CABLECASTING SESSION NO. 2:
Studio Equipment for Local Origination

Session Chairman:
Greg Liptak

Participants:

Frederick Haines and Gerald Hobbs
"A Low Cost Color Camera for Cablecasting"

Keith Y. Reynolds
"A High Quality, Low Cost, Color VTR"

Glen R. Southworth and Carl J. Wenzinger, Jr.
"Local Origination for CATV Systems
Using Slow-Scan TV Techniques and Electronic
Character Generation Systems"

FREDERICK HAINES AND GERALD HOBBS

A significant reduction in the cost of an item, whether it's a color camera or an automobile, implies compromise. I will be frank with you and admit at the start that the design to be described in this paper involves compromise; however, I think you will see as the paper progresses that the compromises we have made have a minimal effect on picture quality, and in fact, result in a design which offers significant advantages in reliability, maintainability, and portability over its big brothers.

Not a single essential performance feature has been sacrificed. IVC engineers have simply taken advantage of the high stability of the solid state circuitry, and eliminated a number of costly and sophisticated trimming circuits. The number of controls on the control panel has been reduced to about one third of the normal complement. Electronic controls that have been dropped include skew, shading, and gamma. A major cost reduction has been achieved by eliminating a separate camera control unit, which normally houses the video processing circuitry and power supplies. With these circuits built into the camera, the camera requires only a 120 volt AC power cord and a single coaxial cable which supplies NTSC compatible video to any cable system. Despite the extreme simplicity of the self-contained version of the color camera, however, all studio accessories are available and can be added at nominal cost at any time. A studio camera cable in that case, links the color camera to a junction box and a remote control panel, both of which mount in a standard studio control console. In the studio version an external NTSC color encoder and an external master synchronizing generator are employed. This differs from the self-contained version of the camera in which the encoder and synchronizing generator are miniaturized, and built into the camera. The foregoing points up the extreme versatility of the IVC 100 color television camera. That is, it can be used as a self-contained camera for the single coaxial cable feeding the CATV system; or in the largest and most complex of television studios of the broadcast type employing switching systems and master synchronizing generators.

A number of important innovations have been made in the optical system to allow more light to reach the image tubes. Standard silver-surfaced reflecting mirrors have been replaced by dichroic mirrors with thin-film coatings. The chemical formula for these coatings was calculated with the aid of a computer which factored in the dispersion of the materials. By using expensive precision tooling to achieve extremely close manufacturing tolerances, it was possible to set mirrors in slots in the base casting, and then seal them in place permanently with optical grade epoxy, eliminating any need or possibility of adjustment.

The net result is a camera that can be used with image enhancers, standard gear in most television studios, to produce quality color pictures which compare quite well with those turned out by the more expensive studio cameras. And the price of the new camera is only $14,500 compared with an average of about $75,000 for most studio units. Despite its compactness, the International Video Corporation's camera is quite versatile. For cable television it can produce an NTSC picture for display on a monitor or for transmission to the home receivers through the modulator. It also can be used with studio cabling, junction boxes, remote control panels, external encoders, and master sync generators. In the latter application the camera is completely equipped with system capability. That is, it has professional intercom circuits, tally lights, and standard broadcast signal levels.

Special low-noise pre-amplifiers are needed to boost the low level red, green, and blue signals from the vidicon pickup tubes to a usable level. The vidicon tube does not generate its own noise to any noticeable extent, so the signal-to-noise ratio of the camera will be primarily set by the entrance noise of the video amplifier system. Since junction transistors act as noise generators at lower frequencies, and since noise is most objectionable at low television frequencies, an FET stage is used at the amplifier input for the best possible S/N ratio. Following the special low noise pre-amplifiers there are three processing amplifiers which provide gain control, clamping (to eliminate bounce), add system blanking, and remove voltage spikes and other irregularities that might be introduced into the vidicon signal.

The IVC 100 in its self-contained form employs a greatly simplified NTSC encoder. The IVC encoder accepts separate outputs from the red, green and blue vidicon tubes, and combines them into a NTSC compatible color signal. As the most complex circuit in the camera system, the NTSC encoder represents a major cost factor in the conventional color television camera channel. Since the decision was made at the outset of development to eliminate the camera control unit, it was necessary to devise an encoder circuit small enough to fit into the camera package. The result is a built-in encoder mounted on a double sided printed circuit board measuring approximately 6 x 7 inches. Of course, when the camera is used in a more sophisticated studio system with an external broadcast style encoder, the built-in miniaturized encoder may be removed.

The miniaturized built-in encoder uses the R-Y and B-Y signals rather than I & Q signals used in more complex encoders. Surprisingly the greatly simplified encoder circuitry does not seriously degrade the reproduced color information, because all available viewing devices including studio monitors and home receivers employ R-Y, B-Y (or equivalent bandwidth) decoders, and the higher potential resolution promised by the I & Q systems is never fully achieved in practice.

The built-in encoder employs aperture correction in the luminance signal to enhance horizontal components of the higher frequency information attenuated by the camera pickup components and the optical system. The aperture correction may be adjusted if desired for optimum correction with good signal-to-noise ratio.

A separate input has been provided in the encoder so that the green signal can be used as luminance, but the color difference signals are still created as previously described, and the composite color video output signal is entirely compatible with the NTSC signal. Use of the optional "luminance from green" circuit provides a measure of image enhancement though it does introduce errors in color saturation. In the self-contained camera a closed circuit type of synchronizing generator is built in for use in cable television where NTSC standards presently need not be followed to the letter, the built-in sync generator produces all the pulses needed for sweep, blanking, color burst, and synchronization. These are added to the encoder video signal. For those who may be concerned about possible new requirements in the future that will force cable television local origination equipment to follow broadcast technical standards, the IVC 100 can be used with a built in EIA synchronizing generator. The built in optional EIA synchronizing generator provides FCC standard synchronization. In addition it allows the built in encoder circuit to operate with locked color, thus meeting all standards of the FCC broadcast specification to be met. Regardless of how the camera is used, however, the color produced by the built in generator is almost indistinguishable on a color monitor from that produced by the color locked generator.

