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Development and Evaluation of an Instructional Manual Concerning the Nagra 4.2 Film Sound Tape Recorder

Helen Bambic-Workman

A Thesis Equivalent

in

The Department

of

Education

Presented in Partial Fulfillment of the Requirements for the Degree of Master of Arts at
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ABSTRACT

Development and Evaluation of an
Instructional Manual
Concerning the Nagra 4.2
Film Sound Tape Recorder

Helen Bambic-Workman

This thesis equivalent has designed and evaluated an Instructional Manual to support an existing sound/slide production on the functions of the NAGRA 4.2, produced by the author.

The work leading up the the development of the learning materials concerning the NAGRA 4.2 included a survey questionnaire sent to one hundred and ten North American Universites. A response of 44% indicated the need for such instructional materials.

The Instructional Manual was formatively evaluated with a sample student population of twelve in July, 1985. Following modifications to the Instructional Manual, summative evaluation procedures were conducted in December, 1985.

Results of this study indicate that the three components of the learning experience, that is, the sound/slide presentation, the Instructional Manual and the hands-on practice are needed for the development of film sound recording skills using the NAGRA 4.2.

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Numerous friends and colleagues have generously contributed their time, expertise and encouragement throughout the various stages that have lead to the completion of this thesis equivalent. I am grateful for their efforts and I would like to make the following acknowledgments. I would like to thank my advisor, Dr. Jon Baggaley, for always making available his lucid and meticulous guidance.

For their technical expertise, I would like to thank Don Cohen, Stephen Dalby, Ron Hallis, Roger Tyrrell and Keith Young.

For their unfailing encouragement and support I thank Heather MacKenzie Lee and Dr. Gary Boyd.

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DEDICATION

To my mother

Anna Szkwarok Bambic

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PART ONE

MEDIA PRESENTATION

INTRODUCTION

This Thesis Equivalent was concerned with the development of an Instructional Manual designed to support existing learning materials on the NAGRA 4.2 tape recorder. These learning materials were produced by the author and consist of a sound/slide presentation, of fifteen minute and forty-five second duration dealing with the functions of the NAGRA 4.2.

The NAGRA is a complex, expensive, precision tape recorder, the acquisition of which represents a major capital expenditure on the part of cinema production teaching programs. Scant supplementary learning materials, apart from the technical manual supplied by the manufacturer, are available.

Elements from the design for Audio-Visual Training Modules, created by Harold Stolovitch, contributed to the Instructional Manual which was designed to provide a useful knowledge base and to serve as a performance guideline tool for cinema production students beginning sound recording for motion pictures for the first time.

The purpose of this Thesis Equivalent was to develop and evaluate an Instructional Manual to support the existing sound/slide learning module which covers the functions of the NAGRA 4.2, and to provide cinema production students with relevant knowledge for developing recording skills.

This sound/slide module on the functions of the Nagra 4.2 was developed and formatively evaluated by the author, using a sample population of thirty first year cinema procdution students. The purpose of developing this particular sound/slide instructional presentation was to provide a supplementary learning resource concerning a complex professional tape recorder for a specific target audience of cinema production students.

There exist at present five NAGRA tape-recorders in the Cinema Production Department at Concordia University, not all of which are at all times functional. As compared to the forty-three universities that responded to the Needs Assessment Questionnaire, this represents a generous number. Most universities indicated they had only one or two, with the exception of an Ontario University that provides the production students with fourteen NAGRA tape-recorders, nine of which are the NAGRA 4.2 and none the NAGRA III model. At Concordia at least, there are few of the one

hundred and sixty-six cinema production students that gain direct hands-on experience with the recorder.

Enthusiastic feedback from both the instructors and students who were using the sound/slide presentation as a learning tool encouraged the author to conduct a pilot study to evaluate the presentation. This pilot study indicated sufficiently significant results to warrant further restructuring, revision and re-evaluation of the sound/slide production. There were indications that the addition of an Instructional Manual to support the sound/slide presentation would be a most useful tool in the hands of the student who would be recording film sound on location for the first time. It was not designed to replace the comprehensive technical manual provided by the manufacturer, but to present a distilled essence of the specialized knowledge for practical film sound recording applications.

INSTRUCTIONAL CONTEXT

THE TECHNOLOGY - PAST AND PRESENT

It should be noted that it was the NAGRA's arrival on the cinema scene in the early fifties that was the technological innovation that helped revolutionize the art of film-making. No longer was it necessary to have a room full, or

in the case of location recording, a truck full of cumbersome equipment in order to reproduce quality sound for film. As late as 1948, mobile sound recording used heavy, bulky units installed in trucks. These required a great deal of electricity to power and were impractical to use.

> 1951 In Prilly/Lausanne, Stefan Kudelski designs and builds a high quality tape-recorder that is portable, self-contained, light and small: the NAGRA.

The above quote is from the historical account of the chronological evolution of sound recording compiled by the Kudelski Company. Stefan Kudelski, born in 1929 in Poland, founded the Kudelski Company in 1951. The same year he developed the NAGRA tape recorder. It is interesting to note that the word **nagra** in Polish means **to record.** After the First International Sound Recording Contest in 1952, no advertising was needed to sell the recorder.

Mention should be made here of the NAGRA III, which was launched in 1958 and widely used. Although none have been manufactured for the past sixteen years, many are still very much in use today. According to the information provided by the Needs Assessment Questionnaire, 40% of the NAGRA tape

recorders in use by film schools are the NAGRA III and 51% are the NAGRA 4.2 which emerged in 1971.

This is indeed a testimony to the statement made in the ARRI/NAGRA NEWS (Edition 3-83) that:

> NAGRA tape-recorders have earned an enviable reputation for extraordinary reliability, quality and long life.

The NAGRA is recognized and used throught the world by professionals who excel, as well as by students learning to develop the skills to excel. In this age when technplogical obsolesence is all too often the norm, the NAGRA has for more than a generation maintained an impeccable standard of excellence. Dr. Joe Sunday, Vice-President of Arri-Nagra Inc., speaking on NEW HORIZONS IN SOUND REPRODUCTION at the Convergence Conference in Montreal (November 29th, 1984), stated:

> We are pleased that our trade name NAGRA has essentially become the definition of location recording for film.

Sunday reported that NAGRA has, in 1984, developed double system audio for video productions with SMPTE (Society for

Motion Picture and Television Engineers) time code as a synchronizer. This innovation has emerged in response to current studies cited by Sunday, that have indicated that the greatest value in production today is placed on the improvement of sound in home video receivers. This makes the superior location recording techniques of recording sound for film available for television production.

Tomlinson Holman, Technical Director of Lucasfilm Ltd and the Skywalker Development Corporation, who has been largely responsible for the sound in RETURN OF THE JEDI, speaking at the Convergence Conference stated:

We are on the brink of an audio revolution.

Sound engineers are now referred to as sound designers and are so credited in the new generation of films being currently being made and distributed.

Learning materials to assist novice cinema production student sound recordists in use of the NAGRA are in short supply and if the sample of cinema students at Concordia may be used as an indication, they are much needed.

EXISTING INSTRUCTIONAL MATERIALS

The content of the sound/slide production presents the functions of the recorder in the same sequence as the information manual provided by the manufacturer of the machine. The audio-tape explains the function while the accompanying visual focuses attention on the particular function under instruction by using close-ups, full shots and arrows where appropriate.

The sound/slide presentation evolved through several stages of formative evaluation. In 1981 a pilot study to evaluate its effectiveness was conducted using thirty first year cinema production students. Instrumentation included a cognitive test which contained twenty-five, mostly multiple choice, questions based on the content of the sound/slide presentation, as well as an opinion questionnaire. Although the results of the cognitive test showed that significant learning had been achieved, the comments on the opinion questionnaire revealed that what the students wanted was time on the NAGRA 4.2 for hands-on practice. There were also indications of a need for supportive print materials that would also serve for future reference. Discussions with the instructors and the students led to the incorporation of changes to the sound/slide presentation.

Titles and captions which were on separate slides prior to original pilot study, were superimposed on to the appropriate slides, reducing the total number of slides from one hundred and twenty-seven to seventy-five to be conveniently accomodated to one carousel for easy use with a single projector. Graphic representations were redesigned based on careful consultation with the cinema instructors teaching Technical Aspects of Cinema Production. Additional "graphic syntax" (Borich, 1982) models the system of various sound inputs and processes that contribute to the production of the final output, sound on a 16mm optical print.

Covering the principal parts and functions of the NAGRA 4.2 in a fifteen minute sound/slide production necessitated the presentation of a good deal of information. Students indicated that there was a need for some print material to support the sound/slide production. The Instructional Manual was designed to fill this need, as well as to provide the novice sound recordist with relevant knowledge that would contribute to the recording of good quality sound for film when on location for the first time.

NEEDS ASSESSMENT STUDY

In order to assess the current state of NAGRA user needs a survey questionaire (Appendix #1) was sent out to in 1984 to one hundred and ten North American Universities involved with teaching 16mm film production. These were selected from THE AMERICAN FILM INSTITUTE, GUIDE TO COLLEGE COURSES IN FILM AND TELEVISION, Seventh Edition, 1980 and from A GUIDE TO FILM AND TELEVISION COURSES IN CANADA, 1978-79.

There were 44 (40%) responses. Six of these universities no longer have a 16mm cinema production teaching program. Out of the 38 that teach 16mm film production, 32 (84.2%) selected the MAX or MED degree of potential usefulness of such a learning module for their students, rather than selecting the MIN or NIL indication. Thus, there appears to be considerable value of potential usefulness for learning materials pertaining to the NAGRA 4.2 tape recorder.

Most of the survey respondents indicated that there are few self-instruction audio-visual learning materials in use by cinema production teaching programs. These few tend to consist predominantly of in-house productions. Three universities replied that they were in the process of producing their own instructional materials.

Responses to the first question of the survey, which asked how many NAGRA 4.2 and NAGRA III recorders were available for use by students, showed a total of fifty-seven NAGRA 4.2 and thirty-eight NAGRA III machines. It is noteworthy that the NAGRA III, which has not been manufactured for sixteen years, is still very much in use.

The second question, asking how many FEMALE/MALE students were enrolled in cinema production in 1st, 2nd, 3rd and 4th years, produced responses that were not clearly listed as to the division by gender. The greatest number of female students tended to appear in 1st year and male students predominated enrollments in 2nd, 3rd and 4th year.

Question three, asking whether all the students were required to do film sound recording, drew a YES from 66.6% of the responses.

Only 11.4% said YES to question four, regarding the use of audio-visual (non-print) self-instructional learning materials by the cinema production students, and these were primarily in-house productions. One response, with an accompanying letter, described a video production developed by one of their graduate students for use as a training tool for undergraduate production classes. An exchange of projects was proposed. Several of the respondents expressed

an interest in learning the results of the survey.

Question number 5 asked how useful a self-instructional learning module on the NAGRA 4.2 might be for their students. The degree of usefulness was indicated by encircling one of MAX, MED, MIN or NIL. The resultant indications were as follows: 17 MAX (44.7%); 15 MED (39.5%); 6 MIN (15.8%); and 2 NIL (5.3%).

One of the comments on the questionnaire said that individual performance had to be domonstrated before students would be allowed to take out the recorder. Interest was expressed in

> An instructional video tape on the NAGRA 4.2, provided it wasn't too lengthy and could provide a good basic understanding of the NAGRA operation to be followed by hands-on practice in a laboratory situation.

Question 6, which requested an indication as to the most useful mode of presentation had thirty-nine responses as follows:

2 AUDIO & PRINT (5%); 2 SLIDE/TAPE (5%); 5 1/2" BETA (13%); 14 1/2" VHS (36%); 16 3/4" VIDEO (41%)

Question seven showed that 29% of students were encouraged to shoot 1/2" video before 16mm film and 71% not.

The responses to question eight, which asked how many student sound films were mixed in each of the years from 1979 to 1984 were incomplete, with several indicating that they did not know. This seemed to be the most difficult question to answer, and the few answers were approximations for the years 1982 to 1984 inclusive. In some cases the numbers matched the numbers of students enrolled.

The most films mixed, indicated by one university, was 70, over these three years. Another had 52, the next 30. Other estimations were under 20 or non-existent. It has been no less difficult to get precise numbers of films mixed right here at Concordia where the estimates over the past five years for the Cinema Production Program, including the Animation Secion, were at over 200 yearly.

The sum of the resultant indications of MAX (44.7%) and MED (39.5%) degree of usefulness of a self-instructional learning module on the NAGRA 4.2 was (84.2%). This high degree of interest expressed by the universities responding to the Needs Assessment Survey, along with the encouragement of the students and faculty of the Cinema Production Program of Concordia University justified the descision to develop and evaluate the Instructional Manual to support the existing sound/slide presentation.

TARGET POPULATION

The sound/slide presentaion and the Instructional Manual was specifically designed for first year cinema production students who have virtually no access to the NAGRA 4.2 and who are sufficiently interested to seek out supplementary information about it. The underlying supposition was that there is a high degree of motivation on the part of the students seeking out this presentation, and there is a fairly low degree of prior knowledge about the tape-recorder itself.

What are some of the characteristics of cinema production students? How do they see themselves?

At Concordia University, the Cinema Production Program is a part of the Faculty of Fine Arts. These students constitute a population of media oriented creative artists, script writers, film directors, producers, designers, actors, educators and social critics in the process of development.

Most of these students want to make an aesthetic statement. These are media technologists in the making, who have an opportunity to develop standards of excellence in the enhancement of their media skills.

This target audience is, by definition, limited to a

small population of university students. Not all cinema production schools require all their students to record sound. It is for these students who are required, or wish individually to improve their film sound recording skills, that this learning module was developed.

Unless these students have had enough sound recording experience with other recording systems to develop some self-confidence, they tend to be intimidated by the complexity, monetary value, limited access and professional mystique that NAGRA tape-recorders seem to generate.

RATIONALE FOR MEDIA SELECTION AND PRODUCTION DESIGN

The field of sound recording for film is an extensive one and it is rapidly growing in complexity. Audio recording skills can only develop with practice and experience. This learning module is designed to help novice film sound recordists take the first step.

The problem defined for this learning situation was to develop materials to support the existing instructional sound/slide presentation on the functions of the NAGRA 4.2.

Romiszowski (1974) models a decision making process for selecting an appropriate medium for instruction. Where verbal communication is the main objective and the topic is complex or its structure involved

A written text will be superior to a spoken commentary. (Romiszowski, 1974)

The manual provided by the manufacturer of the NAGRA 4.2 is fairly complex and designed for use by professionals who have already acquired knowledge and skill in the theory and practice of sound recording. What was needed for the novice sound recordist was selected print material presenting a simplified overview of essential knowledge to assist the cinema production student to begin to use the NAGRA 4.2 for the purpose of recording sound for film.

The instructors teaching Technical Aspects of Cinema Production, who were already using the sound/slide presentation as a part of their instruction, stated that supportive print materials would enhance its value as a learning tool. These print materials could provide a review of the functions covered in the sound/slide presentation, step by step procedures on how to operate the recorder and checklists and warnings to insure the proper care and use of the NAGRA 4.2 to minimize the risks of misuse.

There is no substitute for first hand practice.

(Alfred North Whitehead, 1967)

This learning module is not intended to replace 'hands-on' practice. It is intended to provide the students with

pertinent information, structured for their specific needs, to equip them with the necessary knowledge and motivation to interact confidently and effectively with the Instructional Manual and with the NAGRA 4.2.

Media used for teaching purposes have historically been cast in supportive roles of teaching aids to make instruction more effective. Stolovitch (1978) claims that media can step away from the supportive-only role as an instructional aid to actually being the instruction. He states that recent efforts of innovative instructors have been combining these

> assorted media into a unified package whose function it is to carry the main instructional load.
>
> (Stolovitch, 1978)

The Instructional Manual, combined with the sound/slide presentation comprises complementary learning materials that may be used by the instructors for teaching or by the students for self-instruction. Together they fashion a unit that

> Responds to the necessity of multisensory education. It permits self-pacing. And it offers an affective dimension often absent in other designs.
>
> (Stolovitch, 1978)

EDUCATIONAL OBJECTIVES OF THE MANUAL

It was the broad goal of this Instructional Manual to support the NAGRA 4.2 Sound/Slide Presentation produced by the author, and to structure specific relevant knowledge for the cinema student sound recordist so that it would foster self-initiated, self-paced interaction with the manual and guide hands-on application with the NAGRA 4.2.

The objectives of this Instructional Manual were to enable students to determine whether the tape-recorder was functioning efficiently and to demonstrate basic recording skills.

Step-by-step sequencing of procedural explanations on how to set up the recorder, load the tape, perform the machine check, perform tape identification procedures, test recording levels, record a sound track and check the playback engage the student in trying and experiencing the results, or consequences of his/her performance.

The performance objectives for the testing of the Instructional Manual provide the student with a form and structure to guide hands-on application for first time use of the NAGRA 4.2. Repetition of the exercise for reinforcing, practicing and expanding on the performance skills learned can only be left to the individual initiative

of the student to request hands-on practice time with the recorder. It is the underlying educational objective of the Instructional Manual to provide the student with sufficient motivation, self-confidence and knowledge to overcome the constraints inherent in the fact that the NAGRA tape recorders are primarily available for student productions, and not for hands-on practice.

OUTLINE OF CONTENT AND FORM OF PRESENTATION

For formative evaluation, the content of the Instructional Manual contained thirteen sections covering information that related both to the sound/slide presentation and to the process of sound recording for film using the NAGRA 4.2. The content gave a condensed and succinct treatment of the subject as an aid to the beginning sound recordist. It attempted to winnow relevant fundamental principles from a mass of material to develop a definite framework which would 'create guidelines' that will enable them to do their job well'. (Churchman, 1979)

In AUDIO VISUAL TRAINING MODULES, Stolovitch maintains that

> The response book is the most important component of the design format. It is the part that provides the trainee with opportunities to respond, demonstrate and tryout newly acquired competencies. It also acts as a source for future reference after instruction.
>
> (Stolovitch, 1978)

The Instructional Manual did not fulfill all the requirements of the response book as described by Stolovitch. On-going interaction between the sound/slide presentation and the Instructional Manual was not built into the learning unit. It did provide the student with opportunities to demonstrate and try out newly acquired competencies, when the occasion for hands-on practice with the recorder was made available to them. And it provided a source for future reference after instruction. This was a crucial point. In order to provide an overview of the primary functions of the NAGRA 4.2, the pace and quantity of information in the sould/slide presentation was considerable.

The sections of the draft Instructional Manual which was formatively evaluated were sequenced as follows;

1) Objectives

2) Warnings

3) Turning on Sequence

4) Machine Check

5) Location Sound Recording Materials Checklist

6) Tape Identification Procedures

7) Soundperson's Duties - Recording Clean Location Sound

8) Glossary

9) Historical Account

10) Function Diagrams

11) Graphic Syntax of Slides

12) Script - NAGRA 4.2

13) References

The second to seventh (inclusive) sections resulted from numerous consultations with the instructors as well students to select information that would be most useful to a cinema production student recording sound for film for the first time.

The second section related to use, care, transportation and storage of the NAGRA 4.2. The Turning On Sequence described, step by step , how to turn on the recorder, perform the machine check, test the functions and record, monitor and playback the recorded signal. Section four

consisted of a checklist listing specific machine parts which must be checked to determine whether the NAGRA was functioning efficiently.

Next, a checklist pertaining to materials necessary for the sound recordist to have available for location recording. Explicit instructions on how audio tapes should properly be identified, both aurally on the tape itself and on the exterior of the box comprised section six.

Explanation of the duties expected of a soundperson on location, along with some helpful hints for recording clean location sound made up section seven.

Section eight was a glossary containing common terms used in the magnetic recording of film sound and was included to provide students with a quick source of reference and explanation of new terms they would be encountering. Section nine consisted of an historical account of the chronological evolution of magnetic recording, which was compiled by the Kudelski Company. It was included for its potential interest to the cinema student rather than for its usefulness to the actual recording process. The function diagrams, section ten were copied (with permission) from the official manual for the NAGRA 4.2. Section eleven comprised all the graphic syntax

contained in the sound/slide presentation and were sized so that they could be eaily made into overhead transparencies for teaching purposes if needed. The entire script of the sound/slide presentation, which included photocopies of the slides to provide a rough outline of the image made up section twelve. This gave the student easy access to the information on the principle functions of the machine. Section thirteen listed the books referred to that the student could consult for further information.

All the content of the Instructional Manual was developed with the help of the instructors and other experts in the field of film sound recording. It becomes the

> Integrating and guiding component that gives direction to the student.
>
> (Stolovitch, 1978)

The content of the Instructional Manual will make it a useful resource book that will provide answers for some of the common questions and problems the cinema production student encounters when beginning sound recording for film.

Presentation of the manual was in print form on fifty-six bound pages of letter size paper. The essential instructional content of the manual was stored on diskette (Apple), using Wordstar.

ESTIMATED COST OF PRODUCTION

Needs Assessment Survey	$100.00
Materials	50.00
Graphics	100.00
Word Processing	150.00
Reproduction	200.00
Evaluation	100.00
Total	$700.00

(N.B. Costs pertaining to Authoring, Sample Group, Administration, and Expert Content Advice have been absorbed by the author.)

PART TWO

PRODUCTION EVALUATION

The purpose of the production evaluation was to assess whether the Instructional Manual supported the existing sound/slide presentation and enabled the sample of cinema production students to fulfill the performance objectives to an acceptable degree.

The testability of the skills taught in the manual presented a difficult problem. There are few NAGRA 4.2 tape-recorders available for student use, especially for practice. The priority for use is for production and students must demonstrate ability to use the machine before it is released from the equipment room.

It has been tempting to limit this Instructional Manual to conform to easily testable objectives. But that is not what the needs assessment survey, the instructors and the students themselves indicated would be of maximum value. Neither would that approach to the design enable the cinema students to develop recording skills. Stufflebeam (1971) states:

> We can no longer be cavalier about dismissing as intangible variables that are not evidently measurable

by paper and pencil techniques.

Focus on easily measurable objectives tends to lead to elimination of longer term objectives that are not so easily measurable.

> Since objectives must be specific to be measurable, longer term and higher order objectives intended by program developers may have been eliminated when they had to compete with concrete and short term objectives which were more easily defined and measured. (Borich, 1982)

This tends to make the process of measurement more important than the whole pattern of concepts that is being measured. Borich aptly puts it as follows:

> Test scores could become entities unto themselves while the concepts behind the scores become obfuscated. With highly precise modes of quantification come the illusion that the data themselves are what is important, not the judgement criteria by which the data must be interpreted and made meaningful. (Borich, 1982)

It is Borich's belief that planning and evaluation begins and ends with values. Borich states that

> Values are seldom identified, stated clearly, or even considered, particularly in program evaluation.
>
> (Borich, 1982)

He sees constraints as avenues toward understanding the values undergirding a program.

Boyd (1984) notes that the two fundamental limitations on the engineering of learning activites consist of:

1) complexity of communication and
2) uncertainty of the learner's state.

Complexity of communication increases with the amount and complexity of information to be communicated. Can not these fundamental limitations be perceived as constraints?

> We need to expose constraints for what they really are: values. (Borich, 1982)

Perception of limitations (constraints) as values is a novel notion. Trying to perceive the uncertainty of the learner's state as a value, as opposed to a limitation, puts the focus on the learner, instead of on the content of the

learning. We cannot separate the program from the people who embody the program; that is, those for whom it is designed.

Formative evaluation is the testing process by which data is obtained concerning the efficiency and effectiveness of instructional materials. Dick and Carey (1978) state that there are two important differences between the purposes of formative and summative evaluation. Formative evaluation provides the data for any revisions that might be necessary, while summative evaluation assesses the final product.

The second point made by Dick and Carey (1978) defines the purpose for formative evaluation as the collection of data which 'will facilitate revision' of the instruction, while summative evaluation determines the value of the instructional materials for the defined target population.

