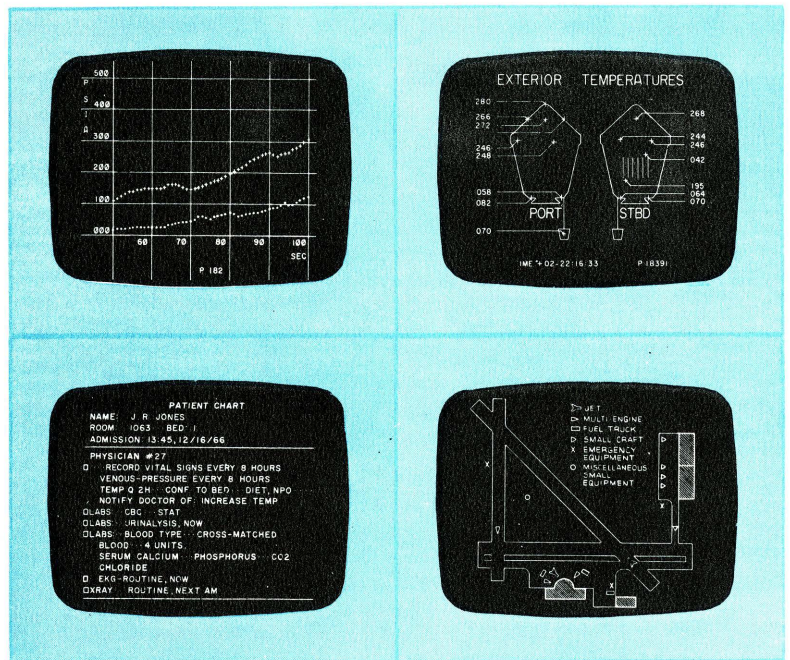


MONITOR 8500  
high performance  
DIGITAL DISPLAY  
GENERATOR  
for  
Computer-Data TV  
(CDTV) Display Systems



The MONITOR 8500 Digital Display Generator interprets computer-generated digital data and presents it in graphic and alphanumeric form on standard commercial television monitors. Input interface options provide for easy direct connection to most digital computers, and to a variety of communications terminals. Up to 20 independent synchronous video outputs provide simultaneous separate images to refresh local or remote TV displays. The number of different images and formats from which each of these outputs may be selected is limited only by the memory capacity and software of the source computer. Model 8540 Display Editors, described in a separate brochure, provide keyboards and operator controls to permit display-format selection and content editing either directly by wired connection or via communication line, or indirectly through the computer.

On a turnkey basis, MONITOR offers powerful new Computer-Data TV (CDTV) systems employing these units in combination with standard TV hardware and with computer software as required for each application.

Presentation of data in flicker-free commercial standard TV form offers advantages not available with stroke-writing or direct-beam-positioning CRT displays:

INEXPENSIVE MONITORS for multi-station applications.

SUPERPOSITION of computer-originated data and graphics on full-gray-scale TV pictures from closed-circuit TV or a vidicon-equipped automatic slide file.

STANDARD TV EQUIPMENT availability for video transmission, switching, mixing, and recording.

