the Sony protocol has been developed in order to allow two recorder machines to be connected simultaneously to the single recorder port of a small video editor. These being a record VTR and a T-Audio TC recorder. This permits real double system editing. This mode is normally only used with video editors that do not have multi recorder possibilities, such as the Sony BVE 800/900. This method of editing keeps the audio on separate 1/4 inch tape. This also has another advantage which is that the audio may be simultaneously recorded on both machines if necessary, giving a possibility of four audio tracks.

For two machine control on one single port of the editor, port C of the TA-RSA must be connected to the editor RECORDER port using an RS-422 cable and then port D of the TA-RSA must be connected to the RS-422 remote control port of the video machine. In this mode the VTR is connected to the editor via the T-Audio. Once again the external "house reference" must be connected to one of the two BNC connectors also on the TA-RSA (as well as on the VTR) and terminated with the termination switch if necessary.

The RS-422 D led on the TACA-TC2 will be ON permanently. If it goes OFF permanently an error in the communication with the VTR has occurred. If so, then check the connection between the T-Audio and the VTR. Make sure that the VTR is switched to the correct remote control mode.

NOTE :   In normal operation the information on the display of the video editor is that of the VTR and not of the T-Audio. However if control of the T-Audio only is selected then the information on the display of the editor will be the time code and status information of the T-Audio and not of the VTR. This selection can either be made in the TACA-TC2 or via the TA-BOX.

SCHEMATIC
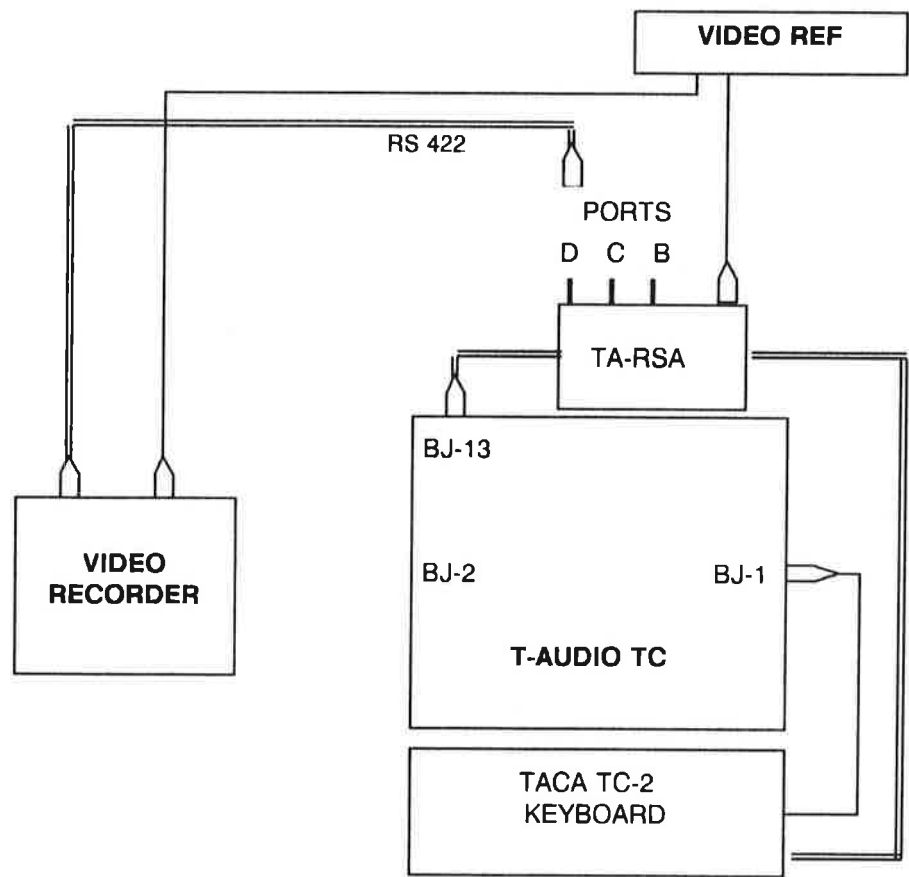
SYSTEM SET UP

The emulation of a Sony VTR by a T-Audio must be set up according to the requirements of the editor. Set the VTR identification according to the type of video machine which is being emulated. When using the two machine system then the following set up, as for normal Sony emulation, can be applied :

All the selections listed below can be made in the STATUS mode of the TACA-TC2 or more easily next to the editor if the TA-BOX accessory is connected to the machine, which remotes these selections from the keyboard.

TRANSPORT SELECTION

This status allows the operator to select which of the two parallel machines will be under the control of the editor. There are three possible selections :

MODE	DISPLAY
- Only the T-Audio transport	tSP t-A
- Only the video transport	tSP Vtr
- Both transports together	tSP botH

AUDIO RECORD SELECTION

This status is used to select on which machine the audio will be recorded during insert editing. This selection is only active when in the two machine control mode (tSP both) mentioned above. The audio can be recorded :

MODE	DISPLAY
- Only on the T-Audio	ArEC t-A
- Only on the Video machine	ArEC VTR
- On both machines simultaneously	ArECbotH

NOTE :   1.   Crash record commands will record audio on both machines irrespective of the above selection.

2.   For the above settings to be correctly set they must be selected when the machine is stopped and not during an edit.

VTR ADVANCE COMMAND

As the T-Audio has no scanner and hence no "flying" erase head it needs to receive the edit related commands 15 frames in advance of the edit "IN" point, it is therefore necessary to set the advance needed by the VTR in the TACA-TC2 so that the video does not make its inserts too early. To do this, execute numerical command 920 in order to access the VTR record advance value. To modify the value, simply type the new value onto the numerical keypad and then press the STO key. This value, is automatically set to the default value when choosing a new VTR, depending on the value needed for the particular VTR. For the T-Audio + VTR mode, the record advance command in the editor must be set to 15 frames.

THE TA-BOX TWO MACHINE AUDIO / VIDEO EDITING MODE CONTROLLER

The TA-BOX is a two machine audio / video editing mode controller accessory for the T-Audio time code (NTA.3 TCR). It is used in conjunction with the TACA-TC2 keyboard and the TA-RSA remote serial adapter. It is only needed when the machine is being used on the Sony-2 RS-422 protocol controlling two separate machines as recorders. The TA-BOX connects to the REMOTE CONTROL IN/OUT connector on the rear panel of the machine and is placed next to the video editor. This allows the operator, to select the control of either or both of the transports, when the T-Audio is located in the machine room away from the operator along with the VTR's. It also allows the selection between audio record on the T-Audio or on the VTR or on both machines simultaneously.
There are three smaller keys at the top that allow the selection of REPRO during record, which will leave the audio channels of the T-Audio in REPRO during the edit recording. The second of these small keys is for resetting the offset between the T-Audio's time code and that of the VTR. The third is for storing the offset between the machines if the time codes on the two tapes are not the same.These functions are all available on the TACA-TC2 keyboard, however usually the keyboard of the machine is not to hand.

USEFUL HINTS ON TWO MACHINE CONTROL

The way the system works, is that the T-Audio is synchronized to the VTR with time code using its internal synchronizer, and therefore it is necessary to pre-stripe the video tape with time code. While this is being done it is recommended to stripe the audio tape simultaneously with the same time code. The system will work perfectly with a time code offset, however this does make the work a little more difficult.

Selection of TRANSPORT CONTROL and AUDIO RECORD DESTINATION must be made in the STOP mode as there may be unpredictable results if these selections are made during an edit.

Finally, ensure that the pre-roll time selected is sufficient. A pre-roll time of between 7 and 10 seconds may be needed to get all the machines synchronized depending which type of video recorders are being used.

NOTE :   When working in the Sony-2 mode on the T-Audio, experience has shown that a minimum pre-roll time of 7 seconds allows for sufficient sync up time. This is because the T-Audio must wait for the VTR to stabilize before it can synchronize to it. However if it is really desired to reduce this pre-roll time (down to 6 or even 5 seconds) then reducing the reaction time of the T-Audio synchronizer may help. This can be done with NUM 012 on the TATC which allows modification of the reaction time (the default value of 15 frames may be reduced down to 10 frames or even 5 frames).

4

REQUIRED SETTINGS ON THE SONY 900 / 9000 EDITOR

These settings must be made for both the Sony and Sony-2 modes of operation. In order to perform accurate edits on the T-Audio, the following requirements need to be met in the editor :

Due to the distance between the erase and record heads of the T-Audio time code, all edit IN/OUT points must be sent to the T-Audio 15 frames in advance. This advance is automatically adjusted by the T-Audio depending on the tape speed, and the T-Audio in turn relays the commands to the VTR at the correct moment. The advance needed by the VTR can be programmed in the TACA-TC2 keyboard using numerical command 920. This should be set to 3, 5 or 6 frames (default automatic setting is 3 for BVU, 5 for BVW and 6 for BVH series) depending on the requirement of the VTR connected to the T-Audio.

SETTINGS IN THE BVE 900/9000 NECESSARY FOR T-AUDIO TC CONTROL WITH TACA-TC2 OR TAERS

As long as the TATC is not officially recognized by the Sony BVE 900, it is necessary to perform some internal settings within the permanent memory of the video editor, to optimize the edit performance and accuracy when controlling a NAGRA T-Audio. All these settings are made using the INIT mode in the editor. (refer to the Sony manual)
The following set up must be done upon initial installation of the machine whether it is being controlled through the TA-RSA or the TAERS.

INIT 1 :   (shift init) This is of no importance for the TATC.

INIT 2 :   (shift init followed by fs, or just fs after the above)

FRAME CONTROL MODE   : Drop frame or non drop frame.
                                              (NTSC systems only)
SYSTEM COLOUR FRAME REFERENCE   : External

(Shift init followed by shift rec on the editor)

MAIN BLOCK :

VTR ID   :   This allows the user to select the allocation of RS-422 ports and the source selection.

INTERFACE   :

BYTE 1 = 0   :   No switcher installed, channels switching on recorder machine.
BYTE 1 = 2   :   Switcher installed, no channel switching on the recorder machine.

VTR BLOCK 1 :   (Bytes 1 and 2 are the machine identification) These two bytes MUST be changed from their original FFFF value.

WARNING :   These two bytes must correspond to the position of the dil switches (S3) in the TAERS and the menu settings in the TACA-TC2 keyboard as well as the frame rate setting of the TATC. If they do not correspond then the TATC will not be recognized by the editor correctly, and the following settings will not be taken into account.

NOTE :   Betacam programming is not possible on the TAERS.

BYTES 3 and 4 :   Minimum pre-roll time

These must be set to the same value as is set for the emulated video recorder.

BYTE 5   :   Edit command advance

For the TATC, the edit "IN" and "OUT" point commands have to be advanced by 15 frames, because of the distance between the erase and record heads.

BYTE 6   :   EE command advance

This command must also be advanced by 15 frames.

NOTE :   All the correct values for the T-Audio are shown in the table on the next page and must be set as indicated.

BVE-900/9000 VTR CONTROL CONSTANTS (depending on VTR emulated)

PAL

GROUP 2,3		BLOCK 1,3,5,7						BLOCK 2,4,6,8						
VTR	**DEVICE TYPE**	**BYTE**						**BYTE**						
		3	4	5	6	7	8	1	2	3	4	5	6	7
T-AUDIO	11 E0	00	7D	0F	0F	02	03	0F	07	FF	00	01	64	7F
BVH-1100PS	01 11	00	AF	0F	0F	04	20	20	06	FF	00	03	32	7F
BVH-2000PS	01 11	00	7D	0F	0F	03	0B	0A	06	FC	00	83	33	7F
BVH-2180PS	01 11	00	7D	0F	0F	03	0B	0A	06	FC	00	83	33	7F
BVH-2500PS	01 11	00	7D	0F	0F	03	0B	0A	06	FC	00	83	33	7F
BVH-2800PS	01 11	00	7D	0F	0F	03	0B	0A	06	FC	00	83	33	7F
BVH-2830PS	01 11	00	7D	0F	0F	03	0B	0A	06	FC	00	83	33	7F
BVH-3000P	01 11	00	7D	0F	0F	07	10	0A	06	FC	00	83	33	7F
BVH-3100P	01 11	00	7D	0F	0F	07	10	0A	06	FC	00	83	33	7F
BVU-800P	11 00	00	7D	0F	0F	02	03	0F	07	FF	00	01	64	7F
BVU-820P	11 00	00	7D	0F	0F	02	03	0F	07	FF	00	01	64	7F
BVU-850P	11 00	00	7D	0F	0F	02	03	0F	07	FF	00	01	64	7F
BVU-870P	11 00	00	7D	0F	0F	02	03	0F	07	FF	00	01	64	7F
BVU-950P	11 00	00	7D	0F	0F	03	06	0A	04	FF	00	01	64	7F
BVW-10P	21 01	00	7D	0F	0F	02	02	0F	07	FB	00	83	32	7F
BVW-40P	21 01	00	7D	0F	0F	02	02	0F	07	FB	00	83	32	7F
BVW-11P	21 01	00	7D	0F	0F	02	03	1E	07	FB	00	83	32	7F
BVW-15P	21 01	00	7D	0F	0F	02	02	23	07	FB	00	83	33	7F
BVW-75P	21 01	00	7D	0F	0F	03	0A	0C	07	FB	00	83	33	7F