To determine what revisions to the draft Instructional Manual were required and to facilitate their implementation, formative evaluation procedures were conducted.

FORMATIVE EVALUATION PROCEDURES

SAMPLE OF TARGET POPULATION

Formative evaluation of the Instructional Manual was done during the month of July, 1985. This time was dictated by when the NAGRA 4.2 could be made available for the study. The sample of the target population, which ideally should have entirely consisted of first year cinema production students, was composed of five third year cinema production students, one fourth year animation student, two film studies students (second and third year), two third year communication studies students and two students in educational technology (production option). None of this sample of twelve students had previously used a NAGRA 4.2. All the cinema production students were keen to take part in the study and gain some learning experience and hands-on practice on the machine.

TESTING DESIGN

A post test only control group design (Campbell and Stanley, 1963) was utilized for formative evaluation and testing was done to simulate natural conditions. As cinema production classes were recessed for the summer term, screening of the sound/slide presentation during class time was not possible.

Students were shown the fifteen minute instructional sound/slide presentation on the functions of the NAGRA 4.2 at their convenience at the AVISTA center. They were each given a copy of the Instructional Manual and the Opinion Questionnaire. The sample of students were also given a copy of the Performance Objectives outlining specifically what they would be required to perform after one week to peruse the Instructional Manual.

During the following week, the students returned by scheduled appointments to AVISTA to execute the performance objectives. A NAGRA 4.2 tape recorder was made available for their use.

They were each supplied with a five inch reel of 1/4" magnetic audio tape. They each had a one hour time slot within which to have some hands-on practice time to become familiar with the machine and to execute the

performance objectives. They were told that they could use the manual while doing so. When finished, they were asked to complete the opinion questionnaire and contribute evaluative comments.

INSTRUMENTATION

Instrumentation for formative evaluation consisted of the opinion questionnaire, the performance objectives and the instructor evaluation sheet.

PERFORMANCE OBJECTIVES

The performance objectives required of the sample students consisted of six tasks (see Appendix II). These tasks were designed to enable the student to determine that the machine was functioning efficiently and to demonstrate basic recording skills. These performance objectives were formulated with the help of two instructors teaching Technical Aspect of Film-Making at Concordia University.

OPINION QUESTIONAIRE

It was important to gather some data reflecting the attitudes of the student sample concerning both the sound/slide presentation and the Instructional Manual. In order to do this, questions were formulated concerning both the sound/slide presentation and the Instructional Manual. The questions were designed using a #1 - #4 Likert scale. It is described by Gronlund as a

> Simple and widely used self-report method for measuring attitude. (Gronlund, 1981)

Students were asked to respond to the questions by circling the number that best represented their assessment by using #1 to indicate the most negative response and #4 the most positive. The first three questions on the opinion questionnaire for formative evaluation (see Appendix II) pertained to the sound/slide presentation.

Question four asked the student to assess, in general, the usefulness of the Instructional Manual. The fifth question asked the student to assess, specifically, the usefulness of the twelve sections of the Instructional Manual. At the bottom of the questionnaire, the students were asked to contribute evaluative comments.

INSTRUCTOR EVALUATION SHEET

In order to evaluate the performance objectives executed by the sample students, the assessment of the students' competence was graded by the instructor to be either accepable (ACC) or non-acceptable (NON) in relation to each of the required tasks. For this purpose, the instructor utilized the instructor evaluation sheet (see Appendix II) on which he was also requested to contribute evaluative comments pertaining to the individual student's performance.

DATA ANALYSIS - FORMATIVE EVALUATION

OPINION QUESTIONNAIRE

a) Quantitative Results

The frequency of responses for question five on the opinion questionnaire are illustrated in Table 1. There were twelve separate parts to the question, each of which referred to the degree of usefulness of specific sections of the Instructional Manual.

The number of responses for the negative NIL usefulness of the sections was three (2.08%). This effect resulted from one student who stated that the Materials Checklist, Soundperson's Duties and References were not crucial to the exercise but would be appropriate for future use of the NAGRA.

The section in the Instructional Manual which the sample of students found to be the most useful was the **Turning On Sequence** which showed a mean of (3.8) with a standard deviation of (.4). Observation of Table 1 shows the following four sections, **Machine Check, Materials Checklist, Tape I/D Procedures** and **Soundperson's Duties** also rated a high degree of usefulness.

The sections least useful were **References, Historical Account** and **Warnings.**

TABLE 1

Formative Evaluation - Opinion Questionnaire

Frequency Distribution of Results Question #5

	NIL 1	MIN 2	MED 3	MAX 4	MEAN	SD
How useful specifically did you find the following sections?						
Warnings	0	1	6	5	3.3	.7
Turning on sequence	0	0	2	10	3.8	.4
Machine check	0	0	4	8	3.7	.5
Materials checklist	1	0	1	10	3.7	.9
Tape I/D procedures	0	2	1	9	3.6	.8
Soundperson's duties	1	1	1	9	3.5	1
Glossary	0	1	3	8	3.6	.7
Historical account	0	2	5	5	3.3	.8
Function diagrams	0	2	4	6	3.3	.8
Graphic syntax of slides	0	1	4	7	3.5	.7
Script of s/s presentation	0	0	5	7	3.6	.5
References	1	2	5	4	3.3	1
NUMBER OF RESPONSES	3	12	41	88		
%	2.08	8.33	28.47	61.11		

b) Qualitative Results (Students' Comments)

Comments made by the students taking part in the formative evaluation testing indicated that although there was a lot of information to absorb, the 'slide presentation could have been even longer'. One student felt there was

> Too long a time lapse between viewing the slide presentation and using the NAGRA.

Another commented that a tape should have been shown being loaded on to the machine. One student stated:

> I think that with all the given information from the slide/tape presentation and manual, one who has never used a NAGRA before should be able to record clean location sound. But only in very ideal conditions.

This same student went on to say that the slide presentation was very clear, but a lot of the technical terms hold little meaning until the manual is read and

> ...therefore, for more effective absorption of the slide presentation, the manual is quite necessary.

Two students wrote that the script of the sound/slide presentation should have been at the beginning of the Instructional Manual. This was also verbally stated by others. A comment was made that

> The manual could have incorporated a section on sample hypothetical sound recording situations and on various ways of improving the quality of the the recording.

This same student, as well as another, would have liked a brief section on microphones and microphone positioning. Two students commented that not enough specifics were provided for the machine check. This was also mentioned verbally.

Three students indicated some confusion about recording levels for voice and ambience. There was one comment made by a student who was quite apprehensive about using the NAGRA 4.2 which was as follows:

> The whole tone of the presentation and manual suggests that if approached rationally and calmly, operation of the NAGRA will be simple enough. And so it was.

Students seemed to like the hands-on experience best, and that

> The problem with a general workshop of this kind is that it doesn't allow enough hands-on time with the machine, which is still the most effective way to learn.

Another comment was this one.

> For one who has never used a NAGRA, I found the manual to be an excellent companion to help me along (it would be great fun to have a NAGRA at home to test everything that's in the book.) As a learning tool for beginners, I feel it is very thorough and essential.

This same student would have liked to have had an alphabetical index of terms for cross-referencing and also remarked

> Apart from that and on the whole it was great fun, and finally I got to use a NAGRA."

Another student wrote:

All in all an excellent workshop/demonstration. Let's get one out on the oxberry!"

The students were on the whole glad to have taken part in the study as they enjoyed the learning experience of hands-on practice with the NAGRA 4.2 and being able to keep the Instructional Manual for future reference.

I'm very happy to have tested it because I can keep the manual, it's important for me, because I want to be a recordist so, that's a good beginning! Thanks a lot.

INSTRUCTOR EVALUATION

a) Quantitative Results

The instructor evaluation sheet (Appendix II) for formative evaluation testing was based on the acceptability (ACC) or non-acceptability (NON) of the performance of the student in relation to each of the performance objectives. In Table 3, the results of the instructor's evaluation are plotted by using the number 1 to represent acceptability and the number 0 to represent the non-acceptability of the students' performances.

Examination of Table 3 reveals that the performance of only four of the twelve sample students was acceptable in each of the divisions of the objectives. #1, #5 and #6 of the performance objectives pertained to tape identification procedures. Only one student neglected to record on tape the identifying sample number. One student ran out of tape and so did not perform the end of tape identification and two tape boxes were submitted unmarked.

Machine check procedures (objective #2) were non-acceptable by three of the students. Voice recording, by two students was non-acceptable in each of the four parts of objective #3. Two other students turned in non-

TABLE 3

Formative Evaluation

Results of Instructor Evaluation

Sample #	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
#1 Tape I/D													
Tone	1	1	1	1	1	1	1	1	1	1	1	1	12
Sample #	1	1	0	1	1	1	1	1	1	1	1	1	11
#2 Machine Check	1	1	0	1	1	1	0	1	1	0	1	1	9
#3 Voice													
3 3/4 ips	1	0	1	1	1	1	1	1	0	1	1	1	10
7 1/2 ips	1	0	1	1	1	1	1	1	0	1	1	1	10
15 ips	1	0	1	1	1	1	1	1	0	1	1	1	10
7 1/2 ips	1	0	1	1	0	1	1	1	0	1	1	0	8
#4 Ambience													
Low	1	1	1	1	1	1	1	1	1	1	0	1	9
Optimum	1	1	0	1	1	1	1	1	1	1	0	1	10
High	1	1	1	1	0	1	1	1	1	1	0	1	10
#5 End of tape													
I/D	1	1	1	1	1	1	1	1	1	1	1	0	11
#6 Tape box													
I/D	1	0	1	1	1	1	1	1	1	1	0	1	10
TOTAL	12	7	9	12	10	12	11	12	8	11	8	10	122

acceptable performances in the fourth part of objective #3. The performance of one student was non-acceptable in all three parts of objective #4 and two students had a non-acceptable grading in two of them.

b) Qualitative Results (Instructor's Comments)

Inspection of the instructor's comments revealed that the performance of only one of the three sample students who were graded acceptable in relation to each of the six objectives was flawless. According to the evaluation, this student 'Had fun.' Another of these three had submitted a tape box with too much information on it. 'Busy box.' The third student elicited the comment 'Slight misunderstanding of objectives'.

One of the students with no voice recording on the tape was 'obviously not listening to tape' and did not check the tape. The other student with no voice recording had Just let the tape run at 3 3/4, 7 1/2 and 15 without really recording anything but roomtone.

Two students had placed themselves 'too close to mic' and six students had problems with overmodulation. One student had 'some distortion' and one had 'horrible distortion'. One student with inconsistent levels did not appear to understand the term ambience.

During the ensuing discussions following the evaluation of the students' audio tapes, the instructor stated that achieving clear, consistent audio levels was a skill that would come with experience. Having the students perform specific objectives, such as the ones used in this formative evaluation, was in his opinion a valuable experience for the students. He made the comment that perhaps the recording of different sound levels would be of more value than recording at different tape speeds.

DISCUSSION OF FORMATIVE EVALUATION

Quantitative and qualitative results of the formative evaluation procedures have indicated that the paticipating sample population of cinema production students, along with their instructors, found these learning materials to be of value. The students contributed thoughtful comments about the content and sequencing of the sections of the Instructional Manual. That they were happy to take part in the study was largely attributable to the fact that they had an opportunity to use the NAGRA 4.2. Hands-on practice was 'the most effective way to learn'. The instructor's comments showed that although the execution of the machine check procedure and the recording of proper levels for voice and ambience were procedural skills that developed with

experience, revision of the performance objectives and parts of the Instructional Manual was in order.

Subsequent consultation with the instructors resulted in the decision to modify the Instructional Manual in the section pertaining to the machine check and to add more clarification on recording levels.

The major modification of the Instructional Manual was made, in form and content, to the section named **Turning On On Sequence.** In form, the information was presented with the key word pertaining to the instruction on the left hand side of the page. The content was shifted so machine check procedures preceded the loading of the tape. More explanation was added about the pilot function and on the level. (See pages twenty-seven to thirty inclusive of the Instructional Manual, Appendix IV.) Minor changes were made to the section on **Tape Identification Procedures.**

The sequencing of the sections of the Instructional Manual was rearranged so that the **Script** was put at the beginning and the **Historical Account** and **Glossary** were inserted as Appendix #1 and #2.

It became apparent that the Opinion Questionnaire should be redesigned to more accurately relate to the performance objectives and to reflect the degree of

usefulness that hands-on practice contributed to the performance of the objectives.

SUMMATIVE EVALUATION

SAMPLE OF TARGET POPULATION FOR SUMMATIVE EVALUATION

For summative evaluation procedures the sample of thirteen cinema production students was drawn from two classes of first year production students. This was the precise target population for which the learning materials were designed. The sample consisted of nine male and four female students. They were all highly motivated to take part in the study and considered it an opportunity to gain advance knowledge and skill to prepare them for second year production. It should be noted here that only fifty percent of first year cinema production students are admitted to second year and their desire to demonstrate to the instructor that they had a keen committment to learning all the technical aspects of cinema production no doubt contributed to their motivation.

None of the students had any prior experience using the NAGRA 4.2 and only one of the sample of students had minimal recording experience with other audio systems.

TESTING DESIGN

As with formative evaluation, a post test only control group design (Campbell and Stanley, 1963) was utilized for summative evaluation and the testing more closely simulated natural conditions. The sound/slide component of the study was presented to two first year classes of cinema production students during class time.

Following the sound/slide presentation, students who agreed to take part in the summative evaluation study were given a copy of the revised Instructional Manual and opinion questionnaire. They were also provided with a list of the performance objectives which they would be required to perform after one week.

A NAGRA 4.2 tape recorder was made available at AVISTA for four days in order to conduct summative evaluation procedures. As with formative evaluation procedures, each of the thirteen sample students was supplied with a five inch reel of 1/4" magnetic audio tape.

One hour per student was the alloted time for hands-on practice time and for the execution of the performance objectives while using the Instructional Manual to do so. When finished, the students completed the opinion questionnaire and contributed evaluative comments.

INSTRUMENTATION

In order to achieve an improved assessment of the students' performance skills, the instrumentation was restructured to reflect the components of the learning experience in relation to the performance objectives.

PERFORMANCE OBJECTIVES - SUMMATIVE EVALUATION

Formative evaluation results, comments and subsequent discussions led to the decision to cluster the six divisions comprising tape identification procedures into one objective. The machine check procedures were broken up into five separate divisions to make up the second objective. This was done to insure performance of each of the machine check procedures.

The third performance objective required the student to demonstrate voice recording skills employing three recording levels for twenty seconds at each level. This was considered to have more value as a performance objective than recording at different speeds.

The fourth performance objective that dealt with the recording of ambient sound, was changed only in the time aspect. Students were required to record only twenty seconds at each level.

The performance objectives for summative evaluation are listed in Appendix III of this Thesis Equivalent.

OPINION QUESTIONNAIRE - SUMMATIVE EVALUATION

The opinion questionnaire for summative evaluation (see Appendix III) was restructured to relate directly to each of the parts of the four performance objectives. The opinion questionnaire for formative evaluation had no provision for the gathering of data to reflect the degree of usefulness of the hands/on practice which, according to the students' comments, was a most crucial part of the learning experience. In order to compare the relative usefulness between the three components, that is, the sound/slide presentation, the Instructional Manual and the hands-on practice, a 0 - 3 Likert scale for each component, relating to each objective was designed. The first four questions on the formative evaluation opinion questionnaire, (Appendix II) were eliminated from the opinion questionnaire for summative evaluation.

INSTRUCTOR EVALUATION SHEET - SUMMATIVE EVALUATION

The sheet designed for the instructor to use for summative evaluation (Appendix III) remained in essentially the same format at for formative evaluation. Provision was made for the acceptability (ACC) or non-acceptability (NON) of each part of the four performance objectives.

The evaluation sheet was altered to reflect the changes that were made to the performance objectives.

DATA ANALYSIS - SUMMATIVE EVALUATION

OPINION QUESTIONNAIRE

a) Quantitative Results

As discussed above, the purpose of the opinion questionnaire (Appendix III) was to determine the relative usefulness, to the performance of the test objectives, of the three components of the learning exercise.

Towards that end, the student was asked to respond to the four questions, each containing a set of subquestions, by encircling a number from 0 (NIL-useful) to 3 (MAXimum utility). Table 3 and Figures 1 - 4 serve to illustrate the percent frequency of responses chosen, with the largest frequencies indicating perceived usefulness.

For the tape identification procedures illustrated in Figure 1, the sound/slide presentation was most frequently rated as being of MIN utility (33.3%) while the Instructional Manual was considered to be equally of MED (34.6%) and MAX (34.5%) usefulness. Hands-on practice recorded the largest percentage of responses in the MAX category (66.7%).

Results of the ratings for the machine check procedures, graphed in Figure 2, indicate that the students

TABLE 3

Summative Evaluation - Opinion Questionnaire

Percent Frequency of Selected Responses

#1	S/S	16.7	33.7	24.4	19.2
	I/M	6.4	19.2	34.6	34.6
	H/O	0	5.1	23.1	66.7
#2	S/S	3.1	21.5	43.1	24.6
	I/M	7.7	15.4	41.5	27.7
	H/O	0	4.6	13.9	81.5
#3	S/S	5.1	48.7	33.3	2.6
	I/M	15.4	33.3	41.0	10.3
	H/O	0	0	30.8	61.5
#4	S/S	17.9	41	20.5	12.8
	I/M	15.4	33.3	33.3	18
	H/O	0	7.7	15.4	69.2

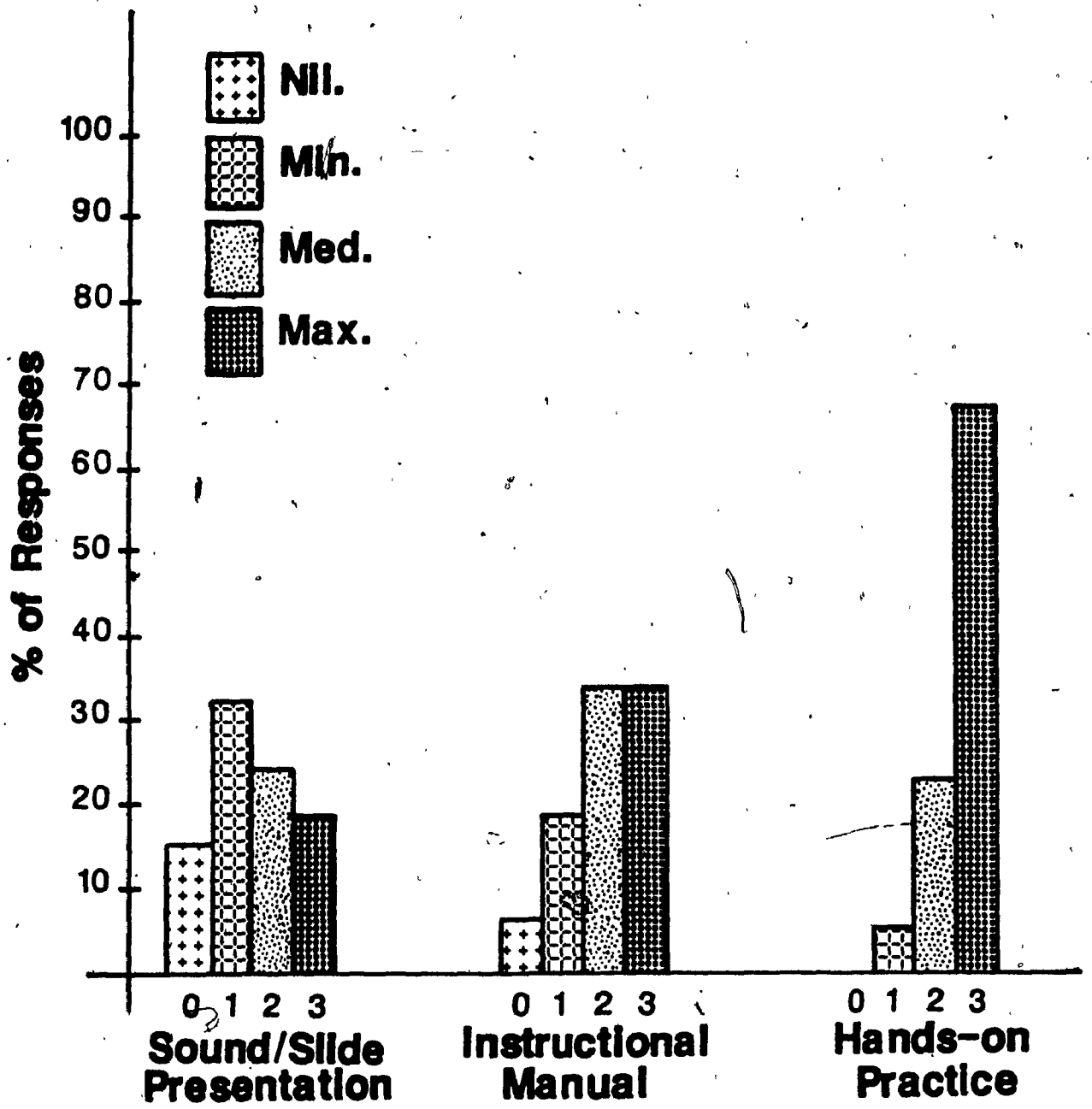

Figure 1 Percent Frequency of Response Categories Selected By Learning Component Question #1 - Tape I/D Procedures

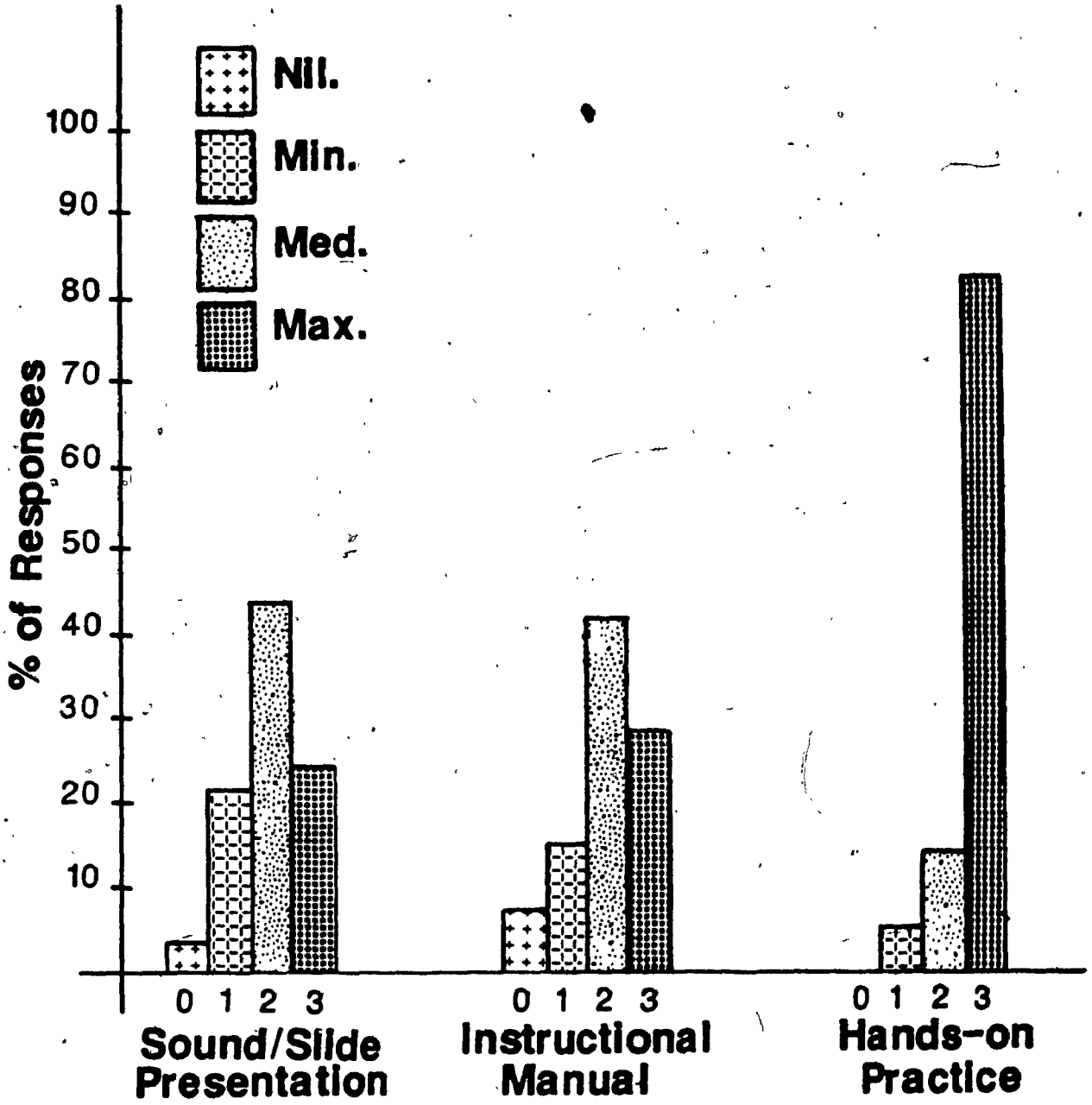

Figure 2 Percent Frequency of Response Categories Selected By Learning Component

Question #2 - Machine Check Procedures

perceived both the sound/slide presentation and the Instructional Manual most frequently as a MED quality aid (43.1% AND 41.5% respectively), and rated the Hands-on practice session most often as a MAX quality learning component (81.5%).

