slides to videotape, the picture monitor should provide meaningful indications of the characteristics of the images being reproduced. For example, a film with a reddish color cast should produce television pictures that have a reddish appearance, and an excessively contrasty film should be reproduced with all detail in shadow areas clipped off. It is only in this way that the operator responsible for reproducing the films and slides can make the proper decisions as to what corrections are needed, so as to give a uniform, high quality picture output.

In a properly adjusted picture monitor the white screen at 100 units video level should be measured at approximately 30 foot lamberts, and its color temperature should be matched with a reference at D6500. Black level should be set with the brightness control at the point where the scanning lines disappear.

Operating a Camera-Type Telecine.

A well-maintained and properly adjusted camera-type telecine should give high quality color television pictures, sharp, clear, well balanced and with an excellent range of color and gray scale values. The greatest care is needed, however, in the alignment of the equipment to make sure that pictures with the best possible quality are being obtained. SMPTE supplies subjective color reference films or slides that can be projected in a review room, and then reproduced in the telecine for comparison.

Most camera-type telecines available at the present time have been designed for automatic operation in what is sometimes termed the "hands-off" mode. The first step that must be taken in setting up a telecine for film post-production is to disable these controls, so that the chain will operate as a passive reproducer, producing television pictures that correspond as closely as possible with the color images in the films or slides.

Because designers have been so much preoccupied with giving broadcasters automated equipment requiring minimum attention, available telecines seldom have adequate flexibility for post production. At the very least, the telecine should have color trim controls in addition to adjustable gain and black level. Most telecine cameras have some provision for electronic image enhancement to sharpen up the edges of picture details. Some telecines are supplied also with color masking and gamma correction circuits.

When a film is being reproduced, the operator cannot see what is on the film. The picture monitor shows only what is being taken off the film by the telecine. If these images are not acceptable or if it is considered that some improvement can be made in their appearance, the operator then adjusts the camera controls in whatever direction seems to be needed.

This method of picture reproduction has the advantage that the effects of any change in a camera control can be seen at once in the picture monitor display, and if the desired effect or picture change is not obtained, the control can be restored to its pre-set position as established during initial alignment. □

Making Recordings on Videotape

no. 4 in a series of 10

by rodger j. ross

4. MAKING RECORDINGS ON VIDEOTAPE.

In the early days of television, film was used extensively to make kinescope recordings of programs produced with live television cameras. But the picture quality obtainable when these recordings were played back in a telecine left a great deal to be desired. Extensive research was undertaken to find some way to record video signals on magnetic tape. At that time sound was being recorded successfully on 1/4-in. tape, but the frequency range in video signals – over 4 MHz as compared with 15 to 20 kHz – appeared to be an insurmountable problem.

Then in 1956 engineers at the Ampex Corp. in California announced that they had developed a workable system for recording television signals on magnetic tape 2 ins. in width by means of a high speed rotating head wheel. With this method narrow, closely spaced video tracks were recorded across the width of the tape as it was drawn over the head wheel at the rate of 15 inches per second. Sound was recorded in a continuous track along one edge of the tape while a control track on the opposite edge was used for synchronization. Demonstrations of production models of the Ampex recorder showed that the pictures recovered from the tape in playback on the same machine were very nearly indistinguishable in side-by-side comparison with the original pictures from a live television camera.

To ensure interchangeability of recorded programs, the 2-in. videotape system with transverse tracing of video tracks by a rotating head wheel fitted with four recording heads was quickly adopted by the television industry as the professional recording standard. The designation, 2-in quadruplex recording, was also adopted at an early stage. In short order almost every television station had at least one – and often several – of these recorders; according to a recent report over 4,000 were in use in North America alone.

Helical Scan Video Recording.

A new and quite different method of video recording developed by Japanese engineers was announced only a few years later. In this system the magnetic tape was wrapped around a large revolving drum containing a single recording head, the tape following a helical path from the feed to the takeup reel. As the tape was carried around the drum, long slanting continuous tracks were laid down on the tape.

This method of recording had several obvious advantages, the most important being greatly simplified machine construction and operation, and much lower cost. Soon, a great variety of helical scan or slant track recorders appeared on the market. Thousands of these machines have been acquired by business, industry and educational institutions for use in what might be

termed semi-professional applications. It was recognized at the outset that playback signal quality obtainable with helical scan recorders was not acceptable for television broadcasting. But for many other purposes the ability to make video recordings with moderately priced equipment was a major consideration and in most situations the deciding factor.

For several years fierce competition among manufacturers for the helical scan recorder market stood in the way of agreement on a common recording standard. A great variety of machine designs, some using tape only 1/4" wide, expanded the market tremendously, but made interchangeability ever more elusive.

When the U-Matic video cassette recorder using 3/4-in tape was put on the market by Sony Corp. in 1972 the price tag was only $1,395, compared with $100,000 for the Ampex AVR-1 quadruplex recorder. The Sony recorder had the additional advantage that it was portable. The demand for electronic newsgathering (ENG) facilities led to substantial improvements in these portable videocassette recorders, to the point where, in 1975, Sony could claim that truly professional electronic editing was possible and broadcasters were using these machines. This type of helical videocassette recording system was adopted as a television industry standard only last year, and designated Type A.

Professional 1-in. Video Recording Systems.

