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NAGRA Tape Recorders Manufacture

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We reserve the right to modify the product, and / or the specifications without notice.



CHAPTER I "INSTRUCTION MANUAL"

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1.1 INTRODUCTION

The Nagra IV-S was introduced originally in 1971. It is a portable 6.35 mm (1/4") analogue audio tape recorder designed for high quality music recording, cinema and television applications.

Many mechanical and electronic modifications have been made to the machine since its release, to adapt it according to modern day requirements. Despite all these modifications, the machine remains remarkably similar to the original. The last major development was made in 1984 when the SMPTE / EBU 80 bits centre-track time code was added.

The Nagra IV-S can be delivered in three different versions all of which are available in either NAB or CCIR equalization. These versions are as follows:

NQS-LSP	Non pilot
NQS-L	Pilot
NQS-TC	Time code

Each version has three speeds: 38 cm/s, 19 cm/s and 9.5 cm/s (15, 7½ and 3¾ ips) with the following standards: NAB, CCIR and NAGRAMASTER (at 15 ips only).

The Nagra IV-S is a stereo recorder with two 2 mm audio tracks (2.75 mm tracks on the NQS-LSP non-pilot machines) and a central track for pilot or time code uses, depending on the machine type.

The two audio channels may be used with either the two internal microphone pre-amplifiers (switchable between Dynamic, T power and Phantom power) or with a current line input, via the QCSE cable. The two potentiometers on the front panel may be mechanically "GANGED" together for easier control, by moving the small white lever located on the green control.

The NAGRA IV-S also contains a switchable limiter, a built-in loudspeaker, provision for connection to an external noise reduction system and an internal reference generator for line up, and calibration purposes.

Optionally the machine may be fitted with either the NAGRASYNC pilot option or the SMPTE/EBU 80 bits time code option.

The machine may also be powered from either an external supply ATN-3 or internal batteries. (See page I 1.2-1).

The IV-S may also be used with the QGB 10" reel adaptor, to allow the use of larger reels for longer recording and playback.

1.2 POWER SUPPLY

All models of the NAGRA IV-S may be powered by an external power supply (ATN-3) or alternatively by internal batteries. The IV-S will accept voltages ranging from -11 V to -30 V with peaks of up to -35 V.

The batteries are placed in the bottom of the machine and the polarity is marked inside the compartment which is opened by turning the two fasteners with a screwdriver or a small coin. All the batteries **MUST** be orientated in the same direction as indicated on the base of the battery compartment.

The NAGRA IV-S houses twelve 1.5 V cells having a maximum diameter of 33.5 mm and a length of between 59.5 and 62.5 mm. The cells manufactured under the following standards are generally acceptable: CEI R-200, ASA "D" and L90.

It is important to remember that corrosive material can leak out of flat batteries, causing severe damage to the recorder, and therefore it is recommended not to leave batteries in the machine during periods of storage.

The external supply is fed into the machine via connector (48) on the right-hand side of the machine. Rechargeable batteries may also be used and can be charged using the ATN-3C (order no 14376) which includes the charger circuitry.

To check the state of the batteries or the external supply, set modulometer switch (12) to the "BATT" position: in this case the red needle of the modulometer indicates the battery voltage on the (volts / cell) scale and the green needle indicates the voltage needed by the motor. The difference between these two readings shows the battery reserve.

When the power supplied to the machine is insufficient for normal operation of the recorder, the rotary indicator "SPEED AND POWER" on the front panel of the machine will turn black. The IV-S will function when the power is as low as 12 V (at 15 ips /38 cm/s) and down to as low as 10.5 V at the lower speeds. (These figures correspond to a machine in perfect condition and working at room temperature).

NOTE: Time Code machines will stop recording Time code when the batteries become flat before the audio recording is affected.

When using an external supply, selector switch (3) must be in the "EXT" position. It must be in the "BATT" position when internal batteries are in use. It is not necessary to remove the batteries when working with an external supply (and vice versa).

NOTE: For information on power supply to the time code circuits of the IV-S TC refer to page IV 6.1-1.

EXTERNAL POWER SUPPLY

On the right-hand side of the machine there is a 6 pin Tuchel-type T 3403 connector marked "POWER PACK". The corresponding plug is the T 3400/1.

The connections are as follows:

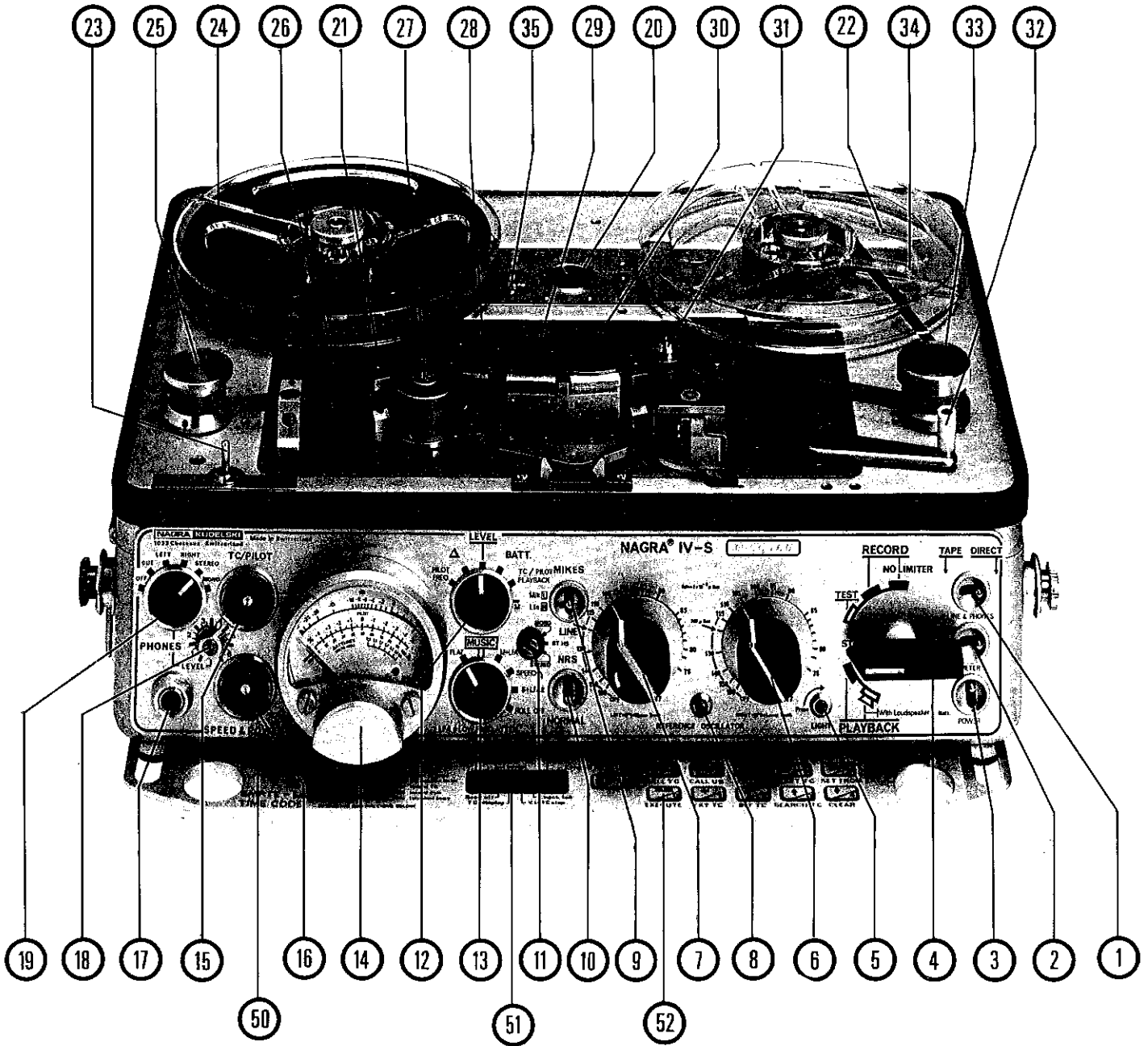
- pin 1 = Battery negative
- pin 2 = Chassis (positive)
- pin 3 = Pilot playback output
- pin 4 = Speed correction signal input
- pin 5 = Negative external supply
- pin 6 = -10 V stabilized output.