Many innovations introduced in the optical system are aimed at significantly cutting the cost of the camera package without seriously degrading the overall performance of the camera. For example, rather than adopt the widely used and very costly image orthicon taking lens, IVC engineers specified a 35 mm single lens reflex format design that can be purchased off the shelf. These lenses with an image diagonal of about 43 mm are very similar to the broadcast variety, but because of volume production less expensive.

The exact zoom lens employed is an auto-nikkor f4.5 50 to 300 millimeter zoom lens, the type used in Nikon F film cameras. The relatively slow speed of this lens is effectively increased at the vidicon to f1.9 by using demagnification. That is, the ratio of the image diagonal of the 43 mm taking lens to the image diagonal of the vidicon tube face plate, which measures 15.88 mm, is approximately 2.73 to 1. Therefore, both the f stop and the zoom range are altered by that factor (in the direction of improved performance) by the demagnification of the image size. The optical paths from the zoom lens to the vidicons have been greatly simplified to insure that all of the available light from the scene reaches the tube target surface. To this end the usual color trimming filters and the neutral density filters for

the red and green channels have been left out. Instead highly efficient dichroic trimming reflectors are used with the main dichroic beam splitters to shape the red and blue light transmission characteristics. And because more light can pass through to the target, overall sensitivity is greatly improved and lag is reduced significantly.

Besides the 6:1 Nikon zoom lens, lenses with fixed focal lengths are available. Where a 10:1 zoom lens is required, the slower monochrome image orthicon variety can be used with apertures as slow as f5.3 and still produce a vidicon equivalent aperture of f1.9 as described earlier.

During assembly the relay lenses are set precisely and permanently locked in place. The three image tube yoke assemblies are likewise aligned and locked into position. The entire optical system is held in the camera by precision dowell pins and can be removed in a matter of minutes for replacement of the vidicons. After a tube is replaced the optics are reinstalled with the aid of the indexing pins to achieve precise realignment, and unlike other systems which must be realigned on occasion, it needs no further adjustment. Because the dichroic mirrors are epoxied in place, adjustments to them are not only unnecessary, they are impossible.

The IVC 100 low priced color camera has put locally originated color cablecasts within the reach of even the smallest CATV installations. Larger systems appreciate the flexibility these light and inexpensive units offer, and now for the first time reasonable color capability is available to cable TV originators throughout the world.

KEITH Y. REYNOLDS

Color helical scan videotape today is a great tool for both originating and delaying CATV programs. However, as with any TV equipment, reliability is extremely important. The IVC-800 Series Helical Scan Color VTR has proved, during the past 2 years, to be extremely reliable in many CATV installations. In other words, the IVC-800 Series Color VTR has proven to be "cable-stable."

There are several reasons why this is true. The first reason is the IVC Tape Format. A short 12-inch video head scan is used to record the video information onto the tape. This very short scan line allows far easier, less critical tracking adjustments. In addition, the 6-mil wide scan is separated from the next video scan by a 3.6 mil guard band. This wider guard band prevents pickup from adjacent tracks if the head is misaligned

due to tape stretch or other factors. For these reasons, the IVC-800 can operate in any physical position, even upside down. Once tracking is set during the playback of a given tape, it can safely be left unattended during the remainder of the program. IVC uses the Alpha Wrap, in which the tape is wound 360° around the video head drum. This allows 100% of the picture information to be recorded, utilizing the full width of the tape. The cross-over interval (the only missing information) is positioned to occur during the vertical blanking interval, after the equalizing pulses. This allows all the TV receivers on a cable system to positively lock on the vertical sync pulse. Many of the competing helical scan VTR's lose several lines of picture information, due to the fact that tape and head lose contact during this period and that the edges of the tape are used for audio and control track information. IVC devised a unique method that allows the recording of the control and audio information in the same area as the video information without any interference or crosstalk between signals.

The horizontal sync pulses line up on each adjacent video tape scan line by the careful selection of tape speed and scanner RPM. Although not usually a consideration for CATV applications, this provides adequate stop motion and allows for the option of slow motion operation.

Time base stability is extremely important, particularly for stable color operation. Since the color burst occurs only at the rate of one per scan line, any velocity change during one line will produce a hue shift in the color.

To achieve this time base stability in the recorder, it was necessary to use an air bearing to make the tape flow smoothly around the drum. The air bearing is generated by a rotating member of the scanning assembly which carries the video head. Without this air cushion, the tape would tend to stick to the drum surface, providing intermittent motion instabilities. Needless to say, reliable color reproduction then would not be possible. Mechanical instabilities (a major source of horizontal jitter) are reduced by careful design of the scanner assembly. Horizontal jitter is consistently less than 0.5% of picture width with monitors of 7.5 millisecond horizontal afc time constant. This means that horizontal jitter is virtually unnoticeable on home color receivers.

Another key to cable television's wide acceptance of the IVC-800 VTR is the capability it has of recording and successfully reproducing a wide bandwidth with a high signal to noise ratio. The IVC-800 is capable of reproducing 30Hz to 4.2 MHz with a signal to noise ratio of 43 dB. This also means that it is possible to record and reproduce color without resorting to pilot tones and receiver modifications.

We have briefly described some of the built-in features of the IVC-800 VTR. Initially, however, we mentioned that reliability is important in any television equipment. What makes the IVC-800 VTR more reliable than competing helical scan VTR's?

First, of course, the IVC-800 utilizes solid state electronics throughout. In the case of any electronic failure, plug-in replacement of the printed circuit board will quickly restore the VTR to normal operation. Solid state electronics have been proven highly reliable by others as well, so that no exclusive claim can be made by IVC except for the fact that the electronic components are carefully selected for reliability. Exclusive claim can be made, however, for mechanical reliability.

All five basic operational modes of the VTR are controlled by momentary electronic push button switches. An interlocked system of relays insures smooth tape handling and virtually eliminates the possibility of tape damage due to improper operation. The five operational modes are: Rewind, fast forward, play, stop, and record.

