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Modern video tape editing

Summary

Modern video tape editing is impossible without the complex electronic accoutrements that make up a fully operational system. Mini-computers, floppy discs, keyboards, CRT terminals, digital devices and microprocessors, have all become intrinsic to the work of turning out highly captivating television programmes. CMX have adopted these technical advances and have combined them into practical workable systems that perform the necessary manipulations while keeping the operational side as simple as possible.

The mechanism, no matter how complicated, is at the disposal of the operator in a logical configuration, allowing the human editor to be the master of his artistic creation, rather than the slave of an unyielding machine.

Introduction

Capturing fixed images for posterity has been a human endeavour since homo sapiens began scrawling charcoal figures in ancient caves. But a single image, regardless of its artistic merit cannot convey unfolding events or the continuous story line, that modern communications systems require to attract vast audiences. To achieve these goals requires a full measure of specialized creative talent coupled with the tools of a rapidly expanding technology.

This unique talent, which may crop up anywhere, is so diverse in nature as to defy definitive description. Eisenstein in Moscow or Griffiths in Hollywood, though widely separated by differing social systems and great distances, nevertheless captivated audiences with their dramatic reconstruction of the murky monochrome film their pioneering movie gear was capable of.

It is a vast leap from those mute flickering frames to a modern television colour production with high quality images, digital effects, time scale manipulation and multi-track sound. But the fundamental requirement remains the same; to give the programme producer a flexibility in handling the images at his disposal, which puts no constraint on the creativity that will guide the final product. The CMX organization was conceived to give birth to such a system. When video tape had already struggled through its initial stages of mechanical editing (with the ubiquitous razor blade) and had rapidly progressed to electronic editing which included frame-by-frame assembly, it was evident that a new overall approach was needed.

The combined skills of a major TV network, CBS and a hardware manufacturer, Memorex, spawned the

CMX600, an editing system so far ahead of its time that few organizations could cope with it in the early seventies. It was unbelievably versatile, with its random access video discs and computer-controlled light pens. But it catered for only a very few ultra-sophisticated applications. Under Orrox guidance the lessons from the 600 were incorporated into more practical systems that satisfied immediate needs. The CMX300 and the CMX50 provided new on-line and off-line editing capabilities that the television production industry badly needed. The results on television screens everywhere began to show, and a grateful Academy awarded its highest prize, an Emmy, for technical achievement to CMX in 1973.

Today there is hardly a major American facility making prime-time television which does not employ a CMX editing system of some sort. As television production in the international world expands to accommodate the burgeoning needs of increased programme time, CMX editing systems are also finding their way into TV facilities all around the world.

Methods of VTR editing

There were three distinct stages of VTR editing which have evolved into the two current methods most widely employed to produce master programme tapes. Mechanical editing, which required the physical cutting of the tape, applied only to quadruplex VTRs where the



Figure 1. Editing in the late fifties required digital dexterity and splicing tape. The videotape was dipped in a carbonyl iron particle dispersion, which made the edit pulses and the transverse tracks visible. A metal jig, a straight edge and a single edged razor blade was used to cut in the guard band of the verticle interval scan

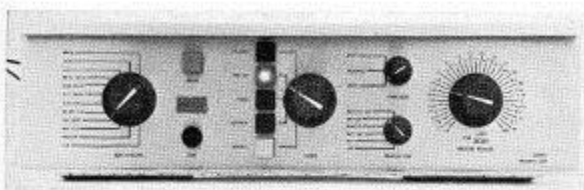


Figure 2. This array of knobs and buttons permitted cue tone editing down to frame-by-frame sequences. A marvel of the early sixties, it gave an impetus to quad VTR programme production but did not solve the problem of frame numbering

video tracks are essentially perpendicular to the tape. While splicing is rarely used today, the edit pulses, that were recorded in the control track to define field or frame locations, are still widely used for electronic editing purposes on quad VTRs. Helical video recorders do not lend themselves at all to physical editing, because the video tracks are stretched across a longer section of tape at a small angle to the edge. Besides, by the time helical recorders became important to the broadcast industry, the methods of electronic editing had already been well developed.

The early techniques of electronic editing also went through their own evolution. The first approach was simply to initiate manually the beginning and end of an insert or assemble recording. This took keen eyesight, super sharp reaction time and adequate intestinal fortitude, as a mistake could be catastrophic. This technique was generally referred to as the 'punch and crunch' style of editing. Eventually, VTR editing began to adopt electronic pulses placed in the cue track that could be used to preview edits, be moved in frame

increments for more precise location and then directed to control the recording process automatically. This system even allowed frame-by-frame assembly of animated sequences in a fairly efficient manner. The major drawback was that editing was still a scene-by-scene, laboriously time-consuming activity, that tied up a lot of expensive machinery while it was being done.

However, by the early seventies, a new technique was beginning to surface which would greatly affect the future of video tape editing, and this was the introduction of a standardized frame-numbering system.

Known colloquially as either the SMPTE or EBU time code, this method applies a unique number to every recorded frame on the tape. This identification, which has hours, minutes, seconds, and frames in a contiguous sequence along the tape recording, also has room for additional information which can be inserted as 'user bits' in the basic 80-bit digital code. Such useful peripheral data as reel number, scene, take, studio, date, etc. can be encoded by an accessory device. The time code may be recorded in a longitudinal track on the video tape, or it may be inserted in the vertical interval, or both. In the longitudinal track it permits fast search and location of specific frames at shuttle speeds exceeding 30 times normal. In the vertical interval, the code can be read out at very slow speeds, or even in the still frame mode.