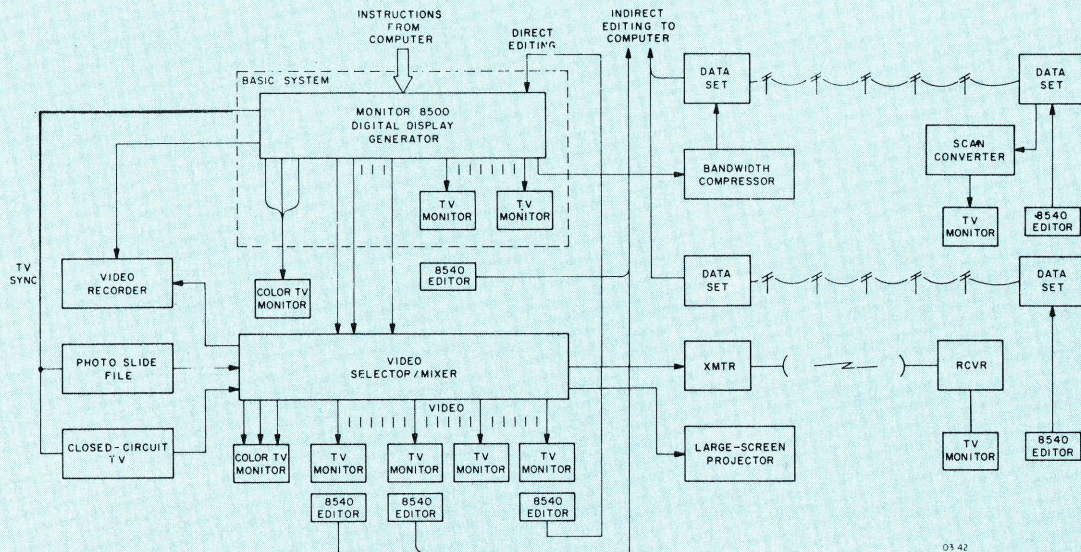
HIGH-SPEED UPDATING of images on remote monitors through use of video link.

COLOR display generation by assignment of one video output to each of the three guns of a standard shadow-mask tube in a conventional color TV monitor.

Low-cost medium-speed Graphic Display Processors are available in MONITOR's 8300 units, each of which includes its own general-purpose computer. See separate bulletin.

Outstanding features of the MONITOR 8500 are:

- Hardware capabilities which minimize computer software requirements.
- Man-machine conversation using companion MONITOR 8540 Display Editor by either direct connection or voice-grade communication link.
- Optional input buffer which permits asynchronous block transfer and minimizes housekeeping in transfer of data from the computer.
- Programmed initialization of
  - character fonts
  - space between characters and lines in "typewriter" mode.
- Synthesis and alteration of TV-raster images from computer-language instructions.
- Automatic generation of vectors between input-specified end points.
- Adjustment-free magnetic-disc Refresh Memory for storage and simultaneous output of up to 20 different display pictures in TV form.
- Quick replacement of images stored in the Refresh Memory by others through rapid processing of computer inputs.
- All-digital integrated-circuit technology.



COMPUTER DATA TV SYSTEM

## APPLICATIONS

The generalized block diagram above suggests the variety of unusually high performance display systems which can be built around the MONITOR 8500. Because of the number and variety of options and peripherals available, wide ranges of performance and price are spanned. An installed system can be augmented as requirements expand.

The MONITOR 8500 accepts input instructions from a computer or a multi-computer complex, and from one or many MONITOR 8540 Display Editors. The standard TV output signals can be fed directly to TV monitors, or can be applied to a Video Selector/Mixer for distribution to a set of monitors.

TV signals from one or more local or remote TV cameras, e.g. the vidicon from an automatic photographic-slide file, may also be applied to this Selector/Mixer matrix. If the full-gray-scale pictures from such sources are to be superimposed on black-and-white display images synthesized in the 8500, common synchronization is employed. The magnetic disc used for the Refresh Memories in the 8500 is normally the prime source of TV sync. The use of an optional disc servo permits the 8500 to be slaved to an external TV sync source.

With optional deletion of TV sync from the composite signal, any three video outputs may be programmed to correspond to the primary colors for a seven-color display, and applied to the guns of a conventional shadow-mask color CRT.

A TV monitor may be used for display only, or may become part of a man-machine link when it is accompanied by a MONITOR 8540 Display Editor. An 8540 can be connected directly to the 8500 Digital Display Generator, or can provide inputs indirectly by way of the computer so that operator commands can be coordinated with computer programs. Alternatively, an 8540 can be equipped with an interface which permits connection to a data set for transmission to the computer over a voice-grade link. This connection is required where the Display Editor is remotely located, as when a monitor is fed via a long-distance video transmission link, or via a telephone type

channel through use of a scan-conversion unit.