1.3 DANGER OF REVERSE POLARIZATION

A reverse polarized power supply (negative to the chassis) WILL damage the machine. To reduce the risk of serious damage a diode is placed in parallel with the supply which will be short-circuited in the event of reverse polarization. If such an event occurs with normal "dry cells", they will be rapidly exhausted and no further damage will occur.

On the other hand, certain accumulators are capable of supplying sufficient current (in excess of 8 amperes) such that the internal wiring of the machine will become hot enough to cause its insulation to decompose. This will then liberate hydrochloric acid gas which causes considerable corrosion. If this happens, contact your nearest NAGRA agent immediately.

NAGRA IV-S TC



1.4 CONTROLS: DESCRIPTION AND USE

FRONT PANEL

1. TAPE / DIRECT SWITCH (line and phones)

When in "TAPE" position, the signal is reproduced directly from the tape.

When in "DIRECT" position, there are two possibilities:

- A. When recording, the signal is available before arriving on the tape.
- B. When playing back, the signal may be adjusted by means of the level controls and corrected by filter switch (13).

2. TAPE / DIRECT (snap switch)

This switch affects the meter in the same way that the previous switch affects the outputs. Thus when it is held to the left, the meter will display the "OFF TAPE" signal whereas normally it displays the "DIRECT" signal.

3. POWER SELECTION SWITCH (EXT / BATT)

The NAGRA IV-S may be powered by either internal batteries or by an external source which may be selected using this switch. See also the "POWER SUPPLY" section of this chapter. (Page I 1.2-1).

4. MAIN FUNCTION SELECTOR (six position rotary)

- | | |
|--|---|
| STOP | Stops the machine completely from any function, and will slightly move the pinch wheel away from the capstan to prevent a flat being caused on the pinch roller. In this mode no circuits are powered (with the exception of the RAM and REAL TIME CLOCK in machines fitted with SMPTE / EBU time code). See section IV "TIME CODE AND PILOT" of this manual for further details. |
| TEST | Will power all circuits and allow level adjustment by means of level controls (6) and (7). In this mode the motor is not powered. All indications of the modulometer will be of the DIRECT input, irrespective of the position of tape / direct switch (1). |
| RECORD | Is the first of the two RECORD positions and corresponds to RECORD WITH LIMITER where the recording level is limited to +4 dB. This level remains constant when the input level is between +4 dB and +10 dB. Thus in this position tape saturation cannot occur and distortion is avoided. |
| RECORD
(no limiter) | The limiter is inactivated in this position so that recordings that should be saturated can be made. (e.g. Gun shots or explosions). |
| PLAYBACK | Is the first of the two playback possibilities and corresponds to playback of the tape to the headphones and line outputs only. |
| PLAYBACK
(with loudspeaker) | This position is exactly as above, only it allows monitoring via the internal loudspeaker at the same time. This is also the only position of the main function selector that permits the FAST FORWARD function to be performed (see page I 1.4-6). |

5. LIGHT (push button)

When pressed, the modulometer (and time code display on T.C. machines) will be illuminated as long as the button is pressed, providing there is sufficient power available to the machine. If this button is pressed and then turned to the right the lamps will remain "ON". This button is active when the main function selector is in any position other than "STOP".

6. LEVEL CONTROL (right-green-lower track)

7. LEVEL CONTROL (left-red-upper track)

These are the main level controls for the two audio channels. They may be linked (ganged) by means of the small white lever situated on the left-hand knob (green) which activates a friction clutch. The 200 μ bar point on each channel corresponds to an acoustic pressure of 200 μ bar on the capsule of a 200 Ohm dynamic microphone having a 0.2 mV/ μ bar sensitivity. In this case the modulometer reading should be 0 dB.

8. REFERENCE OSCILLATOR (push button)

On the lower edge of the front panel, between the left and right level control potentiometers, there is the reference generator push button. When this button is pressed, a composite 1.1 KHz signal with a 10 KHz 9th harmonic at a level of approximately -8 dB is injected into the "DIRECT" chain of the recorder.

The modulometer will show -8 dB. It is useful to record a short burst of this signal at the beginning of each reel of tape so as to enable the level of the playback chain to be accurately calibrated before the real recording is made. This also permits adjustment of the record head azimuth in the field without test equipment. At this point the subject of print-through should be mentioned. After a certain period of time, a recording may be copied (at reduced level) onto adjacent turns of a tape on a reel. This produces a perceptible echo during the silences preceding or following a strong sound.

It is thus recommended to leave a pause of two or three turns of tape after recording the "REF" signal.

9. MIKES / LINE SWITCH

This three position switch is the main input selection switch. It allows the operator to select between MIC or LINE input on both channels simultaneously or "LINE" input on channel 2 (right) and simultaneously "MIC" input on channel 1 (left). The upper position allows "LINE" inputs to both channels via connector (41), and the other positions allow selection between "MIC" inputs (36) and (37).

10. NRS / NORMAL SWITCH

This switch allows the use of an external noise reduction system when connected to the IV-S via connector (42).

When an external "NRS" system is not being used, this switch should remain in "NORMAL".

11. MONO / ST HS / STEREO SWITCH

This switch is used to select the mode of the audio outputs. The position of this switch may only be changed by means of a small screwdriver, to prevent accidental modification while using the recorder, and it selects the mode of the "DIRECT" chain.