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NTSC

GROUP 2,3		BLOCK 1,3,5,7							BLOCK 2,4,6,8						
VTR	**DEVICE TYPE**	**BYTE**							**BYTE**						
		3	4	5	6	7	8	1	2	3	4	5	6	7
T-AUDIO **BVH-1100**	**10 E0**	00	96	**0F**	**0F**	**02**	**03**	0F	07	FF	00	00	78	**7F**
BVH-2000	**00 11**	00	96	**0F**	**0F**	03	0B	0A	06	FC	00	81	3D	**7F**
BVH-2180	**00 11**	00	96	**0F**	**0F**	03	0B	0A	06	FC	00	81	3D	**7F**
BVH-2500	**00 11**	00	96	**0F**	**0F**	03	0B	0A	06	FC	00	81	3D	**7F**
BVH-2800	**00 11**	00	96	**0F**	**0F**	03	0B	0A	06	FC	00	81	3D	**7F**
BVH-2830	**00 11**	00	96	**0F**	**0F**	03	0B	0A	06	FC	00	81	3D	**7F**
BVH-3000	**00 11**	00	96	**0F**	**0F**	07	10	0A	06	FC	00	81	3D	**7F**
BVH-3100	**00 11**	00	96	**0F**	**0F**	07	10	0A	06	FC	00	81	3D	**7F**
BVU-800	**10 00**	00	96	**0F**	**0F**	02	03	0F	07	FF	00	00	78	**7F**
BVU-820	**10 00**	00	96	**0F**	**0F**	02	03	0F	07	FF	00	00	78	**7F**
BVU-850	**10 00**	00	96	**0F**	**0F**	02	03	0F	07	FF	00	00	78	**7F**
BVU-870	**10 00**	00	96	**0F**	**0F**	02	03	0F	07	FF	00	00	78	**7F**
BVU-950	**10 00**	00	96	**0F**	**0F**	03	06	0A	04	FF	00	00	78	**7F**
BVW-10	**20 01**	00	96	**0F**	**0F**	02	02	0F	07	FB	00	81	3C	**7F**
BVW-40	**20 01**	00	96	**0F**	**0F**	02	02	0F	07	FB	00	81	3C	**7F**
BVW-11	**20 01**	00	96	**0F**	**0F**	02	03	1E	07	FB	00	81	3C	**7F**
BVW-15	**20 01**	00	96	**0F**	**0F**	02	02	23	07	FB	00	81	3D	**7F**
BVW-75	**20 01**	00	96	**0F**	**0F**	03	0A	0C	07	FB	00	81	33	**7F**

4

USING THE NAGRA T-AUDIO TC IN SONY-2 MODE

As only three types of video recorders are supported by the Sony software, set the machine identification (VTR BLOCK, Byte 1 & 2) to the generic type (half inch, three quarter inch or one inch), and unspecified values according to the effective model of the video recorder.

NOTE :   .When working in the Sony-2 mode on the T-Audio, experience has shown that a minimum pre-roll time of 7 seconds allows for sufficient sync up time. This is because the T-Audio must wait for the VTR to stabilize before it can synchronize to it. However if it is really desired to reduce this pre-roll time (down to 6 or even 5 seconds) then reducing the reaction time of the T-Audio synchronizer may help. This can be done with NUM 012 on the TATC which allows modification of the reaction time (the default value of 15 frames may be reduced down to 10 frames or even 5 frames).

NOTE :   On some editors the VTR "record advance" may be decreased by 1 frame with respect to the default value if necessary by means of a numerical command in the TACA-TC2 (NUM 920).

EXAMPLE FOR BVW 75 PAL (See table on previous pages)

BLOCK 1

BYTE 1	0010 0001 (21H)*	* Shows that
BYTE 2	0000 0001 (01H)*	this byte has to
BYTE 3	0000 0000 (00H)	be changed from
BYTE 4	0111 1101 (7DH)	the default
BYTE 5	0001 0001 (0FH)*	value.
BYTE 6	0001 0001 (0FH)*	
BYTE 7	0000 0010 (03H)	
BYTE 8	0000 1011 (0AH)	

BLOCK 2

BYTE 1	0000 1111 (0CH)
BYTE 2	0000 0111 (07H)
BYTE 3	1111 1011 (FBH)
BYTE 4	0000 0000 (00H)
BYTE 5	1000 0011 (83H)
BYTE 6	0011 0011 (33H)
BYTE 7	0111 1111 (7FH)*

NOTE :   The record advance value is automatically set to 5 frames when selecting Betacam in the status menu of the T-Audio. Use numerical command 920 to verify / modify if this necessary. Once this has been set it will remain in the memory until another VTR is selected for emulation.

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USING THE TAERS AND TA-RSA

It is possible to use both the original TAERS remote serial interface and the TA-RSA at the same time which allows the T-Audio to be either a player machine or a recorder. That is to say that the T-Audio will work as a recorder machine using the TA-RSA as explained above, and then via the TAERS as a player machine.

The main advantage of this system is that the T-Audio can be selected as either source or recorder from the edit controller without the need to re-cable the remote control on the TA-RSA.

SCHEMATIC OF POSSIBLE CONNECTION AS PLAYER AND RECORDER

4 - 10 AMPEX PROTOCOL

Port C of the TA-RSA is similarly used when using the Ampex protocol to communicate with video editors using the Ampex protocol, and must be connected to the required port of the editor. Communication errors are shown by the RS-422 port C led flashing off. If it remains permanently off then check the connection of the T-Audio with the editor. The software in the T-Audio will now support "NON STANDARD SPEED" editing with editors using the Ampex protocol (AMPEX ACE, AEG-TFK MOSAIC). Depending on the variable speed requested by the editor, one of the three following modes is selected :

Speed ranges from 93.5 to 106.5 % :

True synchronization with a continuously skewing offset.

Speed ranges from 87.5 to 93.5 % and speed ranges from 106.5 to 112.5% :

Both these latter two make the T-Audio set itself into variable speed PLAY and play as close as it can to the desired speed. (guaranteed speed accuracy ± 0.8%) There may be a slight delay at 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 desctibed ranges 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 become more important).

REQUIREMENTS ON THE EDITOR

In order to perform accurate edits on the T-Audio, the following requirements need to be met in the editor :

Due to the distance between the erase and record heads of the T-Audio time code, all edit IN/OUT points must be sent to the T-Audio at least 15 frames in advance.

The necessary advances are as follows :

PAL	19 cm/s :	12 frames
PAL	38 cm/s :	7 frames
NTSC	19 cm/s :	14 frames
NTSC	38 cm/s :	8 frames

As Ampex editors generally use "defer commands" sent a long time in advance, there should be no problem with these timings.

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SYSTEM CONNECTION

Port C of the TA-RSA must be connected to the selected port of the editor. The "house reference" video signal must also be connected to one of the two BNC sockets also located on the TA-RSA and then terminated by means of the line termination switch if necessary. If the reference is correctly decoded then the led EXT TC will light.

SCHEMATIC
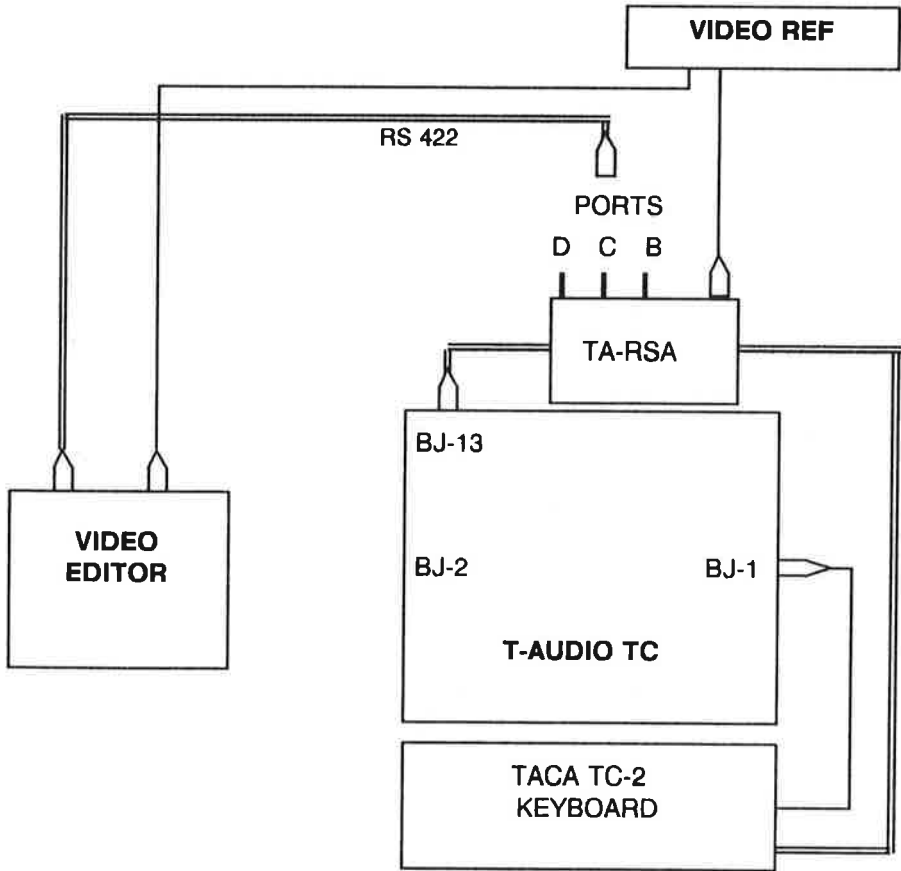
SYSTEM SET UP

The way in which the T-Audio reacts to certain commands sent by the editor may be set in the STATUS mode of the T-Audio. All these settings are stored in the internal permanent memory of the T-Audio and will not be lost when the power is cut.
Ensure that the T-Audio is switched to either the REMOTE or REMOTE + LOCAL position otherwise no communication will be made.
The selections underlined are the settings.

T-AUDIO / VPR-3

This will set the device identity code sent back to the editor. There is actually no difference in the way the T-Audio reacts to the commands received.

0 FRAME DELAY / 1 FRAME DELAY

This status allows the time code which is sent back from the T-Audio to be delayed by one frame or not. Selecting between 0 or 1 frame delay only has an effect on synchronization when used with a Grass Valley editor.

SPEED FAST / SPEED LTD (LIMITED)

The default setting (SPd FASt) means that the shuttle speed of the T-Audio is not limited and any fast forward or fast rewind commands are interpreted normally and the pinchwheel carriage will move away from the heads and the time code on the display will be updated from the counter roller. If MOD is pressed then the display will show (SPd Ltd) and in this case the shuttle speed is limited and the tape will always remain in contact with the time code head so that discontinuities and drop outs in the time code can be detected and accounted for.
To ensure continuous reading of time code, select SPEED LTD on the T-Audio which will always keep the tape in contact with the heads.

STANDARD EDITOR / GRASS VALLEY

Grass Valley editors need a specific software as they do not use the concept of TIME LINE which is the base of Ampex-like editing systems. Set this status to STANDARD EDITOR with any editor other than a Grass Valley.

MACHINE NUMBER

The Ampex protocol relies on the fact that each machine has a number. This number may be programmed into the T-Audio by means of numeric command 200. The new value is then entered onto the numeric keypad and is saved on the memory by pressing the STO key. The relationship between the machine no. and the RS-422 polling address is as follows :

Default value   Machine No 1 : Address 80A2H
                 Machine No 2 : Address 80A4H
                 etc

CONFIGURATION OF THE T-AUDIO

The following set up must be made on the T-Audio for use with an Ampex editor :

REFERENCE SELECTION

Using the status key selects the line of the status menu that determines the type of external reference that the T-Audio is expecting to receive. This can be changed from one to another by pressing the MOD key. The reference should be set to FRAME PULSE and this is shown on the display as rEF.Fr.P.
To check that the reference is being received by the T-Audio verify that the led marked EXT TC is lit without interruption. This also indicates if the external frame pulse reference is correct providing the correct reference setting is made in the STATUS of the machine.

EDIT REHEARSE MODE

When using the Ampex protocol the rehearse mode should be set to REPRO (rEh rEP) on the status display for the best performance.

4

NAGRA PROTOCOL

Port B is, as was previously mentioned, reserved to control the Nagra T-Audio time code from a second keyboard, a TAERS, a computer or an editor with the NAGRA protocol. The RS-422 B led will flash ON each time a command is recieved and correctly decoded by the TACA-TC2. Otherwise the led will remain OFF.

NOTE :   The TACA-TC2 must be in either the REMOTE or REMOTE + LOCAL position otherwise no commands will be accepted, and no status replies will be sent back from the machine to the controller.

(see APPENDIX A for NAGRA protocol)

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CHAPTER 5

PILOT

5

5 - PILOT

5 - 1 GENERAL

The T-Audio TC was originally designed as a time code chase synchronizing audio tape machine, specifically intended for the video post production market. In order to remain compatible with existing pilot systems, optional hardware was developed for the reproduction of such tapes, thus making the T-Audio TC a universal transfer machine. It can be fitted with two options that will allow it to make a resolved playback of pilot tapes recorded on any existing standard. This does not, of course, include the reading and / or resolving of pilot signals recorded on either of the audio channels on a stereo machine.

The T-Audio cannot be fitted with any means of recording pilot signals. Recordings made on a T-Audio should be made using centre-track time code.

What is PILOT ?

Pilot is a recorded speed reference, that can be used for accurate speed stabilization during replay of the tape, and is a format allowing RESOLVING.

Why do we need PILOT ?

Pilot is used so that the original audio track may be replayed at the same speed at which it was recorded, or the speed can be varied according to an external reference signal such as that furnished by a sprocket tape machine. Pilot may theoretically be any frequency, however 50 Hz was chosen for Europe and 60 Hz for the USA due to the ease of availability via the mains.

5

INT/EXT REFERENCE SWITCH

The INTERNAL/EXTERNAL S 1 reference switch, is a small red slide switch located in the centre of the upper part of time code circuit A 05. To change the position of this switch the time code circuit must be removed from the machine. This switch has two positions, and must be moved towards the front of the time code circuit (and hence the machine) in order to select EXTERNAL reference, and slide it towards the rear of the machine in order to select INTERNAL reference. When the switch is set to the "EXTERNAL" position the pilot resolver expects an external frequency (50 or 60 Hz according to the type of pilot tape on the machine) to be fed to pin 2 of the THIRD TRACK INPUT / OUTPUT connector on the rear panel of the machine.

