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ELECTRONIC CUE DOTS

The use of cue dots in motion picture film presentation is well known and permits the smooth linking of separate reels of film in cinemas. The usual procedure is for two cues to be marked near the end of each reel, one is a "motor" cue and the next one, in the case of 35-mm film, eleven feet later, is the "change" cue. As the end of a reel of film is reached the operator starts the next reel when he sees the "motor" cue on the preceding reel and then changes to the next reel when the "change" cue is seen.

WHEN COMMERCIAL TELEVISION started in this country in 1955 it rapidly became apparent that there was a need to pass cueing information from the suppliers of programmes to the various recipients. In the particular method of commercial television presentation used in this country, commercial breaks in the middle of programmes are of a duration mutually agreed by all the programme contractors receiving the programme, but the exact time at which the commercial break will be inserted cannot usually be defined. The running times of the various segments of a complete programme may vary by quite a few seconds depending upon the pace at which the performers are acting, applause, etc., and it was therefore necessary to devise a system of using cue dots which was flexible and amenable to this particular form of presentation.

Video cue dot generators were therefore adopted, and electronic generators were developed which were capable of impressing upon the outgoing waveform an electronic signal which was apparent in the received picture as a small striped square situated in the top right-hand corner of the frame. This position was chosen to be compatible with the existing cue used on motion picture films.

The basic principle adopted is as follows: A generator is installed in a television studio and the producer or his assistant is given a switch by means of which he can impress the electronic signal on his outgoing picture. Figure 2 shows a photograph of a cue dot. As can be seen it consists of a small square of

Fig. 1. Generally only studio control can anticipate the exact timing of a programme break.

Fig. 2. Monitor showing a cue dot in the right-hand top corner.

black and white stripes electronically inset into the picture.

The producer notes during the rehearsal the running order and timing of his programme and when he reaches a point during transmission approximately one minute before the time when he wishes a commercial to be inserted, he switches on the cue dot generator and the cue is impressed on the outgoing waveform. All recipients of the programme see the cue dot appear and immediately alert their telecine operators or master control personnel for the insertion of the appropriate commercial. It should be stressed that in current usage in Great Britain the time of switching on the cue dot is not very critical provided it is not much longer than one minute before the actual insertion point.

As the end of the programme sequence approaches, the producer anticipates the actual end by five seconds and switches off the cue dot generator. The disappearance of the cue dot is the signal for telecine operators throughout the country to start their machines which have a standardized run-up time of five seconds. The producer closes his programme contribution exactly five seconds after the cue dot disappears and by this time the appropriate telecine machines are up to speed and recipients of the network programme are able then to mix or switch from the programme to the commercial which is to be transmitted.

By means of this procedure it is possible to insert commercials smoothly at the end of programme contributions or complete programmes without clipping the beginning of the commercial or alternatively being left with a blank screen for some seconds.

Philosophy of usage varies between the different programme contractors. In some companies the cue dot generator is located in the production control room, and under the control of the individual producers, but in other companies the cue dot generator is in the master control or central collecting point where all the programmes are co-ordinated, and it is the master control operator who impresses on the line going to the network the appropriate cue signal. Both techniques have factors to commend them. If the cue dot generator is in the master control room then there is obviously an economy in the number of cue dot generators required, and furthermore control of cueing is in the hands of the central control personnel. On the other hand cue dot generators located in studio control rooms are under the control of the producer, who, it can be assumed, has a greater artistic appreciation of the exact second at which his picture should be faded down and the commercial inserted.

USE OF CUE DOTS ON VIDEO TAPE RECORDINGS

The application of cue dot generators described above is one covering the use of electronic cueing on conventional live studio or O.B transmissions. When a programme is being recorded on video tape or film then cue dots are used in the manner described to indicate the points at which commercials should be inserted or to indicate the end of the programme. It is common practice when recording, for instance, a thirty-minute programme on video tape, for the studio to give the appropriate cues for the commercial break in the middle of the programme and then go to black and silence for the pre-determined period during which commercials will be inserted. Recorded programmes may therefore have a period of black and silence during the break in programme and on replay the tape can be permitted to run through the machine. Provided the cueing procedure has been followed carefully and the commercials inserted are of the exact duration, it will be found that the programmes will restart automatically at the end of the commercial inserts.