Safe dynamic braking of the reels is achieved automatically simply by pushing the stop button. (Incidentally, as strange as it may seem, efficient dynamic braking is not incorporated on the very expensive broadcast quadruplex VTR's as it should be, but can be found on reliable instrumentation recorders.) Pushing the stop button also initiates a tape tension release after the tape has safely stopped. This relaxes the tape around the video scanner so that the head is not in contact with the tape when the VTR is in standby.

When the end of the tape comes off either reel, the tape tension arm relaxes and activates an end of tape switch. This quickly removes the power to the brake solenoids and brakes are applied to the reel tables. Power is also removed from the supply, takeup and capstan drive motors and also from the capstan idler solenoid. This effectively stops all tape motion automatically, eliminating damaged tape or damaged VTR components.

The IVC-800 VTR has been carefully designed to take advantage of as many electronic controls as are necessary to eliminate mechanical functions since electronic controls have proved to be much more reliable than similar mechanical controls. Because all electronic controls are used, it is also extremely simple to completely remote control the entire VTR. A second audio or cue track is provided along the bottom edge of the tape and this is used to trigger tape motion remotely as in applications for dial or random access systems. In these applications, the VTR is often housed in a central area physically removed from the viewing area and comes in contact with human beings only for routine cleaning, preventative maintenance, or periodical program tape changes.

It can be seen that because of the electrical interlocks and electronic sensors incorporated in the tape transport, the tape always is safely handled regardless of any possible pushbutton combinations. The tape transport cannot run wild or jam. Recordings are protected from accidental erasure due to the push-button arrangement and the fact that the record relay cannot be energized unless both the PLAY and RECORD buttons are pressed simultaneously, since the RECORD switch receives power through a portion of the PLAY switch.

The tape path alignment is set once at the factory and will stay perfectly aligned during the life of the VTR, assuring tape interchangeability for the life of the recorder.

The IVC-800 employs a single ferrite video head. Ferrite heads provide much better frequency response and wear characteristics than metal heads. The IVC head is guaranteed for a life of 1000 hours. Replacement, when necessary, can easily be performed in less than 60 seconds without expensive tools or jigs and can be done in the field by inexperienced personnel.

It is not unusual to listen to a manufacturer boast about his products. Naturally, he believes in them and wants to tell the world about them. Therefore, when an unbiased, respected, independent agency runs a scientific competitive evaluation of commercially available helical scan VTR's, the manufacturers of these VTR's are eager to know how he stands up to his competition. IVC and others in competition with IVC recently had this opportunity when the Swedish Government undertook a helical scan VTR evaluation.

Sweden is a world leader in several technologies, but particularly in the use of audio-visual aids in her highly sophisticated system of education and training.

Recently, the Swedish Government appointed a special committee to objectively evaluate video equipment, since they plan to spend many millions of dollars in the near future equipping the Swedish schools with cameras, video tape recorders, and monitors.

The government contracted to have an objective evaluation made of all helical scan video recorders, and eleven were submitted by various manufacturers throughout the world. IVC submitted 3 VTR's: an 801, an 851 with electronic editing, and the then prototype, low-cost IVC-601 helical scan VTR.

The tests extended over eight working weeks, with strict security to prevent suppliers from altering the settings of their machines after they were delivered to the Swedish Committee. In addition to an exhaustive examination by engineers, the evaluation was based on the recording and playback by the competing machines of a master tape prepared by the Swedish Committee in cooperation with educators, psychologists, and technicians. The overall

quality of the reproduction was then judged on monitor receivers by a representative panel of 320 people.

A crucial aspect of this test was that the video recorders feeding the monitors were in a separate room to prevent members of the panel from knowing which VTR was responsible for the video picture. Their unbiased personal assessments, later subjected to mathematical analysis and computerized accurately, reflected the most important criteria of VTR performance--the acceptability of the picture to a typical audience.

Numerous scientific tests were run to determine which of the 11 VTR's had the best resolution and reliability, and a report was generated. Except for those tests that showed no basic difference between recorders, the three IVC VTR's "clearly appeared to be the best." After ranking the performance of all the VTR's for each test, a final grouping was made.

Group (1) is the top group. This group consisted of 4 VTR's. "These four have based themselves above any discussion when it comes to suitability for educational purposes." Three of the 4 recorders in Group (1) were the 3 IVC VTR's.

Group (2) consisted of 2 VTR's. "No doubtful values have been noted during the test for either of these two."

Group (3) consisted of 3 VTR's. "The limitations of these machines in respect to suitability for educational purposes is commented on below."

Group (4) consisted of 2 VTR's.

The final notes of the report stated that: "The machines in Groups (1) and (2) can be recommended as suitable for educational purposes whilst the machines in Groups (3) and (4) cannot be recommended as suitable."

Complete transcripts of the Swedish report should be available this fall, at which time you can see for yourself the superior performance of the IVC VTR's. Our representative in Sweden assures us that the Swedish Committee, in giving such an authoritative endorsement, recognized the inherent reliability and also that the monochrome VTR could be converted to NTSC, PAL, or SECAM color by field addition of a printed circuit color board. Another influencing fact is that the IVC VTR's require 30% less tape per hour of program than competing VTR's. This would lead to substantial economies in educational projects where many hundreds of tapes will be needed to give a sufficient supply of recorded materials flowing to schools in Sweden.

CATV systems utilizing the IVC-800 series VTR, as well as the Swedish Government, have proved to themselves that the IVC-800 VTR provides high quality and reliability at low cost.

GLEN R. SOUTHWORTH AND CARL J. WENZINGER, JR.

The normal television signal is highly redundant in information content, primarily from the necessity of repeating virtually the same image thirty times a second. If motion is not an essential requirement in the information transmission process, then very large reductions in video bandwidth can be achieved, allowing the use of conventional "voice grade" circuits and "audio type" tape recorders. Program preparation is relatively simple, involving essentially a series of still images with accompanying sound.