NOTE :   The ex-factory setting of this switch is the EXTERNAL position and should remain in this position if a TACO-D2, D2R or D2RS monitoring option is being used with the machine, as in this case the EXTERNAL / INTERNAL switching is done directly on the front panel of the TACO-D2.

5 - 2 SELECTION OF PILOT MODE

Selecting between NEOPILOT and CENTRE-TRACK pilot is made by means of the dil switch S4-6 in the right-hand block of eight switches located on the front edge of time code circuit A05.

OFF = NEOPILOT
ON = CENTRE-TRACK

If the position of this switch is changed then the display of the machine will change to the selected mode (see T-AUDIO INTERNAL STATUS).

NOTE : To ensure cancellation of the pilot signals on the line output when playing back a NEOPILOT tape, switch S 101 on the front of the main logic circuit to the MONO position. If a residual crosstalk of the pilot signal is noticeable then it can be minimized by adjusting the replay level of channel 1 with respect to channel 2. This is performed by a slight trimming of potentiometer "REPRO LEVEL" RP 14 on circuit A01-A8 (located on the far left of the front edge of the audio circuit) Ensure to note carefully the original position of this potentiometer before altering it, so that it can be reverted to its "set up" position after the resolving of the specific tape has been completed.

NOTE : The INT TC led on the left of the display will also function when playing back a pilot tape to indicate that a correct pilot signal is being read from the tape. It will not light up if the speed of the machine is not the same as that of the recorded tape.

TAPFM CIRCUIT

This circuit can be installed onto the time code circuit, and connects to the two 8-pin connectors in the centre of the upper part of the two time code circuits. This allows the reading and resolving of tapes carrying centre-track pilot using the time code head of the machine. The circuit is compatible with both DIRECT (Stellavox) and FM (NAGRASYNC) pilot tapes. Resolving is possible with either the internal time code generator of the machine (the TA-HSX high stability time base option is recommended for this purpose) or with an external pilot signal, as a reference.

NOTE : If the centre-track of the tape has been recorded with commentary using the CUE mic (QSCM-2) on a NAGRA IV-SL then this too will be decoded and amplified and then fed to an asymmetrical line output.

F.M. PILOT (NAGRASYNC) system

This version of pilot is the version used on NAGRA IV-SL stereo machines. There is a central guard band where a third track can be recorded for speed control purposes. The central track is used and a 13.5 kHz carrier signal is modulated by the 50/60 Hz pilot signal. Due to the fact that this signal is recorded between the two audio tracks using a special centre-track head the audio replay head does not pick up this signal. When the tape is being replayed, the F.M. circuit demodulates the pilot signal, which is then used to control the speed of the capstan motor.

DIRECT / FM selection

This switch selects between DIRECT (Stellavox) pilot or F.M. NAGRASYNC (or F.M. Cue track). It is located on the leading edge of the TAPFM circuit and is a small slide switch. FM pilot operation is selected if moved to the left, and DIRECT pilot operation, if moved to the right. The time code circuit must be removed from the machine in order to alter the position of this switch. The two positions are marked on the printed circuit board itself as FM and DIR (F.M and ST on circuits without indices).

5 - 3 NEOPILOT SYSTEM

This is a system designed by Kudelski SA in 1961, for use with the NAGRA III. The same system was then installed in the NAGRA IV, 4.2, IS and E. This system is only used on mono tape recorders and the signal is actually recorded on top of the audio due to the fact that there is no central track. Recording 50/60 Hz on top of the audio would normally cause hum through the replay head, as it is a single track head. The NEOPILOT system consists of a head with two gaps in it, and two pilot signals are recorded onto the tape simultaneously, 180° out of phase. Therefore when the two signals arrive at the replay head they cancel each other out, and cause no audio interference. When the tape is replayed the pilot system reads both signals, one is inverted, and they are then electronically added together. The phase difference between the resulting sine wave and a reference (either internal or external) is used to control the D.C. supply to the capstan motor. This ensures that the required speed is maintained throughout. Thus the tape can be replayed at the recorded speed.

For NEOPILOT operation the machine MUST be fitted with both the TAPFM circuit described above and the TA-ONP head.

5

TA-ONP HEAD

This is a miniature neopilot playback head which must be factory fitted to the right-hand side of the inter head tape tension transducer in the head block. It is used to read NEOPILOT signals from tapes recorded in MONO on any of the following : NAGRA IV, 4.2, E or IS.

PILOT FREQUENCY SELECTION

The selection of the operating frequency of the pilot is made using the same dil switches that are used for the frame rate selection when in the time code mode. This is to say switches S4-1 and S4-2 on the right-hand block of eight on the front of the time code circuit. Again the display will be updated if either of these switches are changed. This is the same for all types of pilot.

NOTE :   If the machine has the TACO-D2RS option then these positions are changed using the switches on the overbridge unit instead of the time code circuit.

5 - 4 RESOLVING OF PILOT TAPES

Many people use the term synchronizing when discussing pilot, but synchronizing means locking a reference with a specific point on the tape. Due to the nature of pilot it is obvious that the 50/60 Hz recorded on the tape has no start or finish, and is the same throughout the duration of the recording. Therefore it is impossible to lock to any specific point on the tape unless previously located manually (which of course would mean returning to the "clap" each time the tapes were stopped).

NEOPILOT RECORDINGS

This explains how to resolve a Neopilot recording using a T-Audio TC against Internal and External reference signals with and without the TACO-D2 pilot and time code monitoring overbridge unit. It covers all switch settings and keyboard operations. Firstly ensure that the STATUS of the machine corresponds to the tape. Thus the machine must be switched to MONO on the logic circuit (to ensure cancellation of the pilot signals) and must be switched to 50/60 Hz NEOPILOT operation depending on the tape, using the dil switches on the front of the time code circuit.
Ensure that the machine is fitted with the TA-ONP and TAPFM pilot options.
Put the NEOPILOT tape on the machine, and set reference switch S 1 on time code circuit A 05-A 23 to the INTERNAL position (towards the rear of the machine).

1. WITHOUT TACO-D2, D2R or D2RS, using the internal generator

Check that the led EXT TC on the keyboard is alight. Set the PILOT mode of the machine as above, press SYNC INC on the keyboard and the tape will start. Ensure that the led INT TC is alight indicating that the NEOPILOT is being read and that after a short period of time the locked led will light. During resolving all FOUR leds on the left-hand side of the display should be alight.

2. WITHOUT TACO-D2,D2R or D2RS, using an EXTERNAL reference

Set the switch in the centre of the TAPFM pilot resolver circuit to the "NORMAL" position as indicated on the sticker on the circuit itself. Supply an external reference of 50/60 Hz +/–4% to pin 2 of the THIRD TRACK INPUT/OUTPUT connector on the rear panel of the machine. The level of the signal should be between 0.5 V and 4 V. Check that the EXT TC led on the keyboard is alight.
The machine is now ready to resolve the NEOPILOT tape to an external reference. Press SYNC INC on the keyboard and the tape will start. Ensure that the led INT TC is alight indicating that the NEOPILOT is being read and that after a short time the locked led will light. During resolving all FOUR leds on the left-hand side of the display should be alight.

3. WITH TACO-D2,D2R or D2RS, using the internal generator

Set the reference selector switch on the TACO-D2 to the INTERNAL position. Set the switch in the centre of the TAPFM pilot resolver circuit to the "NORMAL" position for a TACO-D2 or the "TACO-D2R" position as indicated on the sticker on the circuit itself if either the TACO-D2R or TACO-D2RS is fitted to the machine. Check that the EXT TC led on the keyboard is alight.
The machine is now ready to resolve the NEOPILOT tape to the internal generator. Press SYNC INC on the keyboard and the tape will start. Ensure that the led INT TC is alight indicating that the NEOPILOT is being read and that after a short time the locked led will light. During resolving all FOUR leds on the left-hand side of the display should be alight.

4. WITH TACO-D2, D2R or D2RS, using an EXTERNAL reference

Set the reference selector switch on the TACO-D2 to the EXTERNAL position. Set the switch in the centre of the TAPFM pilot resolver circuit to the "NORMAL" position for a TACO-D2 or the "TACO-D2R" position as indicated on the sticker on the circuit itself if either the TACO-D2R or TACO-D2RS is fitted to the machine. Supply an external reference of 50/60 Hz +/– 4% to pin 2 of the THIRD TRACK INPUT/OUTPUT connector on the rear of the TACO-D2 (RS) The level of the signal should be between 0.5 V and 4 V. Check that the EXT TC led on the keyboard is alight. The machine is now ready to resolve the NEOPILOT tape to an external reference. Press SYNC INC on the keyboard and the tape will start. Ensure that the led INT TC is alight indicating that the NEOPILOT is being read and that after a short time the locked led will light. During resolving all FOUR leds on the left-hand side of the display should be alight.

RESOLVING OF F.M. PILOT RECORDINGS

The resolving of F.M. NAGRASYNC pilot recordings made on a NAGRA IV-SL machine is effected in exactly the same way as for NEOPILOT tapes described in the four configurations 1, 2, 3 and 4 above except dil switch S4-6 on the front of time code circuit A 05 must be in the F.M. position, the slide switch on the TAPFM pilot resolver, circuit A 23, must be in the F.M. position and the STREO / MULTI TRACK / MONO switch must be in the STEREO or MULTI TRACK position.

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CHAPTER 6

SOFTWARE EVOLUTION

6

6 - SOFTWARE EVOLUTION

6 - 1 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 :

```
                                        ─── Indicates that this is in the machine.

                              ─── Actual version of the software.

                      ─── Type of PAL (in this case SYNC, or SYNC + RS 422)
    tA     2.4    S


    CP     1.4

               ─── Actual version of software in the keyboard.

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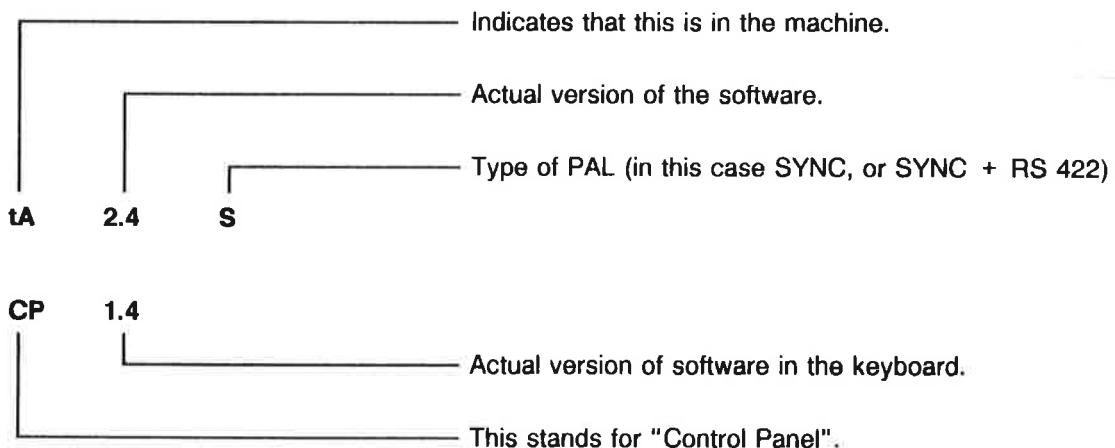
The first digit of the version indicates the hardware compatibility, thus as this version is 2.4 it cannot be installed in an older T-Audio which presently contains version 1.84 without a hardware modification (fitting of TACA-TC2 keyboard). However the version 1.4 in the keyboard can replace a version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

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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).

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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.

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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).

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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

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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.

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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

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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

CHAPTER 7

CONNECTIONS TO THE TA-TC

7 - CONNECTIONS TO THE TATC

7 - 1 BALANCED LINE INPUT

Type : XLR 3-pole female.

CHANNEL 1
(BJ5) (left)

Hi

Lo

CHANNEL 2
(Right) (BJ105)

SENSITIVITY
for 0 dB

390 mV
775 mV
1.25 V
1.55 V
3.1 V
4.4 V

(internal selection)

Zin > 10 k Ω

(BJ 5)   (BJ 105)
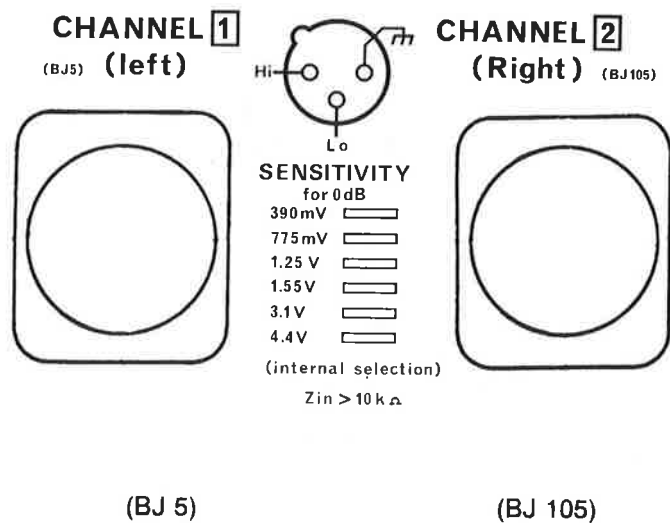
7 - 2 BALANCED LINE OUTPUT

Type : XLR 3-pin male.

CHANNEL 1
(BJ6) (left)

Hi

Lo

CHANNEL 2
(Right) (BJ106)

NOMINAL
LEVEL
for 0 dB

775 mV
1.25 V
1.55 V
4.4 V

(internal adjust.)

minimum load

impedance 200 Ω

(BJ 6)   (BJ 106)
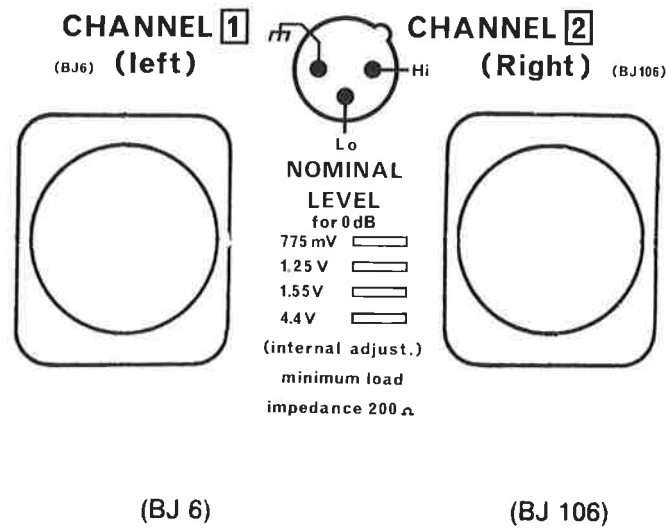
HIGH SPEED COPY (OPTIONAL)

These connectors allow copying at 30 i.p.s. between two NAGRA T-Audio machines. The input and output levels are fixed at 775 mV for 0 dB. The frequency response is fixed at 50 Hz – 60 kHz +/–2 dB. Special connection cable is available : Kudelski SA reference TACR (09505).

Type : 5-pole Tuchel female. Connecting plug 5-pin Tuchel male
(Kudelski SA part No 40 14 306 000)

INPUT
Sensitivity 775 mV
for 0 dB   (BJ 7)
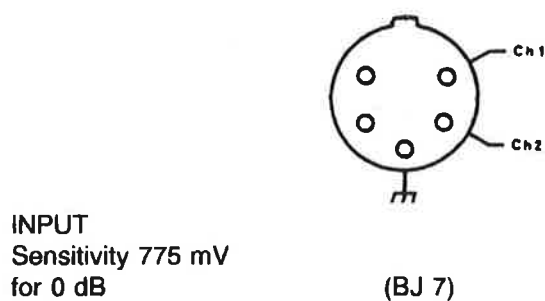
Type : 5-pin Tuchel male. Connecting plug 5-pole Tuchel female
(Kudelski SA part No 40 18 401 000)

OUTPUT
Level 775 mV
for 0 dB   (BJ 8)

nagra
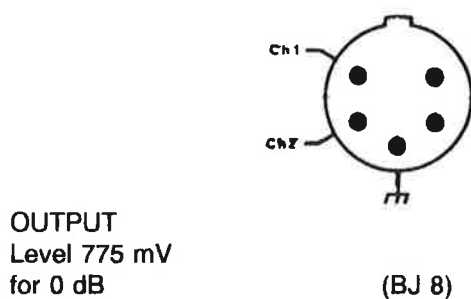
7 - 3 REMOTE CONTROL INPUT/OUTPUT

Type : Cannon "D" 25-pole female (mating plug Kudelski SA part No 40 25 025 000)

This socket permits the full remote control of the T-Audio by an external device through the TAERP parallel interface OR connection of a small remote keyboard TASKR OR the connection of a TA-BOX when the machine is being used in RS-422 mode in Sony-2 protocol.