In 1976 a drive began to develop professional quality helical recorders using magnetic tape 1-in wide. The Ampex VPR-1 recorder, one of several similar makes now available, was designed to give broadcast quality playback, along with slow motion and freeze frame. This continuous field, non-segmented recording system was quickly adopted by the North American television networks, and has now been standardized as Type C. Bosch-Fernseh in West Germany has also developed a series of professional 1-in helical recorders with a two-head drum, producing segmented Type B recordings.

Facilities for Transferring Film to Videotape.

The primary recording standard for professional program production is still the 2-in. quadruplex format. A recording made on any quadruplex machine can be played back successfully on any other machine operating in the 525-line, 30-frame NTSC television system. Type C 1-in. helical recorders are being adopted by the television industry and apparently tapes made on these machines can be successfully exchanged already. So far, Type B recorders are not often seen in North America. Successful interchange of Type A cassettes should be possible, but playback may not be acceptable for serious professional work. Among the great numbers of other makes and models of helical recorders in use around the country it may not be possible to play back recordings on any other machine, even on another machine of the same make and model.

Interchangeability is not the only factor that needs to be taken into account in selecting a recorder for making a film-to-tape transfer. Even more important is the ability of the system to reproduce video signals without significant amounts of degradation. Excessive noise may be introduced in picture playback. Acceptable picture steadiness may be difficult to achieve and maintain. The pictures may not have a perfectly sharp appearance. Partial picture break-ups may be so disturbing as to make a film transfer unuseable.

When arrangements are being made for a transfer, the filmmaker sometimes has little choice but to accept the equipment that has been made available for this work by the television station or production house. But it is always very important to give careful consideration to the purpose for which the transfers are being made. It would not be advisable to put a great deal of time and effort into assembling a program on low cost, semi-professional recording equipment if the program is to be broadcast by a television station. It is true that Type A recorders are now being used extensively by stations for news (ENG) operations, but the quality of the recordings made with this type of equipment simply cannot be compared with a 2-in quadruplex recording.

Quite often, in assembling programs on videotape, it is necessary to make at least one re-recording (dub) from the original transfer — for example, to put in effects such as fades, dissolves and superimposed titles. Even with the very best quadruplex recording and playback system, some — although unnoticeable — losses always occur in re-recording, but excessive degradation may be encountered even in a first generation dub with some semi-professional recording equipment.

Electronic Editing Facilities.

In the assembly of some kinds of programs, a specially important consideration is the availability of adequate editing facilities. If the intention is to transfer many short sections of film to tape and then assemble these into a complete program on tape, it would be a good idea to first of all make sure the work can be done with the equipment assigned for the operation, and just as important, that the work can

be completed within the scheduled time period. Costs per hour for film-to-tape transfer and program assembly with professional television facilities can be quite high. In some situations the facilities may be so heavily booked that run-overs to complete a transfer or assembly operation cannot be tolerated. (Editing alternatives will be the subject of the next article in this series.)

Making a Film-to-Tape Transfer.

To make a film-to-tape transfer, the film is run through a telecine, and the video and audio signals obtained from the film are recorded on a videotape machine. The basic procedure should be much the same whatever type of equipment is being utilized for the transfer operation. In a centre equipped with professional facilities a camera-type telecine or a flying spot scanner may be used to generate the signals.

The film to be transferred should be mounted on a reel with the standard SMPTE leader attached to the head end. Special care should always be taken to ensure that the film is in an absolutely spotless condition, free from even the smallest particles of dust or dirt. Cable connections carry the signals from the telecine to the videotape recorder. In a television station the interconnections (for video and audio) are usually made through a production studio control centre. When the telecine and videotape recorder are located in different parts of the building, an intercom circuit enables all those involved in the operation to communicate with one another.

On a voice cue, or by pre-arrangement at a specified clock time, both machines are started. (Sometimes the machines can be started by remote control from the production studio. In that kind of a situation the operators of the telecine and videotape recording equipment only have to load the film and a roll of videotape on the machines and advise the production studio that the machines are ready to roll.)

As the film passes through the telecine projection gate and over the sound drum, video and audio signals are displayed on the monitoring devices (waveform monitor and VU meter) while the pictures appear on a color picture monitor and the sound can be heard from a loudspeaker. The purpose of these monitoring facilities is to ensure that the video and audio signals being fed to the recorder conform with television industry standards and practices.

Alignment of the Videotape Recorder.

Prior to the start of a transfer session, the videotape recorder should be very carefully checked and aligned with a standard test tape. It is customary to record test signals, such as color bars, at the head end of the tape, in the leader section. When the recording is being played back on a different machine, at another time or location, the test signals recovered from the tape provide a quality assurance that the original pictures and sound from the film are being properly reproduced.

The normal practice in the operation of videotape equipment is to avoid as far as possible making any adjustments of machine controls during playback. This puts the onus for picture and sound quality on those responsible for making the original recordings. When the original recordings are being made that machine is checked and aligned with the test tape also, and the color bars recorded in the leader provide verification of recorder alignment. This in turn puts the onus on those at the sending end, feeding the signals into the recorder. In transferring films to videotape this responsibility falls on the telecine operator, and in the end, on those who made the films in the first place. Any adjustments needed to modify color picture appearance or correct for density variations in the films must be made at the telecine video control position. □

Next – Editing Alternatives.