Figure 3 illustrating the perceived utility of the learning components towards meeting the objectives of voice recording with crystal pulse, indicated the highest frequencies of student ratings as follows: MIN utility for the sound/slide presentation (48.7%); MED usefulness for the Instructional Manual (41.1%); and MAX utility for Hands-on Practice (61.5%).

Finally, the students opinions of the degree of usefulness of each of the components toward ambience recording without crystal pulse are illustrated in Figure 4. The sound/slide component received the highest frequency of ratings as a MIN quality aid (41%), while the Instructional Manual garnered equal results in the MIN (33.3%) and MED (33.3%) classes. Hands-on practice was most often rated as being of maximum benefit (69.2%).

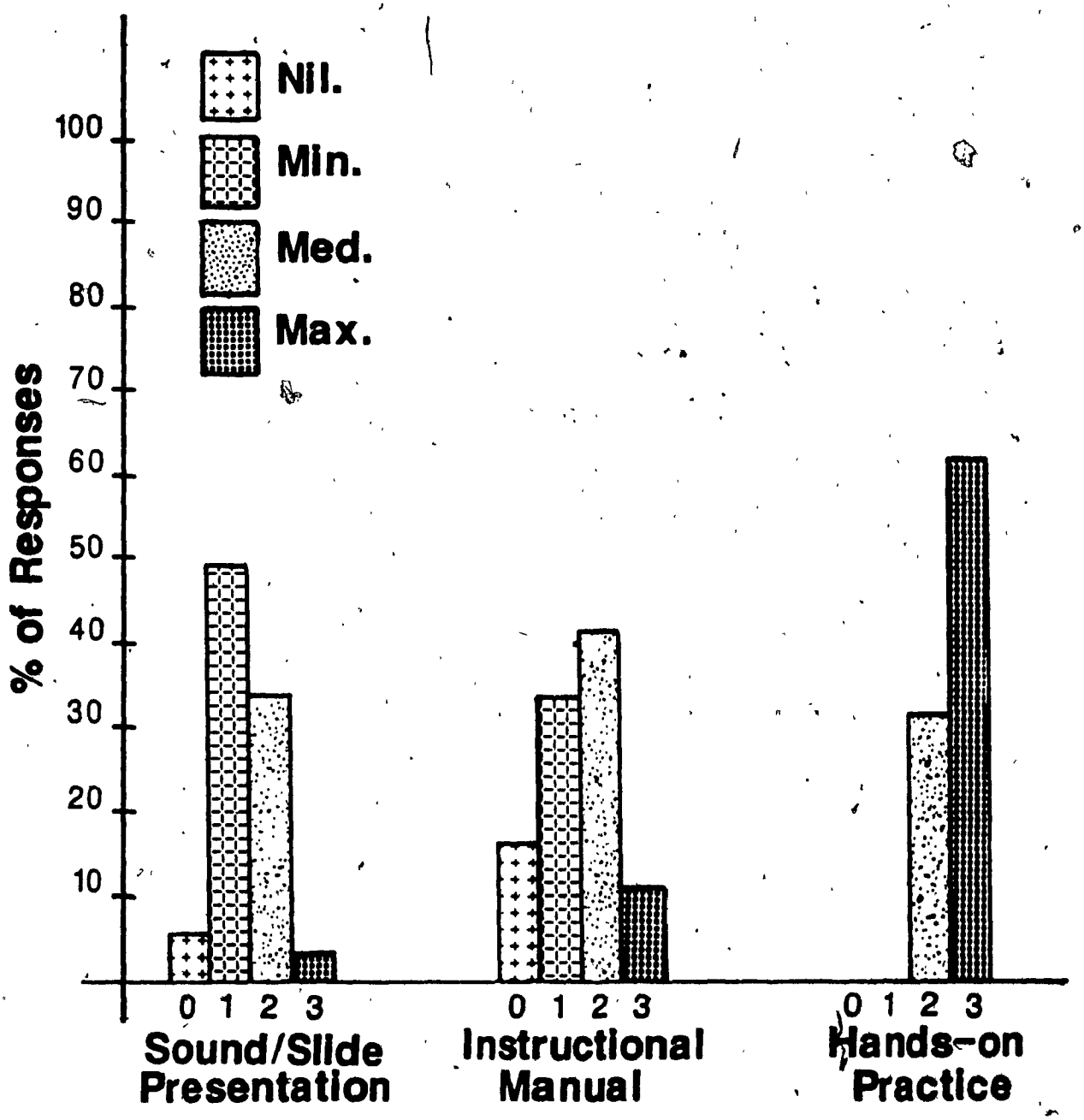

Figure 3 Percent Frequency of Response Categories Selected By Learning Component

Question #3 - Voice Recording

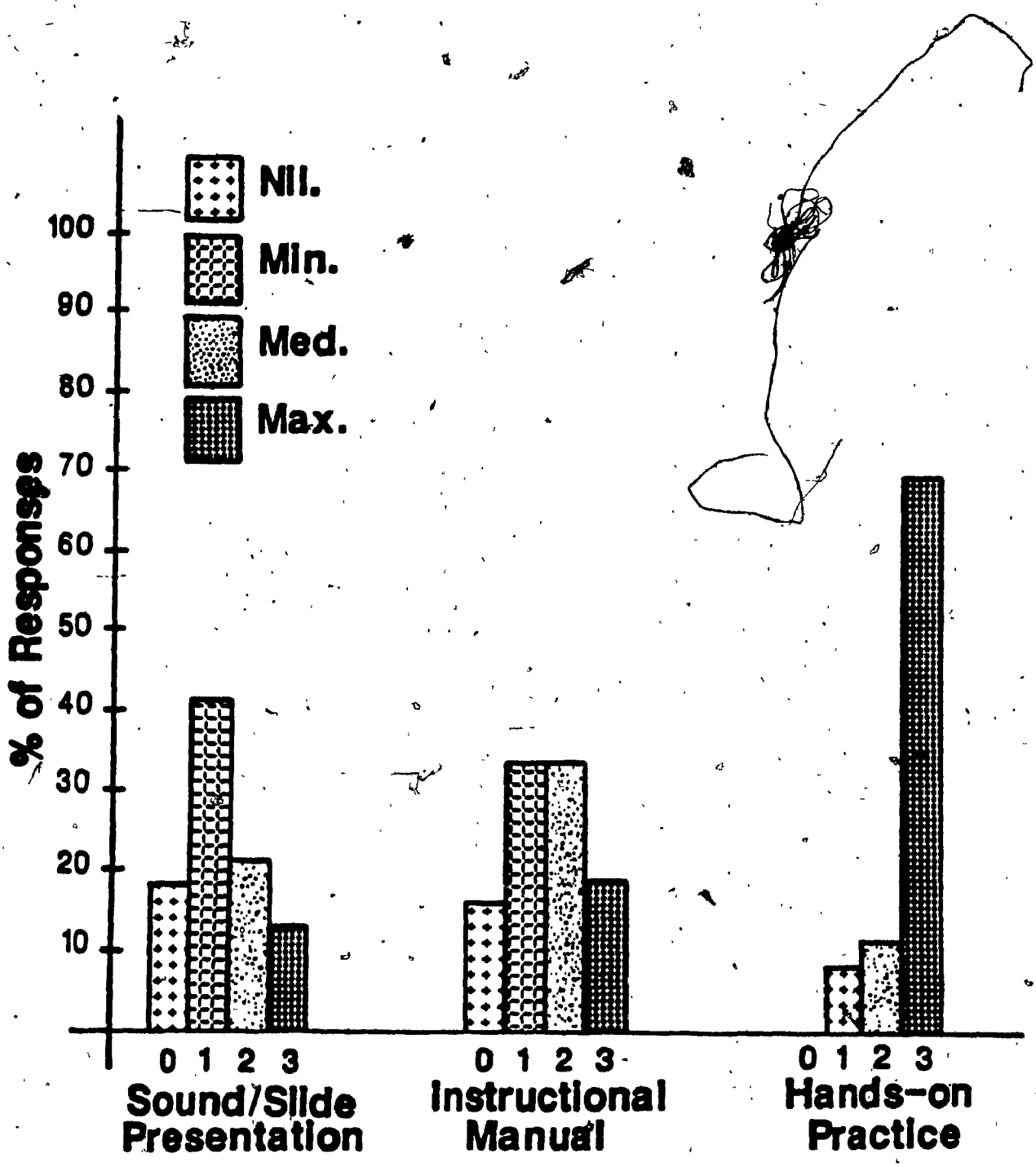

Figure 4 Percent Frequency of Response Categories Selected By Learning Component Question #4

Question #4 - Ambience Recording

b) Qualitative Results (Students' Comments)

One student commented that the Instructional Manual helped her to understand the functions of the machine but that she needed more time to touch and work with the machine before she would feel fully confident with recording levels. Her final comment was

> Did learn a lot and thank-you for letting me work with it.

Another comment stated that the Instructional 'Manual's

> Testing and tape identification procedures fills in a gap in the sound/slide; more information needed on recording levels.

Another student felt there should have been better examples of recording levels and that the manual should have referred to the glossary for more information as well as making the official manual from the Kudelski Company available for reference.

Several students noted that the script for the sound/slide presentation was a useful section. It was 'a great idea to have the script in the I/M'.

Hands-on practice was referred to as the 'most valuable way of learning' and that

Optimal learning comes from having S/S + I/M or a previous experience, but actually the best learning depends on the work on the set itself.

The sample of students seemed on the whole 'glad to be knowledgeable of some of the technical aspects of the NAGRA', and found the exercise to be 'very interesting, good idea, have learned a lot'.

One student commented that this was

An extremely beneficial exercise for me as a film student. Students should have more opportunities to participate in exercises such as these.

Overall, the general observed attitude of the thirteen sample students who participated in the study could be summed up by this comment

There should be more fun and exciting learning events like this one.

INSTRUCTOR EVALUATION

a) Quantitative Results

The thirteen 1/4" audio tapes produced by the sample of first year cinema students were analysed by the instructor and graded according to the acceptability (ACC) or non-acceptability (NON) of the results.

It became apparent that the criteria for grading should be specifically defined as follows:

1) correct recording of tape identification procedures

2) correct recording of knowledge of and execution of machine check procedures

3) aural quality of the sound of the voice recording for each of the low, optimum and high levels

4) the aural quality and distinctions between the three levels of low, optimum and high recordings of ambience.

In each case, the instructor determined whether the students' performance met the criteria for satisfaction.

Table 4 illustrates the results of the students' performance according to the expertise of the instructor.

TABLE 4

Instructor's Summative Evaluation Results

Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL
#1 Tape I/D														
Tape wind	1	0	0	1	1	1	1	1	1	1	1	0	1	10
Reference tone	1	0	1	1	1	1	0	1	1	1	1	1	1	11
Sample #	1	1	1	0	1	1	0	1	1	1	1	1	1	11
Title	1	1	1	0	0	1	1	1	1	1	1	1	1	11
Reel #	1	1	1	0	1	1	1	1	1	1	1	1	1	12
Tape end	1	1	1	0	1	1	1	1	1	1	1	1	1	12
#2 Machine Check														
Batt/reserve	1	1	1	0	1	1	0	1	1	1	1	0	1	10
Volt/cell	0	1	1	1	1	1	0	1	1	1	1	0	0	9
Pilot	1	1	1	1	1	1	1	1	1	1	1	0	0	11
Motor	1	1	1	1	0	1	1	1	1	1	1	0	0	10
Tape speed	1	1	1	0	0	1	1	1	1	1	1	0	0	9
#3 Voice														
Low	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Optimum	1	1	1	1	1	1	1	1	1	1	1	0	1	12
High	1	1	1	1	1	1	1	1	1	1	1	0	1	12
#4 Ambience														
Low	1	1	0	1	0	1	1	1	1	0	1	0	1	9
Optimum	1	1	1	1	1	1	1	1	1	0	1	0	1	11
High	1	1	1	1	1	1	1	1	1	1	1	0	1	12
TOTAL	16	15	15	11	13	17	13	17	17	15	17	6	13	

b) Qualitative Results (Instructor's comments)

According to the instructor's comments, only one of the sample students appeared not to be taking the exercise seriously and his performance on the objectives were not acceptable. He indicated that three of the students showed varying degrees of confusion. One of these seemed confused both about tape identification procedures and the machine check procedures, one showed some confusion with the machine check and the third only minor confusion with announcement terminoloy at the beginning of the tape. Another of the students who gave no indication of having performed the machine check procedures satisfactorily performed the other three objectives. The remaining eight students seemed comfortable with the machine. Four of these submitted perfect results on all levels of the performance objectives. Following the evaluation of the audio tapes, the ensuing discussion with the instructor yielded some verbal comments about the performance objectives. He stated that particularly in sound recording, it was important for students to begin to practice careful habits of documentation and identification of what the recording consists of, both externally on the tape box as well as

where appropriate on the audio tape. Beginning student recordists tend not to do so properly and consistently and that the tape identification procedures outlined in the manual should help them to develop correct habits.

Although there was some confusion in the execution of machine check procedures to determine whether the tape-recorder was functioning efficiently, he said the it would only take two or three more sessions with the NAGRA 4.2, for the students to be able to check the functioning of the machine with confidence.

Except for the one student who appeared not to be taking the exercise seriously, all of the students were acceptably graded on performance of the three levels of voice recording. He remarked that being able to achieve the quality of excellence recording dialogue for film, could only result from many hours of hand's on experience in the field and learning to cope with the varied problems that present themselves to the sound recordist on location.

The instructor felt that the students' judgement of the correct levels for ambient sound had room for improvement, but that this too would develop with experience.

He stated that the overall performance of the students, using the NAGRA 4.2 for the first time, was very good and

that the sound/slide presentation along with the Instructional Manual provided a useful learning tool for both instructors and students.

DISCUSSION OF SUMMATIVE EVALUATION

In general, the results support the major contention of this thesis equivalent; that the Instructional Manual is a necessary adjunct to the sound/slide presentation as a learning tool for the NAGRA 4.2. This is reflected in the students' ratings, which were consistently higher for the Instructional Manual as opposed to the sound/slide presentation. Additional results indicated that hands/on practice was most often rated as of maximum benefit.

In sum, these results indicate a type of 'work up' method for learning to operate the NAGRA 4.2: the sound/slide presentation at the outset to provide the overview, followed by the more detailed Instructional Manual and culminating with sufficient opportunity for hands-on experience for the development of film-sound recording skills.

The results imply that more hands-on practice time on the NAGRA 4.2 should be made available to the cinema production students.

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APPENDICES

APPENDIX I

NEEDS ASSESSMENT QUESTIONNAIRE

RESEARCH QUESTIONNAIRE

RESEARCH QUESTIONAIRE

SUBJECT: **NAGRA 4.2 INSTRUCTIONAL MODULE**

An instructional slide/tape package on the functions of the NAGRA 4.2 is under development and formative evaluation, as a Master's Thesis Equivalent for the EDUCATIONAL TECHNOLOGY PROGRAM at Concordia University, Montreal, Canada. Whether or not your students use the NAGRA for film sound recording, response to this questionaire would provide the designer with valuable information. Please feel free to write additional comments on back of this page.

1) How many NAGRA's are available for use by students?
   NAGRA 4.2_____NAGRA 3_____

2) How many students are in cinema production?

	FEMALE	MALE
1st year	____	____
2nd year	____	____
3rd year	____	____
4th year	____	____

3) Is every student required to do film-sound recording? YES NO

4) Are audio-visual (non-print) self-instructional learning materials used by your cinema production students? YES NO
   (If YES, kindly list on back of page)

5) How useful might a self-instructional learning module on the NAGRA 4.2 be for your students? MAX MED MIN NIL

6) Most useful mode of presentation would be as:-
   AUDIO & PRINT SLIDE/TAPE 1/2" BETA 1/2" VHS 3/4" VIDEO

7) Are students encouraged to shoot 1/2 " video before 16mm? YES NO

8) How many student sound films mixed in

1979	_____	1982	_____
1980	_____	1983	_____
1981	_____	1984	_____

9) What percentage of these films go to answer print? _____%

10) What percentage of 16mm films produced are purchased for, or deposited in your film library? _____%

PLEASE RETURN THIS QUESTIONAIRE IN THE SELF-ADDRESSED ENVELOPE THAT IS PROVIDED FOR YOUR CONVENIENCE. THANK-YOU FOR YOUR VALUABLE COOPERATION.

HELEN WORKMAN, Head, AVISTA, Audio-Visual In Service Teaching Area, Concordia University, 2150 Bishop Street, Montreal, PQ, H3G 1M8.

APPENDIX II

FORMATIVE EVALUATION

PERFORMANCE OBJECTIVES

OPINION QUESTIONNAIRE

INSTRUCTOR EVALUATION SHEET

GIVEN THE SOUND/SLIDE PRESENTATION, THE PERFORMANCE OBJECTIVES, THE INSTRUCTIONAL MANUAL AND ONE WEEK TO STUDY IT, THE STUDENT WILL PERFORM THE FOLLOWING TASKS.

#1
Set up the NAGRA 4.2 and perform correct tape identification procedures on 1/4" magnetic tape.

#2
Perform the machine check procedures and verbally list what you did on the tape.

#3
Identify and record with crystal pulse, 2 minutes of voice recording:

(a) 30 secs. at 3 3/4 ips
(b) 30 secs. at 7 1/2 ips
(c) 30 secs. at 15 ips
(d) 30 secs. at 7 1/2 ips with overmodulation

#4
Identify and record without crystal pulse, 3 minutes of ambient sound:

(a) one minute at low level
(b) one minute at optimum level
(c) one minute at high level

#5
Record the end of tape reel identification.

#6
Identify tape box.

QUESTIONAIRE TO EVALUATE THE INSTRUCTIONAL MANUAL SUPPORTING THE SOUND/SLIDE PRESENTATION ON THE FUNCTIONS OF THE NAGRA 4.2

DATE_____MAJOR_____YEAR 1st____ 2nd____ 3rd____
FEMALE____ MALE____ 1st LANGUAGE_____

PLEASE ANSWER THESE QUESTIONS BY CIRCLING THE NUMBER THAT BEST REPRESENTS YOUR ASESSMENT: #1 INDICATING MOST NEGATIVE TO #4 INDICATING MOST POSITIVE.

1. How much did you like the sound/slide presentation? 1-2-3-4

2. Was there enough time for you to absorb the information from each slide? 1-2-3-4

3. How useful did you find the titles on the slides naming the functions? 1-2-3-4

4. How useful, in general, did you find the Instructional Manual? 1-2-3-4

5. How useful, specifically, did you find the following sections?

Warnings	1-2-3-4
Turning on sequence	1-2-3-4
Machine check	1-2-3-4
Location sound recording materials checklist	1-2-3-4
Tape identification procedures	1-2-3-4
Soundperson's duties	1-2-3-4
Glossary	1-2-3-4
Historical account	1-2-3-4
Function diagrams	1-2-3-4
Graphic syntax of slides	1-2-3-4
Script of sound/slide presentation	1-2-3-4
References	1-2-3-4

Please comment if you think any procedures are lacking or information missing that would better enable you to record clean location sound.

INSTRUCTOR EVALUATION

STUDENT SAMPLE # _____ DATE _____

INSTRUCTOR _____

This evaluation is based on the ACCEPTABILITY (**ACC**) or NON-ACCEPTABILITY (**NON**) of the student's performance of the test objectives. The assessment of the students' competence is made according to the instructor's expertise.

		ACC	**NON**
#1	Tape identification procedures		
	20 second reference tone	---	---
	student sample #	---	---
#2	Machine check	---	---
#3	With crystal pulse, 2 min. voice recording		
	30 secs. at 3 3/4 ips	---	---
	30 secs. at 7 1/2 ips	---	---
	30 secs. at 15 ips	---	---
	30 secs. at 7 1/2 ips with overmodulation	---	---
#4	Without crystal pulse, 3 min. ambient sound		
	60 secs. low level	---	---
	60 secs. optimum level	---	---
	60 secs. high level	---	---
#5	End of reel identification		
	6 quick beeps	---	---
#6	Tape box identification	---	---

COMMENTS:

APPENDIX III

SUMMATIVE EVALUATION

PERFORMANCE OBJECTIVES

OPINION QUESTIONNAIRE

INSTRUCTOR EVALUATION SHEET

GIVEN THE SOUND/SLIDE PRESENTATION, THE PERFORMANCE OBJECTIVES, THE INSTRUCTIONAL MANUAL ONE WEEK TO STUDY IT AND ONE HOUR HANDS ON PRACTICE, THE STUDENT WILL PERFORM THE FOLLOWING TASKS.

#1
Load the tape on the NAGRA 4.2 and perform correct tape identification procedures at the beginning and end of 1/4" magnetic tape, as well as on the tape box.

#2
Perform the machine check procedures and verbally record at 7 1/2 ips and at optimum level, a list of check points.

#3
Identify and record **with crystal pulse** at 7 1/2 ips, 1 minute of voice recording.

(a) 20 secs. at low level
(b) 20 secs. at optimum level
(c) 20 secs. at high level

#4
Identify and record **without crystal pulse** at 7 1/2 ips, 1 minute of ambient sound (room tone).

(a) 20 secs. at low level
(b) 20 secs. at optimum level
(c) 20 secs. at high level

QUESTIONNAIRE TO EVALUATE THE INSTRUCTIONAL MANUAL, THE SOUND/SLIDE PRESENTATION AND HANDS/ON PRACTICE.

DATE_____MAJOR_____YEAR 1st____ 2nd____ 3rd____
FEMALE____ MALE____ 1st LANGUAGE_____

PLEASE ANSWER THESE QUESTIONS BY CIRCLING THE NUMBER THAT BEST REPRESENTS YOUR ASESSMENT: #0 INDICATING MOST NEGATIVE TO #3 INDICATING MOST POSITIVE.

How useful was the Sound/Slide Presentation (S/S), the Instructional Manual (I/M) and the Hands/On Practice (H/O) to help you perform the test objectives.