```
D 1    ──┤1 O   O     ├── D 2
D 3    ──┤ O   O 14   ├── D 4
D 5    ──┤ O   O      ├── D 6
Shift  ──┤ O   O      ├── Clock
T.FWD  ──┤ O   O      ├── T.BWD
FWD in ──┤ O   O      ├── TC.Clock
D 8    ──┤ O   O      ├── BWD in
K.en   ──┤ O   O      ├── TC.Data
Pot.   ──┤ O   O      ├── Sp.cor.
Bus    ──┤ O   O      ├── ▽(+13V)
▽(+13V)──┤ O   O      ├── ▽(±7.5V)
+7.5V  ──┤ O   O 25   ├── ▽(±7,5V)
+13 V  ──┤13 O   O    ├── −7.5 V
```
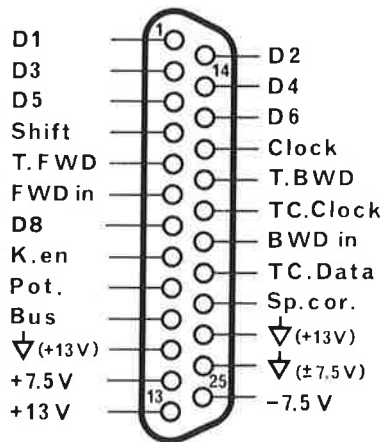
(BJ 3)

Other special remote facilities are also provided:

PIN	NAME	DESCRIPTION
5 & 18	T Fw	(tape forward and tape backward (T Bw)) indicates the tape motion and direction (150 pulses/second at 19 cm/s).
6 & 20	FW in	(forward) Bw. in (backwards) when the T-Audio is fitted with the TASC servo option (this is standard on all time code versions of the machine). These inputs may receive external pulses as incremental capstan positioning (4000 pulses/s max. corresponding to 38 cm/s)
9	Pot	Input for speed variator potentiometer. Speed correction value (0V to 5V) giving a variation of +/− 6.5 % if switch SI on A03 is on the speed variator position.
22	Sp.cor	(speed correction) Input of playback var. speed correction signal (−7.5 V to +7.5 V)
8	Ken	Keyboard enable. This can inhibit the use of the keyboard fitted to the machine if this pin is grounded.
7	TC play	Playback or monitoring of the time code signal recorded on the tape.
21	TC data	TC Clk, time code clock (pin 19) outputs signals from the internal playback tc decoder.

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

7 - 4 AUDIO MONITORING OUTPUT

Type : Cannon "D" 25-pole female (mating plug Kudelski SA part No 40 25 025 000)

This connector provides connection for an external monitoring console, and external time code devices. The following connections are possible:
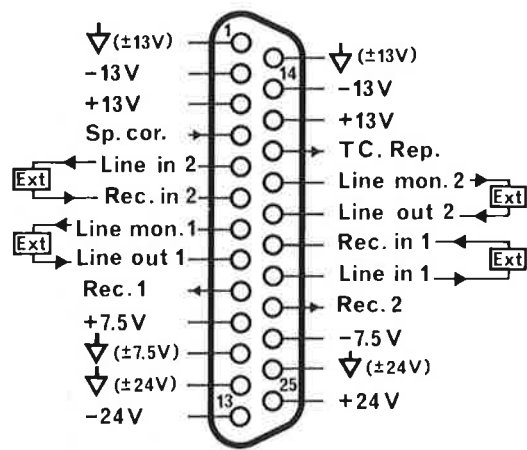
(BJ 4)

PIN	NAME	DESCRIPTION
21 & 5	**Line in 1 & 2**	Monitoring of the line input signal on the balanced line input, after the input pre-amplifier.
20 & 6	**Rec. in 1 & 2**	Input to the recording preamplifier.
7 & 18	**Line mon. 1 & 2**	Monitoring of the off tape recorded signal
8 & 19	**Line out 1 & 2**	Input to the line output transformer.
17	**TC. Rep.**	Monitoring of the reference signal recorded onto the tape.
9 & 22	**Rec. 1 & 2**	(Audio Record Tallies). The information present on these outputs can be used to switch on an external indicator to indicate that the NAGRA T-Audio is in record mode.

Pins 10 to 13 and 23 to 25 are stabilized supply outputs to feed the monitoring console. The upper six pins of this connector are for the TACO-M1 monitoring unit and are wired as follows for machines carrying serial number 0900195 onwards.

1 and 14	Ground (13 V)
2 and 13	– 13 V Unregulated power supply
3 and 12	+ 13 V Unregulated power supply

7 - 5 TC INPUT/OUTPUT (front of tc circuit)

Type : LEMO 5-pole female (mating plug Kudelski SA part No 25 50 400 024)

PIN	NAME	DESCRIPTION
1	**GND**	Ground
2	**TC IN**	External time code input, parallel to pin 2 of the main time code input XLR on the rear panel of the machine.
3	**SERIAL I/O OPTION**	For serial communication.
4	**TC PLAY**	Direct output of off tape time code, paralled to pin 17 of the AUDIO MONITORING OUTPUT connector on the rear panel of the machine.
5	**TC OUT**	Processed output of time code from internal generator, playback tc or external tc (depending on the tc matrix position), parallel to pin 12 of the THIRD TRACK IN/OUT connector.
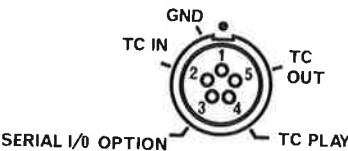
(BJ 14)

TC INPUT

Type : XLR 3-pole female

PIN	NAME	DESCRIPTION		
1	**GND**	Earth		
2	**TC IN HIGH**	Time code input, high	Sensitivity :	100 mVpp to 24 Vpp
3	**TC IN LOW**	Time code input, low	Impedance :	5 kOhm
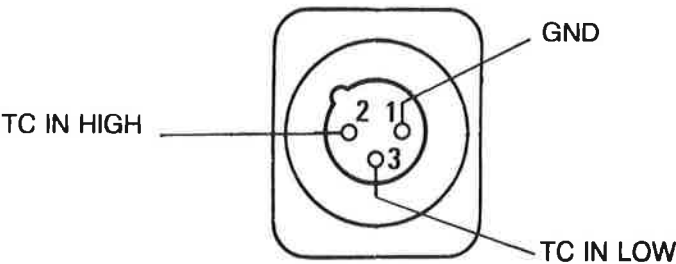
(BJ 9)

TC OUTPUT

Type : XLR 3-pin male

PIN	NAME	DESCRIPTION		
1	**GND**	Earth		
2	**TC OUT HIGH**	Time code output, high	Level	: 2 Vpp
3	**TC OUT LOW**	Time code output, low	Impedance :	300 Ohm
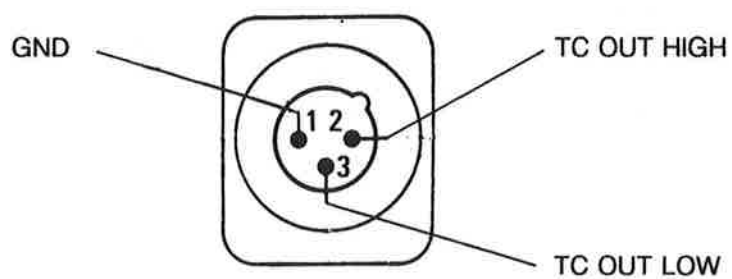
(BJ 10)

7 - 6 THIRD TRACK INPUT/OUTPUT

Type : Cannon "D" 15-pole female (mating plug Kudelski SA part No 40 25 015 000)

PIN	NAME	DESCRIPTION
1	**Cue out**	Output from optional TAPFM pilot resolver. Band pass filtered approximately 200 Hz to 3 kHz. Level : 1.2 V rms for +/–20% modulation at 1 kHz. Impedance : Z-load minimum 1 kOhm.
2	**Ext Ref**	Input of the external reference signal for optional TAPFM pilot resolver and/or time code synchronizer. With TAPFM installed : Sensitivity : 0.8 V to 14 Vpp Impedance : 47 kOhm Without TAPFM installed, with bridging jumper between pins 1 and 8 of XA25 P-2 on A 05 board 5V logic square wave (CMOS load)
3	**BWD Ext rol**	Input from the TACO-D2R/D2RS Bi-phase interface.
4	**Sp 1**	Spare 1 output (software programmable Input / Output). Presently used as a logic signal indicating the position of the FM / NEOPILOT selection.
5	**TC/PILOT**	Logic signal indicating the position of the TC/PILOT selection switch on the front edge of the time code circuit, used in the TACO-D2, D2R and D2RS time code and pilot monitoring units.
6	**+5 V**	Stabilized power supply.
7	**50/60 Hz**	Pilot output signal derived from off tape time code during playback in time code playback mode or from the internal generator in pilot or time code generator mode. Level : +5 V logic square wave Impedance : 1 kOhm (Z load minimum 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 is set to EXT UNPROCESSED and bridge ST 10 / ST 11 on A 05-A22 is in the ST 10 position . Sensitivity : 500 mV Impedance : 100 kOhm.
9	**Pilot out**	Output from the TAPFM (optional pilot resolver) Level : 1.7 Vrms. Impedance : Z load minimum 5 kOhm
10	**Fwd ext rol**	Input from the TACO-D2R, D2RS Bi-phase interface.
11	**Sp 2**	Spare remote input output (see REMOTE).

12	**TC OUT UNPROCESSED**	Output of time code from the 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 dependant upon the position of the time code channel matrix. The bit rate of this output is always nominal independent of tape speed. Level : 5 V logic square wave Impedance : 1 kOhm
14	**GND**	(+ 5 V) logic ground.
15	**TC PLAY**	Time code playback output with time shift applied. Not available in high speed shuttle modes.

Cue out
Ext. ref
BWD Ext. rol.
Sp. 1
Pilot/TC
+ 5V
50/60 Hz
from TC
Direct TC in

Pilot out
FWD Ext. rol.
Sp. 2
TC out unprocessed
TC. out
(+ 5V)
TC. play
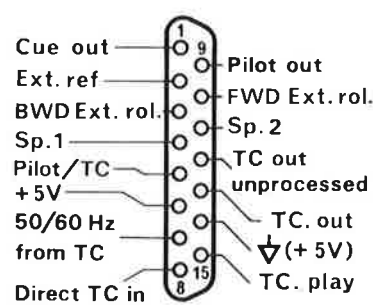
(BJ 11)

7 - 7 SERIAL REMOTE CONNECTOR

RS-422

This connector is used permanently by the TACA-TC2 Keyboard. It is an RS-422 9-pole female. If external serial remote control is necessary the machine must be fitted with the TA-RSA accessory. (see REMOTE).

RS - 422

Frame pulse

(BJ 13)
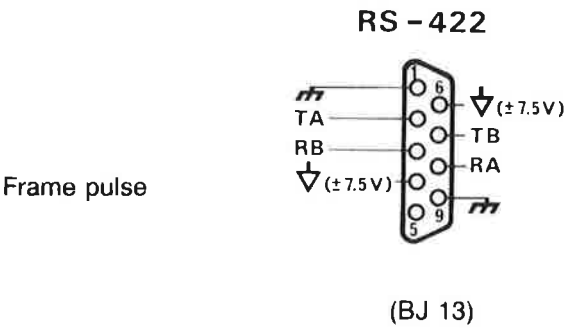
PIN	NAME	DESCRIPTION
1	**GND**	Ground
2	**TA**	Transmit A
3	**RB**	Receive B
4	**±7.5 V**	Ground ±7.5 V
5	**REF**	External reference frame pulse
6	**±7.5 V**	Ground ±7.5 V
7	**TB**	Transmit B
8	**RA**	Receive A
9	**GND**	Ground

RS-232

The RS-232 25-pin connector is only available with machines fitted with the old keyboard, and cannot be used with the TACA-TC2 attached to the machine as the machine must be set to the RS-422 mode at all times to communicate with the TACA-TC2.

(BJ 12)
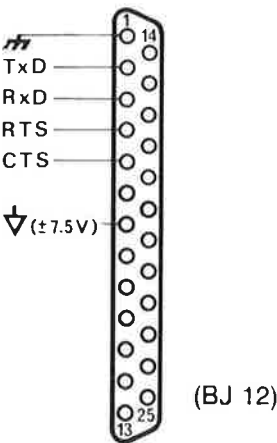
CHAPTER 8

CONFIGURATION OF SWITCHES IN THE NTA. 3

8

8 - CONFIGURATION OF SWITCHES IN THE NTA. 3

8 - 1 DESCRIPTION AND LOCATION OF SWITCHES IN THE NTA. 3

This section will cover in turn all the switches in the machine and will give a brief description and position in the machine.
The switches listed below are located on the electronic circuit boards behind the front cover of the machine. They are as follows:

A 01 Audio circuit channel 1
A 01 Audio circuit channel 2
A 02 Main control logic
A 03 Speed stabilizer
A 05 Time code circuit.

<u>Main transport control logic board A 02</u>
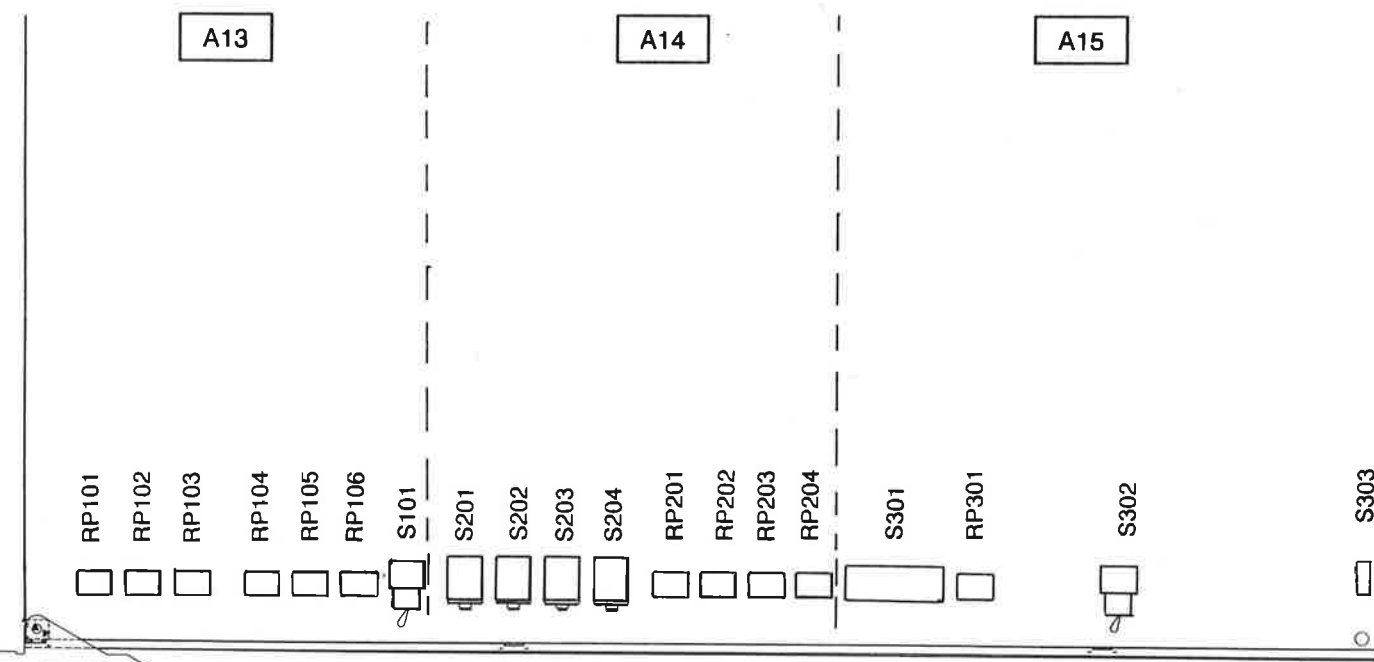
Record Inhibit switch (S 301)

This is a small red-capped switch on the front right-hand corner of the logic board. It is a two position slide switch. When towards the FRONT of the machine the recording of audio and time code is enabled. If the switch is put towards the REAR of the machine then recording of audio and time code is prohibited. If attempted the pinchroller carriage will move out to the PARK position and the led in the record key will flash to show that the command was received but not executed.

Initialization switches (S 201)

This is a block of 8 dil switches. The switches, 1, 2,3, 4 and 5 have no function in the time code versions of the machine as their location is overruled by the microprocessor. S 201-6 is for unhibiting the sync position of the channel matrix when in the "ON" position, thus inhibiting replay through the recording head. S 201-7 is the skip defeat function (only with TACA TC keyboard) this will keep the tape in contact with the head during fast skip when in the "ON" position. S 201-8 is the slow down enable that will limit the maximum winding speed of the transport.

8 - 2 TAPE SPEED/STANDARD SELECTION SWITCHES (S 202 - S 205)

These are four vertically mounted rotary switches that may be changed using a small screwdriver. They are labeled A, B, C and D and correspond to the four possible preset positions of the machine. Each of them is numbered from 0 to 9 which corresponds to the following speed and standard selections:

```
0 =    9.5   cm/s CCIR / NAB
1 =    19    cm/s CCIR
2 =    38    cm/s CCIR
3 =    76    cm/s CCIR
4 =    7.5   ips  NAB
5 =    15    ips  NAB
6 =    15    ips  NAGRAMASTER
7 =    30    ips  AES
```

NOTE :   If only two speeds are selectable on the keyboard due to the position of the speed selection jumpers on the logic card, then only positions A and B will be affected by these switches. These equalization standards listed above affect both the record and the playback chain of the machine. However proper recording calibration at any other than preset selection requires the additional calibration of TACAL (–S) recording calibration circuits.

Clear tape detector switch

This is a three-position toggle type selector and it changes the operation of the machine upon the detection of clear tape (leader tape). In the left position the machine will simply stop upon reaching clear tape. In the OFF position (middle) there will be no reaction, and when switched to the right the machine will pass into rapid rewind until the tape is fully rewound.

Mono / multi / stereo selection

This switch allows selection of the mode of operation of the audio channels of the machine. The three positions being MONO, MULTI TRACK (2 track) or STEREO. In the MONO position the input of channel 1 is recorded on both channels and the input of channel 2 is not taken into account.

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Tape transport speed stabilizer board A 03
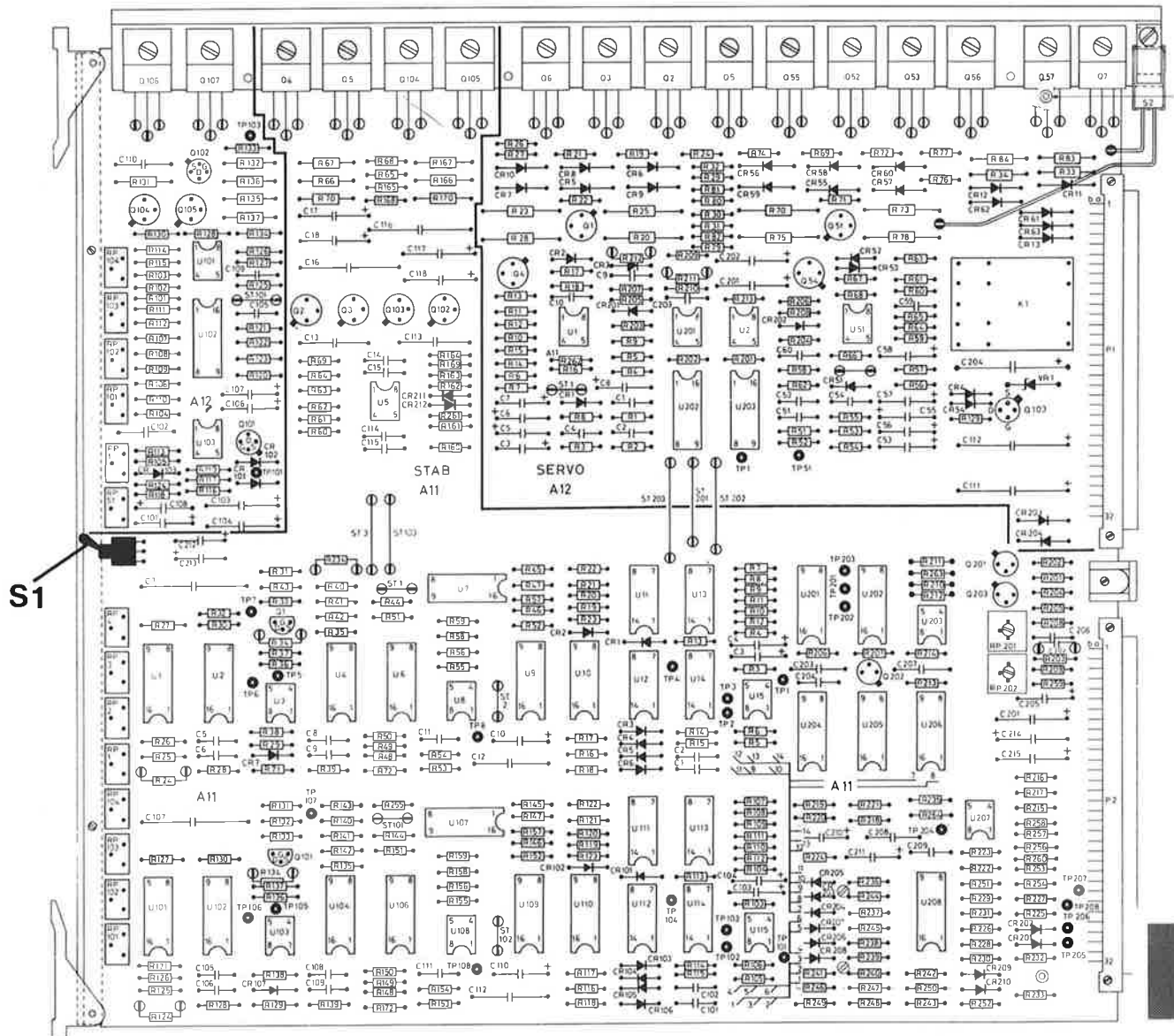
Synchronizer / speed variator switch (S 1)

This switch mounted on the front edge of the speed stabilizer circuit A 03 allows the selection between "Speed cor." and Pot." speed reference, thus in normal operation it should be in the SYNCHRONIZER position. If it is in the SPEED VARIATOR position, then the speed reference can be fed to the Pot. signal on connector BJ-3 on the rear panel of the machine.

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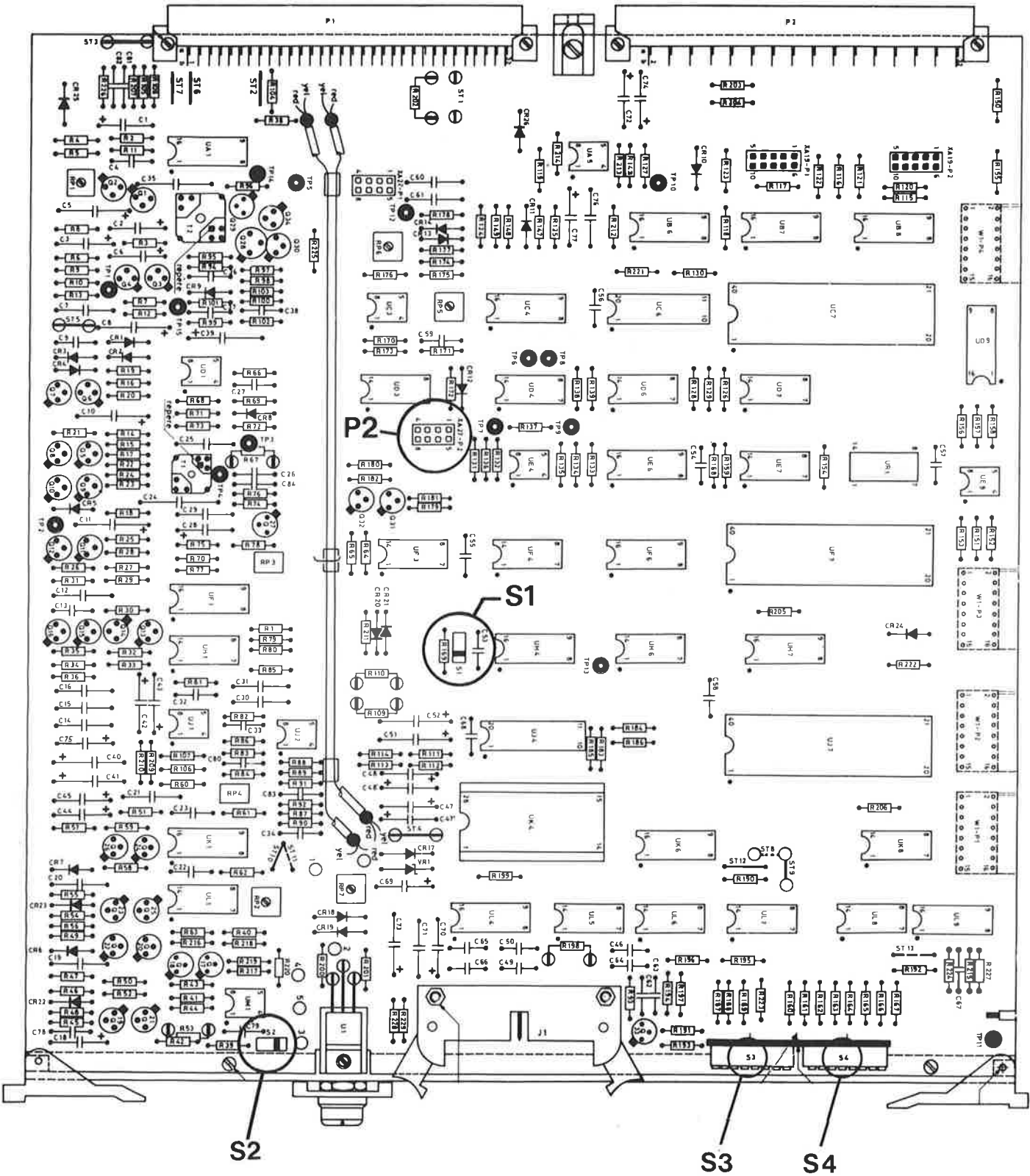
8 - 4 INTERNAL/EXTERNAL REFERENCE SELECTOR

This is a small slide switch located in the center of the upper of the two time code circuits. When slid towards the rear of the machine, the selection is INTERNAL reference. If the switch is slid towards the front of the machine, then the selection is EXTERNAL. This selector actually selects from where the reference that the machine is to use is coming. It should only be set to INTERNAL when resolving pilot tapes to the internal crystal time base and when no TACO-D2 (RS) is connected to the T-Audio.

Time code record source

Located on the left-hand front side of the time code circuit.
When this selector is set to the normal position, the time code recorded will be the signal generated by the internal generator. In order to obtain phase coincidence between the audio and the time code on the tape, an external time code will be regenerated and thus shifted in time, and cleaned from any drop outs. When set to EXTERNAL UNPROCESSED, an external time code signal may be applied to pin 8 of the THIRD TRACK IN / OUT connector and the signal will be fed directly into the time code recording amplifier without any time correction or compensation.

NOTE :   About 5 cm from this switch a soldered jumper st 10 / st 11 is provided through which it is possible to use the standard time code input XLR for such a direct feed.

This input may also be used to record digital information other than time code. The Baud rate of such a signal must not exceed 4000 bits/sec. The playback signal will be available on pin 12 of BJ 11 (THIRD TRACK IN / OUT) only.

C.P.U. reset button

This is not a mode selector for the machine and will cause the microprocessor to make a software and hardware reset similar to what happens during power-up.

Time base selection

This slide switch under the dil switches on the front edge of the time code circuit selects between the standard time base of the machine or the TA-HSX high stability time base option. This option is needed for the generation of 29.97 time code and is also highly recommended for machines resolving pilot tapes to the internal generator. The accuracy of the TA-HSX is ± 2 ppm. from − 10° to +60°, but due to possible ageing drift it is recommended to recalibrate the crystal everyone or two years.

8

8 - 5 DIL SWITCHES

These two blocks of eight dil switches are located on the right-hand side of the time code circuit, and will update the display of the keyboard the moment they are altered.

BLOCK 1 (left)

S3 1 + 2   Are interdependent and are used to select the serial Baud rate. Their position is only relevant for RS-232 operation.

S3-3   OFF = RS-422 operation
            ON = RS-232 operation.
            Must be in the OFF position for machines fitted with the TACA-TC2 keyboard.

S3 4-8   Not presently used.

BLOCK 2 (right)

S4 1 + 2   The position of these two switches determines the frame rate that the T-Audio is set to. This changes not only the generator but also the time code readers and the synchronizer. Therefore always verify the setting of these switches by looking at the internal status of the machine. Since the internal generator of the machine may also be used as a reference to resolve pilot and time code tapes, these switches will also determine the frequency of the reference expected.

SWITCH 1	SWITCH 2	FRAME RATE	REFERENCE FREQ.
OFF	OFF	24 FPS	48 Hz
ON	OFF	25 FPS	50 Hz
OFF	ON	29.97 FPS	59.94 Hz
ON	ON	30 FPS	60 H

S4-3   This selects between drop (ON) and non drop frame (OFF) modes of operation.

S4-4   Changes between DATE (ON) and FREE (OFF) user bits operation.

S4-5   Switches between Time code (ON) and Pilot (OFF) operation.

S4-6   This selects between fm/direct pilot (ON) and Neopilot (OFF). The selection between the two is made on the TAPFM circuit. (see PILOT)

S4-7   Selects between limited shuttle speed (ON) and free shuttle speed (OFF)

S4-8   This selects between roller update (ON) or no roller update (OFF).

Note :   Whenever a TACO-D2RS option is fitted to the T-Audio, all 8 switches should be in the OFF position as the switching action is perfomed in the TACO-D2RS

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8 - 6 TASIM-2 SELF SYNC AMPLIFIER

The TASIM-2 self sync amplifiers are fitted to each channel, and allow the monitoring of recorded signals through the recording head. There are two switches on the circuit :

S1   located on the edge of the circuit connects a low pass filter at 8 kHz (low pass position) or leaves the upper end of the band flat.

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

See below:
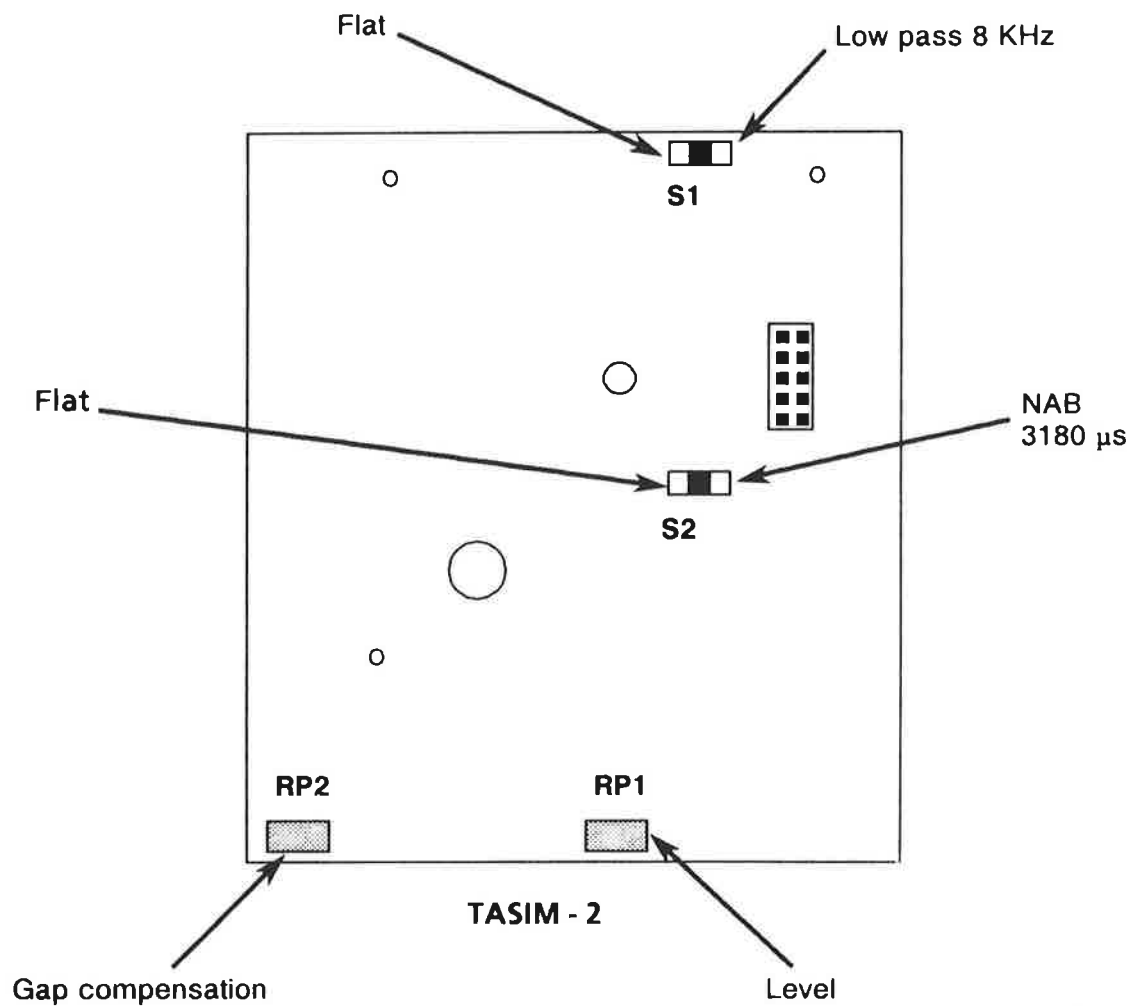
CHAPTER 9

SPECIFICATIONS OF THE T-AUDIO TC

9

9 - SPECIFICATIONS OF THE T-AUDIO TC

9 - 1 TAPE TRANSPORT

Tape tension
Between capstan motors   :   75 g (adjustable)
between spool and capstan :   normally 75 g max tape tension when starting or stopping from fastest spooling speed 180 g.

Tape counter   Better than 0.1% (measured with PEM 468) (for 50µ back coated tape)

Tape speeds

3 3/4	ips	(9.525 cm/s)
7 1/2	ips	(19.05 cm/s)
15	ips	(38.1 cm/s)
30	ips	(76.2 cm/s)

Speed accuracy   Better than 0.07% from –20°C to + 70°C (max. 0.95%).

Tape width   6.35 cm (1/4 inch)

Tape thickness   From 25 microns to 50 microns (0.7 mil to 1.5 mil) without adjustment of mechanics.

Max spool diameter
Up to 180 mm (7") with lid
Up to 300 mm (11.8") without lid.

Spool hub type   NAB, AEG and cinema (by means of interchangeable hubs)

Wow and flutter

Weighted peak flutter recording / playback system IEE (19-3-1971) / ANSI S (4-3-1972) / DIN 45507 standards:

30	ips	better than 0.025% (typical value 0.018%)
15	ips	better than 0.032% (typical value 0.022%)
7.5	ips	better than 0.040% (typical value 0.027%)
3.75	ips	better than 0.050% (typical value 0.032%)

Start up time

30	ips	500 mS.
15	ips	300 mS.
7.5	ips	250 mS.
3.75	ips	200 mS.

Stop time

Measured with a 300 mm (11.8") full reel of tape, IEC standard:

From fastest wind to stationary 1.5 sec.
From 30 ips play to stationary   0.5 sec.

NOTE :   Automatic muting of the audio outputs is provided during acceleration and deceleration.

Fast winding   Up to 10 m/s (730 m or 2400 ft 100 s)

9 - 2 HEAD BLOCK

Audio   Record / Playback - Two 2.00 mm (0.079 inch) tracks, with track spacing of 2.4 mm (0.095 inch).

Erase   Single two track erase head for audio and separate centre track erase head.