The use of narrow-band video technology leads to some interesting possibilities in CATV operations. First, in some instances the "front end" of the CATV system may be on a mountain top or other remote location, making it an expensive proposition to transmit live video from downtown studios for injection into the overall system. Narrow-band video transmission is not only less costly than wide-band microwave or coaxial cable facilities, but in some instances existing voice-grade communications circuits can be used, thus minimizing time required for an installation.

Programming with narrow-band video is, however, necessarily somewhat limited in scope because of the inability to reproduce motion. Typically, a new picture may be transmitted every 10 seconds and would appear on the viewer's screen as a succession of still images. Nevertheless, this seems acceptable for announcements, advertising, messages, weather maps, time, temperature, barometer, and other readings as well as still photographs or slides.

Conversion of normal real-time video signals from either broadcast or closed-circuit type television cameras to narrow-band format may be readily accomplished with high fidelity by means of a relatively low-cost device, using data sampling techniques. In an instrument of this kind, a small segment of each television line is examined for its brightness content and the video data point "stretched" for 63.5 microseconds after which another sample is taken on the next TV line. When looking at a normal television image, you might visualize an imaginary vertical row of dots or data points which moves slowly across the television raster from left to right with the complete transmission of an 8 kHz narrow-band video image taking place in approximately 7 seconds.

The video output signal obtained by the sampling process is very similar in nature to conventional "slow-scan TV", but the method of its generation has some important advantages. First, virtually any conventional camera can be used as a video source, thus making practical extensive use of existing "real-time" equipment, facilities, and techniques. Second, the sampling converter is a relatively simple and reliable device requiring a minimum of maintenance

and adjustment, while at the same time providing narrow-band output signals of essentially the same quality as the real-time input. Third, color images may be relatively easily trnasmitted in narrow-band format by either sequentially sampling the R-G-B outputs of a broadcast color camera or by simply interposing color filters between the subject and the lens of a monochrome camera, providing a form of "field sequential" color slow-scan TV.

Narrow-band video signals do require some special handling during transmission as they are subject to essentially the same distortions as real-time video signals in terms of frequency and phase distortion as well as noise susceptibility. The transmission channel used should, when practical, have DC response and a bandwidth extending to approximately 10 kHz for optimum image reproduction. Narrower bandwidths, even "dial-up" voice-grade phone lines, can be used, but essentially involve increasing the transmission time per picture, so that as much as 2 minutes per monochrome image may be required.

For normal picture distribution it is necessary to have some means of converting the 7 seconds per frame narrow-band video back to normal 525-line 30-frame-per-second standards. This may be accomplished by means of a unique form of scan converter which is remotely related to the "instant replay" video disc recorder. With a device of this nature, incoming narrow-band video information is first translated into a series of narrow amplitude modulated pulses with an interval between pulses of 63.5 microseconds, thus essentially reversing the process used to obtain the narrow-band video signal at the transmitter. These pulses are then used to record information on a magnetic disc memory rotating at 1800 rpm build up an image at standard TV rates.

When the recording process is observed, an image appears on the TV monitor growing from left to right in very much the same manner as a slow horizontal "wipe," with the viewer being aware of the mechanics of the image recreation. Alternately, the addition of a second record/playback head to the disc memory allows one image to be displayed while a second image is being recorded, with the result that instantaneous switching from one scene to another may be accomplished without the viewer becoming aware of the recording process. Similarly, the usage of three heads allows the synthesis of color signals through R-G-B recording, although the outputs of the three disc channels must be subsequently properly encoded to approximate NTSC standards.

In addition to the origination of programs for general viewing, narrow-band video technology makes possible interesting potential activities for the CATV operator, such as specialized services to hotels, motels, and convention centers as well as for industrial uses. The utility of a given wide-band television channel can be greatly expanded by means of multiplexing a series of narrow-

band video signals for cable distribution with both transmitting and receiving scan converters being located at appropriate locations in the CATV system.

GLEN R. SOUTHWORTH AND CARL J. WENZINGER, JR.

The many requirements of CATV Systems for origination of public service announcements, local news, weather and advertising has opened a new area of application for television scan compatible character generation systems.

Computer system requirements for alphanumeric displays have caused the development of many types of character generating systems. Many of these are quite specialized and are either not compatible with television scanning systems or the characters are too small and between-character spacing too close to provide good readability on a standard television receiver. However, the Visual display system is specifically designed to be compatible with standard TV scan systems and provides character size and spacing which is easily readable on any standard TV receiver.

The heart of the system is the DISPLAY CONTROL UNIT (DCU), which is an electronic character generator combined with a core memory of sufficient storage capability to store data equivalent to one television frame or "page" of alphanumeric information. The DCU accepts standard USASCII coded data input and converts that input directly into a composite video output meeting FCC and EIA standards. The DISPLAY COMPOSER which consists of a Keyboard and one or two video monitors, provides the normal manual data input. The keyboard contains all the alphanumeric and special character keys. In addition, a separate group of control keys is included on the right hand side of the keyboard. These control keys provide for control of the "cursor", which is a half-white spot which appears on the DISPLAY COMPOSER MONITOR ONLY and indicates where the operator is "typing" on the screen.

The output "page" is made up of up to 16 horizontal rows of 24 characters per row. The standard character set consists of 63 different block-style symbols and includes the alphabet, the numerals one through zero plus numerous standard symbols and punctuation marks. Thus, practically any alphanumeric message, filling one frame may be manually composed by use of the DISPLAY COMPOSER. The keyboard portion of the DISPLAY COMPOSER in this case provides the ASCII coded data input.

The DISPLAY CONTROL UNIT by itself is not very flexible due to the single "page" information storage limitation. To fully utilize the capability of the basic character generator, peripheral units must be added to provide storage and retrieval of information or to interface with other information sources.

In addition to the keyboard data input, the VISUAL DISPLAY CONTROL UNIT has a second data input which permits interfacing with other data sources including storage devices. The DISPLAY CONTROL UNIT provides a data output, in addition to the video output. This data output permits interfacing with data storage devices or data lines.