The continuous operation of the machine during the commercial break permits operators to make any small adjustments which may be necessary to the machine during the middle of the programme. Some companies are using video tape machines for the pre-recording of inserts into programmes. It may be

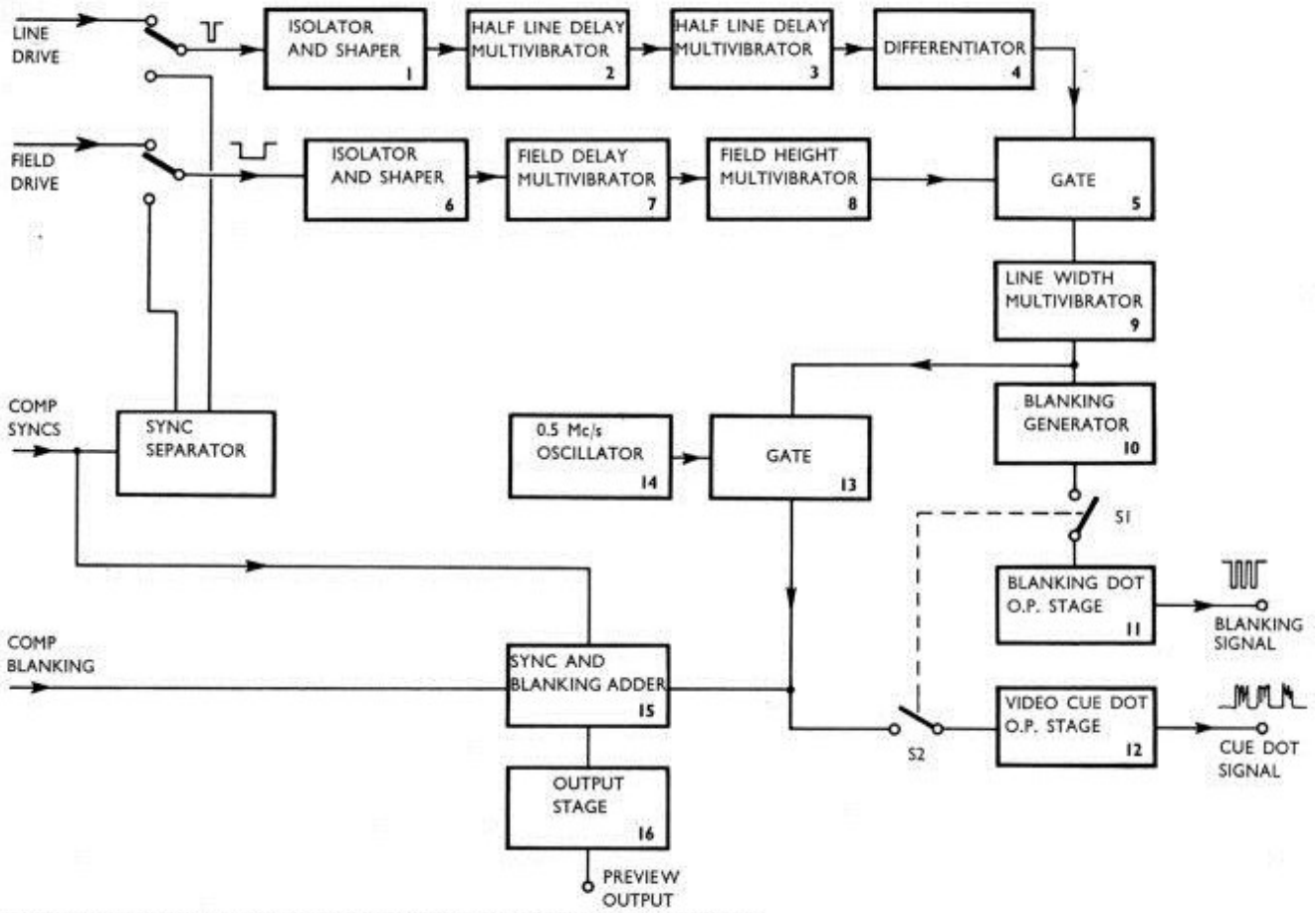

Fig. 3. BLOCK DIAGRAM OF A TYPICAL ELECTRONIC CUE DOT GENERATOR.

necessary, for instance, to insert into a live studio programme a pre-recorded insert to enable a costume or scene change to be effected. Prior to the advent of video tape recorders this was usually done on film, but the use of video tape represents a distinct advantage over film in view of the better match in quality obtained.

To permit a smooth insertion of the recorded material into the live transmission it is essential for cueing signals to be provided, and the electronic generators primarily developed for cueing of commercials have been modified to permit cueing of video tape inserts to be achieved. Modifications to the generator are simple in that the cue dot appears on the top left-hand corner of the screen. This is used by the producer to give a five-second cue at the end of a pre-recording to permit him to effect the transition from the pre-recorded insert back to the live programme being produced. The start of the insert is effected in the usual manner by the addition of a leader at the beginning of the film or video tape being used.