	S/S	I/M	H/O
#1 Tape identification procedures			
Load tape	0-1-2-3	0-1-2-3	0-1-2-3
Reference tone	0-1-2-3	0-1-2-3	0-1-2-3
Sample #	0-1-2-3	0-1-2-3	0-1-2-3
Title	0-1-2-3	0-1-2-3	0-1-2-3
Reel #	0-1-2-3	0-1-2-3	0-1-2-3
Tape End	0-1-2-3	0-1-2-3	0-1-2-3
#2 Machine check			
Battery Reserve	0-1-2-3	0-1-2-3	0-1-2-3
Volt/Cell	0-1-2-3	0-1-2-3	0-1-2-3
Pilot	0-1-2-3	0-1-2-3	0-1-2-3
Motor	0-1-2-3	0-1-2-3	0-1-2-3
Tape Speed	0-1-2-3	0-1-2-3	0-1-2-3
#3 Voice recording with crystal pulse			
Low level	0-1-2-3	0-1-2-3	0-1-2-3
Optimal level	0-1-2-3	0-1-2-3	0-1-2-3
High level	0-1-2-3	0-1-2-3	0-1-2-3
#4 Ambience without crystal pulse			
low level	0-1-2-3	0-1-2-3	0-1-2-3
optimum level	0-1-2-3	0-1-2-3	0-1-2-3
high level	0-1-2-3	0-1-2-3	0-1-2-3

COMMENTS:

INSTRUCTOR EVALUATION

STUDENT SAMPLE # _____ DATE _____

INSTRUCTOR _____

This evaluation is based on the ACCEPTABILITY (ACC) or NON-ACCEPTABILITY (NON) of the student's performance of the test objectives. The assessment of the students' competence is made according to the instructor's expertise.

	ACC	NON
#1 Tape identification procedures		
Tape stored, TAIL or HEAD OUT	---	---
20 second reference tone	---	---
Student sample #	---	---
Title	---	---
Reel #	---	---
Tape end (6 quick beeps)	---	---
#2 Machine check		
Battery Reserve	---	---
Volt/Cell	---	---
Pilot	---	---
Motor	---	---
Tape Speed	---	---
#3 With crystal pulse, 1 min. voice recording		
20 secs. at low level	---	---
20 secs. at optimum level	---	---
20 secs. at high level	---	---
#4 Without crystal pulse, 1 min. ambient sound		
20 secs. low level	---	---
20 secs. optimum level	---	---
20 secs. high level	---	---

COMMENTS:

APPENDIX IV

SUMMATIVE EVALUATION - OPINION QUESTIONNARIE

RAW DATA - SOUND/SE[illegible]E

RAW DATA - INSTRUCTIONAL MANUAL

RAW DATA - HANDS-ON PRACTICE

Summative Evaluation - Opinion Questionnaire

Raw Data Pertaining to the Sound/Slide Presentation

		NR	NIL 0	MIN 1	MED 2	MAX 3
#1	Tape I/D					
	Load tape	1	2	4	2	4
	Reference tone	-	0	3	7	3
	Sample #	1	3	3	5	1
	Title	1	2	6	1	3
	Reel #	-	2	6	2	3
	Tape end	2	4	4	2	1
#2	Machine check					
	Batt/reserve	1	0	5	3	4
	Volt/cell	1	0	4	5	3
	Pilot	1	1	2	7	2
	Motor	1	1	2	7	2
	Tape speed	1	0	1	6	5
#3	Voice					
	Low	1	1	7	4	0
	Optimum	2	0	5	5	1
	High	2	1	7	4	0
#4	Ambience					
	Low	1	3	5	3	1
	Optimum		1	6	3	2
	High	1	3	5	2	2

Summative Evaluation - Opinion Questionnaire

Raw Data Pertaining to the Instructional Manual

	NR	NIL 0	MIN 1	MED 2	MAX 3
#1 Tape I/D					
Load tape	1	1	4	3	4
Reference tone	-	1	2	7	3
Sample #	-	1	4	4	4
Title	1	0	2	5	5
Reel #	-	1	2	3	7
Tape end	2	1	1	5	4
#2 Machine Check					
Batt/reserve	1	1	2	5	4
Volt/cell	1	1	2	5	4
Pilot	1	1	2	6	3
Motor	1	1	2	7	2
Tape speed	1	1	2	4	5
#3 Voice					
Low	-	2	5	5	1
Optimum	-	2	4	5	2
High	-	2	4	6	1
#4 Ambience					
Low	-	2	5	4	2
Optimum	-	2	4	4	3
High	-	2	4	5	2

Summative Evaluation - Opinion Questionnaire

Raw Data Pertaining to Hands-On Practice

	NR	NIL 0	MIN 1	MED 2	MAX 3
#1 Tape I/D					
Load tape	-	0	0	3	10
Reference tone	2	0	1	2	8
Sample #	1	0	1	5	6
Title	-	0	1	2	10
Reel #	1	0	1	3	8
Tape end	-	0	0	3	10
#2 Machine Check					
Batt/reserve	-	0	0	3	10
Volt/cell	-	0	0	1	12
Pilot	-	0	0	2	11
Motor	-	0	1	2	10
Tape speed	-	0	2	1	10
#3 Voice					
Low	-	0	0	4	8
Optimum	-	0	0	4	8
High	-	0	0	4	8
#4 Ambience					
Low	-	0	1	2	9
Optimum	-	0	1	2	9
High	-	0	1	2	9

APPENDIX V

INSTRUCTIONAL MANUAL

INSTRUCTIONAL MANUAL

SUPPORTING THE NAGRA 4.2

SOUND/SLIDE PRESENTATION

AVISTA
CONCORDIA
UNIVERSITY

MASTER'S
THESIS
EQUIVALENT

HELEN BOMBIC-WORKMAN 1985

TABLE OF CONTENTS

INSTRUCTIONAL MANUAL

DESIGNED TO SUPPORT THE NAGRA 4.2 SOUND SLIDE PRESENTATION

FOR USE BY CINEMA PRODUCTION STUDENTS

This Instructional Manual is designed to be used by Cinema Production students after they have viewed the Sound/Slide Presentation on the functions of the NAGRA 4.2. It is not designed to replace the official manual for the NAGRA 4.2 provided by the Kudelski Company. Rather, it systematically structures selected fundamental principles and knowledge for the novice cinema student sound recordist, to guide hand's on practice and location use of the NAGRA 4.2.

OBJECTIVES

It is the broad goal of this Instructional Manual to support the NAGRA 4.2 Sound/Slide Presentation produced by the author.

The objectives of this Instructional Manual are to enable cinema production students to determine whether the tape recorder is functioning efficiently and to demonstrate basic recording skills.

WARNINGS

1) If you are operating the recorder with the power pack be sure you are using the mains power supply.

2) Check proper inputs to voltage. (Normally 110-120V.60Hz.)

3) Keep the recorder out of direct sunlight, and

4) Away from any possible sources of electrical interference such as transformers, large motors, telephones, fans, TV sets and computers.

5) Keep the protective leather case around the machine and be sure the lid is latched. Use the handbar to transport the machine, and never use the shoulder strap. In a car, carry it on your lap.

7) Store the recorder with the PRINCIPAL FUNCTION SELECTOR in **STOP**. This automatically disengages the pinch wheel and prevents the development of **flats**, which would be heard as wow and flutter (see glaossary) and enables the NAGRA to be put away with the PINCH WHEEL AND TAPE GUIDE CONTROL LEVER in the engaged position so that the lid may be closed.

8) To disconnect the batteries, put the POWER switch in **EXTERNAL** to avoid accidentally discharging the batteries. Many sound recordists always remove the batteries when the machine is not in use, as a corrosive liquid can leak from discharged batteries.

9) Use only denatured alcohol to clean heads, pinch roller and capstan.

SCRIPT

NAGRA 4.2

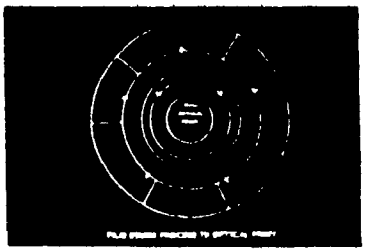
SOUND/SLIDE PRESENTATION

1985

PRODUCED BY: HELEN BAMBIC-WORKMAN
AVISTA
CONCORDIA UNIVERSITY
1455 DE MAISONNEUVE BLVD
MONTREAL, P.Q. H3G 1M8

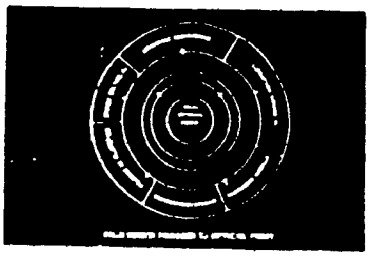
1

2



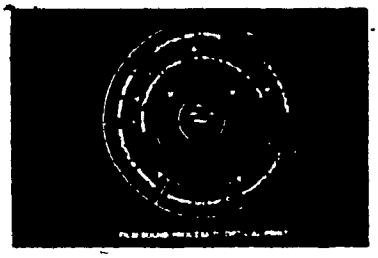
THE FUNCTIONS OF THE NAGRA 4.2 ARE CRUCIAL ELEMENTS IN THE PROCESS OF MAKING AN OPTICAL SOUND TRACK FOR A FILM.

3



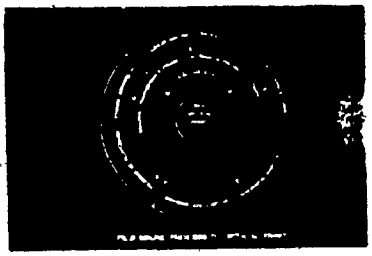
BASIC INPUTS FOR A FILM SOUND TRACK CONSIST OF LOCATION RECORDING. LOCATION SOUND FX. STUDIO RECORDING. FILMING IN PLAYBACK. STOCK SOUND FX AND STUDIO DUBBING.

4



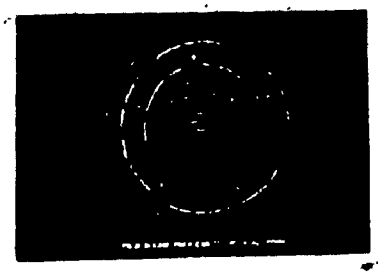
THESE VARIOUS TRACKS CAN BE TRANSFERRED TO 16MM MAGNETIC TAPE USING THE NAGRA.

5



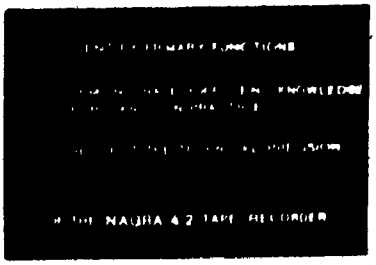
THEY ARE THEN SYNCHRONIZED TO THE PICTURE BY THE SOUND EDITOR.

6



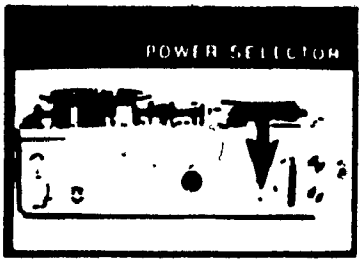
THE SOUND MIXER COMBINES THESE TRACKS ON TO A SINGLE MASTER TRACK WHICH IS THEN TRANSFERED TO OPTICAL SOUND ON THE EDGE OF A FILM.

7



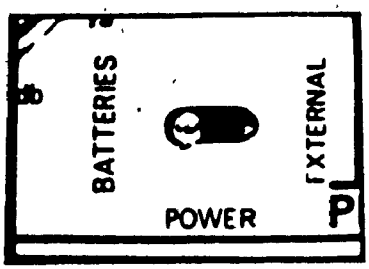
THIS LEARNING MODULE SHOULD ENABLE YOU TO
1) IDENTIFY THE PRIMARY FUNCTIONS
2) DEMONSTRATE SUFFICIENT KNOWLEDGE FOR HANDS ON PRACTICE AND
3) RESPECT THE TECNICAL PRECISION OF THE NAGRA 4.2

8



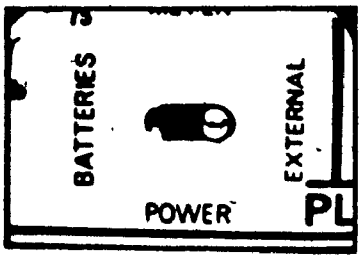
THE POWER SELECTOR SWITCH IS A TWO POSITION SWITCH ALLOWING THE NAGRA TO BE POWERED BY THE INTERNAL BATTERIES OR BY AN EXTERNAL POWER SUPPLY. WHICH SUPPLIES POWER FROM A 110 VOLT AC SOURCE.

9

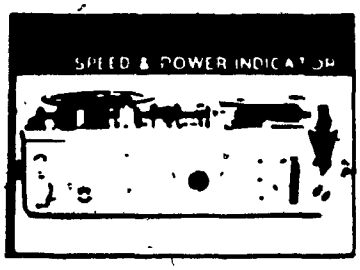


FIRSTLY. WHEN USING THE NAGRA. ASCERTAIN THE POSITION OF THIS SWITCH. IF YOU HAVE NO POWER PACK. IT MUST BE IN BATTERY TO FUNCTION.

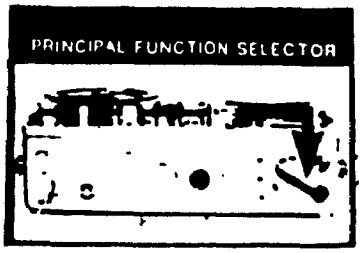
10



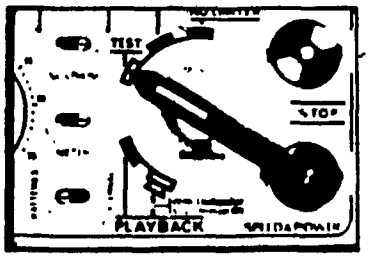
WHEN YOU HAVE FINISHED USING THE NAGRA, RETURN THE SWITCH TO EXTERNAL TO AVOID ACCIDENTALLY RUNNING DOWN THE BATTERIES.

11 

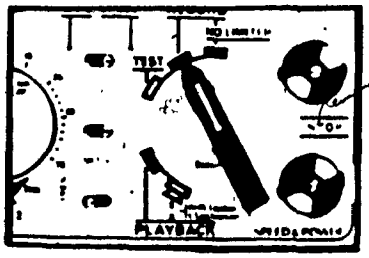
WHEN THE NAGRA IS IN THE RECORD OR PLAYBACK MODE THE SPEED AND POWER INDICATOR WILL SHOW A WHITE FLAG WHICH WILL DISAPPEAR IF THE POWER FROM THE BATTERIES IS INSUFFICIENT AND ALSO IF THE NAGRA IS SHAKEN OR JARRED WHILE RUNNING.

12 

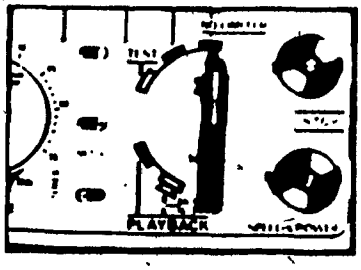
THE PRINCIPAL FUNCTION SELECTOR HAS FIVE POSITIONS.

13 

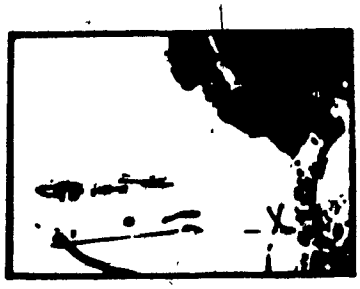
TEST - SUPPLIES POWER TO THE NAGRA AMPLIFIER CHAIN WITHOUT HAVING THE TRANSPORT SYSTEM FUNCTIONING. IT IS USED TO TEST A VARIETY OF FUNCTIONS. SUCH AS BATTERIES AND PILOT FREQUENCY. AS WELL AS FOR REHERSALS AND CHECKING YOUR MICROPHONE LEVELS.

14 

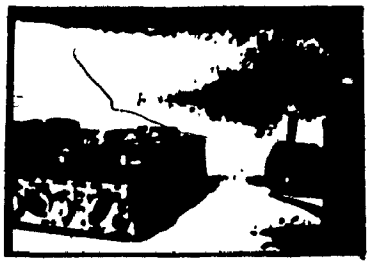
IN THE RECORD WITH LIMITER MODE. AN AUTOMATIC LIMITER RAPIDLY REDUCES ANY EXCESS AUDIO SIGGNAL. THEREBY AVOIDING DISASTROUS DISTORTION. THIS FUNCTION ALLOWS MORE REACTION TIME IN SURPRISE SITUATIONS.

15 

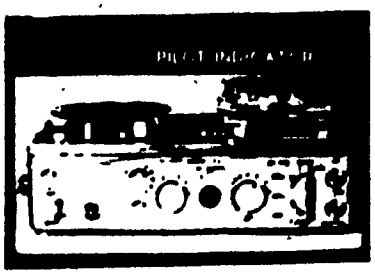
RECORD WITH NO LIMITER MAY BE USED IN INSTANCES OF SUDDEN BURSTS OF SOUND. SUCH AS GUN SHOTS AND DOOR SLAMS. THESE WILL OTHERWISE SOUND UNNATURAL IF RECORDED WITH LIMITER.

16 

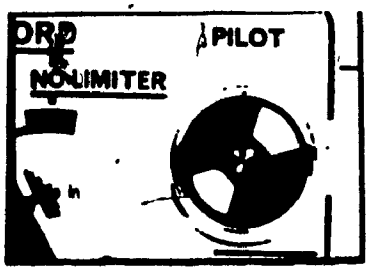
THERE ARE TWO PLAYBACK POSITIONS. THE FIRST IS FOR PLAYBACK. MONITORING THROUGH HEADPHONES.

17 

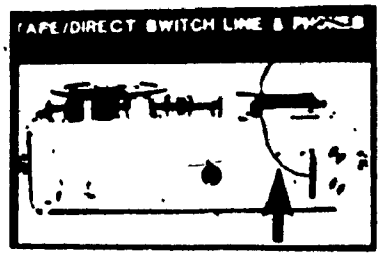
PLAYBACK WITH SPEAKER ENABLES YOU TO HEAR WHAT HAS BEEN RECORDED THROUGH A TINY SPEAKER ON THE SIDE OF THE NAGRA.

18 

THE PILOT TONE INDICATOR INDICATES THAT A SYNC PULSE IS PRESENT. THIS IS ESSENTIAL FOR PICTURE SYNCRONIZATION.

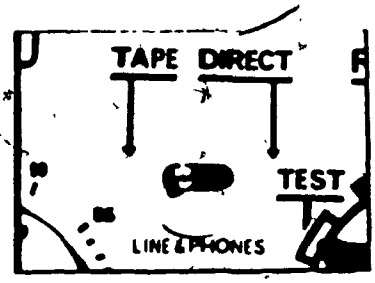
19 

A WHITE FLAG WILL APPEAR. IT SHOULD BE ON WHEN YOU RECORD AND WHEN YOU PLAYBACK.

20 

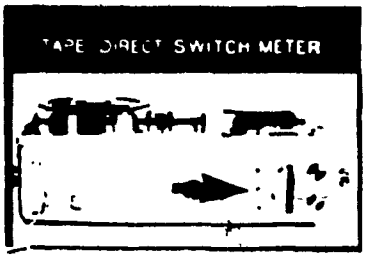
THE TAPE/DIRECT SWITCH LINE AND PHONES ALLOWS SELECTION OF MONITORING FROM EITHER THE RECORD HEAD IN DIRECT. WHICH GIVES THE DIRECT INPUT FROM THE MICROPHONES. OR THE PLAYBACK HEAD IN TAPE POSITION.

21



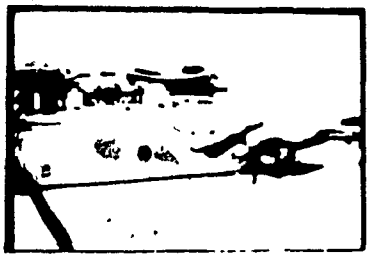
IN THE TAPE POSITION THE RECORDED SOUND WILL BE HEARD WITH A SPLIT SECOND DELAY THAT TAKES GETTING USED TO. MONITORING IN TAPE POSITION ALLOWS THE RECORDIST THE ADVANTAGE OF CONSTANTLY HEARING THE QUALITY OF THE RECORDED SIGNAL AND THAT THE TAPE IS STILL RUNNING AND HAS NOT RUN OUT.

22



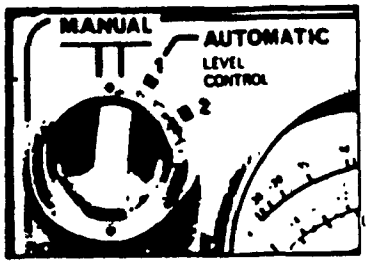
THE TAPE/DIRECT SWITCH METER. WHICH ONLY FUNCTIONS ON THE METER IS NORMALLY IN DIRECT.

23



IT CAN BE HELD IN THE TAPE POSITION TO READ ON THE METER THE LEVEL YOU HAVE RECORDED ON THE TAPE. THIS IS A USEFUL CHECK.

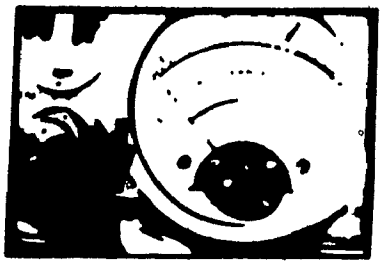
24



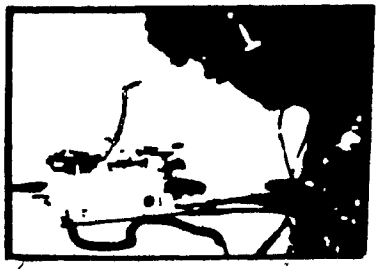
THE MANUAL AUTOMATIC MICROPHONE SELECTOR SHOULD NORMALLY BE VERTICAL ON MANUAL. WHICH MEANS THAT THE VOLUME OF YOUR MICROPHONES IS CONTROLABLE BY THE MIC INPUTS 1 AND 2.

25

THE HEADPHONE JACK TAKES A STANDARD 1/4" PHONO JACK.

26 

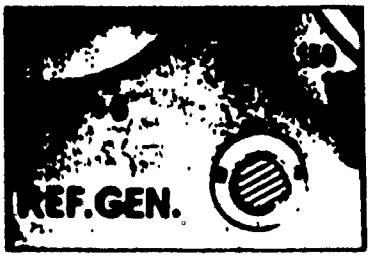
BELOW AND TO THE RIGHT IS A SMALL WHEEL MARKED PHONES LEVEL WHICH CONTROLS THE HEADPHONE VOLUME. DETERMINE A COMFORTABLE VOLUME AT THE BEGINNING AND KEEP TO IT.

27 

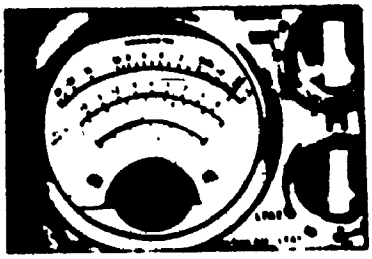
MIC INPUT LEVEL CONTROLS. 1 AND 2 ON THE FRONT OF THE NAGRA. CONTROL THE LEVEL OF THE SOUND COMING FROM THE MICROPHONES. ABOVE 80 DB THE NOISE OF THE MIC PRE-AMPLIFIER STARTS TO BECOME DOMINANT ALONG WITH THE BACK GROUND NOISE.

28 

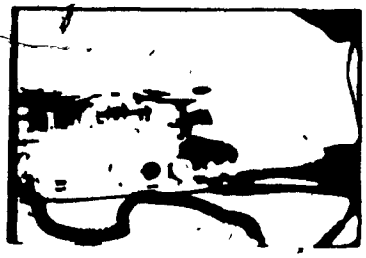
IN BETWEEN IS THE LINE INPUT LEVEL CONTROL WHICH CONTROLS ANYTHING PUT IN ON THE LINE INPUT OF THE RECORDER. THIS ALSO CONTROLS THE LINE OUTPUT LEVEL WHEN YOU ARE USING THE RECORDER TO PLAYBACK FOR TAPE TRANSFER PURPOSES.

