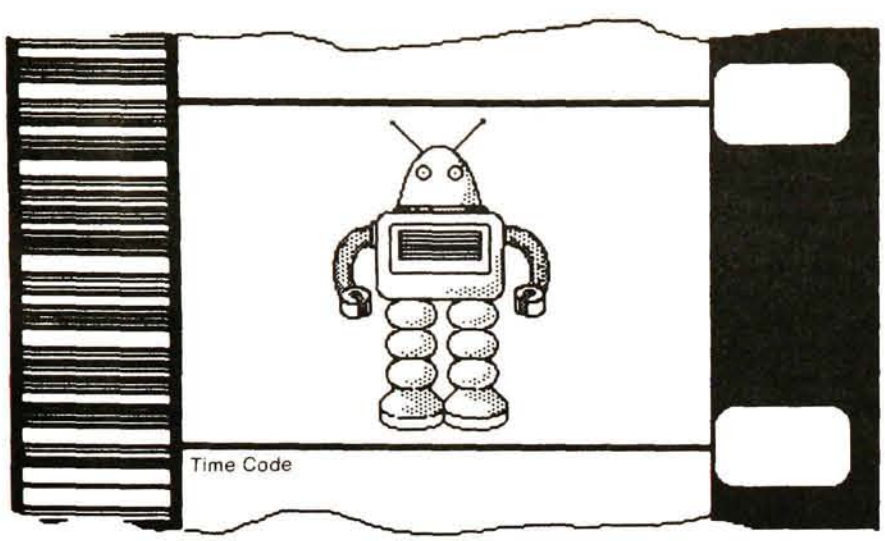

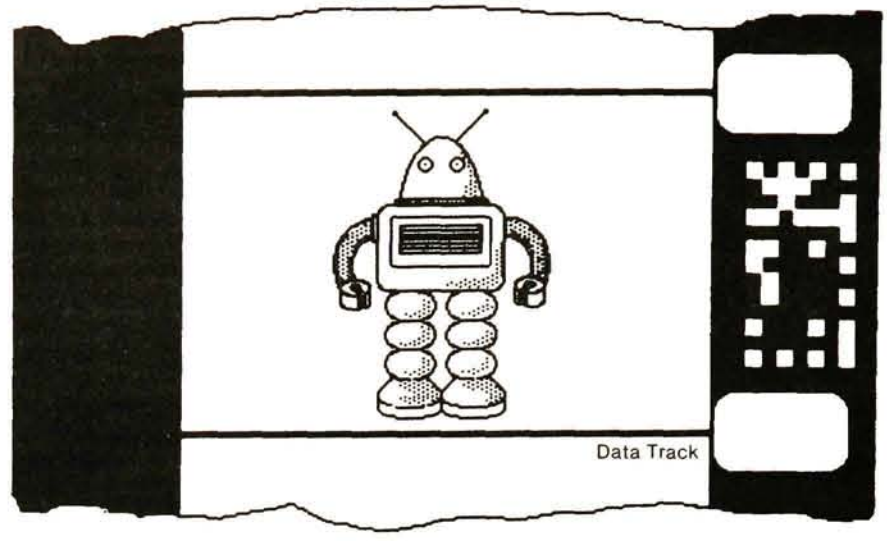

The SMPTE time-code: an update

by Arthur Makosinski

Since the issue of the first patent for a film and tape synchronisation system, granted in Germany in 1941 to E. Schuller of A.E.G., successively improved systems have appeared on the market every eight to twelve years. Until now, the goal of synchronisation systems was to provide means of recording and playing back audio information from a specific slate-sync point, in precise synchronisation with the picture.

With the emergence of low-cost, sophisticated digital electronic components, a more flexible synchronisation system became possible, where a starting slate point is no longer required, but precise time and frame sync is still achieved.

This new approach is at the root of the Society of Motion Picture and Television Engineers (SMPTE) standard for a Time and Control Code Standard, currently in its final drafts.

Several manufacturers, however, are already producing "Time Code" equipment based in part on similar and already established standards specified in American National Standard Time and Control Code for Video and Audio Tape for 525-Line/60-Field Television Systems, ANSI V98.12M-1981.

One of the basic reasons for the delay in releasing the SMPTE's standard has been caused by the disparity in terminology used in the audio and video sections of the standard.