TECHNICAL DESCRIPTION

Figure 3 shows a block diagram of a typical electronic cue dot generator.

Isolator stages 1 and 6 accept line and field drive pulses respectively, which are either obtained separately or from the output of a sync. separator fed by the composite syncs. of the studio concerned. The clipped and shaped line drive pulses emanating from stage 1 are caused to trigger a multi-vibrator, stage 2, which produces a pulse of width almost equal to a half line of the television waveform. The back edge of this pulse triggers a further multi-vibrator, 3, which again has a pulse width of approximately half a line. Both multi-vibrators 2 and 3 are adjustable such that the back edge of the pulse emanating from stage 3 can be positioned to produce the start of the cue dot pulse eventually produced.

The shaped pulses emanating from the isolator and shaper, stage 6, are caused to trigger a multi-vibrator, stage 7, the pulse width of which is adjustable to position the start of the cue dot in the field direction.

The back edge of the pulse emanating from stage 7 triggers a further multi-vibrator, stage 8, and adjustment of pulse width of this stage dictates the height of the cue dot when seen on a television monitor. The output of stages 4 and 8 are gated at stage 5. The pulses from stage 8, occurring at field repetition rate, permit a short burst of the pulses from stage 4 to leave the gate 5, the number of pulses being determined by the width of the pulse produced by stage 8. Stage 9 is a further multi-vibrator which is triggered off by the burst of pulses coming from gate 5, and the width of these pulses determines the width of the cue dot seen on the television monitor. The basic pulses produced by stage 9 are now used to generate the two important signals required from the cue dot generator. One is a negative going blanking pulse which is mixed with picture producing equipment in the studio to create a "black hole" in the outgoing waveform. The other signal is the positive going cue dot which is mixed with the output of the vision mixer of the studio concerned and fills in the "black hole" created by the blanking pulse. Stage 10 is a blanking generator, and stage 11 a blanking output stage producing a suitable signal for connection to the vision mixing equipment. Stage 14 is a 1·0 Mc/s square wave oscillator, the output from which is gated through stage 13 by the pulses emanating from stage 9. The cue dot output stage 12 is designed to deliver a positive going signal suitable for connection to the vision mixing apparatus. A preview output stage is provided (stage 16) and stage 15 accomplishes the adding of composite syncs. and blanking to the video cue dot signal.

In practice the cue dot generator is operating and producing a preview signal but the blanking and cue dot output stages numbers 11 and 12 are made non-operative by remotely controlled biasing potentials. The switch remotely provided to impress the cue dot on an outgoing picture is arranged to remove a cut-off bias applied to stages 11 and 12, but the time constants are so chosen as to prevent over modulation of the transmitted picture. When the cue dot is impressed on the outgoing waveform it is arranged that the blanking stage 11 is made operative before the cue dot output stage 12. In other words a "black hole" is punched in the picture before the video cue dot is mixed with the picture. On switching off the cue dot both the blanking output and cue dot output stages are rendered inoperative at the same instant.

Where it is required to create a left-hand cue dot, means are provided for eliminating stage 3 and a pre-set adjustment of stage 2 is switched into circuit to delay the line drive pulses by a short amount such as to position the cue dot in the appropriate position on the left-hand side.

Commercial television operators in Great Britain have adopted the video cue dot generator for cueing commercials and in consequence certain technical standards have been laid down. For the 405 line system they are:

Cue dot width—4 micro seconds.

Cue dot height equivalent to twelve lines of picture.

Safety margin—two lines field direction. 1½ micro seconds line direction.

Frequency of modulation—1·0 Mc/s.

THE USE OF CUE DOT GENERATORS IN AUTOMATION OF EQUIPMENT

Even when the first cue dot generators used in this country were installed it was realized that the device could be used to great effect in the event of automation of master control equipment. It will be appreciated that visual observation of the disappearance of the cue dot initiates certain operations such as starting of telecine machines, video tape recorders, cueing of announcers, etc. Since the cue dot generator operates on the principle of removing all picture information in the area where the video signal is to be impressed, it follows that the video cue dot signal can be effectively gated out of a received waveform and used to initiate certain mechanical operations. It was for this reason that a proposal that the cue dot modulation frequency be crystal controlled at 1·0 Mc/s was made.

One of the reasons for not crystal controlling the original cue dot generators was to permit the random variations of the oscillator to make the striped pattern of the cue dot more obvious. It has been observed, however, that even with crystal controlled operation of the oscillator the line phase modulation inherent even in the best of synchronizing generators produces movement of the stripes rendering the cue dot quite obvious. A further suggestion is that the 0·5 Mc/s modulation signal should have the facility of being keyed in and out at a repetitive rate of 25 c/s instead of the conventional 50 c/s field rate. Furthermore variation of the modulation frequency can provide an alternative source of cueing information.