29 

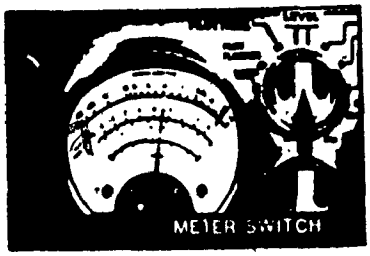
UNDERNEATH IS A SMALL BUTTON CALLED THE REFERENCE SIGNAL GENERATOR SWITCH. A 20 SECOND REFERENCE TONE PUT AT THE HEAD OF ALL SOUND ROLLS IS THE QUALITY CONTROL DEVICE THAT IS USED TO LINE UP THE LEVELS ON THE NAGRA. THE CONSOL AND THE RECORDING DUBBER. REFER TO THE INSTRUCTIONAL MANUAL FOR CORRECT TAPE IDENTIFICATION PROCEDURES.

30 

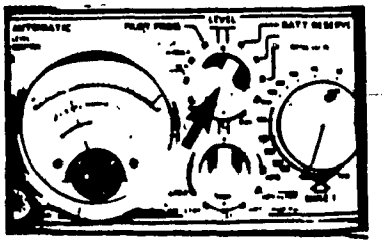
THE SOUND LEVEL METER ON THE NAGRA IS A MODULOMETER INDICATING RECORDING LEVELS AS WELL AS OTHER FUNCTIONS. IT IS A PEAK READING METER THAT GIVES EXACT IMMEDIATE READINGS OF SOUND LEVELS IN DECIBELS.

31 

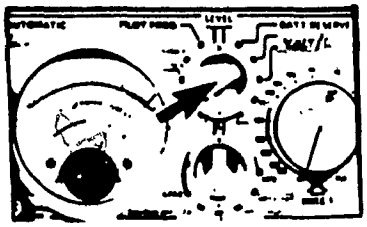
THE RECORDING SHOULD BE ADJUSTED SO THAT THE MAXIMUM DEFLECTION OF THE NEEDLE PEAKS AT ODB AT THE TOP OF THE SCALE. THE RECORDING WILL THEN BE MADE AT WHAT IS CALLED THE NOMINAL LEVEL.

32 

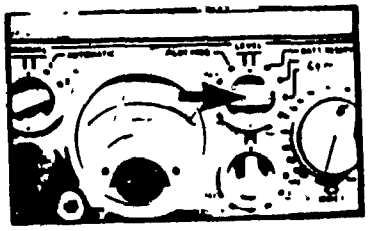
THE METER SWITCH SELECTS THE FUNCTIONS OF THE METER. IN ITS NORMAL VERTICAL POSITION THE METER READS THE LEVEL YOU ARE RECORDING.

33 

FIRST TO THE RIGHT IS BATTERY RESERVE WHICH READS ON THE BOTTOM SCALE OF THE METER. THE NEEDLE SHOULD BE READ LIKE THE FUEL GAUGE OF A CAR. AS LONG AS THERE IS DEFLECTION, THERE IS CURRENT.

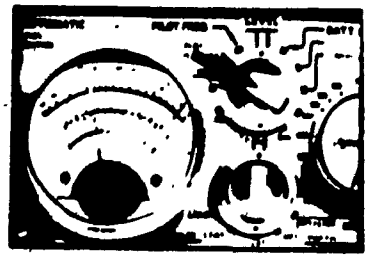
34 

SECOND TO THE RIGHT IS VOLTS PER CELL WHICH READS ON THE LOWER CENTRAL SCALE OF THE METER. THIS ALLOWS THE DIRECT MEASUREMENT OF BATTERY VOLTAGE PER CELL. BELOW 1.1 VOLTS PER CELL, THE BATTERIES SHOULD BE REPLACED. IF NOT, YOU RUN THE RISK OF MOTOR NOISE AND THE LOSS OF SPEED AND POWER.

35 

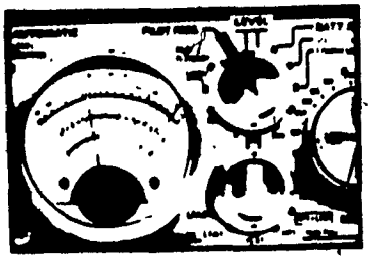
COMPRESSION IS READ ON THE LOWER PART OF THE BOTTOM SCALE. IT INDICATES BY HOW MUCH THE SENSITIVITY OF THE AMPLIFIER HAS BEEN REDUCED WHEN RECORDING IN AUTOMATIC.

36



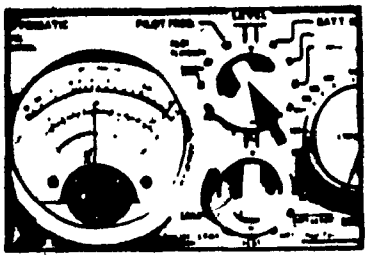
NEXT. MARKED MOTOR. IS AN INDICATION OF CURRENT BEING TAKEN BY THE MOTOR. IF THE NEEDLE MOVEMENT IS UNSTABLE. THERE IS A PROBLEM. AND THE NAGRA SHOULD BE CHECKED BEFORE USE.

37



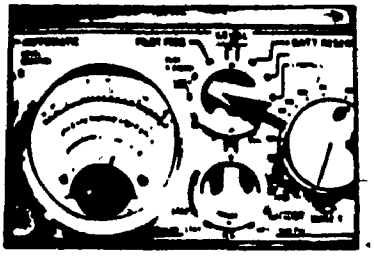
LAST ON THE RIGHT IS MARKED BIAS. READING A HIGH FREQUENCY SIGNAL BEING APPLIED TO THE TAPE IN THE RECORD POSITION ONLY. IT IS USED BY TECHNICIANS TO LINE UP THE RECORDER.

38



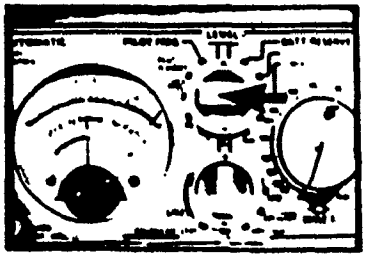
ON THE TOP LEFT IS PILOT FREQUENCY. READ ON THE MIDDLE SCALE OF THE METER. AND SHOULD NORMALLY BE AT ZERO WITH THE CRYSTAL. A PILOT TONE CABLE WILL ONLY INDICATE FREQUENCY WHEN THE CAMERA IS RUNNING.

39



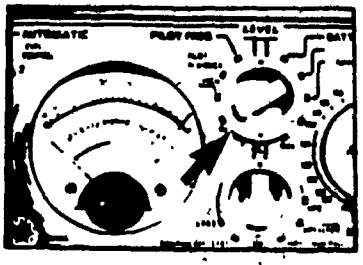
NEXT TO THE LEFT IS PILOT PLAYBACK WHICH INDICATES THE FLUCTUATIONS OF THE PILOT TONE AS IT WAS RECORDED.

40



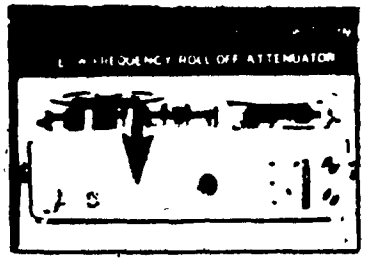
SYNC IS A FUNCTION OF THE NAGRA WHEN IT IS EQUIPPED WITH AN INTERNAL RESOLVER. IT ALLOWS FOR PERFECT PLAYBACK IN SYNC WHEN TRANSFERRING OR FILMING IN PLAYBACK.

41



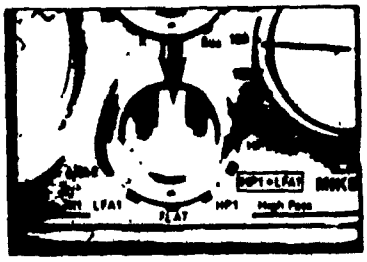
THE LAST TWO POSITIONS ARE SELECTORS FOR USING RADIO SLATING AND RARELY USED.

42



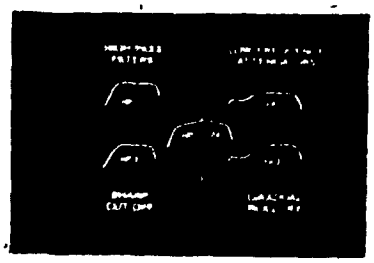
BESIDE THE MODULOMETER, IS THE LOW FREQUENCY ROLL OFF ATTENUATOR.

43



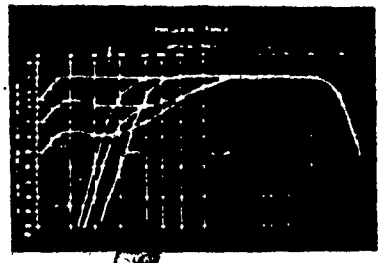
FLAT MEANS THAT NO FILTRATION IS BEING APPLIED, LFA1, LFA2, HP1, HP1+LFA1, AND HP2 ARE THE FILTERS AND ATTENUATORS.

44

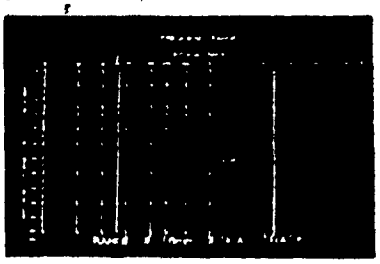


THESE ARE LOW FREQUENCY ATTENUATORS, AND HIGH PASS FILTERS. LFA1 AND LFA2 GRADUALLY REDUCE THE LOW FREQUENCY RESPONSE OF THE AUDIO SPECTRUM AND MAY INCREASE THE INTELLIGIBILITY OF THE HUMAN VOICE - DEPENDING UPON THE SITUATION.

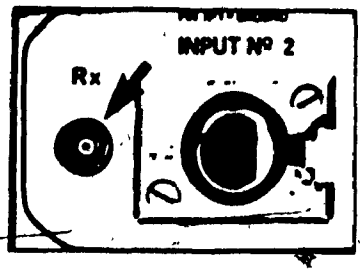
45



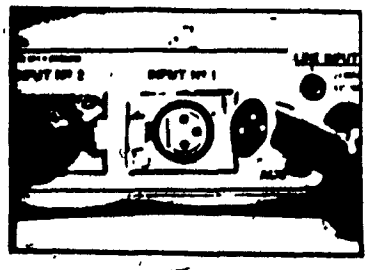
HP1 AND HP2 ARE FILTERS USED FOR ATTENUATING OR CUTTING OFF A GIVEN BAND OF AUDIO FREQUENCY AS FOUND ON SOUND STAGES, OR PRODUCED BY MIKS ON BOOM POLES AND FOR REDUCING WIND NOISE TO A GREAT DEGREE. FILTERING SHOULD BE DONE WITH DISCRIMINATION. THERE IS THEN LITTLE CHANCE OF OVER FILTERING AND IRREPARABLE DAMAGE. FILTERING CAN BE DONE DURING THE MIX.

46 

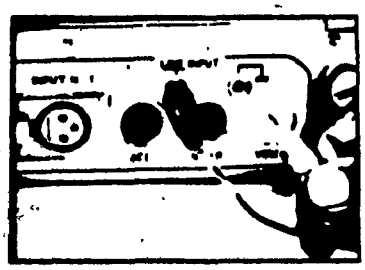
THE RANGE OF THE 16MM OPTICAL TRACK ACCOMODATES 80 TO 6,500 CYCLES.

47 

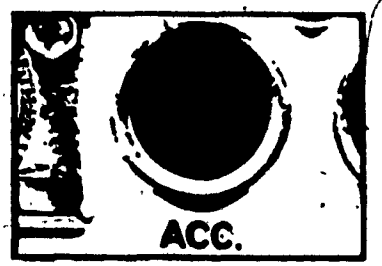
ON THE LEFT SIDE PANEL OF THE NAGRA IS A SMALL SOCKET MARKED RX. THIS IS FOR THE ANTENNA AND SELDOM USED.

48 

MIC.INPUTS NUMBER 2 AND NUMBER 1 ARE THE CONNECTIONS FOR THE MIC CABLES. MAKE SURE THE MICROPHONES YOU ARE GOING TO USE ARE MATCHED FOR IMPEDANCE FOR THE PRE-AMPLIFIERS INSTALLED IN THE NAGRA.

49 

NEXT ARE TWO BANANA TYPE PLUGS MARKED LINE INPUT - THESE LEAD INTO THE LINE CONTROL ON THE FRONT. USED FOR EXAMPLE, IF YOU ARE PLAYING INTO THE NAGRA ANOTHER TAPE RECORDER OR TURNTABLE.

50 

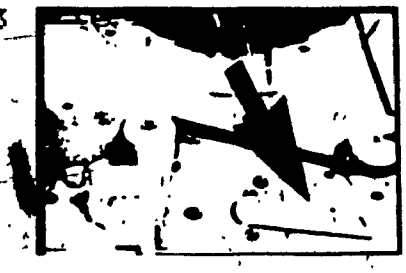
THE ACCESSORY INPUT CAN SUPPLY VOLTAGE FOR RUNNING OTHER PIECES OF EQUIPMENT.

51 

THE MIXER SOCKET IS TO BE USED WHEN YOU ARE USING AN EXTERNAL MIXER.

52 

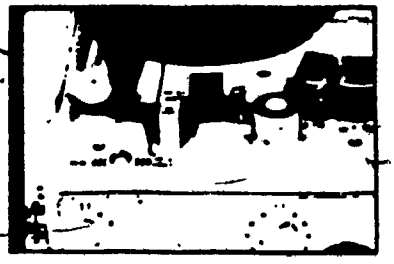
THE CONTROL MARKED VOL CONTROLS THE PLAYBACK LEVEL ON THE NAGRA LOUDSPEAKER. THIS SHOULD BE KEPT AT A CONSTANT LEVEL TO AVOID GETTING A FALSE IDEA OF WHAT IS ON THE TAPE.

53 

THE PINCH WHEEL AND TAPE GUIDE CONTROL LEVER MUST BE ENGAGED TO BE CORRECTLY TENSIONED FOR RECORDING.

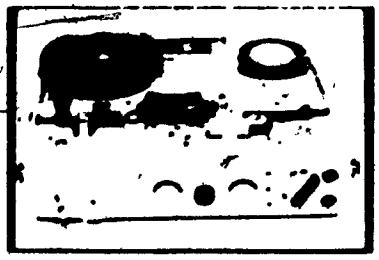
54 

WITH THE PINCH WHEEL AND TAPE GUIDE CONTROL LEVER DISENGAGED, YOU CAN REWIND BY PUTTING THE PRINCIPAL SELECTOR TO EITHER PLAYBACK POSITION.

55 

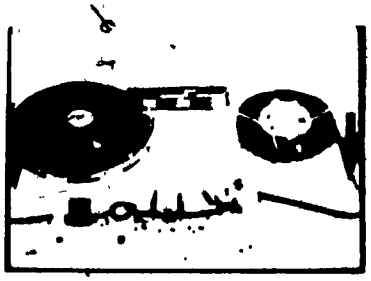
AND USING THE REWIND SWITCH.

56



THE REWIND AND FAST FORWARD SWITCH WILL ONLY OPERATE WITH THE PRINCIPAL FUNCTION SELECTOR IN PLAYBACK. WHEN THE PINCH WHEEL AND TAPE GUIDE CONTROL LEVER IS DISENGAGED. YOU MAY REWIND. IT MUST BE ENGAGED TO OPERATE IN THE FAST FORWARD MODE. HOWEVER, THE PRINCIPAL FUNCTION SELECTOR MUST BE IN PLAYBACK WITH SPEAKER.

57



THE TWO ROLLERS ON EACH SIDE OF THE MACHINE ARE TENSION ROLLERS.

58

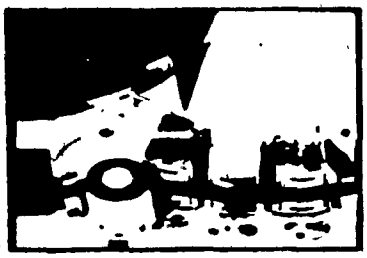
THE CAPSTAN IS THE WHEEL WHICH DRIVES THE TAPE.

59

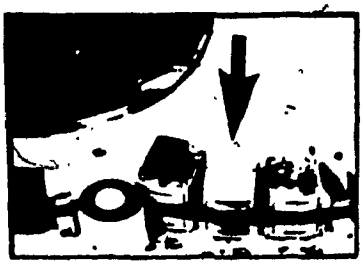
TO THE LEFT IS THE ROLLER FILTER AND STROBE DISC. UNDER 60 CYCLE LIGHT THE STROBE DISC WILL SHOW YOU WHETHER THE NAGRA IS RUNNING AT THE CORRECT SPEED.

60

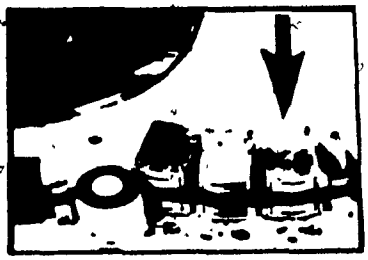
THE ERASE HEAD IN THE RECORDING POSITION. ERASES ANYTHING THAT HAS PREVIOUSLY BEEN ON THE TAPE.

61 

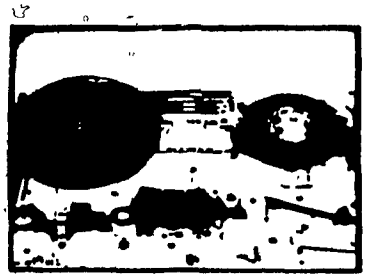
THE RECORD HEAD FUNCTIONS WHEN YOU ARE IN RECORD.

62 

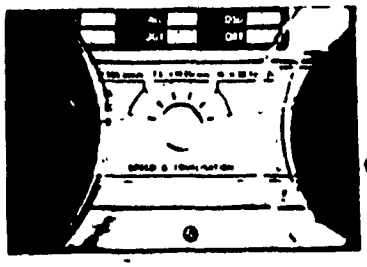
THE PILOT HEAD RECORDS THE PILOT TONE SIGNAL ALONG THE CENTER OF THE TAPE.

63 

THE PLAYBACK HEAD IS IN OPERATION ALL THE TIME. WHETHER IN RECORD OR PLAYING BACK. DURING RECORDING. BY OPERATING THE TAPE DIRECT SWITCH YOU ARE ABLE TO HEAR WHAT YOU ARE RECORDING.

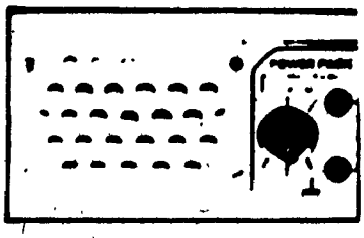
64 

THE TWO TAPE REELS ARE NORMALLY 5 INCH REELS. 7 INCH REELS CAN BE USED WITH THE LID OPEN. OR WITH A LID MADE FOR 7 INCH REELS. THERE ARE ALSO SPECIAL ATTACHMENTS AVAILABLE FOR USING 10 INCH REELS OF TAPE.

65 

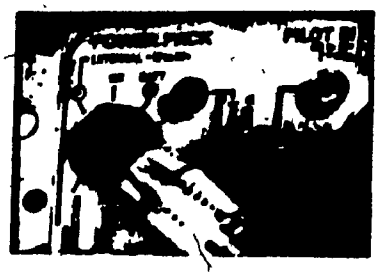
THERE ARE THREE SPEEDS ON THE NAGRA. 3 3/4. 7 1/2 AND 15 INCHES PER SECOND. EACH SPEED HAS AN STD AND LN POSITION LN IS FOR LOW NOISE TAPE AND STD FOR STANDARD. NORMAL TAPE. TAPES NOT SPECIFIED AS LOW NOISE SHOULD BE REGARDED AS NORMAL. THE USUAL SPEED FOR FILM RECORDING IS 7 1/2 IPS.

66



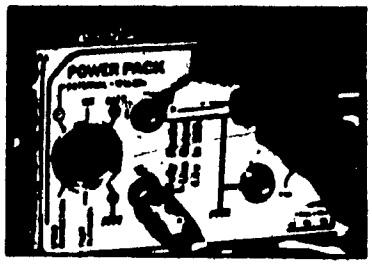
ON THE RIGHT SIDE PANEL OF THE NAGRA IS A SMALL LOUD SPEAKER. THIS WILL NOT GIVE HIGH FIDELITY.

67



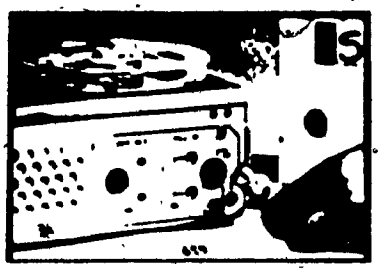
THE CONNECTOR MARKED POWER PACK IS THE INPUT SOCKET WHICH YOU WOULD USE IF YOU HAD A POWER PACK SUPPLYING THE NAGRA FROM A HYDRO SUPPLY. IT ALSO GIVES YOU THE PILOT SIGNAL WHEN TRANSFERRING.

68



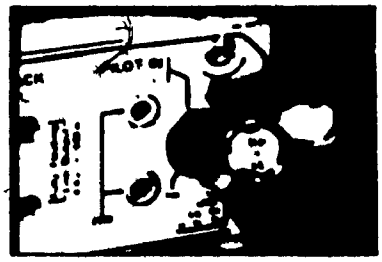
NEXT ARE THE LINE OUTPUT SOCKETS FOR USE WHEN THE NAGRA IS FUNCTIONING AS A PLAYBACK DEVICE. EITHER TRANSFERRING OR PLAYING INTO A LARGE AMPLIFIER. THE GROUND SOCKETS ARE MARKED WITH THE INTERNATIONAL SYMBOL FOR EARTH.

69



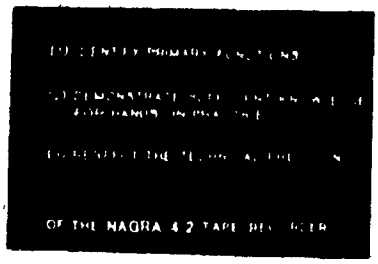
WHEN USING AN ELECTRONIC SLATE. IT ALSO IS PLUGGED INTO PLACE.

70



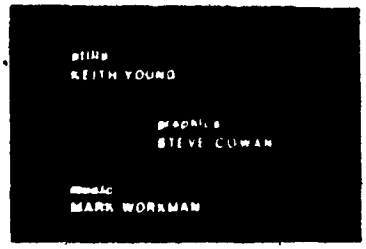
THE SMALL CRYSTAL DUMMY PLUG MUST BE IN PLACE FOR THE PILOT TONE GENERATOR TO FUNCTION. WHEN USING PILOT TONE CABLE. THIS PLUG SHOULD BE REMOVED. AND THE CABLE PLUGGED IN.

71

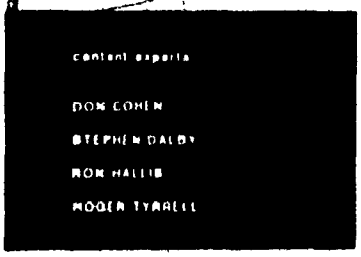


THE USE OF THIS LEARNING MODULE WITH THE INSTRUCTIONAL MANUAL SHOULD ENABLE YOU TO IDENTIFY THE PRIMARY FUNCTIONS. DEMONSTRATE SUFFICIENT KNOWLEDGE FOR HANDS ON PRACTICE AND RESPECT THE TECHNICAL PRECISION OF THE NAGRA 4.2.