Time code   0.35 mm (0.0138 inch) centre track.

9 - 3 AUDIO PERFORMANCE

Erase   Frequency, 256 kHz crystal controlled
                Efficiency, typically 88 dB at maximum peak level : 1250 Hz at 1020 nWb/m.

Bias   Frequency : 256 kHz crystal controlled

Crosstalk   better than 55 dB at 1 kHz
                better than 47 dB at 10 kHz

**Frequency
Response**

Test tapes : 3M-808 for NAB standard and BASF 911, LGR-50 and PEM 468 for CCIR standard.

30	ips CCIR :	50 Hz to 20 kHz ± 1 dB	(± 2 dB)
30	ips AES COPY :	50 Hz to 60 kHz ± 1.5 dB	(± 2 dB)
15	ips NAB/CCIR :	30 Hz to 20 kHz ± 1 dB	(± 1.5 dB)
7.5	ips NAB/CCIR :	30 Hz to 15 kHz ± 1.5 dB	(± 2 dB)
3.75	ips NAB/CCIR :	30 Hz to 8 kHz ± 1.5 dB	(± 2 dB)

**Phase fluctuation
between channels**

± 10° for 10 kHz at 7½ ips (19 cm/s)

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SIGNAL-TO-NOISE RATIO AND DISTORTION

Measured NTA. 3TC with optional wideband predistortion: (recording amplifier inserts type TACAL) with "MASTER" tape.

Signal-to-noise ratio measurements are made with reference signal at the following maximum peak level:

$$510 \text{ nWb/m } + 6 \text{ dB } = 1020 \text{ nWb/m for 15 and 30 ips}$$
$$405 \text{ nWb/m } + 6 \text{ dB } = 810 \text{ nWb/m for 7.5 ips}$$

Following values are RMS, ASA A weighted.

Signal-to-noise ratio

	CCIR		NAB
	AGFA PEM-468	BASF LGR-50	3M* 808
15 ips	73 dB	74 dB	66 dB
7.5 ips	67 dB	69 dB	64.5 dB
30 ips AES	75 dB	75 dB	74 dB
15 ips Nagramaster	75.5 dB	77 dB	75.5 dB

* MPL = 0dB

Distortion :

Measured on NTA. 3TC with optional wideband predistortion:

Distortion measurements are made at 160 Hz, 1000Hz and 1600 Hz at maximum peak level:

1020 nWb/m (810 nWb/m for tape speed 7,5 ips)

	NAB		CCIR	
	H2	H3	H2	H3
15 ips	0,3 %	0,7 %	0,3 %	0,7 %
7 1/2 ips	0,3 %	1,0 %	0,5 %	1,0 %

9

Measured on NTA. 3TC without wideband predistortion :
(recording amplifier inserts type TACAL-S)

Signal-to-noise ratio measurements are made with reference signal at the following maximum peak level:

510 nWb/m + 4 dB = 810 nWb/m for 15 ips and 30 ips
405 nWb/m + 4 dB = 640 nWb/m for 7,5 ips

Following values are RMS, ASA A weighted.

Distortion measurements are made at the same maximum peak levels.

Signal-to-noise ratio

<div align="center">

CCIR

	AGFA PEM-468	BASF LGR-50
15 ips	71 dB	72 dB
7.5 ips	65 dB	67 dB
30 ips AES	73 dB	73 dB
15 ips Nagramaster	73.5 dB	75 dB

</div>

Distortion:

Typical values:
15	ips	2.5% 3rd harmonic (max 3%)
7.5	ips	2.0% 3rd harmonic (max 2.5%)

Measured on time code version NTA. 3TC with optional wide band predistortion for NAB Standard with 3M-808 tape:
(recording amplifier inserts type TACAL)

The following measurements (NAB standard) are made with 3M-808 tape. Values are RMS, ASA A weighted.

Reference maximum peak level:

510 nWb/m   (= 320 nWb/m + 4 dB at 15 ips)
              (= 250 nWb/m + 6 dB at 7.5 ips)

Distortion: (at maximum peak level 510 nWb/m)

15	ips	1.5% 3rd harmonic
7.5	ips	1% 3rd harmonic

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9 - 4 INPUTS/OUTPUTS

Inputs   Symmetrical floating (insulated from chassis)
                Input impedance 10 kOhm
                Nominal 0 dB level 390 mVrms to 4.4 Vrms. (internally selectable)
                Clipping level +14 dBm.

Outputs   Symmetrical floating (insulated from chassis)
                Output impedance 30 Ohms.
                Maximum load 200 Ohms.
                Nominal 0 dB level 775 mVrms to 4.4 Vrms. (internally selectable)
                Maximum output level +24 dBm

TIME CODE

Time code generator

Frame rates

        24 fps, 25 fps and 30 fps, 29.97 fps (with or without dropframe)

Stability

        ±50 ppm from –10°C to +70°C

with optional TAHSX:

        ± 1 ppm from +10°C to +30°C
        ± 2 ppm from –10°C to +60°C

Recording

        Track width 0.35 mm
        Track position centre of the tape
        Recording level 700 nWb/m Peak to Peak ±3dB (rms equivalent 250 nWb/m)
        Rise and fall time is 65 microseconds ± 10 microseconds.
        Audio to time code coincidence is better than 0.5 ms (= 1 time code bit)

Playback

        Minimum speed is 0.25 X nominal speed.
        Maximum speed is 60 X nominal speed, frame rates 24 and 25 fps
        Maximum speed is 50 X nominal speed for frame rates of 29.97 and 30 fps.

Crosstalk

        Residual time code signal at the audio outputs measured with 1/3 octave filter set is better than –85 dB.

**Time code
decoding**

When a time code is read from a tape, the tape machine reading it, the quality of its transport, the bandwidth of its playback head and amplifiers, will set the speed limits at which it can be decoded. The following figures represent the limits of the T-Audio TC's electronic capability only:

Minimum speed: 0.02 X nominal speed
Maximum speed: 70 X nominal speed (frame rates of 24 and 25 fps)
Maximum speed: 60 X nominal speed (frame rates of 29.97 and 30 fps).

Input

Symmetrical floating (insulated from chassis)
Input impedance : 5 kOhm
Sensitivity :   100 mVpp to 24 Vpp with automatic level
                  compensation.

Output

Symmetrical floating (insulated from chassis)
Output impedance :   300 Ohm.
Level: 2 V pp.

Remote   Serial Remotes according to RS-422 standard.

Synchronizer

Accuracy at nominal speed is better than ± 25 microseconds.
Possible offset programming is ± 24 hours (minus 1 frame) in steps of one time code bit.
Sync-up time, from stopped to nominal speed locked at 19 cm/s is better than 2.5 seconds.

PILOT

**Pilot
Output**

Assymmetrical
Output impedance 1 kOhm
Output level 1.7 Vrms (5 Vpp)

Formats   Neopilot, F.M. centre-track and direct centre track.

Playback   50 / 60 Hz.

9 - 5 CHARACTERISTICS

Size: (W x D x H)

with closed cover without keyboard
400 x 335 x 238 mm
15.75 x 13.19 x 9.37 inch

with 30 cm (11.8") reels and
without keyboard
610 x 420 x 250 mm
24.02 x 16.54 x 9.84 inch

keyboard only:
400 x 130 x 40 mm
15.75 x 5.1 x 1.57 inch

Power supply

accepted voltage
110 V. or 220 V. selectable
tolerance:
+ 15 %, −10 %
power consumption:
Typically 55 VA (55 Watts)
max. peak 85 VA (85 Watts)

Operating position Any

Operating temperature
−20 to + 50°C
−4°F to + 122°F

NOTE : Unless otherwise stated all measurements made in accordance with IEC standard (publication 94-3, 1st. edition 1979) at 23°C with 60 % relative humidity at ground level (approx. 600m MSL).

All values mentioned are typical (average measured values), values between brackets are maximum values (value below which or above which the machine is rejected when going through the final check procedure).
Specifications may be subject to modification without notice.

9 - 6 THREADING THE TAPE

TAPE THREADING

OXIDE IN

small spools

TAPE THREADING

OXIDE OUT

small spools

TAPE THREADING

OXIDE IN
OXIDE OUT

smalls spools
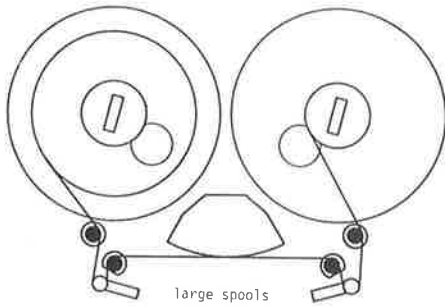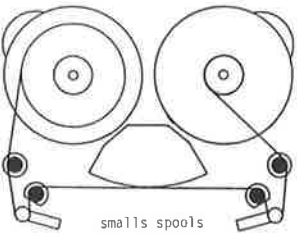
TAPE THREADING

OXIDE OUT
OXIDE IN

smalls spools

large spools

TAPE OXIDE POSITION

INSIDE		TAKE UP REEL: OUTSIDE
		SUPPLY REEL: INSIDE
OUTSIDE		TAKE UP REEL: INSIDE
		SUPPLY REEL: OUTSIDE

large spools

TAPE OXIDE POSITION

INSIDE		TAKE UP REEL: OUTSIDE
		SUPPLY REEL: INSIDE
OUTSIDE		TAKE UP REEL: INSIDE
		SUPPLY REEL: OUTSIDE

large spools

TAPE OXIDE POSITION

INSIDE		TAKE UP REEL: OUTSIDE
		SUPPLY REEL: INSIDE
OUTSIDE		TAKE UP REEL: INSIDE
		SUPPLY REEL: OUTSIDE

large spools

TAPE OXIDE POSITION

INSIDE		TAKE UP REEL: OUTSIDE
		SUPPLY REEL: INSIDE
OUTSIDE		TAKE UP REEL: INSIDE
		SUPPLY REEL: OUTSIDE

CHAPTER 10

RS-422 PROTOCOL IMPLEMENTED
IN NAGRA T-AUDIO TIME CODE (V. 2.4)

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10 - RS-422 PROTOCOL IMPLEMENTED IN
NAGRA T-AUDIO TIME CODE (V. 2.4)

10 - 1 GENERAL DESCRIPTION

The signalling rate of the T-AUDIO is 20.0 kBaud (about 4% higher than the standard 19.2 kBaud), however this should not be a problem for systems having a 19.2 kBaud rate. Each character consists of a START bit, 8 DATA bits, a PARITY bit and 2 STOP bits. The parity is such that the sum of the "ONES" in the data and the parity bit itself is an EVEN number. The connectors, voltage levels and source impedances are similar to RS-422 standards.

WARNING :   All the following commands and status describe the protocol of the eprom
version 2.4

MESSAGE STRUCTURE

TO NAGRA T-AUDIO TC
STX	: (02H) At the start of every message byte