Up to now it has been found that a simple five-second cue can be used to initiate most automatic operations, but in the event of cueing certain mechanical devices which may require more than five seconds

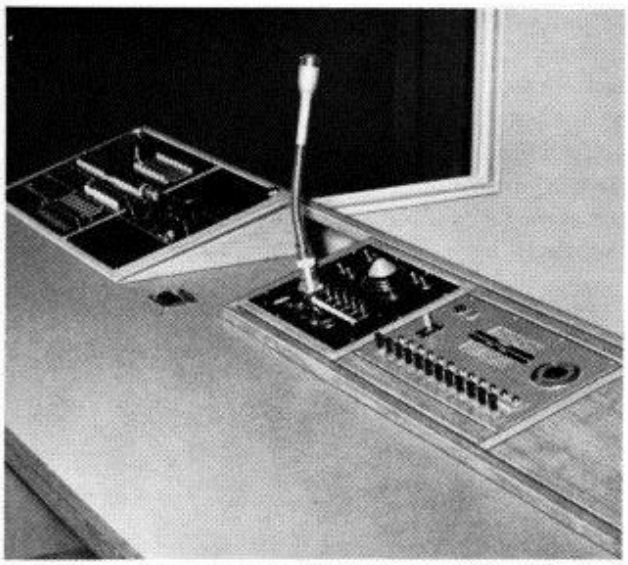

Fig. 4. Production desk in Studio 1 Production Control Room, Westward Television Studios at Plymouth. Cue dots are originated on the panel on the left.

to run up to speed (which is non-standard operation among commercial companies) it can be arranged, for instance, that the cue dot pulse when initially applied has a 50 c/s field repetition rate which at minus 10 seconds is changed to a 25 c/s repetition rate followed by the usual switch off of the cue dot at a minus five second point. The change of field modulation rate at the minus ten second point can be used to initiate an automatic operation while the remaining recipients of the cue dot act in the usual fashion at the five-second cue point.

THE USE OF CUE DOTS IN THE INTERNATIONAL EXCHANGE OF PROGRAMMES

Especially in the case of Eurovision use of cue dots can be of great assistance to recipients of programmes in the absence of control line communication. One important point must be observed, of course, that in Great Britain it is universally accepted that a right-hand cue dot be used to indicate the end of a programme or part of a programme, at which point commercials should be inserted. Thus the right-hand cue dots should not be used to indicate the end of a part of a programme which is to be followed immediately by a further part of the programme. An example of this would be in the case of a video tape recording occupying more than one reel, where cue dots would be used to indicate the changeover point.

In the application of cue dots to reels of video tape which are to be played in continuity without a commercial break it is suggested that a left-hand cue dot be used, thus removing the likelihood of commercial television operators inserting commercials at the wrong point!

A possible method of using cue dots to effect reel change overs when video tape is being used is as follows:

Let us assume that the programme is of such a duration as to require the use on recording and playback of two video tape machines. Both machines are loaded up with full reels of tape and machine number one used to record the first part of the programme. As the end of the reel approaches, a left-hand cue dot is impressed on the signal at a time approximately three minutes before the end of the reel of tape. On seeing the cue dot the video tape operators switch on the second machine in the record mode thus providing an overlap of recording for the end of reel one and the beginning of reel two. The cue dot is switched off after being impressed on the signal for one minute but the first video tape machine is left in the record mode until the very end of the reel is reached. By this means there is approximately three minutes of simultaneous recording on the end of reel one and the beginning of reel two.

When replaying the reels of tape, reel two would be cued up in its replay machine ready to start at the point where the programme is co-incident with the switching off of the cue dot. The operator would watch the first tape being replayed and on seeing the cue dot appear on the output of the first machine, would stand by ready to start the second machine. The disappearance of the cue dot on the first machine is the cue to start the second machine, and, assuming the cueing procedure has been followed accurately, sound and picture of the two machines will then be within acceptable limits of synchronization. There is then a period of two minutes in which the second machine's sound and video signals can be selected and this would normally be done (as in the case of cinema film) at a change of scene when picture and sound are non-existent.

It should be noted that the above practice has not yet been adopted by any organization, and it is not suggested that the procedure is without faults. It could, however, be the basis for negotiation between bodies concerned as a standard for international exchange of programmes recorded on video tape, in the same way that standards are being agreed for leaders of video tape.