72



73



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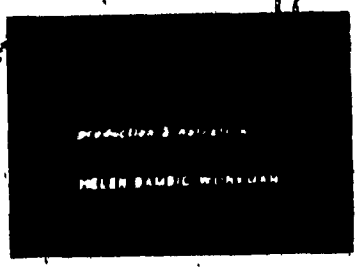

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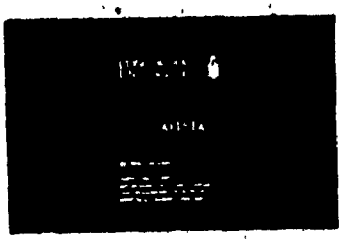
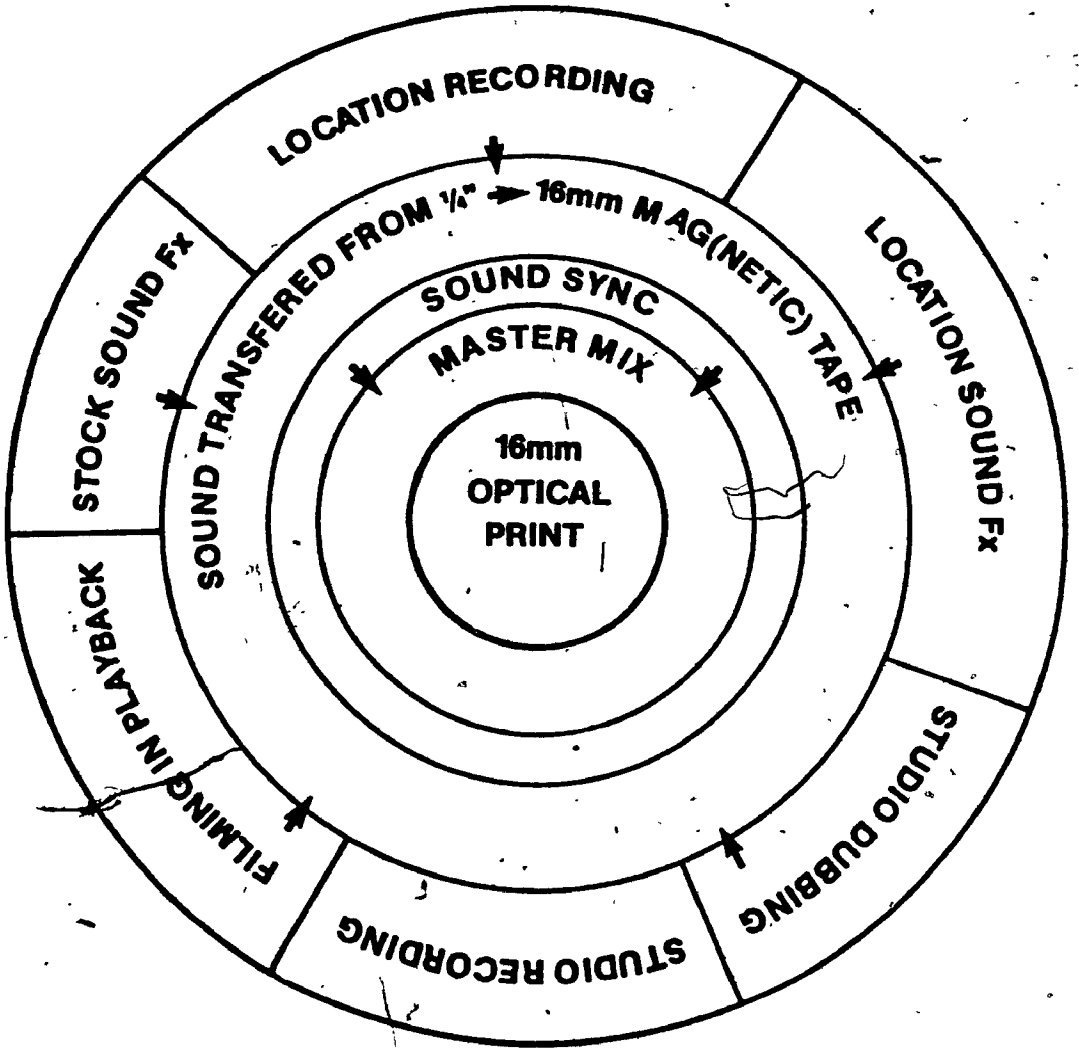
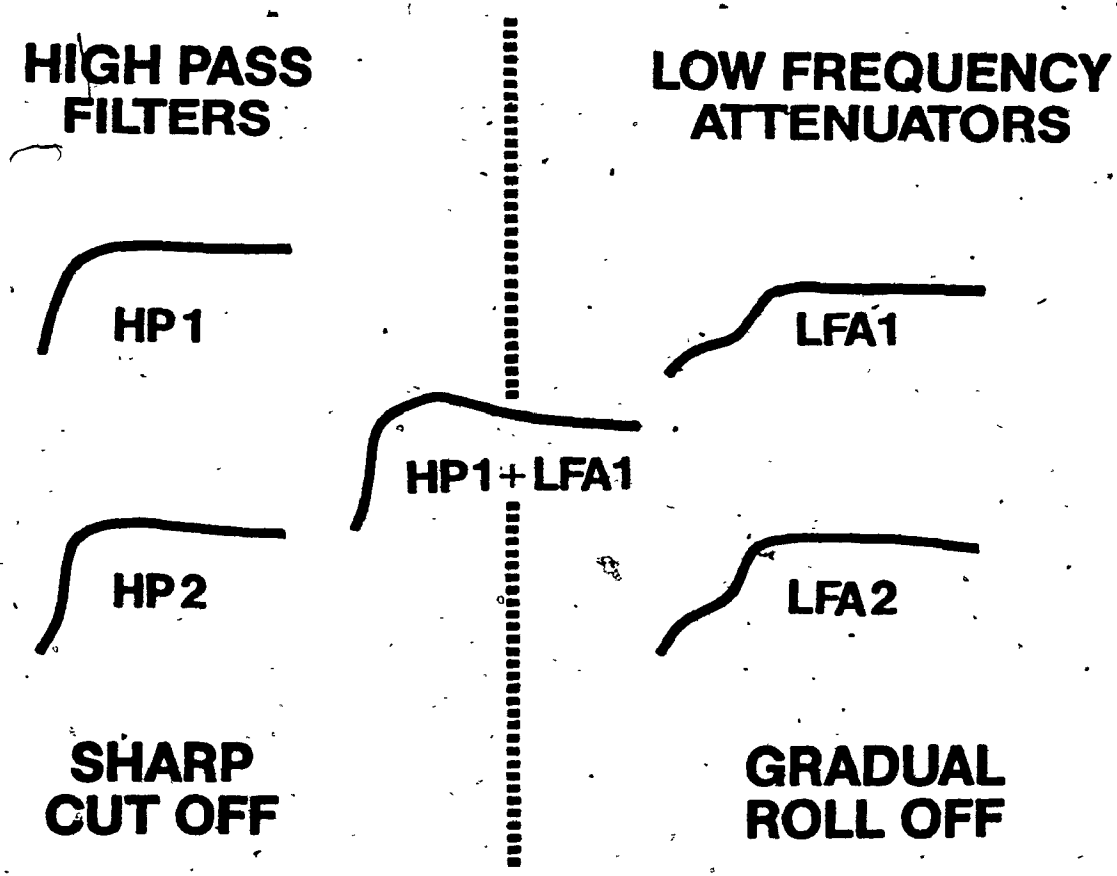


SLIDE 6

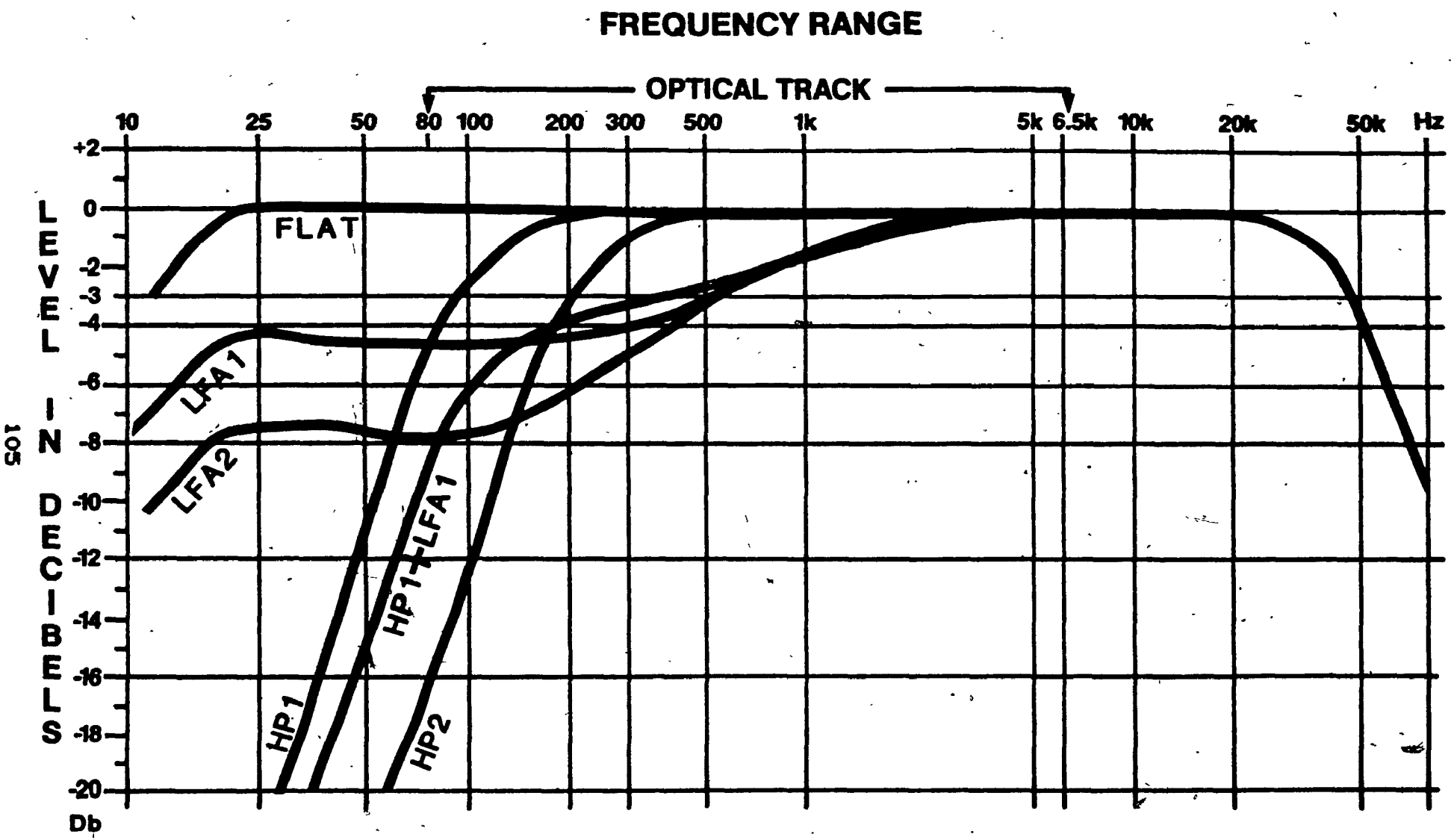


FILM SOUND PROCESS TO OPTICAL PRINT

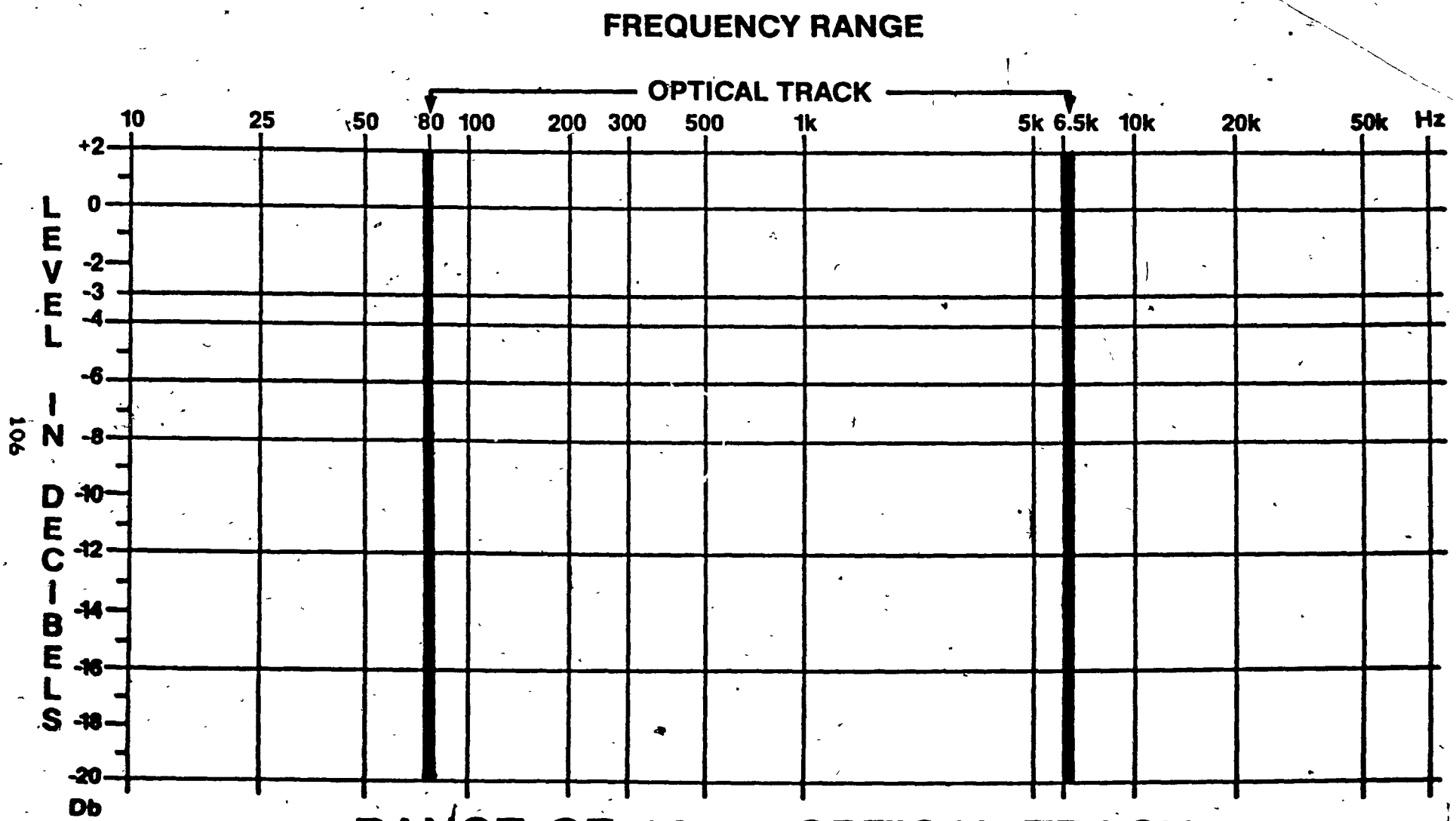
Slide #6


HIGH PASS FILTERS
LOW FREQUENCY ATTENUATORS
HP1
LFA1
HP1+LFA1
HP2
LFA2
SHARP CUT OFF
GRADUAL ROLL OFF

Slide #44


FREQUENCY RANGE
OPTICAL TRACK
10
25
50
80
100
200
300
500
1k
5k
6.5k
10k
20k
50k
Hz
+2
0
-2
-3
-4
-6
-8
-10
-12
-14
-16
-18
-20
Db
LEVEL IN DECIBELS
105
FLAT
LFA1
LFA2
HP1
HP1+LFA1
HP2

Slide #45



RANGE OF 16mm OPTICAL TRACK

Slide #46

1 - Power Selector
- Interrupteur "Batteries-Alimentation externe"
- Umschalter "Batterie-Aussenspeisung"

2 - SPEED & POWER Indicator
- Voyant SPEED & POWER
- SPEED & POWER Schauzeichen

3 - Principal Function Selector
- Commutateur principal
- Hauptschalter

4 - Pilot Indicator
- Voyant pilote
- Pilotschauzeichen

5 - Tape/Direct Switch
- Interrupteur Tape/Direct
- Tape/Direct Umschalter
(Line & Phones)

6 - Tape/Direct Switch
- Interrupteur Tape/Direct
- Tape/Direct Umschalter
(Meter)

7 - Pinch wheel and Tape Guide Control Lever
- Levier d'engagement du contre-cabestan et des guides
- Einschalthebel der Gegenrolle und der Bandführung

8 - Tension Roller
- Tensiomètre
- Tensiometer

9 - Capstan and Pinch Wheel
- Cabestan et contre-cabestan
- Antriebsachse und Gegenrolle

10 - Record, Pilot and Playback Heads
- Tête d'enregistrement, tête pilote et tête de lecture
- Aufnahme-, Neopilotton- und Wiedergabeköpfe

11 - 5" Take-up Reel (7" Reels can also be used with lid open)
- Bobine réceptrice de 13 cm (les bobines de 18 cm peuvent être utilisées avec le couvercle ouvert)
- 13 cm Aufwickelspule (18 cm Spulen können bei offenem Deckel benützt werden)

12 - Speed and Tape Selector
- Commutateur de vitesse et ruban
- Geschwindigkeits- und Bandumschalter

13 - Roller Filter and Strobe Disc
- Filtre de scintillation et stroboscope
- Tonhöhenschwankungsfilter und Stroboskoprolle

14 - Erase Head
- Tête d'effacement
- Löschkopf

15 - 5" Supply Reel (7" Reels can also be used with lid open)
- Bobine débitrice de 13 cm (les bobines de 18 cm peuvent être utilisées avec le couvercle ouvert)
- 13 cm Ablaufspule (18 cm Spulen können bei offenem Deckel benützt werden)

16 - Tension Roller
- Tensiomètre
- Tensiometer

17 - Antenna Socket for Receiver
- Prise antenne pour récepteur
- Empfängerantennendose

18 - Mike Input No. 1
- Entrée micro n° 1
- Mikrophoneingang Nr. 1

19 - Mike Input No. 2
- Entrée micro n° 2
- Mikrophoneingang Nr. 2

20 - Line Input
- Entrée ligne
- Linieneingang

21 - Accessory Input
- Entrée accessoire
- Zubehöreingang

22 - Mixer Socket
- Prise Mixer
- Mixerdose

23 - Rewind and Fast Forward Switch
- Interrupteur de rebobinage et d'avance rapide
- Rückspul- und Schnellaufschalter

24 - Manual/Automatic Microphone Selector
- Commutateur micro Manuel/Automatique
- Schalter für Mikrophonhandregulierung oder Automatik

25 - Headphone Jack
- Prise casque
- Kopfhörerdose

26 - Headphone Volume
- Volume casque
- Lautstärkeregler für Kopfhörer

27 - Meter
- Galvanomètre
- Galvanometer

28 - Low Frequency Roll-off Attenuator
- Commutateur des filtres d'atténuation des basses fréquences
- Filterselektor

29 - Meter Switch
- Commutateur du galvanomètre
- Galvanometerschalter

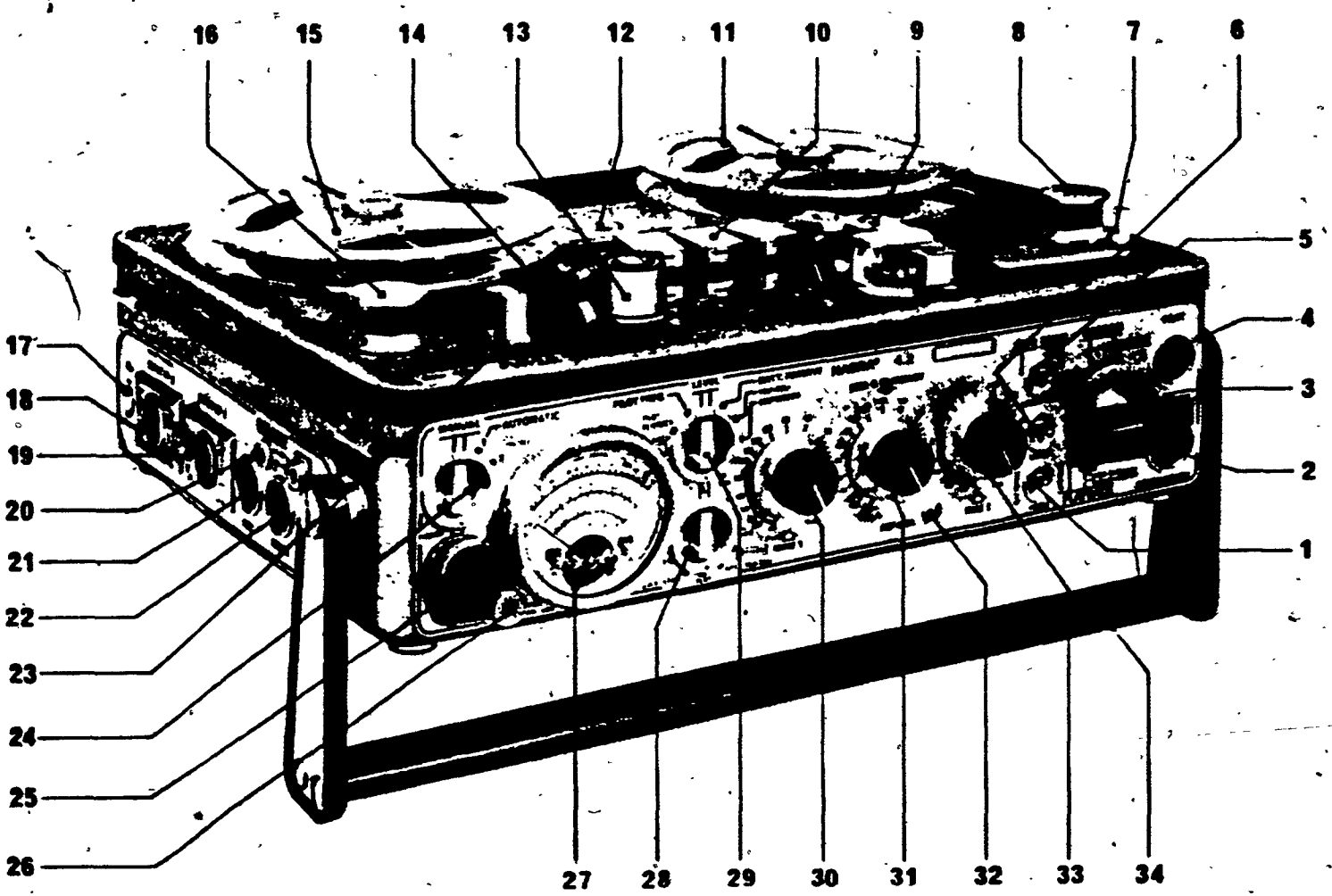
30 - Mike 1 Input Level Control
- Potentiomètre d'entrée micro n° 1
- Potentiometer des Mikrophoneingangs Nr. 1

31 - Line Input Level Control and Playback
- Potentiomètre d'entrée ligne et de lecture
- Linieneingang- und Wiedergabepotentiometer

32 - Reference Signal Generator Switch
- Commutateur du générateur de référence
- Schalter für Referenzgenerator

33 - Mike 2 Input Level Control
- Potentiomètre d'entrée micro n° 2
- Potentiometer des Mikrophoneingangs Nr. 2