In CATV origination, it is many times desirable to program local news, weather, financial information, announcements, national news or other information on different channels, while maintaining normal program activities on other channels. Electronic character generation can become uneconomical if a separate DISPLAY CONTROL UNIT is required for each channel to be programmed.

To relieve this economic problem, Visual Electronics has developed the VISUAL MULTI-CHANNEL ORIGINATION SYSTEM. This system consists of the DISPLAY COMPOSER, THE DISPLAY CONTROL UNIT, and THE VISUAL PAGEFILE combined with a storage unit such as the VISUAL READYFILE or MASTERFILE. These modular subsystems make up a composite system which will permit precomposing and storage of information for instant retrieval and for multi-channel display of up to 70 different messages simultaneously.

Locally originated messages are manually composed through the DISPLAY COMPOSER Keyboard. The message is then edited and upon completion of editing, the "page" is "filed" in the data storage unit for later retrieval. The READYFILE will store 62 "pages" of information, in data form, on each plug-in magnetic tape cartridge.

The MASTERFILE is a data storage unit which utilizes a magnetic disc on which over 700 "pages" of information may be stored in data form. These messages may be instantly retrieved by electronically addressing the disc utilizing a simple 5 digit code. Upon retrieval, the data is instantly "copied" into the DISPLAY CONTROL UNIT and converted to video. The original data stored in the MASTERFILE is not disturbed until new data is purposely recorded on the disc to replace previous information. The "page", or frame of video from the DCU is then routed to one of up to 70 channels of the PAGEFILE.

The PAGEFILE is also a magnetic disc unit; however, the information is recorded in the form of one frame of Television Video on each of up to 70 tracks. The basic PAGEFILE is equipped with one sync track and seven video tracks. Video tracks may be added in groups of eight. Since each video track includes its own head and amplifier, any or all outputs may be used simultaneously. The video output from each track is then fed to the input of a modulator. Therefore, one track or channel may be used for local weather, another for general public announcements, another for sports scores and so on.

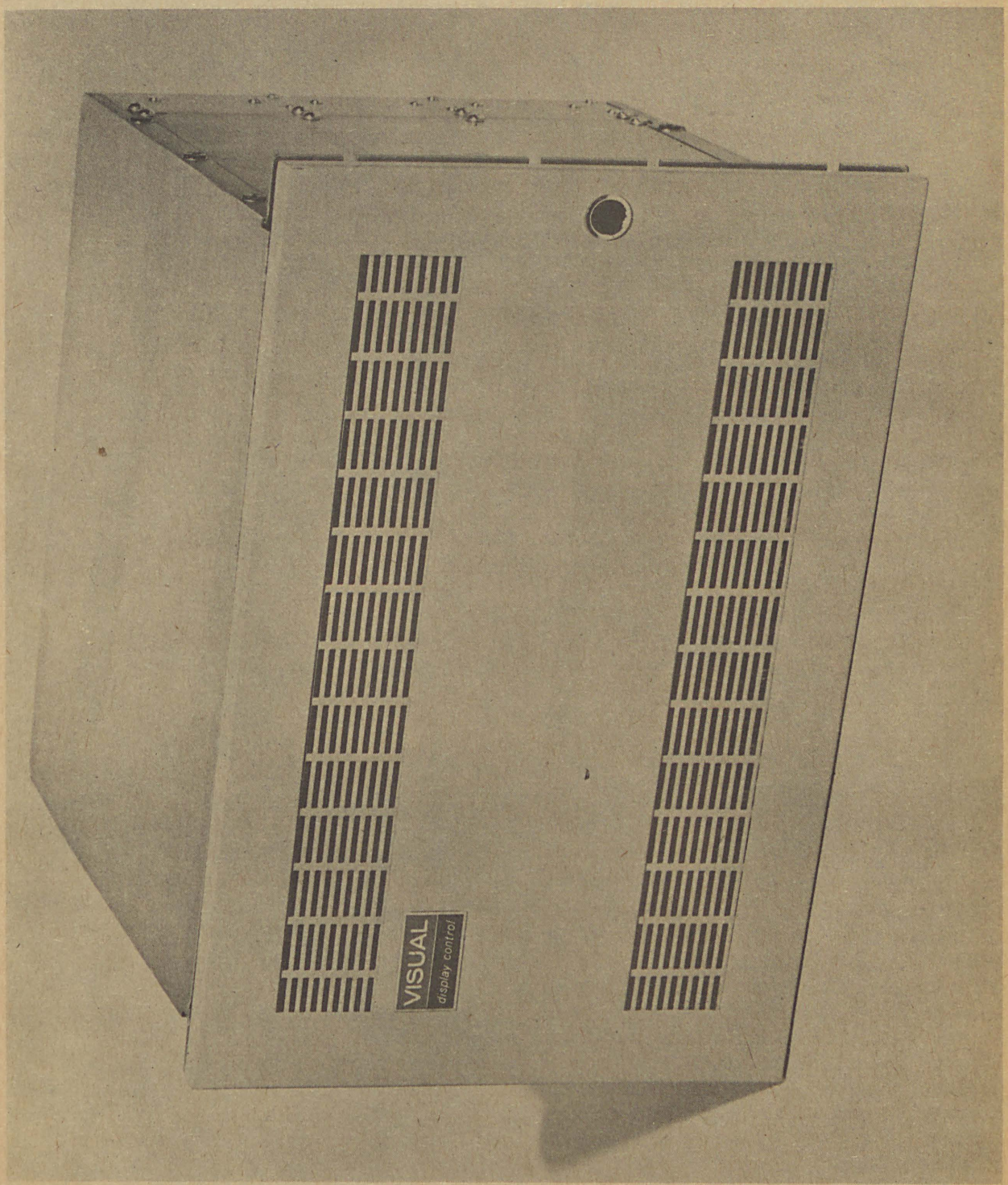
In some instances more than one "page" may be required to fulfill the requirements of any given r-f channel. Typical of this would be a civic announcement channel, displaying local meeting schedules, school bulletins, adult education course schedules and other general public announcements. In such cases, multiple PAGEFILE channels may be assigned to that r-f channel. An automatic sequencing switcher then periodically and automatically changes the display on that channel providing practically unlimited automatic programming.