- MONO** The input of each channel is fed to the output of both channels.
- STEREO** Each input is connected to its corresponding output.
- ST HS** (Stereo high sensitivity): As for "STEREO" but the sensitivity is 6 dB higher. This position is useful when the recording source level is very low. However, it must be noted that certain characteristics of the recorder such as signal-to-noise ratio and crosstalk are not quite as good in this mode.

12. MODULOMETER MODE SELECTION SWITCH

This is a six position rotary switch allowing different information to be displayed on the modulometer.

Each position is described below:

PILOT FREQUENCY

The red needle indicates on the pilot scale of the modulometer the frequency of the pilot signal from +4% to -4%, as determined by the QFMS frequency meter (if fitted), between the pilot signal either recorded or played back and the internal crystal or the external pilot reference signal via connector (44). (There will be no reading if the QFMS option is not fitted).

The green needle indicates on the dB scale the audio channel which has the highest recording level.

DELTA Δ

The red needle indicates on the % scale between 0 and 100%, the groove depth of a record made from recorded signals in accordance with NAB weighting, thus a 100% reading corresponds to a 50 μm vertical deviation of the cutting stylus.

The green needle gives the same indication as for pilot frequency.

LEVEL

The red needle indicates the "DIRECT" or the "RECORDING" level of the left channel (1) in dB.

The green needle indicates the "DIRECT" or the "RECORDING" level of the right channel (2) in dB.

BATT

The red needle indicates on the volt / cell scale the battery voltage.

The green needle indicates the voltage required by the motor.

The difference between the two readings shows the battery reserve.

TC / PILOT PLAYBACK

The red needle gives the same indication as for pilot frequency.

The green needle indicates on the % scale the level of the signal recorded or played back on the FM track. A deviation of 100% corresponds to an actual frequency deviation of 40 %.

On time code machines, the green needle indicates the time code playback level.

M (MOTOR)

The red needle indicates on the % scale the current through the motor. A reading of 100% corresponds to a current of 250 mA through the motor.

The green needle gives the same indication as in the pilot playback position.

13. FILTER SWITCH

This is a six position rotary switch affecting both channels.

FLAT	The machine has a linear frequency response between 20 and 20000 Hz (Direct chain).
MUSIC	A high pass filter is put in the direct chain, which has a response of -3 dB at 40 Hz.
M + LFA	This puts the MUSIC filter and LOW FREQUENCY ATTENUATION of -7 dB at 40 Hz and -3 dB at 400 Hz into the direct chain.
SPEECH	This puts a high pass filter of -3 dB at 80 Hz into the direct chain.
S + LFA	This corresponds to the SPEECH filter and LOW FREQUENCY ATTENUATION of -7.5 dB at 80 Hz and -3 dB at 400 Hz.
ROLL OFF	This position gives the direct chain strong low frequency attenuation, -10 dB at 100 Hz and -3 dB at 400 Hz.

14. MODULOMETER

This two needle meter is the visual indication of many functions and levels of the machine. The modulometer displays information according to the position of mode selector switch (12). All IV-S modulometers are fitted with two small lamps which will light up the display when switch (5) is pressed. The right-hand lamp will also light up the time code display, when the keyboard is out, via a small lens in the bottom of the modulometer on the time code version of the recorder.

The modulometer has 4 scales:

1. Recording level in dB
2. Frequency deviation in %
3. Groove depth and motor supply current
4. Battery voltage (volts / cell)

15. TC / PILOT INDICATOR

This rotary "SASS" type indicator shows a white segment when the frequency (in the case of a pilot machine) and the amplitude of the time code / pilot signal are correct.

NOTE: This only indicates the presence of a correct signal being fed to, or coming from the head, and does not guarantee correct recording of the signal. This should be checked by switching the modulometer to TC / PILOT playback (this does not function in the RECORD mode). In the case of a time code machine, the signal should also be verified by means of the display on the keyboard, because both the previous methods will show a signal even though the time code generator may have been stopped and the same time code will be recorded over and over again.
This indicator functions in all modes other than test.

16. SPEED AND POWER INDICATOR

This rotary "SASS" type indicator gives a quick visual indication that the machine is functioning correctly and will indicate a white segment when this is the case, and will turn black whenever any of the following conditions occur:

- Power supply voltage (batteries or external) becomes insufficient for correct operation of the machine.
- The motor current reaches its maximum limit, in this case voltage and speed stabilizer circuit A22 requires the motor to run faster, but this is not possible because the automatic current limiter circuit has been activated. (If this occurs during normal operation, then contact your nearest NAGRA agent.)
- Tachometric WOW and FLUTTER is out of tolerance. (Contact NAGRA agent).

Thus, when a white segment is indicated, the operator can be absolutely sure that the power supply is sufficient, that the motor current is correct, and that the tape speed is within tolerance.

17. HEADPHONES OUTPUT

This 1/4" jack type socket (type 297) is the headphones output socket accepting headphones with an impedance of anything from 25 Ohm to 600 Ohm. (Optimum value is 200 Ohm).

18. HEADPHONES VOLUME CONTROL

This small potentiometer is adjustable using a screwdriver and adjusts the level fed to headphones output connector (17).

Position 1 is the minimum and position 6 is the maximum.

19. HEADPHONES MODE SELECTOR

This is a six position rotary switch allowing the operator to select the signal which is sent to the headphones connector. It selects between CUE channel (FM centre track), left audio channel, right audio channel, mono or stereo. The first position of the selector is "OFF".

TAPE DECK

20. TAPE SPEED AND STANDARD SELECTOR

This is a four position rotary switch permitting the selection of the speed and standard of the IV-S in both record and playback.

Possible settings are:

- 3 $\frac{3}{4}$ ips (9.525 cm/s) NAB/CCIR
- 7 $\frac{1}{2}$ ips (19.05 cm/s) NAB/CCIR
- 15 ips (38.10 cm/s) NAB/CCIR
- 15 ips (38.10 cm/s) NAGRAMASTER

For best quality recordings the 15 ips speed is recommended. The 15 ips NAB / CCIR position is chosen when the recorded tape is to be played back on any machine other than a NAGRA T-AUDIO or NAGRA IV-S.

However, when this is not the case it is recommended to use the NAGRAMASTER position which has a different equalization and gives a better signal-to-noise ratio.

For normal recordings, the 7 $\frac{1}{2}$ ips speed is supplied. The 3 $\frac{3}{4}$ ips speed is available for those cases where the length of recording time of the tape is more critical than the actual quality of the recording.

21. BIAS SELECTOR

This switch makes it possible for the operator to modify the bias voltage using a small screwdriver when recording on special tapes for which the machine has not been calibrated. Each position of this switch corresponds to a bias variation of 5%.