34 - Removable Handle
- Poignée amovible
- Abnehmbarer Tragegriff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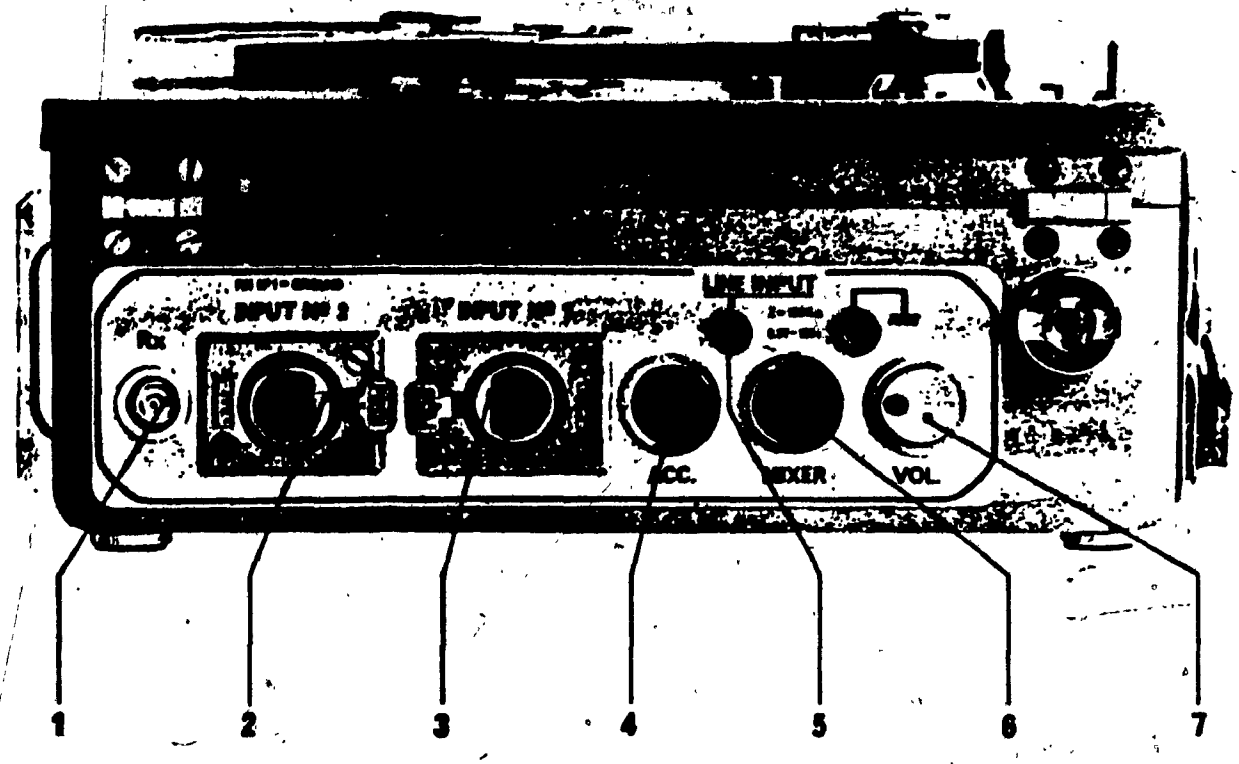
108

NAGRA 4.2

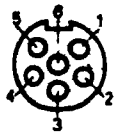


1 - Antenna Socket for Receiver
- Prise antenne pour récepteur
- Empfängerantennendose

2 - Mike Input No. 1
- Entrée micro n° 1
- Mikrophoneingang Nr. 1

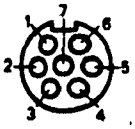
3 - Mike Input No. 2
- Entrée micro n° 2
- Mikrophoneingang Nr. 2

4 - Accessory Socket
- Prise accessoire
- Zubehördose

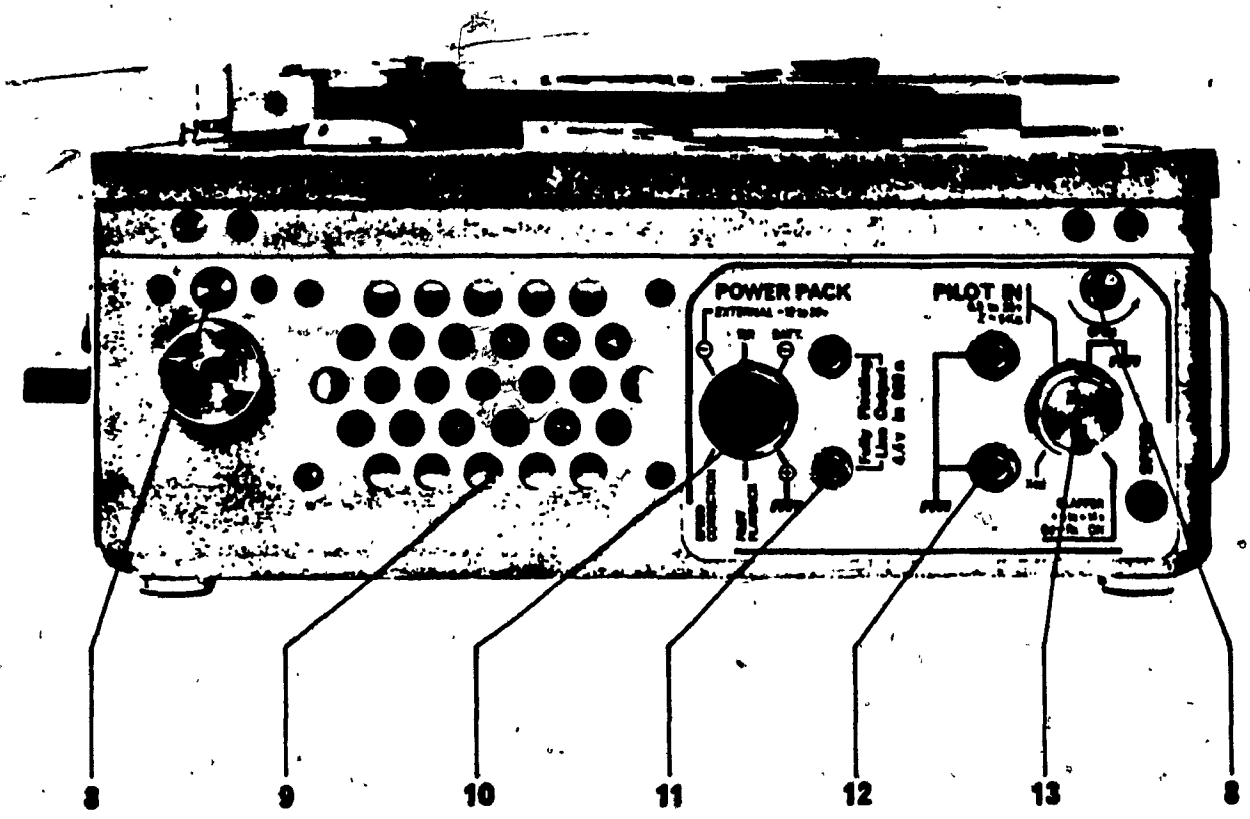


5 - Line Input
- Entrée ligne
- Linieneingang

6 - Mixer Socket
- Prise Mixer
- Mixerdose

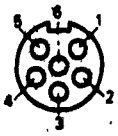


7 - Loudspeaker Volume
- Volume haut-parleur
- Lautstärkeregler für Lautsprecher



8 - Box Fastener
- Fermeture boîtier
- Gehäuseverschluss

9 - Loudspeaker
- Haut-parleur
- Lautsprecher



10 - Power Supply Input and Pilot Output
- Prise d'alimentation et sortie pilote
- Fremdspeisung und Pilotausgang

11 - Line Output
- Sortie ligne
- Linienausgang

12 - Ground Sockets
- Prises de masse
- Erdanschluss

13 - Pilot and Clapper Inputs
- Entrées pilote et claquette
- Pilot- und Startmarkierungseingänge

TURNING ON SEQUENCE

MACHINE CHECK

1) Place the machine on a flat surface - remove the cover. it is fragile at the hinges. Check that the machine is clean.

2) Clean and de-magnetize heads. be sure machine alignment has been checked.

POWER SELECT

3) Place the POWER SELECTOR (#1 on diagram on preceeding page) to **BATTERIES** and the PRINCIPLE FUNCTION SELECTOR (#2) at **TEST.** This switches on the amplifier but not the motor.

BATTERY RESERVE

4) Set the METER SELECT (#29) to **BATT. RESERVE** and observe the meter. The needle of the meter should fall on the scale indicating that the Nagra is correctly powered. With fresh batteries. the needle will not advance to more than half way up the scale. It only reaches the extreme right of the scale with an external power supply unit. The needle should be read like the fuel gauge of a car. as long as there is deflection there is current.

VOLT/CELL

5) Set METER SELECT (#29) to **VOLT/CELL** and read the lower central scale on the meter. This allows the direct measurement of battery voltage per cell. Below 1.1 volts per cell the batteries should be replaced. If not. you run the risk of motor noise and the loss of speed and power.

PILOT

6) The PILOT INDICATOR (#4) should show white. PILOT FREQUENCY (if available on the machine) is like a 'note' that the machine 'hums' steadily. PILOT LEVEL shows you whether the machine is 'humming' loudly enough. The CRYSTAL is actually a 'hummer'. A PILOT TONE cable, when used. brings the hum from the camera.

MOTOR

7) Set the METER SELECT (#29) to MOTOR and check the motor for wow and flutter. Is it clean?

LOAD

8) Release the pinch wheel by pulling the PINCH WHEEL AND TAPE GUIDE CONTROL LEVER (#7) forward.

9) Place the full tape reel on the left reel spindle and the empty one on the right. Screw in securely.

10) Draw the tape across the TENSION ROLLER (#16), the HEADS (#10), the CAPSTAN (#9) and TENSION ROLLER (#8).

11) Thread the tape onto the take-up reel.

12) Engage the tape by moving the PINCH WHEEL AND TAPE GUIDE CONTROL LEVER (#7) back to its initial position.

13) Set METER SELECT (#29) to **LEVEL.**

REFERENCE TONE

14) Place PRINCIPAL FUNCTION SELECTOR (#3) to RECORD and press the REFERENCE SIGNAL GENERATOR SWITCH (#32) for 20 seconds to record the reference tone.

STROBE SPEED CHECK

15) Check the tape speed by looking at the STROBE DISC (#13). Under artificial light it should look like it is still.

16) Set MANUAL/AUTOMATIC MICROPHONE SELECTOR (#24) to **MANUAL.**

CONNECT MICROPHONE

17) Insert the mic connector into MIC INPUT No. 1 (#19) and advance the MIC INPUT LEVEL CONTROL No. 1 (#30) while speaking normally. The METER will show the amount of signal being applied to the tape. It should not be allowed to peak over the 0dB point, or the sound will distort. Any sound of importance should register above the -10dB level.

CONNECT HEADPHONES

18) Connect the headphones to the HEADPHONE JACK (#25) to the left of the METER and with approximately -4dB signal on the METER, set the headphone volume by the HEADPHONE VOLUME (#26) small screw and then keep to it.

19) The recording can now be made. Place the PRINCIPAL FUNCTION SELECTOR (#3) at RECORD, NO LIMITER and the tape should advance.

20) During recording, the signal coming from the microphones (and which is being recorded) is the **DIRECT** signal. The signal which has already been recorded is the **TAPE** signal. The record and playback -chains function simultaneously. The playback head situated after the record head permits the playback of a newly recorded tape with a fraction of a second delay from the **DIRECT** signal, and this takes getting used to. With the switch at **TAPE**, if you run out of recording tape, (a common problem with beginning recordists) you will know immediately. This is not so, with the switch in **DIRECT**.

TAPE/DIRECT CHECK

LISTEN

17) **Listen** to the ambient location sound. The LOW FREQUENCY ROLL OFF ATTENUATOR (#28) switches various filters into the circuits of the microphones. The position **FLAT** means that no filtration is being applied. It is best to record and listen to the sound of each filter position one by one. Remember, filtering can be done either in the transfer or the final mix. Only filter when absolutely necessary. You cannot put back what you have taken out.

FILTERSFF

STOP

18) At the end of recording, put the PRINCIPAL FUNCTION SELECTOR (#3) to **STOP**.

REWIND

19) To rewind the tape, disengage the PINCH WHEEL AND TAPE GUIDE CONTROL LEVER (#7), put the PRINCIPAL FUNCTION

SELECTOR (#3) to either of the playback positions and put the REWIND AND FAST FORWARD SWITCH (#23) to REWIND. The tape should then rewind. To stop the rewinding, place the REWIND SWITCH to its vertical position, or STOP the recorder.

20) For playback to the internal loudspeaker, re-engage the PINCH WHEEL AND TAPE GUIDE CONTROL LEVER (#7) and place the PRINCIPAL FUNCTION SELECTOR

SPEAKER VOLUME

(#3) to PLAYBACK WITH SPEAKER. The control marked **VOL** controls the playback sound level on the loudspeaker. This should be kept at a constant level to avoid getting a false idea of what is on the tape.

21) For playback to headphones (or to an external speaker), put the PRINCIPAL FUNCTION SELECTOR (#3) to **PLAYBACK**. (this disconnects the internal loudspeaker).

FAST FORWARD

22) To FAST FORWARD the tape, put the PRINCIPAL FUNCTION SELECTOR (#3) in **PLAYBACK WITH SPEAKER** and the REWIND AND FAST FORWARD SWITCH to **FFW**.

ON THE LEVEL

23) Optimum sound levels are set so that the maximum deflection of the needle peeks at **0dB**. Sounds that may pass unnoticed by the human ear have a unhappy knack of being rendered prominent by the microphone. Levels of background noise (ambience) are different for each location and usually pass unnoticed until altered. Major alterations of recording levels will affect background noise. Be sure to check your sound for quality, clarity, consistency and continuty.

MACHINE CHECK

1) Battery reserve
2) Pilot indicator
3) Pilot frequency
4) Pilot level
5) Motor check for wow and flutter. Is it clean?
6) Clean and demagnetize heads
7) Tape speed
8) Tape running
9) Compare TAPE to DIRECT
10) Level set

LOCATION SOUND RECORDING MATERIALS CHECKLIST

1) Recorder, reels, tape stock
2) Spare batteries and fuses
3) Microphones (proper impedence)
4) Microphone stands, holders, boom and cables
5) Audio cables (test and bring extras)
6) Headphones and adapter (proper impedance) for recordist and boom
7) Pilot tone cable or "dummy plug"
8) Wind screens (socks) or isofoam
9) Baffle for camera noise
10) Q-tips, methyl hydrate
11) Gaffer tape and masking tape
12) Sound report sheets
13) Pencils, pens, felt markers
14) Appropriate power supply

TAPE IDENTIFICATION PROCEDURES

1) At the beginning of **each** roll of tape record **20 seconds** of **reference tone** (this is a quality control device to line up the levels on the Nagra, the consol and the recording dubber for transfer to 16 mm magnetic tape). Identify the **title** of the production and your **name** as recordist.

2) On tape, identify the **tape reel #** at the beginning of each tape reel.

3) Identify each **shot #** and **take #**

4) Precede any wild or ambient sound with **what** it is, **where it is recorded** and the **shot #** it refers to.

5) At the **end** of each tape reel, record a series of **six quick beeps** for the transfer technicien.

6) Indicate on each tape reel whether the head or tail is put.

7) Identify each box carefully.

TITLE_____
ROLL #_____
TAPE SPEED_____
DATE_____
TAPE WIND_____ (head or tail out)

8) Keep **accurate** SOUND REPORT SHEETS while shooting.

SOUNDPERSONS'S DUTIES - RECORDING CLEAN LOCATION SOUND

1) Know the script and shot locations.

2) Know your equipment and production needs.

3) Double check that you have the appropriate equipment, and that all equipment and audio cables are **functional.**

4) **LISTEN** to the **sound** of the location. Eliminate unwanted background ambient noise whenever possible. Turn **OFF** air conditioners, refrigerators and florescent lights.

5) Rehearse the shot **with the camera** for best microphone placement.

6) Be sure you have **enough tape on the roll** to complete the shot.

7) Maintain consistent sound levels and quality of recording for **continuity.**

8) Remember to identify and record **location sound FX.** Stock sound FX are not recommended for principal sound FX.

9) Remember to identify and record **room tone** after the last take in a particular room **with** the same number of people in the room, **and** the camera **running.**

10) Identify and record **wild ambient sound.**

11) Identify and record **wild dialogue** when shots are a problem. Promote the use of **wilding in dialogue** for difficult takes, it gives the performers a better chance for an effective delivery.

12) Don't dub unless you have to. It is costly, labour intensive, and requires a rare skill. If you must dub, remember to identify and record an appropriate ambiance track to avoid dead holes.

13) Compare **TAPE/DIRECT** positions occasionally. A marked difference usually means dirty heads or poor level settings.

14) Store tape TAIL out. (Professional sound recordists tend to store tape tail out as the tape has been carefully reeled on at recording speed.)

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HISTORICAL ACCOUNT

The following brief historical account will situate the KUDELSKI company in the chronological evolution of recording. (Reprinted with permission of ARRI NAGRA.)

RECORDING

Ever since it was thought to be possible, people have tried to store sound by diffferent means: wax rolls (Edison), metallic wire (Poulsen), tapes, records, etc.

1807 The American Thomas Young builds an instrument capable of inscribing acoustic vibrations on the surface of a soot-coated cylinder.

1877 Thomas Edison builds the first device allowing recording and playback of sounds: the phonograph. The conversion of acoustic waves into recorded information was accomplished by engraving an aluminum foil covering a rotating cylinder

1888 Oberlin Smith studies the fundamental idea of magnetic recording and propounds some experiments.

1889 The first magnetic recording is achieved by the Danish physicist Valdeman Poulsen. His device, the TELEGRAPHON, is made of a steel wire wound helically on a cylinder rotating under an electromagnet connected to a carbon microphone or an earphone.

1903 Poulsen uses biasing by a continuous magnetic field, which constitutes an important improvement.

1905-1926 The 78 rpm record industry grows rapidly and research on magnetic recording is slowed down.

1927 Carlson and Carpenter invent alternating magnetic field biasing. At the same time, O'Neil tests flexible magnetical base materials.

1930 The German, Stille, and Marconi form the Marconi-Stille Company which builds the first steel band recorders for the BBC; the specifications are the following: width 3mm (1/8"); thickness 80 micrometers (0.003 mm); speeed 1.5m/s (60 ips); mass of a full reel 25kg (55 lbs); fairly dangerous to use (risk of deep cuts).

1931 In Germany, Pfleumer and AEG design and build the first magnetic recorder, close to what is used nowadays. They call it the MAGNETOPHON.

1934 The I. G. Farben (BASF), at the request of AEG, manufacture the first magnetic tape on plastic base whose specifications are good enough for industrial production. 50,000 m (160,000 ft.) were manufactured.

1941 Weber and Von Braunmühl from AEG develop the high frequency biasing; the improvement is decisive and the MAGNETOPHON becomes a machine of excellent quality.

1947 Launching of the microgroove 45 rpm record.

1948 Recorders become current but are still heavy and bulky; the mobile units are installed in trucks. They use a lot of electrical power and are impractical to use. In Switzerland, several research workers try to improve these points.

1949 In Zurich, Willi Studer develops a high quality portable tape recorder, but it must still be powered by mains.

1951 In Prilly/Lausanne, Stefan Kudelski designs and builds a high quality tape recorder that is portable, self-contained, light and small: the NAGRA.

1955 Stereophonic tape recorders are marketed.

1957 Launching of the multitrack prerecorded cartridges.

1958 The first portable tape recorder, self-contained, light, small, all solid state, whose technical data are equal to or better than those of studio machines, begins to be produced in Lausanne by the KUDELSKI company; the success is immense; it is the NAGRA III.

1959 Instrumentation tape recorders are marketed.

1961 Invention of the NEOPILOT system.

1964 The compact cassette recorders appear in great numbers. They are of medium quality, but their low price make them popular.

1968 Series production of the first multitrack (16 or more tracks) audio tape recorders.

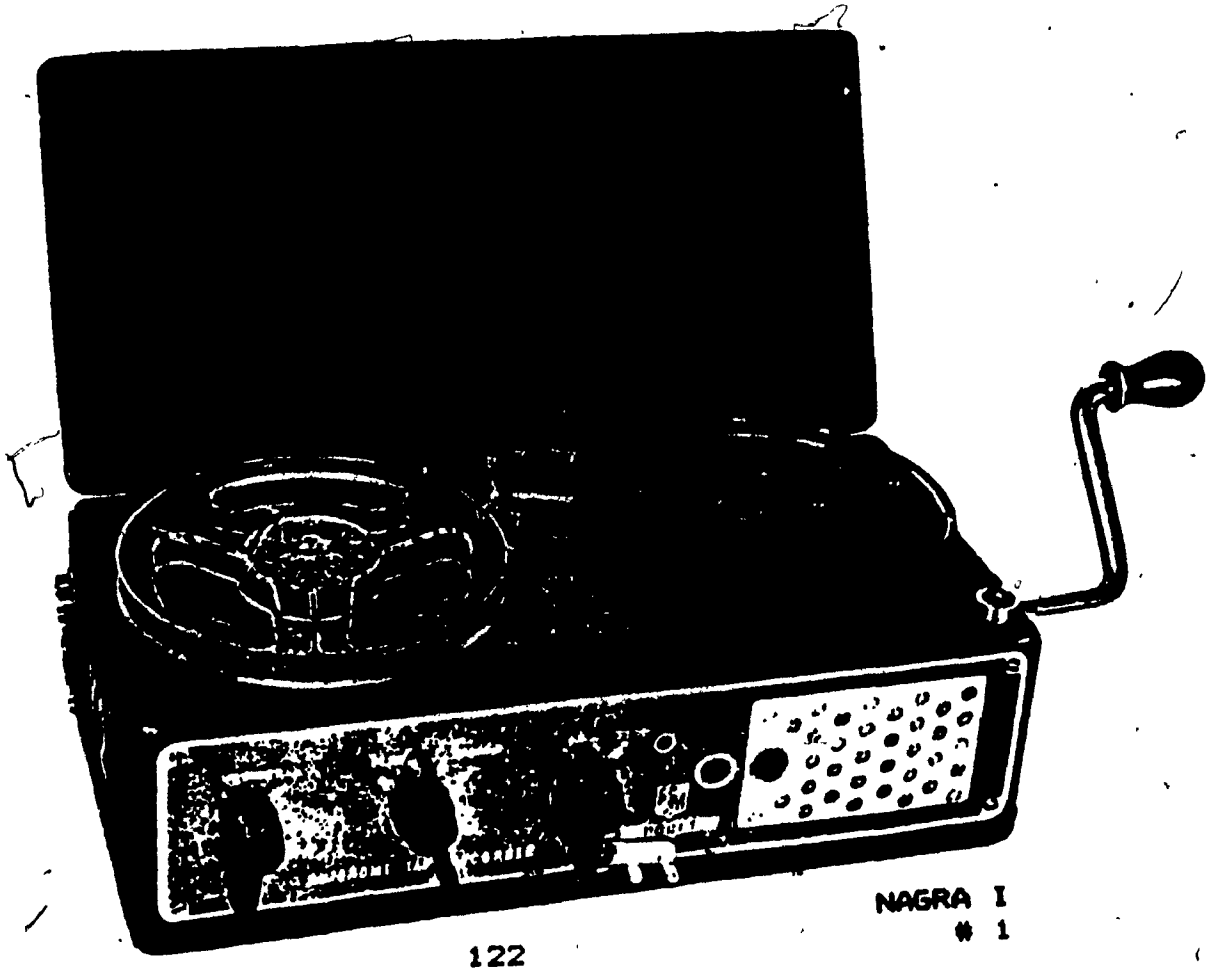
1974 The first digital PCM instrumentation tape recorders appear.

1975 Prototypes of recorders with statical digital memories appear.

THE KUDELSKI S.A. COMPANY

The Kudelski Company was founded by Stefan Kudelski in the year 1951. Stefan Kudelski was born in 1929 in Warsaw, Poland, where he went to primary school and started his first experiments. In 1939, when war was declared in Europe, the Kudelski family fled first to Hungary, then to France and finally to Switzerland in 1943. Stefan Kudelsi returned to his studies, first at the College Florimont in Geneva, then at the Ecole Polytechnique de l'Universite de Lausanne, EPUL (the Swiss Federal Institute of Technology) in 1948.

In 1951, his much valued invention took concrete form: a tape recorder with exceptional specification, i.e. light, small, self-contained, protable and of high quality. It was the NAGRA. In Polish, nagra means recorded.



NAGRA I
1

The following lists the number of different machines created by Stefan Kudelsi's inventive genius.