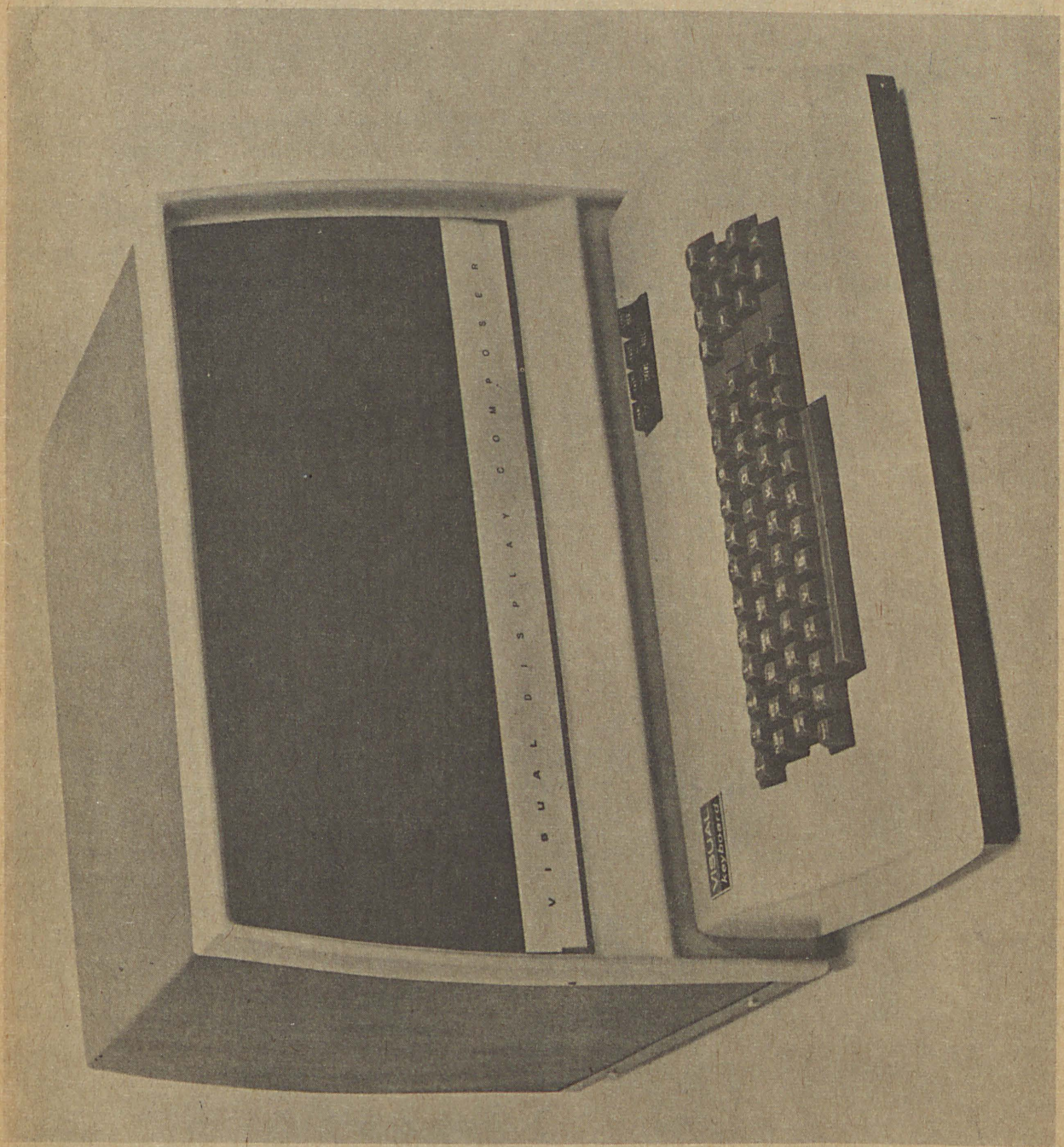
Other uses of the MULTI-CHANNEL ORIGINATION SYSTEM include a local news and sports channel, a Recreation channel listing current movies, plays, concerts and the like.

So far we have only considered the display of pure alphanumeric information. The Visual DISPLAY CONTROL UNIT also features a separate video input to a built in non-additive mixer. This permits feeding a video signal, derived from a slide or film chain into the DCU and mixing same with electronically generated alphanumerics as would be required for titling. This, however, ties up the DCU during the period that particular display is "On air".

On the other hand, an external non-additive mixer may be used as indicated in Figure 4 to provide titling of film or slides, or live pick-ups. In such a system configuration, one DISPLAY CONTROL UNIT is used to program the MULTI-CHANNEL MESSAGE ORIGINATION SYSTEM, yet can also be used for "on air" titling of live, film or slide programs. This provides maximum utilization of a single character generator.

As the Cable Television Industry expands into local program origination, the need for more flexible production and programming becomes obvious. The electronic character generator, when integrated into a MULTI-PAGE ORIGINATION SYSTEM offers a very flexible, easy to operate and economical system for the composing and display of alphanumeric messages.