Byte count of message	: does not include the STX, itself or the checksum
Message	: variable length, max. 40 bytes
Checksum	: The 2's complement of the one byte sum of the message and the byte count

Several commands may be sent together in the same message as follows

STX (HEX 02)
Byte count of all the commands
Command 1
Command 2
....
Command n
Checksum

FROM NAGRA T-AUDIO TC	: (periodically, min. 33 ms, max. 45 ms)
STX	: (02H)
Byte count	: 14 to 23 bytes of status depending on byte count
Checksum	: (does not include the STX)

On power up the T-AUDIO sets itself in IDLE mode. It will not accept any command or send back the above mentioned status before having received a break character. This is not necessary when controlling the T-Audio through Port B of the optional TA-RSA. To transmit all the status, it requires about 16 ms max (half an NTSC frame) with a signalling rate of 19.2 kBaud. Synchronizing on an external square wave extracted from a video signal, at the frame rate of the T-AUDIO requires numerical function 004 (rEF.Fr.P) to be executed. Synchronizing on an external time code requires numerical function 005 (rEF. tc) to be executed (or by pressing MOD when displaying the type of reference on the keyboard).

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10 - 2 COMMANDS

The following are the commands decoded in the NAGRA T-AUDIO TC software version 2.4. Numbers are hexadecimal values. Time code values are transmitted in packed BCD, as fields of 4 bytes -hours first, frames last -or as fields of 5 bytes - hours first, bits last. Most significant nibble is tens, the least significant is units.

26 DEFER RELATIVE COMMANDS :

+ 1 byte :   relative time in frames for the deferred command
+ 1 byte :   byte count of the commands to be deferred
+ n bytes   of commands to be deferred.

This command allows the user to defer some commands without caring about time line value. Maximum time value is 24 frames or 29 frames according to the frame rate.

27 DEFER COMMANDS :

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

This command allows the user to send commands to be executed at a given time line value.

NOTE modif. 2.4 :   The time line is an internal time code software counter, synchronous to the external reference which can be loaded, started or stopped by the controller.
NOTE modif. 2.4 :   The T-Audio provides up to ten "defer commands" event buffers.

2E STOP TIME LINE :

Stops incrementing the software counter.

2F LOAD TIME LINE :

+ 4 bytes of time code data.
Starts the time line counter with the given value.
This value must be earlier than the first deferred command.

30 CLEAR TIME LINE :

All the 10 deferred events buffers are cleared.

31 XEQ TIME LINE :

All the commands stored in the time line registers are immediately executed regardless of their own time of execution, then the time line is cleared.

41 STOP :

Sets the T-AUDIO to STOP or PARK depending on the READY status. (READY = 1 = > STOP)

42 SLOW PLAY :

+ 2 bytes of data, most significant first.

Play at variable speed from 0 to +/– nominal speed, linear.

– 512 = nominal speed backwards
   0 = steady,
+ 512 = nominal speed forwards.

NOTE :   Slow play rate may not exceed 38 cm/s.

43 PLAY :

Sets the T-AUDIO to normal PLAY mode.

46 SHUTTLE :

+ 2 bytes of data

Same format as command Slow play (42), maximum value + 32767, minimum value –32767.
Linear progression.
Variable speed mode for speeds greater than nominal speed

47 TAPE SPEED OVERRIDE :

+ 1 byte of data

Variable speed about nominal speed, linear progression.

   0 : –12.8 %
128 : nominal speed
255 : + 12.7 %

48 READY :

+ 1 byte of data.

0 = OFF, command STOP (41) is considered as PARK.
1 = ON , command STOP (41) is considered as STOP.

4D TIME CODE GENERATOR :

+ 1 byte of data

0 = generator halted,
1 = generator running.

4E TARGET SEARCH :

+ 4 bytes of time code data

Causes the T-AUDIO to move to the specified time code ignoring preroll.

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4F PREROLL SEARCH :

Causes the T-AUDIO to move to the point specified by the command SET MEMORY (6E), parameter CUE 1, with preroll specified by command SET MEMORY (6E), parameter PREROLL DURATION.

50 ROLL :

Synchronous PLAY. If the time line is not running, this command starts it. If editor mode is crash record, this command starts the recording.

51 CANCEL SYNC :

Returns to PLAY when previously synchronized or to STOP when trying to synchronize.

54 SYNCHRONIZE SELECT :

+ 1 byte of data.

Used to set the external reference mode.

bit 2 :   0 = data dependent 1 = data independent
bit 1 : }00 = time code 01 = bi-phase
bit 0 : ʃ 10 = frame pulse 11 = color frame

56 CHANGE OFFSET :

+ 1 byte of data, positive or negative, indicating the number of bits to add to the offset memory.

5F SET FROM EXTERNAL :

+ 1 byte of data : 00 = time code, 01 = user bits.

Sets the time code generator or the user bits generator to the external value provided tc generator is not in protect mode.

61 SET SYNC POINT :

+ 4 bytes of time code data
This command is used to set the edit "IN" point required by the command PREROLL SEARCH (4F). Edit in point is CUE 1.

62 SET CONTROL POINT :

+ 4 bytes of time code data
+ 2 bytes of speed : same format as SLOW PLAY (42).

Sets a point of synchronization for non standard play speed edit (Slow motion edit).

69 JOG FORWARD :

Causes the T-AUDIO to advance one frame. The T-AUDIO sets itself in servo mode.

6A JOG BACKWARD :

Causes the T-AUDIO to return back one frame. The T-AUDIO sets itself in servo mode.

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6B TIME SOURCE SELECT :

+ 1 byte of data

<div style="text-align:center">

0 = time code,

1 = tape timer
</div>

Sets the time source for the synchronization process : Time code or tape timer.

6C SET MACHINE NUMBER :

+ 2 bytes of data.

Stores machine number, useful with Ampex editors. Machine number is programmed in BCD, most significant byte first.

6E SET MEMORY :

+ 1 byte indicating memory to be stored.
+ 5 bytes, hours or msb first, bits or lsb last.

Stores a 5 bytes data in the selected memory of the T-AUDIO.

01 :	counter (tape timer)
02 :	time code
03 :	user bits
04 :	external time code
05 :	external user bits
06 :	time code generator
07 :	user bits generator
09 :	offset
0A :	preroll duration
0B :	postroll duration
0C :	synchronizer reaction time
20 :	machine number (not yet implemented)
6X :	Cue point number X. [0..9]

74 REHEARSE MODE SELECTION :

+ 1 byte of data.

Sets the rehearse mode to REPRO or SYNC when in REHEARSE or AUTO-REHEARSE mode (see command Edit Mode 7D).

75 EXECUTE NUMERICAL COMMAND :

+ 2 bytes of BCD data.

Numerical command number is to give in BCD, most significant byte first.

76 DATA REQUEST :

+ 1 byte of data
Allows the user to select what will be sent back in data buffer.

00 :	no data buffer
01 :	counter (tape timer)
02 :	time code
03 :	user bits

04 : external time code
05 : external user bits
06 : time code generator
07 : user bits generator
08 : delta
09 : offset
0A : preroll duration
0B : postroll duration
0C : synchronizer reaction time
20 : Device identification and number
60 + X : Cue point No X [0......9]
80 + X : T-Audio status number X

NOTE :   Time code and user bits values sent back always depend on the time code
              channel status. For example, if the time code channel is set to INPUT, requesting
              time code   (02), external time code (04) or time code generator (06) will always
              produce the external time code to be sent back.

77 T-AUDIO SPECIAL COMMANDS :

+ 1 byte which is the byte count
+ n bytes of T-AUDIO parallel bus commands.

Sends to the T-AUDIO any command available on its parallel bus. Refer to service manual binary
code on REMOTE CONTROL socket.

Example :   Set audio channel 1 to SAFE and SYNC : 02, 04, 77, 02, 33, 34, 1D

7A RECORD START :

Causes the T-AUDIO to start recording on the selected channels by command CHANNELS
READY (7C). No action on the channels status matrix. For this command to be executed, the T-
AUDIO must be in the locked state. The edit mode (set by command 7D) must be set to insert or
assemble.

NOTE :   This command requires prior sending of command CHANNELS READY (7C).

7B RECORD END :

Causes the T-AUDIO to stop recording on all its channels. No action on the channel status
matrix. Working conditions are the same as for RECORD START.