22. PLAYBACK EQUALIZATION SELECTOR

This switch (also adjustable with a small screwdriver) offers the possibility to reproduce tapes recorded using the CCIR standard equalization on a machine that has been calibrated to the NAB standard equalization, and vice versa.

23. REWIND AND FAST FORWARD SWITCH

REWIND is possible with main selector (4) in any position other than STOP, assuming pinch roller lever (32) is in the fully open position.



FAST FORWARD is possible only with main function selector (4) in the playback (with loudspeaker) position and pinch roller lever (32) fully engaged.



The central position of this switch is OFF and this is the position that the switch should be in whenever the machine is not required to spool. Keeping it in this position will prevent accidental spooling of the tape when opening the pinch roller gate or playing back a recorded tape through the internal loudspeaker.

24. & 34. TAPE REELS

The IV-S can be used with reels up to a maximum diameter of 5" (127 mm) with the plexi-glass lid closed, or up to 7" (178 mm) with the lid open. However, if the QSET option is fitted to the machine the 7" (178 mm) reels may be used with the lid closed.

If it is necessary to use reels of up to 10" (254 mm), then the QGB large reel adapter may be used. See chapter V of this manual.

25. & 33. TENSION ROLLERS

These two rollers keep the tape tension constant and ensure correct tape handling and positioning. During normal use neither of these two rollers should be at either end of its travel. If this is the case refer to the MECHANICAL CALIBRATION section of this manual (section II Service manual, page II 2.3-1).

The two rollers can be replaced by either the QTIM or QLEN tape measuring rollers. The QTIM is supplied in the place of the take-up reel tension roller as standard equipment. QLEN instead of QTIM optional. (To be stated when ordering).

26. ERASE HEAD

This is a full track erase head. It means that it is not possible to record one channel on the IV-S while preserving the original recording on the other channel. This also includes the centre track whether Time Code or FM pilot.

27. STROBOSCOPE ROLLER

This roller comes in two versions: 50 Hz (CCIR machines) and 60 Hz (NAB machines). Using this roller, it is possible to check that the machine is running at the correct speed, either in record or playback. This works at all speeds and uses the stroboscopic effect whenever a mains powered lamp is shone upon it. When at the correct speed, the bars on the roller should appear stationary.

28. RECORDING HEAD

Two channel audio recording head.

29. TIME CODE / PILOT HEAD

Centre track head used for both recording and playback, of FM pilot, CUE and SMPTE / EBU time code, according to the type of machine.

30. PLAYBACK HEAD

Two channel audio playback head.

31. CAPSTAN SHAFT

Tape main drive.

32. PINCH WHEEL AND TAPE GUIDE CONTROL LEVER

This lever engages and disengages the tape from the heads and motor capstan shaft. It also moves the stroboscope roller and mobile tape guide in and out, to allow easy loading of the tape.

When it is in the open position, rapid rewinding is possible. (This lever should never be left in the open position for long periods of time as this may cause a "FLAT" on the capstan shaft "O" ring).

33. TAPE TENSION ROLLER (OR TIMER) (see 25)

34. TAKE-UP REEL (see 24)

35. EQUALIZATION ADJUSTMENT POINT (see Chapter II service manual)

POSITIONS 36 TO 49 SEE CONNECTORS (Pages I 1.5-1 to I.1.5-3)

50. KEYBOARD

This is the small slide-out control panel for the IV-S time code machines. It allows setting and modification of all time code functions (except frame rate). For further details see "TIME CODE AND PILOT" section IV of this manual.

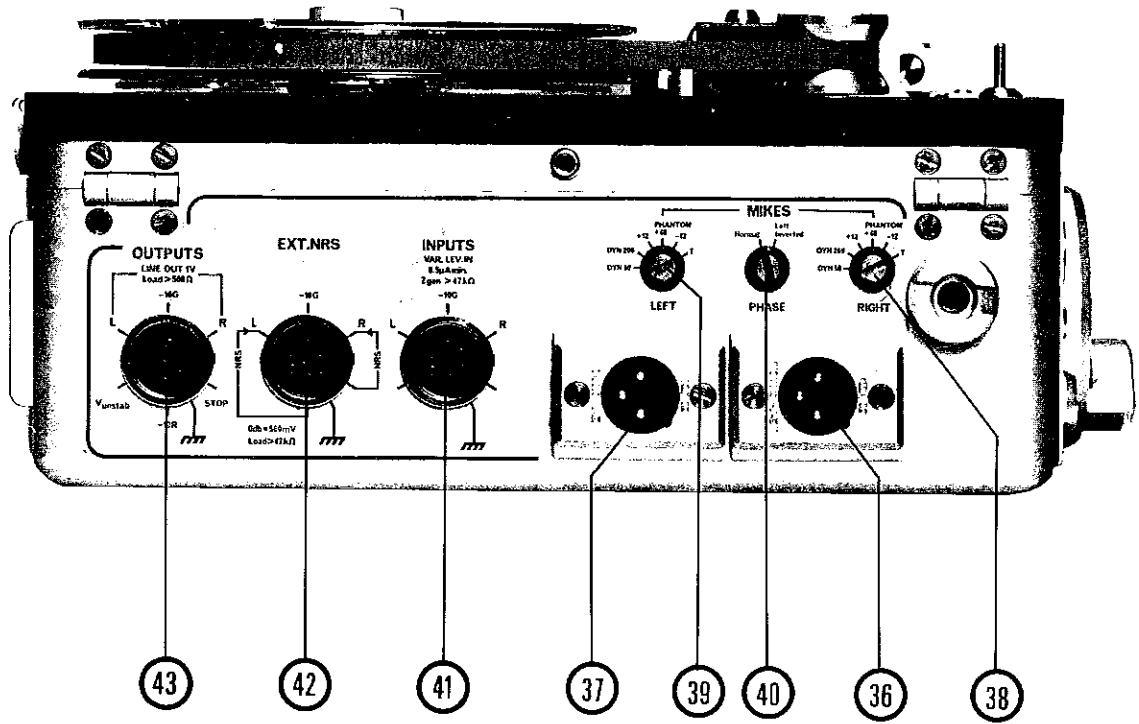
51. LIQUID CRYSTAL DISPLAY

This is the display for time code, user bits and status of the IV-S TC (See "TIME CODE AND PILOT" section IV of this manual).

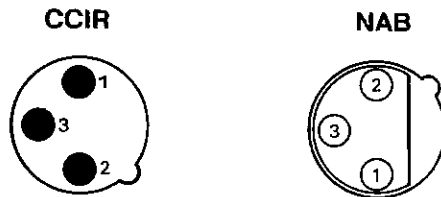
52. CONTROL KEYS

These eleven keys allow the operator to modify all time code functions except frame rate (see "TIME CODE AND PILOT" section IV of this manual).