VISUAL
display control


VISUAL DISPLAY COMPOSER
VISUAL
KEYBOARD

63-ASCII CHARACTER SET

1 2 3 4 5 6 7 8 9 0

! " # $ % & ' ( ) `

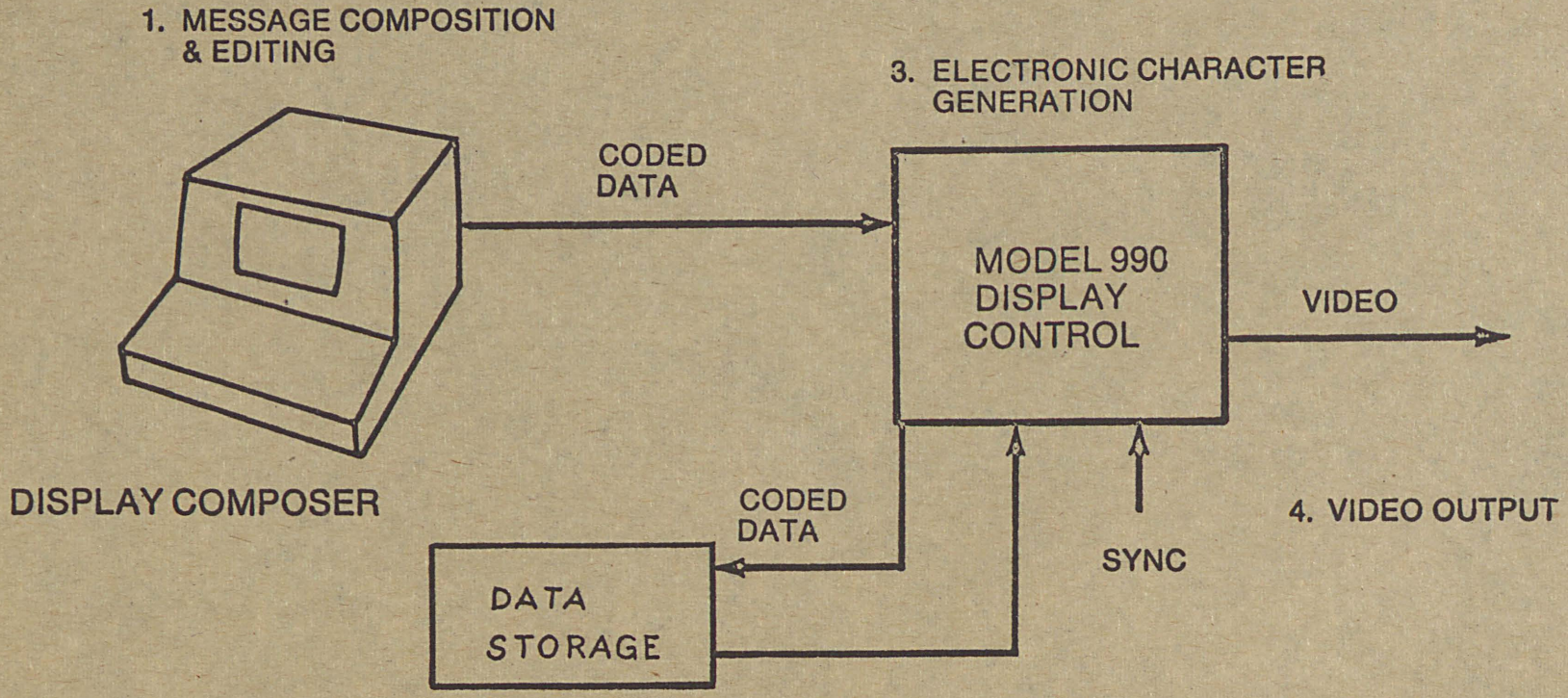
- = < >] [+ * _ ?