YEAR	MODEL
1951	NAGRA
1952	NAGRA I
1953	NAGRA II
1955	NAGRA II - CI (PRINTED CIRCUIT)
1958	NAGRA III
1960	NAGRA SN PROTOTYPE
1962	NAGRA III - P (NEOPILOTE)
1968	NAGRA IV
1970	NAGRA SNN
1971	NAGRA 4.2 and NAGRA IV-S
1972	NAGRA IV-SJ and NAGRA SNS
1974	NAGRA IS
1975	NAGRA IS (T)
1976	NAGRA E
1977	NAGRA SNST and NAGRA FAX
1978	NAGRA TI
1979	NAGRA TRVR
1981	NAGRA TA

Some of the important awards received by Stefan Kudelski are the following:

1965	Technological Oscar in Hollywood for the NAGRA III
1967	SMPTE Award for the NAGRA III
1972	Alan B. Gordon Award for the NAGRA SNN
1977	Technological Oscar in Hollywood for the NAGRA 4.2 L
1979	Technological Oscar in Hollywood for the entire NAGRA line
1982	Full Academy Award for contribution to the development of audio recording for film.

Oscar 1965

GLOSSARY

COMMON TERMS USED IN MAGNETIC RECORDING OF FILM SOUND

ACOUSTICS — Science of dealing with the production, effects and transmission of sound waves; the transmission of sound waves through various mediums, including reflection refraction, diffraction, absorption and interference; the characteristics of auditorium, theatres, studios, as well their design.

ACOUSTIC FEEDBACK — The screeching sound caused when a microphone picks up vibrations from its own speaker system.

AMBIENCE — The residual "room sound" of a musical environment. In classical music, for example, the term ambience is used interchangeably with the word reverberation, to refer to the persistence of decaying sounds in the concert hall. (Not to be confused with **ambient noise**, which refers to background noise.)*

AMBIENT NOISE — The average amount of background noise in an environment, measured in dB.*

AMPLIFY — To increase levels of voltage, current, or power.

ANECHOIC — An extremely dead acoustical condition in which reverberation is non-existent (i.e. anechoic=no echo). Because of the absence of acoustical character in such an environment, specially designed rooms called **anechoic chambers** have been developed in which critical audio testing can be done.*

ATTENUATE	To decrease levels of voltage, current, or power as with volume control.
AUTOMATION	The computerization and automatic control of normal mixing functions, such as volume level, effects, equalization etc. Automation is made possible by storing information about the mix on a separate track of a multi-track tape. This track is subsequently used to retrieve and operate mixing functions, independently, via the use of voltage controlled amplifiers (V.C.A.'s).*
AZIMUTH ADJUSTMENT	In sound recording and playback, the adjustment to position the magnetic head gap exactly perpendicular to the horizontal base of the tape. (see **GAP**)
BAFFLE	A device used to inhibit the propagation of sound waves.*
BIAS	A high-frequency alternating current fed into the recording circuit and used as a carrier of the audio signals to the record head. Improper bias will cause distortion and/or high **signal-to-noise ratio.**
BILATERAL SOUND TRACK	A type of variable-area photographic sound track consisting of a clear region in the center of an otherwise opaque sound track area. The width of the clear area varies in accordance with the amplitude of the recorded audio signal.
BINAURAL MONITOR JACK	Output jack of tape (or other) recorded wired to accept binaural earphones.
BINAURAL SOUND	Two-channel sound in which each channel recorded is heard through one ear. (Channel 1 - left ear, Channel 2 - right ear)

BULK ERASER — A strong alternating electromagnetic device used to erase magnetic patterns on tape while the tape in still wound on a reel or other bulk form.

CAPSTAN — The rotating shaft that engages the tape and pulls it across the heads at a constant speed.

CANCELLATION — The destructive interference of two or more sound waves. Waves of similar frequencies and amplitude, but of opposite phase (180 degrees) can produce mutual cancellation effects.*

CHANNEL — Complete signal path of a sound system.

CLOSE-MIKING — A technique where the microphone is very close to the instrument being recorded to eliminate the pickup of unwanted noise or other instruments.*

COMPRESSION — Reduction of dynamic range, or the difference between the loudest and softest passages of an audio recording. It is accomplished by means of a compressor or limiter.

CPS — Cycles per second. (See **Hertz, Hz**).

CROSS TALK — Signal (sound) leakage between channels.

CUT-OFF — The frequency at which a given effect ceases to operate. Practically speaking, exact cut-offs are rarely desirable, for they would cause noticeably distinct and unnatural alterations of the sound. Instead, cut-offs are usually graduated or "rolled-off". In this way a smoother and more natural sounding transition is made.

CYCLE — A complete to and fro movement of a vibrating sound source corresponding to a high and low pressure wave.*

DEAD

An acoustical condition in which reverberation is absent.*

DECIBEL
dB

The measuring unit of sound pressure and hence loudness. The decibel is actually a numerical ratio between the sound pressure of a given sound and the sound pressure of a reference sound (usually .0002 microbar). Common decibel levels encountered vary from the rustling of grass (15 dB) to conversation (50 dB), to live rock groups (110 dB) to jet plane engines at close range (130 dB).*
A relative measure of sound intensity. One dB is the smallest change in sound volume that the human ear can detect. A change of plus or minus 3 dB doubles or halves apparent sound volume.

DIAPHRAGM

The delicate membrane used in dynamic microphones to sense incoming sound waves In the microphone the diaphragm is attached to a coil in a magnetic field, which moves with the diaphragm when affected by a sound pressure wave. The movements of the coil induce a current which becomes the mike's output.*

DIFFRACTION

The bending of a sound wave around an obstacle. Low frequency sound waves, which can measure up to 50 feet long, diffract easily in the studio, contributing to the phenomenon of leakage.*

DIRECT FIELD

The area in a room which is in the immediate vicinity of the sound source. Because of the close proximity of the source, the acoustical characteristics of the room have little influence on the sound quality in the direct field (see reverberant field).*

DIRECT SOUND

Sound waves arriving at the listening location directly from the source. To be distinguished from **reflected sound**, which

	arrives at the listening location after bouncing off the surrounding surfaces.*
DISTORTION	Any difference between the original sound and the recorded/reproduced signal.
DISTORTION (HARMONIC)	The production of harmonics which do not exist in the original waveform.*
DUAL BILATERAL SOUND TRACK	A type of variable-area photographic sound track consisting of two narrow bilateral sound tracks side-by-side in the sound track area.
DUAL-TRACK RECORDER	Type of monophonic recorder that records or plays back half of a tape in one direction and the other half in the opposite direction.
DUBBING	The art of transferring recorded signals onto magnetic materials. Also, recording lip-synchronized dialogue with existing film picture (often over existing sound).
DYNAMIC MICROPHONE	An electromagnetic type of mike that employs a moving coil in the magnetic field to generate an electrical signal.
DYNAMIC RANGE	The ratio between the softest and loudest sounds a tape recorder (or other device) can reproduce without distortion.
ECHO	A distinctly discernible reflection or repetition of the source signal. The term is often used incorrectly to refer to **reverberation**, which consists of **multiple** decaying reflections so closely spaced that they are indistinguishable from one another.*
EDITING	Selection of certain sections of tape recordings and deletion of unwanted portions; followed by assembling them in the desired sequence.

EQUALIZATION The electronic adjustment, or compensation, of the frequency and level characteristics of audio signals to make the reproduced sound approximate the original as closely as feasible.

ERASE HEAD The magnetic assembly on a tape recorder over which the tape passes to remove previously recorded signals.

FADER A linearly operated potentiometer or volume control. Faders are used almost exclusively for volume adjustments in mixing consoles, instead of rotary potentiometers, because of their ease of operation and visual correspondence to the level setting.*

FAST FORWARD Provision in a tape recorder to run tape rapidly forward through the machine.

FEED REEL The reel on a tape recorder that supplies the tape; **supply reel.**

FLAT RESPONSE Reproduction of sound in such a way that the volume of different frequencies or tones has the same relative volume in the original sound.

FLUTTER Very short and rapid variations in tape speed causing audio distortion.

FREQUENCY The speed of vibration of a sound wave, measured in cycles per second or hertz. Frequency determines pitch; the faster the frequency, the higher the pitch. The human ear can hear frequencies in the range of 20 to 20,000 Hz.*

	The rate at which electronic impulses or sound is repeated in a specific time peiod. Low frequencies refer to bass tone and high frequencies refer to treble.
FREQUENCY RESPONSE	The capability of audio equipment to transmit or reproduce all of the frequencies of a given sound or sound source.
GAIN	The increase in signal provided by an amplifier between input level and output level.
GAP	The tiny distance between the magnetic poles of tape heads. The actual gap is not empty space, but is filled in by non-magnetic material.
GRAPHIC EQUALIZERS	Equalizers which provide a visible display of the frequency response curve by the relative position of the knobs on the unit. Graphic equalizers usually provide control over many frequencies simultaneously, with each knob being able to provide cut or boost of up to 15 dB per frequency.*
GROUND	A point in any electrical system that has zero voltage.
HARMONIC DISTORTION	The production of harmonics which do not exist in the original waveform.*
HARMONICS	The overtones of a fundamental note. The first harmonic of a note is the note itself. The second harmonic is the note doubled. The third harmonic is the note tripled..... and so on. (i.e. 500, 1,000 Hz).*
HEAD	On a tape recorder or projector, an electromagnet across which the tape or film is drawn and which magnetizes the iron oxide coating on the tape base.
HEAD ALIGNMENT	In tape recorders or projectors, the position alignment of the tape head and gap, with respect to the magnetic tape or film.

HEADSET — Small sound reproducers in a suitable frame for wearing about the head. Close coupled to the ears for private listening and exclusion of ambient sound. Earphones.

HERTZ
Hz — The measuring unit of frequency or the speed of vibration of a sound wave. Synonymous with "cycles per second" (CPS).*
Hz: Cycles per second. A unit of frequency. One hertz equals one cycle per second. Larger units are the kilo hertz (kHz 1,000 Hz), the megahertz (MHz one million hertz).

HOMOGENEOUS — Uniform in structure and composition.*

HUM — Low frequency noise in an audio component usually induced from the power line or stray magnetic fields.

IMPEDANCE — Resistance characteristics of an electrical circuit to alternating currents. (e.g. audiosignals)

IN-LINE HEADS — Arrangement of heads on a tape recorder in which the head gaps are mounted one directly above the other. Also called **stacked heads.**

INPUT — Receptacle or other connection through which a signal is fed into an amplifier.

IPS — Abbreviation for tape speed in inches per second.

INVERTER — A device to change one type of electrical current for another, usually direct current to alternating current. With an inverter, a tape recorder designed for 110 volt, 60 Hz current can be powered by a dc source, such as a 12 volt automobile battery.

JACK — Receptacle for input or output circuit of a tape recorder or other component.

LEVEL INDICATOR Indicates the level at which the recording is being made and serves as a warning against undermodulating or overmodulating (providing too low or too high a signal level). It usually takes the form of a VU meter. (VU = volume units)

LIVE A reverberant acoustical condition, usually used in reference to a room whose many reflective surfaces encourage lengthy reverberation time.*

LOGARITHM A mathematical operation which compresses a large range of numbers to a smaller range. In base 10, the logarithm of a number is simply the power to which 10 must be raised to produce that number. For instance, the log of 100 is 2 since $100 = 10^2$. The log of 1,500 is 3.2 since $10^{3.2} = 1,500$. What is the log of 10,000? (ans. 4)*

LOUDNESS The intensity of the sound stimulus, and chiefly, a function of sound pressure.

MAGNETIC TAPE Usually 1/4 inch plastic tape that has been coated with an emulsion of iron oxide particles. Used on tape recorders as the recording medium and provides the highest fidelity of reprodiction practical today. In film use, it also comes in various formats to coincide with Super 8, 16 mm, and 35 mm films, and it is sprocketed.

MICROPHONE A device which converts sound pressure waves to electrical impulses. Because it converts energy from a mechcanical form to an electrical one, a microphone is called a mechanical-electrical transducer. The three basic types of microphones used in recording are, the dynamic, ribbon and condenser.*

MIL 1/1000 of an inch. Tape thickness is usually measured in **mils**.

MIXDOWN The process of balancing and combining the tracks of a multi-track recording. Mixdown is accomplished by connecting the outputs of the multi-track recorder (i.e. 4, 8, 16 or 24 track) to the inputs of a mixing console which, in turn, feeds the the master machine (i.e. 4 track for quad, 2 track for stereo, full track for mono).*

MIXER A device by which signals from two or more sources can be combined and fed simultaneously into a recorder or projector at the proper level and balance. An individual operating a mixing device is is also called a **mixer** or **sound mixer**.

MIXING The blending of two or more signals for special effects on a multi-sound track.

MIXING CONSOLE The console used to balance and combine the sounds of several sources in recording. During a **session**, the console can be used to combine the outputs of several **microphones** or instruments onto a single track of the multi-track recorder. During **mixdown** the console can be used to combine the tracks of the multi-track recording onto a master. In addition to volume adjustments, most professional mixing consoles allow the flexibility of **altering** the signal by adding selected amounts of equalization and reverberation as well as other effects. Most consoles also provide a talkback system (for communication with the studio) and a separate monitor section for allowing the engineer to monitor levels independently of the mix.*

MODULOMETER A device for measuring the signal level on Nagra tape recorders. It measures the peak value of the signal. (see **VU meter**).

MONITOR

The control room reference loudspeaker. Because the monitor system is used as the standard by which all sounds in the control room are judged, it is important that the monitor contain no arbitrary **peaks** or **dips** in response and that the monitor-room frequency response curve be **flat**, especially in the listening area.

Note: The work **monitoring** is often used synonymously with the work **listening** in studio terminology, e.g. "While monitoring, we noticed some distortion in the guitar track."

MONITOR HEAD

The head on a tape recorder or camera that, when connected to the proper circuitry, makes it possible to listen to the material directly off the tape while the recording is being made.

MONO

Common abbreviation for **monaural**, meaning from a single source. Since most pop music receives its initial exposure on AM radio, which broadcasts monaurally, it is important that mixes be made in mono as well as in stereo to insure the integrity of the mix. When a stereo tape is played monaurally the center images will appear to boost by 3 dB.*

MONOPHONIC RECORDER

Sometimes incorrectly called a monaural recorder. It is capable of only one-channel recording, because it has only recording head. (Nagra, Studer, etc.)

MULTITRACK

The capability of recording as many as 40 individual synchronized tracks (each representing an original musical performance) on a single piece of tape. As a result of multitrack technology, many instruments, !though played at different times and perhaps in different studios, can be combined to produce a single recording which gives the impression that all instruments and voices performed simultaneously. Most pop and rock music

recording utilizes multitrack technology to expand its creative limits (see overdubbing).*

NAB CURVE — Standard record and playback equalization curve set by the National Association of Broadcasters.

NOISE — Unwanted sound.*

NOTCH FILTER — A filter of extremely narrow bandwidth used to eliminate discrete frequency noises, such as the hum from an improperly grounded guitar amp. Notch filters are usually tunable, and can sometimes be used to eliminate specific room or instrument resonances.*

OMNI-DIRECTIONAL — Equally sensitive to sound from all directions.*

OSCILLOSCOPE — An electronic device that forms graphic representations of an electrical signal (sound waves) on a television screen or cathode-ray-tube (CRT). Used for testing and measuring of electrical and electronic equipment (tape recorders).

OUTPUT — The signal (sound) voltage coming from components such as pre-amplifiers and amplifiers. In tape recorders, there are line outputs, speaker outputs and monitor outputs.

OVERDUBBING — The addition of musical or vocal parts to a recording after the initial recording session. By use of overdubbing, all musicians participating in a recording need not be present at the same time. This enables one musician to perform more than one part, and, if desired, to do all the instruments and vocals in a recording. Generally, an initial rhythm track or reference track using drums, bass, piano and guitar is recorded first,

and subsequent musical parts are added later. Almost all professional recordings utilize overdubbing to some extent.*

OXIDE As used in reference to magnetic tape; microscopic particles of ferrous oxide.

PATCH BAY A panel of jacks, corresponding to the inputs and outputs of all devices in the control room to be interconnected by simply inserting a **patch cord** between the appropriate inputs and outputs. If two devices are wired together in the patch bay (the tape outputs to the console inputs, for example), they are said to be **normalled** to one another. The insertion of patch cord into either input or output jack is said to **break the normal.*** Sometimes referred to as a **PATCH FIELD.**

PATCH CORD A short cable with a plug or other connector at both ends used to inter-connect equipment, such a tape recorders, mixers and amplifiers.

PHASE The state or condition existing when two devices or sound waves are in perfect synchronization.

PHASE INTERFERENCE The addition and subtraction of two waves of similar or multiple frequencies, causing peaks and dips in the overall response curve. Phase interference is largely responsible for the **hollow** or **tinny sound** sound associated with distant miking techniques.*

PHON The empirical unit of loudness. Since the ear has different sensitivities at various frequencies (Fletcher-Munson), it does not hear equivalent **sound pressure levels** as being equally loud. For example, a 100 Hz tone must be a full 64 dB (**spl**) before it is perceived to be as loud as a 1000 Hz tone of only 50 dB (**spl**). The phon was created to alleviate this problem, and to measure loudness independently of frequency. Therefore, a 50 phon sound at 100 Hz is perceived to be just as loud as a 50 phon sound at 1000 Hz. For reference, phons are numerically equal to decibels (**spl**) at 1000 Hz. At other frequencies their value is determined by referring to the Fletcher-Munson Equal Loudness Contours.*

PICK-UP PATTERN The directional characteristics of a microphone. Standard pick-up patterns are cardioid (heart-shaped), super cardiod, hyper-cardiod, figure eight and omni-directional. Pick-up patterns may vary considerable within one microphone with respect to frequency. Most microphones tend to have more directional pick-up patterns at the high frequencies, because of the smaller wave lengths.*

PINCH ROLLER (Pressure roller) A resilient roller that holds the tape against the capstan which pulls the tape with constant speed. It also prevents slippage.

PITCH The subjective human perception of frequency. In general, the higher the frequency, the higher the pitch. However, pitch is also a function of the **intensity level** of a sound (owing to the non-linear characteristics of the basilar membrane of the inner ear). For example, if a 100 Hz tone is increased from 60 dB to 100 dB its pitch goes down by about 10%. The phenomenon also varies with frequency (generally becoming less pronounced at higher frequencies).*

PLAYBACK The process of playing back a recorded tape.*

PLAYBACK HEAD The magnetic head that picks up signals from tape for playback.

PREAMPLIFIER An amplifier that boosts extremely weak signals voltages, such as those from microphones, magnetic playback heads, or phonograph pickups, to a level usable by power amplifiers and at the same time accomplishes any necessary equalization.

PRESENCE A quality that gives the impression to the listener that the person speaking is present in the room. It is obtained by microphone placement, proper equalization in the mid-frequency range, the acoustics of the recording studio, and the signal-to-noise ratio of the studio and recording system.

PUNCHING-IN The process of incorporating a **correction** into an otherwise well-recorded track. Depending upon the speed of the recorder's electronics and the engineer's reaction time, single words or notes can be instantaneously overdubbed onto a track without disturbing the continuity of the existing recording.*

RECORD (verb)

To transfer electrical impulses from a sound-producing source to magnetic tape via the process of magnetic induction.*

RECORD (noun)

A vinyl disc with audio information incorporated into the circumferential grooves on its surface. To be retrieved, the disc must be played with a phono cartridge which converts the impressions in the grooves back to electronic impulses. These impulses can then be fed to a speaker system.*

ROOM-TONE

The recording track of the noise of a room or set, made when everyone on the set is quiet. This ambient track is later used in editing for intercutting between shots and scenes for a uniform background noise.

SIBILANTS

High-frequency sounds uttered with a hissing effect. The letters S and Z and the combinations SH, ZH and CH are typical examples of sibilant sounds. These sounds are a constant source of annoyance to the recording engineer. For motion-picture recording, sibilant sounds are attenuated by the use of a **de-esser** installed in a compressor amplifier.

SIGNAL-TO-NOISE RATIO

The ratio, measured in dB, between a specified signal level, usually near the maximum that tape can record, and the noise level in the absence of a signal. The greater the signal-to-noise ratio, the quieter the tape.

SOUND

The phenomenon caused by the vibration of our eardrum. The drum itself is set into motion by pressure waves traveling through the air, originating at the sound source.*

A wave motion propagated in an elastic medium, traveling in both transverse and longitudinal directions, producing an

auditory sensation in the ear by the change of pressure at the ear.

SOUND LEVEL METER — A pressure-sensitive device which measures loudness. Sound level meters have several scales corresponding to the sensitivities of the human ear at different frequencies.*

SOUND-ON-SOUND — A method in which previously recorded material on one track may be re-recorded on another track while simultaneously adding new material (sound). Sound added to a previous recording may be called sound-on-sound, but has disadvantages, and is not a professional way to add, for example, background music to a sound recording.

SOUND SYSTEM — Sound recording and reproduction involves a series of transformations of energy from one form to another. Listed below are basic elements of a sound recording and reproduction system.

SOURCE	ACOUSTIC
MEDIUM	AIR PRESSURE
MICROPHONE DIAPHRAGM	MECHANICAL
MICROPHONE OUTPUT	ELECTRICAL
AMPLIFICATION	ELECTRICAL
RECORDING	MAGNETIC
TRANSFER	MAGNETIC
RE-RECORDING	MAGNETIC
OPTICAL TRANSFER	LIGHT
PROCESSING	PHOTOCHEMICAL
OPTICAL PLAYBACK	LIGHT

	PHOTO ELECTRIC CELL	ELECTRICAL
	AMPLIFICATION	ELECTRICAL
	LOUD SPEAKER	MECHANICAL
	MEDIUM	AIR PRESSURE
	EAR	ACOUSTIC

SPLICING TAPE A special pressure-sensitve non-magnetic tape used for splicing magnetic recording tape.

STACKED HEADS See **IN-LINE HEADS.**

TAKE-UP REEL The reel that accumulates the tape as it is recorded or played.

TAPE GUIDES Grooved posts located on either side of the head assembly to keep the tape tracking properly across the heads.

TAPE INDEX COUNTER A digital counter used mostly to aid in finding a particular portion of tape.

TAPE RECORDING SYNCRONIZATION Matching, or alignment, of the sound recording to the film's picture so that the lip movements in a motion picture coincide with speech sounds. Also called **LIP SYNC.**

TAPE SPEED The speed at which tape moves past the heads, measured in inches per second **(ips).**

TAPE TRANSPORT The mechanical portion of the tape recorder with motors, reel spindles, heads and controls. It does not include pre-amplifiers, power amplifiers, speakers or carrying case.

TIMBRE The subjective tonal quality of a sound. The timbre of any musical or non-musical sound is determined largely by the

harmonic structure of the sound wave. Rich sounding musical tones tend to have a great number of inner harmonics which contribute to their lush timbre, while thin sounding musical tones tend to be lacking in the presence of harmonics.*

TONE CONTROL — Used to vary bass and treble response to achieve desired balance of tone.

TRACK — A channel or independent division of the tape width, capable of storing information. 1/2-track stero recorders divide the tape into two widths, left and right, and are said to have two tracks. 16 and 24 track machines divide the tape into 16 and 24 tracks of information carrying capability.*

TRANSFORMER — A device used to change electrical energy usually that of an alternating current (ac) from one voltage to another; especially, a pair of multiple-wound, inductively coupled wire coils that affect such a transfer with a change in voltage, current, phase, or other electrical characteristic, as in a step-up transformer. Often used to match impedances, as in using a low-impedance mic with a high-impedance amplifier.

UP FRONT — Refers to a sound notable for its prominence among other sounds.

VU METER — A volume unit meter that indicates the relative levels of sound. An averaging meter. VU stands for Volume Units. Zero VU is considered to be standard operating level.

* All definitions marked with an asterisk have been used from **BUILDING A RECORDING STUDIO** (Fourth Edition, by Jeff Cooper. Calabasas, CA: Synergy Group, Inc., 1984, with kind permission of the publishers.

Unmarked definitions have been compiled by Don Cohen.