1.5 CONNECTORS



36. MIKES (RIGHT) (Channel 2)



1 = Input signal Ground

2 + 3 = Balanced signal Input

37. MIKES (LEFT) (Channel 1)

Identical to No 36 above, but for the other channel.

38. SIX POSITION MICROPHONE TYPE SELECTOR, channel 2 (right)

DYN 50 = Dynamic microphone impedance 50 Ohm 0.1 mV / μ bar (1mV/pa) sensitivity

DYN 200 = Dynamic microphone impedance 200 Ohm 0.2 mV / μ bar (2mV/pa) sensitivity

+ 12 = Condenser microphone, 1 mV/ μ bar (10mV/pa) sensitivity + 12 V phantom powering

+ 48 = Condenser microphone, 1 mV/ μ bar (10mV/pa) sensitivity + 48 V phantom powering

- 12 = Condenser microphone, 1 mV/ μ bar (10mV/pa) sensitivity - 12 V phantom powering

T = Condenser microphone, 1.5mV/ μ bar (15mV/pa) sensitivity + 12 V T powering

(Tonaderspeisung since 1984)

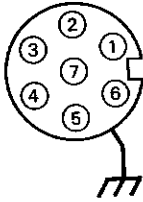
39. SIX POSITION MICROPHONE TYPE SELECTOR, channel 1 (left)
 (Identical to No 38) except for the other channel.

40. MIKES PHASE: Phase inverter for channel 1 (left) mic input

This can be used to invert the phase of the left channel.

41. INPUTS

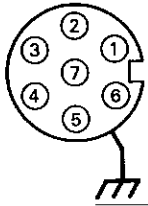
Line inputs connector. (Both channels)



- 1 = Channel 2 (right) input: impedance variable from 0 to 5 kOhm (0 to 10 kOhm when switch 11 is in the ST.HS position). Current drive with minimum source impedance 47 kOhm. Current to obtain 0 dB at max. sensitivity is 7.8 μ A.
- 2 = -10G: -10 V stabilized voltage output; maximum current 100 mA for all -10 V terminals
- 3 = Channel 1 (left) input. Identical to pin 1
- 7 = GROUND : For input signals

42. EXT. NRS

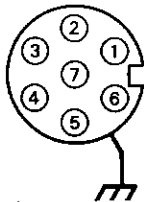
(External noise reduction system): Connection to external NRS. Output and input voltage 560 mV for 0 dB.



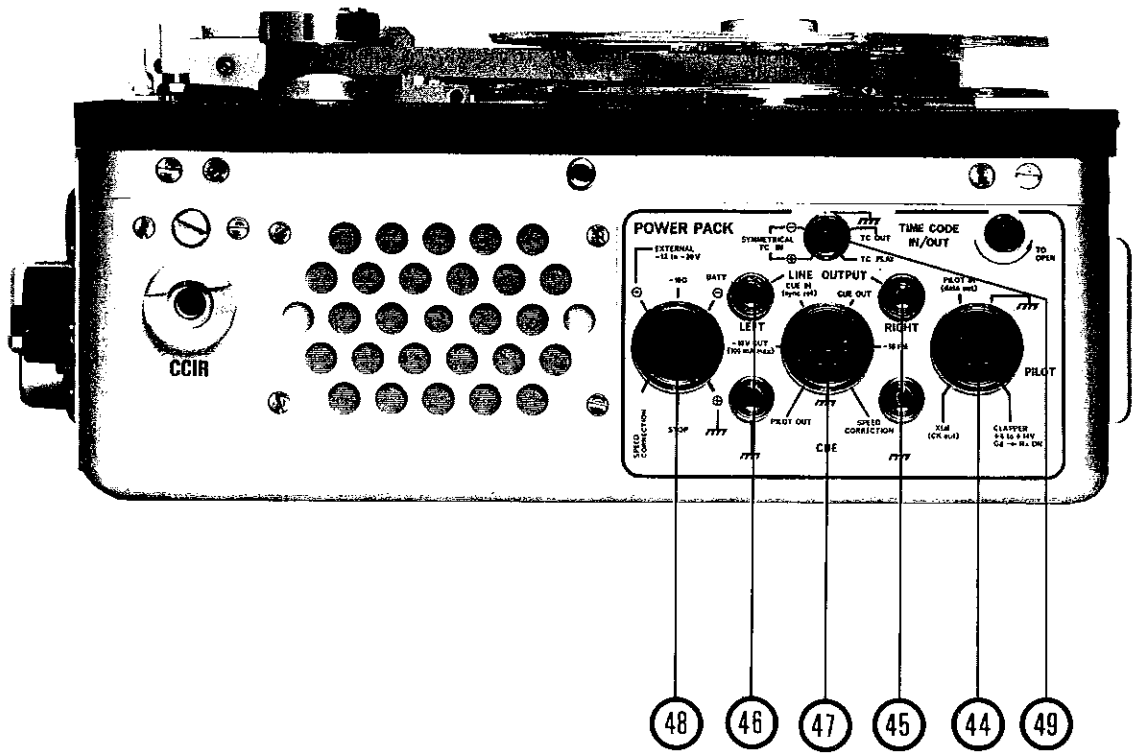
- 1 = EXT. NRS. output, channel 2 (right)
- 2 = -10G : -10V stabilized output. I_{max} = 100 mA
- 3 = EXT. NRS. output, channel 1 (left)
- 5 = EXT. NRS. input, channel 1 (left). Minimum impedance 47 kOhm
- 6 = EXT. NRS. input, channel 2 (right). Minimum impedance 47 kOhm
- 7 = GROUND : Ground for input signals

43. OUTPUTS

Line output connector.

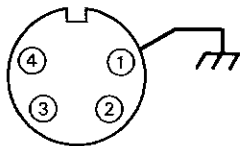


- 1 = Channel 2 (right) output: output voltage 1 V at 0 dB. Minimum impedance load 500 Ohm.
- 2 = -10G : -10 V stabilized voltage output. I_{max} = 100 mA
- 3 = Channel 1 (left) output. Identical to pin 1
- 4 = V unstab: Unstabilized power supply voltage
- 5 = -10R stabilized voltage available in record only. I_{max} = 100 mA
- 6 = STOP. Input for motor stop control. Connect to -10 V to stop the motor
- 7 = GROUND



44. PILOT

Pilot signal input for pilot track.



1 = GROUND

2 = Clapper : Reference oscillator or crystal pilot generator input

3 = X-TAL : 50 or 60 Hz internal generator output

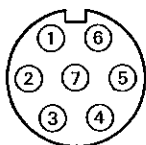
4 = Pilot in : Pilot signal input

45. **LINE OUTPUT (right)** : Channel 2 (right) output on banana plugs.