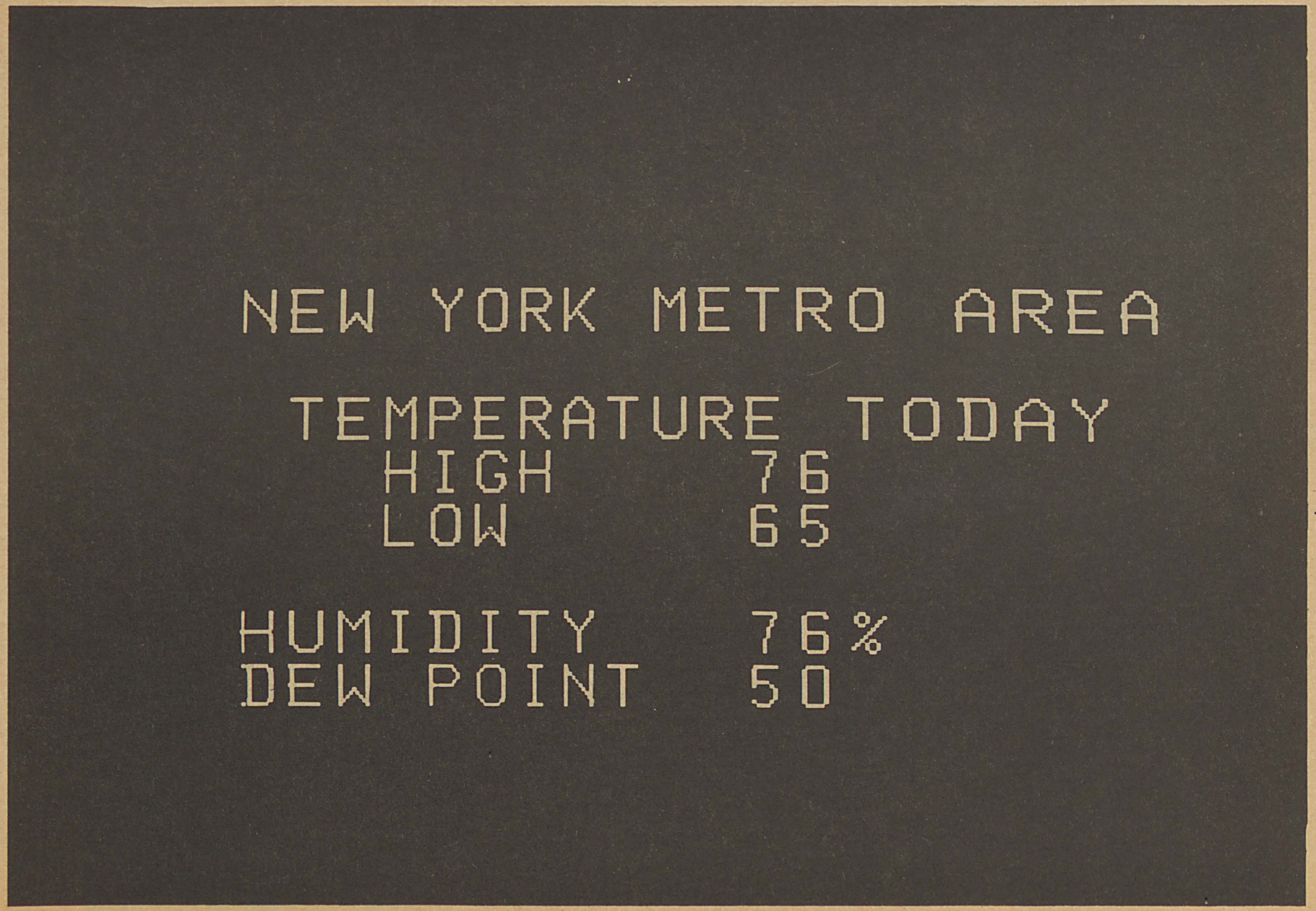
~ ^ ; : , . /

A B C D E F G H I J

K L M N O P Q R S T

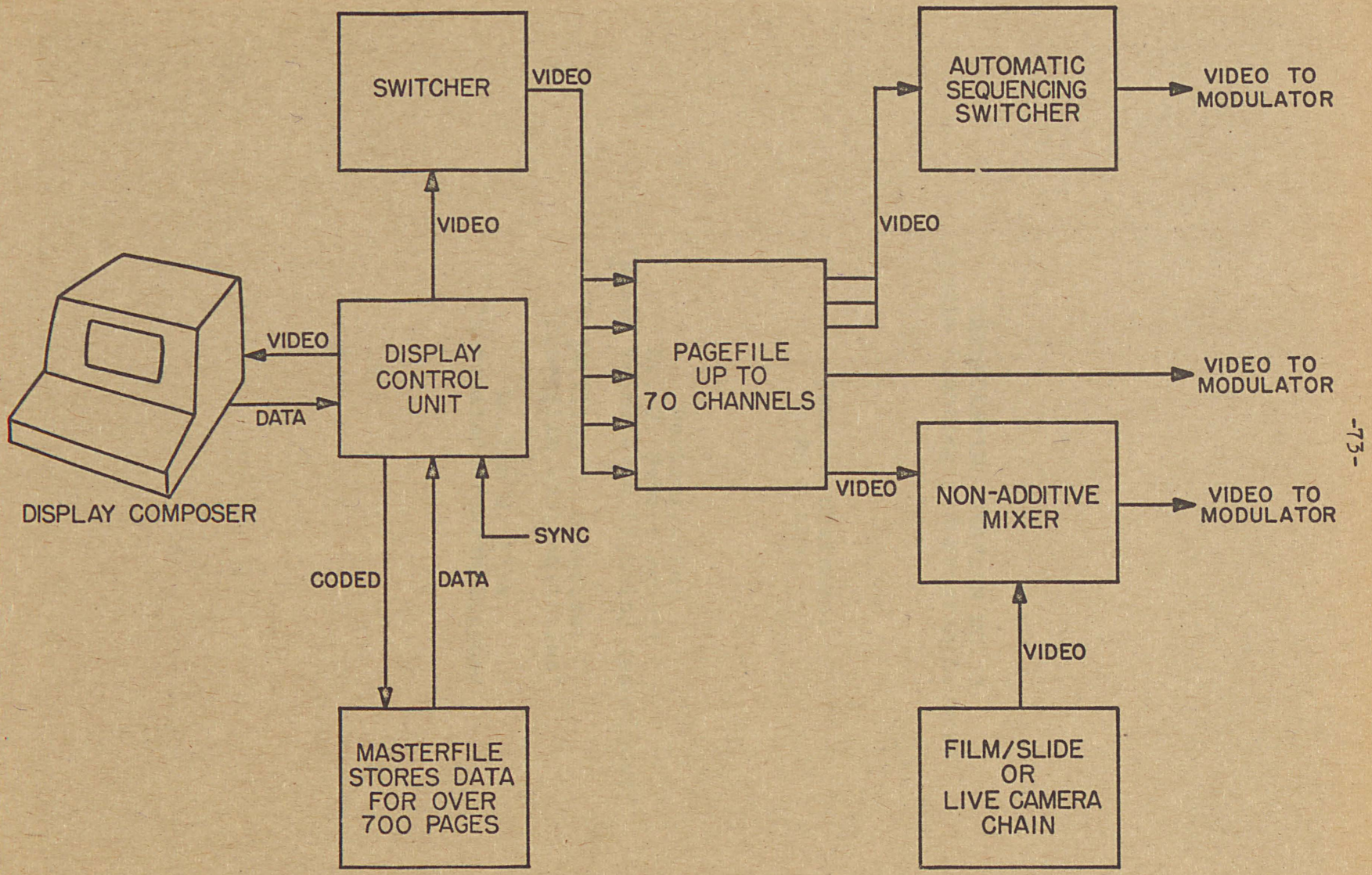
U V W X Y Z


1. MESSAGE COMPOSITION & EDITING
3. ELECTRONIC CHARACTER GENERATION
CODED DATA
MODEL 990 DISPLAY CONTROL
VIDEO
DISPLAY COMPOSER
CODED DATA
4. VIDEO OUTPUT
SYNC
DATA STORAGE
2. STORAGE OF MESSAGE IN DATA FORM


NEW YORK METRO AREA
TEMPERATURE TODAY
HIGH 76
LOW 65
HUMIDITY 76%
DEW POINT 50

A.P. VIGNETTE

(NIAGARA FALLS)--- PART OF THE TRADITIONAL MECCA FOR HONEYMOONERS IS GOING TO BE TURNED OFF FOR EIGHT MONTHS. ENGINEERS AND GEOLOGISTS WILL DIVERT WATER FROM



TYPICAL MULTI-CHANNEL MESSAGE ORIGINATION SYSTEM