7C CHANNELS READY :

+ 1 byte of data

Sets the specified channels to READY and the other ones to SAFE.

              Bit 1 : Audio channel 1,
              Bit 2 : Audio channel 2,
              Bit 7 : Time code channel.

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7D EDIT MODE :

+ 1 byte of data

        0   = off
        1   = insert
        2   = assemble
        3   = rehearse
        4   = crash record.
        9   = auto insert
        11   = auto rehearse

NOTE :   Auto insert and auto rehearse select the internal editor of the T-Audio which is
              using Cue 1 and Cue 2 as edit "IN" and "OUT" points.

7E SELECT EE :

+ 1 byte of data

Sets the specified channels to INPUT and the others to REPRO, SYNC or OFF depending on the
editor mode selected by command EDIT MODE (7D) and on the T-AUDIO settings set by
SYNCHRONIZE SELECT (54).

        Bit 1 : Audio channel 1,
        Bit 2 : Audio channel 2,
        Bit 7 : Time code channel.

10 - 3 STATUS FROM THE NAGRA T-AUDIO TIME CODE

From 14 to 23 bytes of status are sent back each frame from the T-AUDIO if an external video reference in rEF.Fr.P mode or an external time code in rEF.tc. mode is present or each 45 ms if no correct reference is present.

1-4 : TIME CODE BUFFER : 4 bytes, hours first

5-8 : USER BITS BUFFER : 4 bytes, msb first

9 : TRANSPORT STATUS

00	:	stopped
01	:	stopping
02	:	playing
03	:	tape speed override
04	:	shuttle
05	:	fast forward
06	:	fast rewind
07	:	synchronizing
08	:	sync source
09	:	sync master
0B	:	record
0C	:	cueing (with preroll)
0D	:	cued (with preroll)
0E	:	searching (without preroll)
0F	:	search completed (without preroll)
13	:	slow play
14	:	power not on
15	:	local
16	:	unthreaded
20	:	parked
21	:	parking
22	:	playing backward
24	:	edit free spool
2E	:	going to zero
2F	:	zero reached
33	:	cut
36	:	load (from EPROM version 2.5 on)

10 : AUDIO STATUS

bit 7 :	RECORD 2
bit 6 :	READY 2
bit 5 : ⎫	00 = OFF 2
	01 = INPUT 2
bit 4 : ⎬	10 = REPRO 2
	11 = SYNC 2
bit 3 :	RECORD 1
bit 2 :	READY 1
bit 1 : ⎫	00 = OFF 1
	01 = INPUT 1
bit 0 : ⎬	10 = REPRO 1
	11 = SYNC

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11 : TIME CODE STATUS

bit 7 : TC GENERATOR RUNNING
bit 6 : INT. GEN. TC
bit 5 : EXTERNAL TIME CODE OK
bit 4 : INTERNAL TIME CODE OK
bit 3 : RECORD TC
bit 2 : READY TC
bit 1 : ⎤   00 = OFF TC
         ⎬   01 = INPUT TC
bit 0 : ⎦   10 = REPRO TC
              11 = SYNC TC

NOTE : Time code channel is in the INTERNAL GENERATOR position each time bit 6 is set and regardless of bits 1 and 0.

12 : STANDARD

bit 7 : OFFSET IS ZERO
bit 6 : ⎤   00 = NEOPILOT
         ⎬   01 = FM PILOT
bit 5 : ⎦   1X = TIME CODE

bit 4 : ⎤   FRAME RATE
         ⎬   00 = 24
         ⎬   01 = 25
bit 3 : ⎦   10 = 29.97
              11 = 30

bit 2 : DROP FRAME

bit 1 : ⎤   SPEED
         ⎬   00 = 9.5 cm/s
         ⎬   01 = 19 cm/s
bit 0 : ⎦   10 = 38 cm/s
              11 = 76 cm/s

13 : SYNCHRONIZATION STATUS

bit 7 : TAPE EE STATUS (1 = EE)
bit 6 : READY STATUS   (1 = ready)
bit 5 : STILL
bit 4 : SENSE (0 = forward)
bit 3 : SYNCHRONIZER LOCKED
bit 2 : SYNC DATA INDEPENDENT (1), DEPENDENT (0)
bit 1 : ⎤   00 : sync source time code
         ⎬   01 : sync source frame pulse
         ⎬   10 : sync source bi-phase
bit 0 : ⎦   11 : sync source color frame

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14 : EDITOR STATUS

bit 7 :   TIME LINE BAD
bit 6 :   DEFERRED BUFFER FULL
bit 5 :   TIME LINE RUNNING
bit 4 :   SMALL DELTA (less than 1 second)
bits 3, 2, 1 and 0 :

                      0000 : editor off
                      0001 : insert
                      0010 : assemble
                      0011 : rehearse
                      0100 : crash record
                      1001 : auto insert   (using cue 1 and cue 2)
                      1011 : auto rehearse (using cue 1 and cue 2)

15 : MESSAGE IDENTIFICATION (Not always sent)

00 :	empty buffer	(data buffer : 0 bytes)
01 :	tape timer (counter)	(data buffer : 5 bytes)
02 :	time code	(data buffer : 5 bytes)
03 :	user bits	(data buffer : 5 bytes)
04 :	external time code	(data buffer : 5 bytes)
05 :	external user bits	(data buffer : 5 bytes)
06 :	time code generator	(data buffer : 5 bytes)
07 :	user bits generator	(data buffer : 5 bytes)
08 :	delta	(data buffer : 5 bytes)
09 :	offset	(data buffer : 5 bytes)
0A :	preroll	(data buffer : 5 bytes)
0B :	postroll	(data buffer : 5 bytes)
0C :	reaction time	(data buffer : 5 bytes)
20 :	ident and number	(data buffer : 3 bytes)
21 :	error number	(data buffer : 1 bytes)
22 :	service message	(data buffer : 5 bytes)
60 + X :	Cue point X	(data buffer : 5 bytes)
80 + X :	T-Audio status X	(data buffer : 8 bytes)

16 : DATA BUFFER

As defined by byte 15, hours or msb first 23 max (Not always sent depending on command DATA REQUEST 76)

When the data buffer contains device identification and number, first byte is device identification (1DH for the NAGRA T-AUDIO time code). Bytes 2 and 3 contain serial numbers in bcd, high byte first, mainly used by Ampex editors.

When the data buffer is 5 bytes long, it contains time code data, with the following format : hours first, minutes, seconds, frames, bits.

Error number is indicated as 1 byte of BCD data.

The T-AUDIO status are sent back as 8 ascii characters.

10 - 4 T-AUDIO SERIAL AND PARALLEL BUS COMMANDS

00	(000)	STOP	40	(064)	PARK
01	(001)	PLAY	41	(065)	VARIABLE SPEED
02	(002)	REWIND	42	(066)	GOTO LEADER
03	(003)	FORWARD	43	(067)	SPOOLING
04	(004)	RECORD	44	(068)	SHIFT RECORD
05	(555)	*	45	(069)	*
06	(006)	LISTEN TC	46	(070)	*
07	(007)	*	47	(071)	*
08	(008)	FREE SPOOL	48	(072)	SYNC SLOW
09	(009)	SERVO	49	(073)	SYNC FAST
0A	(010)	EDIT BACK	4A	(074)	CUE 2
0B	(011)	EDIT FWD	4B	(075)	CUE 1
0C	(012)	LOAD	4C	(076)	DISPLAY TC UB
0D	(013)	LOAD RIGHT	4D	(077)	DISPLAY OFFSET
0E	(014)	LOAD LEFT	4E	(078)	DISPLAY DELTA
0F	(015)	CUT	4F	(079)	SYNC INCREMENTAL
10	(016)	PAUSE	50	(080)	LOCK TIME LINE
11	(017)	GOTO 0	51	(081)	LOCATOR
12	(018) #	MODIFY SPEED	52	(082)	NUM EXECUTE
13	(019)	RESET COUNTER	53	(083)	RESET DISPLAY
14	(020)	SHIFT	54	(084)	SHIFT
15	(021)	RECORD REPRO ON	55	(085)	RECORD REPRO OFF
16	(022)	CAPSTAN OVERRIDE ON	56	(086)	-----
17	(023)	CAPSTAN OVERRIDE OFF	57	(087)	-----
18	(024)	DISABLE MOM FUNCTION	58	(088)	TAERP PARK
19	(025)	SKIP BACK 3	59	(089)	STORE SET
1A	(026)	SKIP FWD 3	5A	(090)	RECALL
1B	(027)	SKIP BACK 1	5B	(091)	LEFT
1C	(028)	SKIP FWD 1	5C	(092)	RIGHT
1D	(029)	SKIP BACK 2	5D	(093)	UP
1E	(030)	SKIP FWD 2	5E	(094)	DOWN
1F	(031)	DUMP	5F	(095)	TRIM OFFSET
20	(032)	READY 1	60	(096)	*
21	(033)	SAFE 1	61	(097)	*
22	(034)	SYNC 1	62	(098)	*
23	(035)	REPRO 1	63	(099)	*
24	(036)	INPUT 1	64	(100)	*
25	(037)	OFF 1	65	(101)	*
26	(038)	-----	66	(102)	-----
27	(039)	-----	67	(103)	-----
28	(040)	READY 2	68	(104)	*
29	(041)	SAFE 2	69	(105)	*
2A	(042)	SYNC 2	6A	(106)	*
2B	(043)	REPRO 2	6B	(107)	*
2C	(044)	INPUT 2	6C	(108)	*
2D	(045)	OFF 2	6D	(109)	*
2E	(046)	-----	6E	(110)	-----
2F	(047)	-----	6F	(111)	-----

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30	(048)	*	70	(112)	*	
31	(049)	# VTR ONLY REQ	71	(113)	# VTR ONLY ACK	
32	(050)	# AUDIO REC. TA REQ	72	(114)	# AUDIO REC. TA ACK	
33	(051)	# AUDIO REC. VTR REQ	73	(115)	# AUDIO REC. VTR ACK	
34	(052)	# AUDIO REC. TA + VTR REQ	74	(116)	# AUDIO REC. TA + VTR ACK	
35	(053)	# TA ONLY REQ	75	(117)	# TA ONLY ACK	
36	(054)	RESET OFFSET AND CUE REQ	76	(118)	RESET OFFSET AND CUE ACK	
37	(055)	STORE OFFSET REQ	77	(119)	STORE OFFSET ACK	
38	(056)	READY TC	78	(120)	*	
39	(057)	SAFE TC	79	(121)	*	
3A	(058)	SYNC TC	7A	(122)	GEN TC	
3B	(059)	REPRO TC	7B	(123)	*	
3C	(060)	INPUT TC	7C	(124)	*	
3D	(061)	OFF TC	7D	(125)	*	
3E	(062)	-----	7E	(126)	-----	
3F	(063)	-----	7F	(127)	-----	

* Means that this command may not be used without problem

\# Means that this command is only active when sent through the serial bus.

Commands 15, 55 and from number 31 to 37 and from 71 to 77 are used for communication between the TACA-TC2 keyboard and the TA-BOX.

These are the commands of the serial bus of the T-Audio time code and they are not sent through RS-422. They can be accessed through the remote control input/output connector on the rear panel of the machine.

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CHAPTER 11

OPERATION MANUAL INDEX

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11 - OPERATION MANUAL INDEX

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