46. **LINE OUTPUT (left)** : Channel 1 (left) output on banana plugs.

47. CUE

Connector for recording and playback of the pilot track:



1 = Sync reference

2 = -10 V stabilized voltage output

3 = Pilot output

4 = Speed correction input

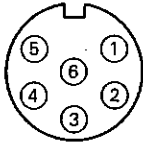
5 = -10 V FM connect to -10 V to activate modulator

6 = Cue output

7 = GROUND

48. POWER PACK

Connector for external power supply.



- | | |
|-------------------------|--|
| 1 = - BATT | : Negative pole of battery compartment. |
| 2 = + BATT | : Positive pole of battery compartment. |
| 3 = STOP | : Motor stop control terminal. Connect to -10 V to stop the motor. |
| 4 = SPEED CORRECTION | : Tape speed correction input. |
| 5 = EXTERNAL -12 to -30 | : Input for external power supply -12 to -30 V negative pole. |
| 6 = -10 g | : -10 V stabilized voltage output, I max 100 mA |

49. TIME CODE INPUT / OUTPUT



- | | |
|---------------------------|---|
| 1 = GROUND | |
| 2 = Time code input | |
| 3 = Serial input / output | (for use with AATON origin C master clock) if QSIA optional interface is fitted |
| 4 = Time code play | |
| 5 = Time code output | |

1.6 TAPE SPEED AND STANDARD SELECTION

The NAGRA IV-S is capable of running at three different speeds which can be selected by changing the position of "SPEED AND STANDARD" selector (20) on the top plate of the recorder between the two spools.

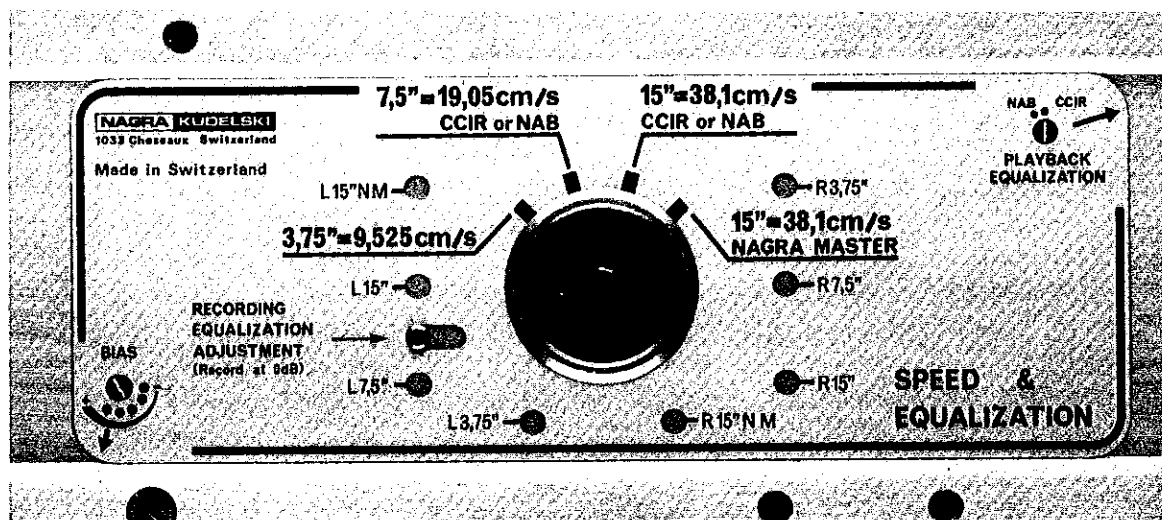
The speeds available are :

3 $\frac{3}{4}$ ips (9.525 cm/s)

7 $\frac{1}{2}$ ips (19.05 cm/s)

15ips (38.10 cm/s)

Each position of this selector automatically selects the correct equalization of the machine according to the chosen speed. There are two different positions available for 15 ips (38.1 cm/s) the first being normal equalization NAB or CCIR, the second being the special NAGRA MASTER position.



For adjustments of equalization and checking of tape speed refer to section III CALIBRATION of this manual. During playback the IV-S may also be switched between NAB and CCIR using switch (22) located in the right-hand rear corner of the deck.

NOTE: The NAGRA IV-S is only equipped with one recording bias oscillator and it is therefore only possible to bias the recorder for one specific tape type at any one time. However, it is possible to optimize the equalization at other speeds than the biased speed for different tapes.

1.7 LOADING A TAPE ON THE RECORDER

Select "STOP", then release the tape from the heads, guides and capstan shaft by pulling lever (32) forward, until it comes to a complete stop. Remove the spool retaining nuts and place a reel of tape on the left-hand turntable, with the loose end of the tape coming from the left-hand side of the spool. Pass the tape around the left-hand guide roller and across in front of the heads, and around the right-hand guide roller. Attach the end of the tape to the empty spool on the right-hand turntable. Replace the two spool retaining nuts, and close lever (32) until it reaches its original position, thus putting the tape into contact with the heads.

NOTE: It is important to lower the double head-shield before loading a tape, otherwise the tape may pass behind it, and thus not be in contact with any of the heads. When the tape has been loaded and lever (32) has been restored to its original position, the shield may be lifted in front of the heads.

1.8 FIRST TIME OPERATION

Main function selector switch (4) is on the front right-hand side of the recorder. It controls the mode of operation that the machine is in. By switching it to the "TEST" position all the circuits in the recorder are powered up but the motor is not.

Select "EXT" or "BATT" depending on the power available. It is now possible to check the supply to the machine by putting modulometer switch (12) to the "BATT" position as explained previously. After checking the power, put the modulometer switch back in the level position.

Using main function selector (4) the machine may be put into the "RECORD", "PLAYBACK" or "TEST" positions (for level checking etc.) depending on the desired mode.

To interrupt any mode on the machine, the main function selector should be put to the "STOP" position.

FAST FORWARD / REWIND

To rewind a tape put the main function selector in the "STOP" position, and open the pinch wheel gate by using operating lever (32) then select "TEST" and rewind the tape by means of toggle switch (23) located on the top left-hand front corner of the deck.

When the tape is fully rewound always place operating lever (32) back in the fully closed position (this will prevent a "flat" portion being made on the capstan "O" ring).

To wind a tape fast forward use switch (23) as for rewind. However, it is not necessary to open the pinch roller gate. The FAST FORWARD position of the toggle switch is only active when the main function selector is in the PLAYBACK (with loudspeaker) position. This is done to prevent accidental winding of the tape during RECORDING.

RECORDING

The NAGRA IV-S can make a recording using either microphones or a "DIRECT" line input signal.

RECORDING WITH MICROPHONES

When using microphones, connect a microphone to one or both of the two XLR type connectors on the left-hand side of the recorder. Check that the switches above each of the connectors are in the correct position corresponding to the type of microphone to be used. The possible selections are T-power, +12 V and +48 V phantom, powering 50 Ohm or 200 Ohm dynamic.