When the final draft is released it will describe two types of code:

- The "C", or Continuous code, which comprises the heart of the code system and is very similar to the standards established under ANSI V98.12M-1981. It is specifically designed for systems using continuously moving media like audio and video tape.
- The "B", or the Block code, where data is encoded into blocks between frames, and designed so that the code can be recorded and played back on intermittent movement devices like cameras and projectors, but still can be decoded on the same electronic equipment as used to read the continuous, or "C" code.

The chief feature of the Time Code idea is that the code makes both the film and audio parts independent of the start slate marks. As such, it's possible to pick a piece of coded film and coded audio tape, read the code, and allign the two in perfect sync.

Time Code is essentially a packet of information that contains data in a digital form concerning the specific time period in which a particular frame of film was exposed in. This packet is imprinted on the edge of the film itself, and is recorded simultaneously on tape alongside the audio track. The time-code data contains eight binary groups of smaller, four-bit packets.

The first packet, called Data Identification Index, identifies the rest of the data that will follow in the next seven packets. The eighth packet is a special checksum group which tests for dropout errors from the previous seven groups.

This allows a variety of information that can be assigned to the seven, four-bit groups.

For example, if the number in the Data Identification Index is one (1), the data in the following six groups will contain:

2. Units of the day of the month
3. Tens of the day of the month
4. Units of the month
5. Tens of the month
6. Units of the year
7. Tens of the year

For Different Index numbers, other bits of information can be recorded as alphanumeric number or code such as:

Producer number
Equipment identification
Scene Number
Take Number
Roll number
Frame number

Variety of numbers are to be assigned in the future.

In addition, "Flags", or individual bits, are assigned for identification, whether the code belongs to film or audio, sync sound or picture or no sound/no picture, whether take is to be printed or not, if shot in sync speed or not, if shot day or night, in tungsten or daylight, etc.

The final data structure of the SMPTE Code had not been set as of May 1, and the Society warns against publishing details of the code. However, pre-release drafts are available from SMPTE, and several manufacturers are bringing out equipment base on the original ANSI 1981 standard, as well as on the almost identical, EBU 80 (European Broadcasters Union) code standard.

Nagra has adapted their model IVS recorder with a slide panel and internal code generating and synchronising electronics, while Coherent Communications Inc. of Sylmar, California, is selling a code module which goes under a standard multitrack recorder such as an unadapted Nagra IVS or the Stellavox SP8.

With the Coherent system, the code can be recorded on the sync or on the spare audio track. If the sync code is recorded on the separate sync head, it is automatically offset in time to compensate for the distance to the audio record-head.

In this case it is possible to splice the tape and retain the data information in exact sync with the audio.

Kingsway of Toronto, and Zellan of New York also sell a modified Sony WM-D6 portable cassette recorder with a built-in crystal sync, and code generating module.

The unit is very small and weighs less than 1 1/2 lbs. It uses one of the stereo tracks for Dolby C Audio information and the other for recording a 2400 Hz tone frequency modulated by the code, as well as a standard 60 Hz pilotone sync signal.

Once the tape is made, it is given to a sound house, where the audio, the code, and if necessary the pilot sync, are separated during the transfer.

The SMPTE standard allows for recording the code information on 8, 16, and 35mm film.

In each case it specifies that 112 binary bits be recorded opposite each frame, in total no longer than 90% of the frame height.

This applies to all film formats, and for optically or magnetically encoded information. The standard does not specify the exact recording technique. In 35mm equipment the data is recorded as optical bars between the sprockets and the very edge of the film. This presents no problem to the soundtrack which would be on the opposite side of the sprockets, next to the image.

However, the same format cannot be used for 16mm, where there simply is not enough room on the sprocket side of the film for a reliable audio track. One manufacturer has therefore decided to use the optical track area of the 16mm frame. While this permits a simple and reliable optical, or magnetic data track, it robs the user of possible super-16 capability.

Another idea, demonstrated by Aaton at the last SMPTE conference, uses the area in-between the 16mm sprocket holes to optically encode a 7 x 13 square checkerboard pattern which holds the code data.

The idea has advantages including that in actuality a much greater area is dedicated to each digital bit of information than with the bar code. Its 300 x 250 microns per square, versus a 30 micron-width with the bar. Also the sound track area is retained for Super 16.

The readout is done with a photodiode array and translated with a microcomuter into alphabetic and decimal display information.

No doubt the time code is here to stay, and it is already greatly improving and sophisticating the synchronisation link between film, audio, and video production equipment.●

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