The use of time code has become the accepted method of modern video tape editing and the basis for computer-assisted control for the range of equipment needed to create a complex television production. This may involve quad or helical broadcast quality recorders, switchers with special effects, multi-track audio recorders, disc machines, telecine units and even low cost cassette VTRs for preliminary review.



Figure 3. A CMX 340 X about to leave the Santa Clara facility. Interfaced with a modern production switcher and four VPR series one-inch helical recorders, this combination will serve as a production centre for a major TV facility



Figure 4. The Videola is the latest addition to the comprehensive CMS Systems line of editing equipment. A joint development with Vidtronic of Hollywood, this edit decision automatic logger uses floppy discs to accumulate the sequential edits during programme production.

On-line and off-line systems

As television programme production on tape began to mushroom, the load on existing studio recording facilities began to exceed the supply of available high quality VTRs for direct on-line use. In the meantime, relatively inexpensive recorders (such as the U-Matic format) were finding increasing use as preview machines. Obviously, it is not mandatory that a three-machine bay of quad VTRs be tied up to do scene selection, and so the off-line concept developed. The master programme tapes are copied on cassette machines with the time code recorded into the picture. The cassettes are then used to make all of the edit decisions, thus freeing the studio VTRs for other uses. The decision list developed from the cassette playback can then be turned into a punched tape, a floppy disc or a magnetic tape which is used to control the final assembly of the master programme tape on the on-line equipment (quad or 1in helical VTRs) dedicated to this purpose. So far, this has proved to be the most precise and efficacious method to do programme productions.

At present, two distinct editing systems are used by programme producers, employing time code and non-time code techniques. Where no time code has been inserted on the tape, editing is done by counting control track pulses (hence the name 'pulse count editing') and using the picture or sound as the visual or aural guide for edit points. A number of simple low-cost editors are available for such operations, and they are mostly used for non-broadcast programme production or for such simple tasks as daily news compilation of ENG inputs at local TV studios.

Time code editing covers most of the major TV programme production activity, where the end product must meet stringent quality requirements. In this area, the gamut of CMX Systems editors fill the needs of the most sophisticated production centres.

The CMX 340 X

All CMX Systems editors share certain fundamental features which include the use of time code, precision, frame-accurate editing and logical operational functions to make them the most flexible editors around.

The 340X, which was introduced a few years ago, extended the total system flexibility through some new concepts that have been widely accepted. The first such concept is distributive processing, a means by which digital signals, sent over a single two-wire pair, can be connected from the central console to the machines to be controlled (VTRs, ATRs, switchers, etc.) and can perform all the complex procedures appropriate to the most advanced video tape editing.

This technique of machine control is made possible by a CMX development called the Intelligent Interface or I². All video or audio recorders have uniquely inherent characteristics with regard to start-up time, lock-up cycles, reel ballistics or tape transport parameters. In addition, non-recorder inputs from telecine units, disc machines or switchers also need special interfacing to accommodate the mechanical or electrical idiosyncrasies of these devices.

The I² unit accommodates the special needs of each piece of editing equipment by tailoring the micro-processor circuitry within itself to contain the correct memory and command functions. Thus, it is possible to mix a variety of different machines with vastly varying characteristics from separate manufacturers, and still come out with a single, smooth functioning editing system.

This was amply demonstrated at the 1978 NAB show in Las Vegas, where the CMX booth had an array of recorders, connected to a control console, which included Ampex, Bosch/Fernseh and Sony VTRs in 3/4in cassette, 1in helical and 2in quad models, all working together.

While no individual user of a CMX system might require such ambidexterity, the potential flexibility of the 340X is unlimited, and I² units have been designed for virtually every piece of recognized broadcast equipment.

Because of the simple single-wire control and the switchable central console, the 340X can be allocated to control groups of machines in both off-line and on-line configurations. A typical set-up would include an off-line console where U-Matic recorders are used to develop the decision list, which is then converted to a punched paper tape. The tape is subsequently used to control the automatic assembly of the finished master programme tape on quad or 1in helical broadcast VTRs.

The Videola

The latest addition to the CMX Systems line of editing equipment is the Videola, an accessory that further simplifies the operational side of creative editing with a 340X.

Up to now, the decision list generated by an editing session required entry into the mini-computer memory via the keyboard on the control console. Human editors were also required to think in terms of frame numbers in order to extract and actuate the decision list, and that was the most error prone part of the system.

The Videola removes this constraint from the editing sequence, and it adds another dimension to VTR editing which makes it even more attractive than before. By providing automatic logging of the edit decision list on a floppy disc memory, the Videola also allows the human editor to work from picture and sound without concern for the time code numbers going by on the

screen. Of course, the time code is indispensable to the edit decision list, but that is handled automatically by the electronic machinery, while the creative editing is done by following the story line on the picture monitor or the speaker. Film editors with little or no video tape editing experience can translate their existing skills very rapidly by using the Videola. The Videola is that perfect bridge between the basic need of an editor to create an interesting image sequence and the computer-assisted sophistication of the most modern time code editing systems such as the 340X.

Last year Marconi Communication Systems took the first steps towards completing its total capability in the provision of complete television system by signing an agreement to manufacture and market the new Ampex range of 1in helical video tape recorders as the MR1 and the MR10. The final step in this direction occurred later in the year with an agreement with the Orrox Corporation for the world-wide distribution rights for all CMX brand video tape editing systems and exclusive UK distribution rights for Orrox's latest modular CMX 340 X system.

These undertakings not only complete the Company's product range and make it the only supplier capable of delivering all main item television broadcast systems which are of UK manufacture, but it also establishes it in a strong position to exploit the booming video tape equipment market.