Set switch (9) to one of the two upper positions depending on which channels are to be recorded by microphone. The level of the signal coming from the microphones may now be observed by putting the machine into the "TEST" position and switching modulometer switch (12) to the "LEVEL" position. The gain may now be adjusted using potentiometers (6) and (7) on the front panel, which can either be adjusted separately or together by moving the small plastic slider on the red control knob.

NOTE: The RED control corresponds to the left channel and the GREEN control corresponds to the right channel.

Turn the main function selector to either of the two RECORD positions, depending upon whether the limiter is required or not. Observe the modulometer to see that the levels remain correct throughout the recording.

Depending on the position of "LINE AND PHONES" switch (1) it is possible to monitor on the headphones output either the input signal, or the off tape signal during the recording. This is possible because the NAGRA IV-S is a three head machine. (Moving this switch will not affect the recording).

RECORDING A LINE SIGNAL

Set switch (9) to the "LINE" position and switch (10) to the "NORMAL" position. Feed line input connector (41) using a QCSE cable with the signal source to be recorded (minimum 0.5 V).

Set switch (11) to "STEREO" and switch (12) to "LEVEL". Turn the main function selector to "TEST" and adjust the levels using gain potentiometers (6) and (7). Finally switch the main function selector to one of the two "RECORD" positions to start the recording. When the recording is complete, select "STOP" then rewind the tape as previously described.

PLAYING BACK A RECORDED TAPE

Set main function selector (4) to one of the two possible "PLAYBACK" positions (either with, or without loudspeaker). The signal from the tape is now available on line output connector (43) or banana outputs (45) on the opposite side of the recorder. If line and phones switch (1) is in the "TAPE" position, then the signal is fed directly to the line outputs with no possibility of adjustment. However, if it is in the "DIRECT" position then each output may be adjusted with its corresponding control potentiometer.

The frequency response may also be modified using "FILTER" switch (13).

WORKING WITH HEADPHONES

If headphones are to be used, they can be plugged into the jack socket on the lower left-hand front side of the machine (17).

The level of the headphones may be adjusted using potentiometer (18). In record, the signals can be monitored either off tape or directly, depending on the position of the line and phones switch.

NOTE: When the machine is in the "TEST" position, the headphones output is always fed with the "DIRECT" signal.

The headphones output will accept a 1/4" stereo "JACK" connector (type 297) and can be used with headphones having an impedance from 25 Ohm to 600 Ohm. (Optimum value is 200 Ohm).

1.9 SPECIFICATIONS

The typical and maximum values stated below are defined as follows:

Typical value	:	Average value measured on 100 new recorders.
Maximum value	:	(shown in brackets) is the value above or below which a machine is rejected, when going through final inspection.

DIMENSIONS AND WEIGHT

Dimensions of the box alone with cover closed, without knobs, feet, handle or handle mounts:

	= 12.6 x 8.8 x 4.4"
	318 x 222 x 110 mm
overall dimensions except handle	= 13.2 x 9.6 x 4.5 "
	333 x 242 x 113 mm
Thickness of the box	= 0.08" or 2 mm
Thickness of tape deck	= 0.12" or 3 mm
Weight without batteries or tape	= 11.6 lbs or 5.25 kg
Weight with batteries and 5" tape	= 15 lbs or 6.4 kg

POWER SUPPLY

Power supply voltage necessary: D.C. (positive to chassis) -10.5 V to -30 V.

	non pilot	pilot	time code
power consumption			
"TEST"	100 mA	110 mA	140 mA
"LINE PLAYBACK"	175 mA	180 mA	200 mA
"LOUDSPEAKER PLAYBACK"	230 mA	240 mA	250 mA
"RECORD"	250 mA	270 mA	270 mA
"RAPID REWIND"	280 mA	290 mA	300 mA
"STOP"	0 mA	0 mA	2.8 mA

Type of batteries: 12 x IEC standard R20 or ASA standard D or L90.

Approximate length of service when using regular dry cells:

4 hours in every 24 hours	:	10 hours
Continuous service	:	7 hours
Continuous service with high capacity cells	:	25 hours

MAGNETIC TAPE

Width of tape	1/4" (6.25 mm)
Admissible thickness	0.0005 to 0.002" (12-50 μm)
Maximum reel diameter (cover open)	7" (178 mm)
Recording time (7½ ips / 19 cm/s, 35 μm tape)	45 minutes
Maximum reel diameter (cover closed)	5" (127 mm)
Recording time (same conditions)	22 minutes
Rewind time (5" / 127 mm reels, 35 μm tape)	2 minutes

TAPE TRANSPORT

Switchable tape speeds:

15 ips = 38.10 cm/s < 0.1%

7½ ips = 19.05 cm/s < 0.1%

3¾ ips = 9.525 cm/s < 0.1%

The stability of the average speed depends on temperature, the position of the recorder and the power supply voltage.

WOW AND FLUTTER

(Weighted p-p value according to DIN 45507 standard)

15 ips (38.10 cm/s) ± 0.05% (0.07)

7½ ips (19.05 cm/s) ± 0.07% (0.11)

3¾ ips (9.525 cm/s) ± 0.12% (0.15)

(Weighted rms value according to NAB standards)

15 ips (38.10 cm/s) 0.028%

7½ ips (19.05 cm/s) 0.030%

3¾ ips (9.525 cm/s) 0.043%

STARTING TIME: < 3 SECONDS

AMPLIFIER CHAIN MICROPHONE INPUTS

Maximum sensitivity for 0 dB on the modulometer:

dynamic microphones 50 Ohm	0.1 mV / µbar	0.14 mV ± 10%
dynamic microphones 200 Ohm	0.2 mV / µbar	0.28 mV ± 10%
condenser microphones (phantom powering +12 V, +48 V and -12 V)	1.0 mV / µbar	1.40 mV ± 10%
condenser microphones T powering	1.5 mV / µbar	2.20 mV ± 10%

Distortion at 1 KHz in the condenser microphone position, T powering, input level 40 dB (420 mV) maximum sensitivity:

2 nd harmonic > 0.22 % (0.3%)

3 rd harmonic > 0.05 % (0.1%)

maximum input voltage for a distortion of 1 % at 1 kHz:

dynamic 200 Ohm 135 mV (120 mV)

T- powering 1040 mV (1000 mV)

+48 V phantom 655 mV (600 mV)

Frequency response (output loaded with 5 kOhm) dynamic microphones:

50 Hz 0 dB (-1.5 dB)

80-20 Hz ± 0.7 dB (± 1 dB)

Signal-to-noise ratio of the microphone preamplifier when switched to dynamic, ASA A weighting, reference

1 mW 125 dBm (124 dBm)

Noise level of the condenser microphone preamplifier, input ASA A weighted
0.6 µV (0.8 µV).

LINE INPUTS

The input impedance is variable from 0 to 5 kOhm or from 0 to 10 kOhm in the ST.HS position of the stereo / mono switch; this is a current input.

Input current for 0 dB on the modulometer, maximum sensitivity 7.8 μ A \pm 5%

Maximum input level for 1% distortion under the same conditions (23 μ A)

Signal-to-noise ratio at maximum sensitivity 86 dB (80 dB).

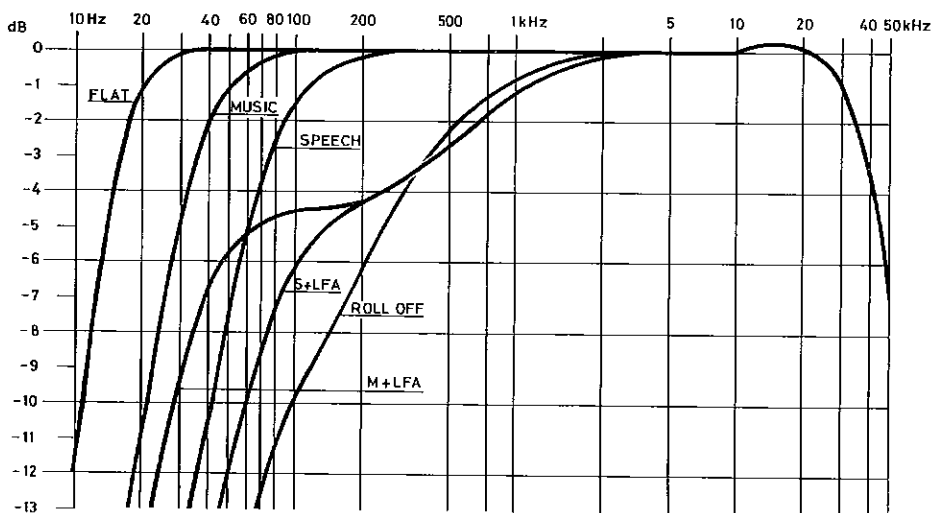
MODULOMETER

The integration time for -1 dB 10 ms \pm 20 %
 Usable scale -30 to + 5 dB.
 Frequency response 40 Hz to 20 kHz \pm 0.5 dB
 Instrument class 1.5

CROSSTALK BETWEEN CHANNELS

0 dB on the modulometer 1 kHz 70 dB (65 dB)
 10 kHz 60 dB (50 dB)

Filters		Attenuation
FLAT	linear frequency response	
MUSIC	high pass filter	-3.0 dB at 40 Hz
M+LFA	music + low freq. attenuation	-7.0 dB at 40 Hz
		-3.0 dB at 400 Hz
SPEECH	high pass filter	-3.0 dB at 80 Hz
S+LFA 2	speech + low freq. attenuation	-7.5 dB at 80 Hz
		-3.0 dB at 400 Hz
ROLL OFF	strong low freq. attenuation	-10.0 dB at 100 Hz
		-3.0 dB at 400 Hz



RECORDING AND PLAYBACK

Nominal recording level 0 dB = 510 nWb/m
Maximum peak recording level + 4 dB

The types of tape for which the machine is adjusted appear in the protocol of measurements, e.g.:

CCIR version	AGFA PEM 468	(15" and 7½")
	AGFA PEM 369	(3¾")
NAB version	SCOTCH 3M 808	(15", 7½", 3¾")
	SCOTCH 3M 226	(15" NAGRAMASTER)
Erase efficiency at maximum peak level		83 dB (80 dB)

Frequency response, recorded at -20 dB:

15 ips	(38.10 cm/s)	from 30 Hz	to 20 kHz	± 1dB	(± 2 dB)
7½ ips	(19.05 cm/s)	from 30 Hz	to 15 kHz	± 1dB	(± 2 dB)
3¾ ips	(9.5 cm/s)	from 30 Hz	to 10 kHz	± 2dB	(± 3 dB) CCIR
3¾ ips	(9.5 cm/s)	from 30 Hz	to 8 kHz	± 2dB	(± 3 dB) NAB

Distortion at maximum peak level, 15 ips STD 3rd harmonic 1% (2%).

Signal-to-noise ratio, record and playback, at maximum peak level:

15 ips (38 cm/s) NAGRAMASTER (13 µs)	NAB	74.5 dB (72 dB)
	CCIR	75 dB (72 dB)
15 ips (38 cm/s) STD	NAB	70.5 dB (68 dB)
	CCIR	71 dB (69 dB)
7½ ips (19 cm/s) STD	NAB	68 dB (65 dB)
	CCIR	69 dB (64 dB)

Non-pilot version (wide track)

Signal-to-noise ratio improved by approximately 1.5 dB

Phase fluctuation between channels 7½ ips (19.05 cm/s), 10 KHz ± 5° (± 20°)

Cross talk during record and playback	1 KHz	60 dB (50 dB)
	10 KHz	50 dB (40 dB)

Insertion of a noise reduction system (NRS).

Low impedance output to NRS, voltage for 0 dB on the modulometer 560 mV.

Input for NRS, impedance approximately 10 kOhm, voltage for 0 dB on the modulometer 560 mV.

OUTPUTS

Line output voltage at 5 kOhm, for 0 dB on the modulometer 1 V.

Maximum output voltage for 5 kOhm, giving 1% distortion at 1 kHz V (2.8 V).

Maximum output voltage to 200 Ohm headphones, for 0 dB modulometer, at 1 kHz = 560 mV ± 20 mV.

PILOT TRACK

Possible speeds	$3\frac{3}{4}$ ips / $7\frac{1}{2}$ ips / 15 ips.
Carrier frequency	13.5 kHz.
Static linearity	(2%).
Maximum frequency deviation delta f0	$\pm 45\%$ ($\pm 40\%$).
Frequency response at -3 dB	0 to 2.7 kHz (0 to 2.5 kHz).
Signal-to-noise ratio for 40 % frequency deviation	> 50 dB.
Input voltage for 20 % frequency deviation	Pilot input ± 1.4 V $\pm 5\%$ Cue ± 1.0 V $\pm 5\%$
Distortion for 40 % frequency deviation at 400 Hz	< 2%

REFERENCE GENERATOR

1.1 kHz composite sine wave signal with 10 kHz component, level 0 VU = -8 dB \pm 0.2 dB.

OPERATING CONDITIONS

Temperature:	with alkaline batteries	- 4°	to + 160°F
		- 20°	to + 71°C
	with external power supply	- 67°	to + 160°F
		- 55°	to + 71°C

The recorder functions in any position.

TIME CODE

TIME CODE SPECIFICATIONS see Chapter IV.