Where permanent records of displays are required, for purposes such as after-the-fact evaluation of operator decisions and reactions, conventional magnetic-tape video recorders can be employed. A selected channel may be recorded continuously, or a switching network can be used in such a way that a snapshot of every channel is recorded whenever a channel is updated.

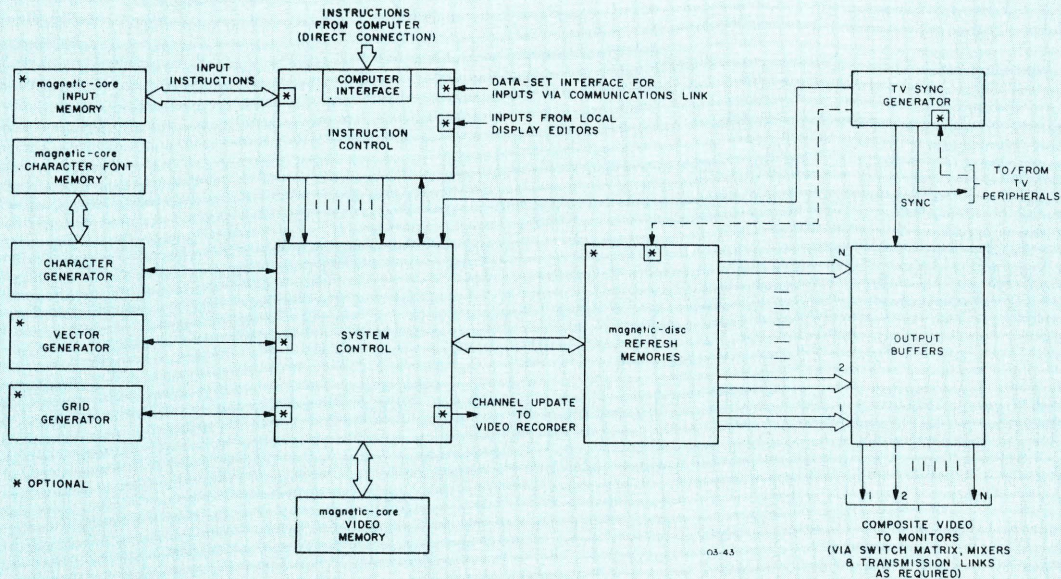
## FUNCTIONAL DESCRIPTION

As depicted in the block diagram of the MONITOR 8500, instructions for channel selection, posting of new alphanumeric and graphic information, and initializing are received via a computer interface in Instruction Control. Instructions may also be received from direct-connected MONITOR 8540 Display Editors. Alternatively, inputs from both computer and Display Editors can be from a remote location via common-carrier communication links.

Optionally, an Input Memory is available as a first-in, first out buffer which permits block transfers from the computer. Decoded commands derived from the input instructions are applied to System Control, where all operations are supervised.

Initially, dot matrices for each of the characters in the programmed repertoire are stored in the magnetic-core Character Font Memory. To permit discretionary programming of character sizes, inter-character and inter-line spacings are also stored in initializing registers. These character fonts and pitches are uniformly available to all display channels.

During operation, input instructions which specify characters are interpreted by Instruction Control and applied to the Character Generator, which controls the non-destructive readout of the proper character matrix from the Character Font Memory and its storage at appropriate coordinates in the Video Memory. In the random mode, character position in the display raster is specified by the instruction. In the



MONITOR 8500 - DIGITAL DISPLAY GENERATOR

sequential character mode, position is automatically referred to that of the previous character, using the pre-stored character and line pitches.

The optional Vector Generator responds to instructions which specify the locations of the two ends of a vector. The set of dot positions representing the best approximation to a straight line between the end points is generated automatically and stored in the Video Memory.

The optional Grid Generator uses stored horizontal and vertical line pitches and boundaries to control the operation of counters and logic which generate a set of grid lines usable for point-plot graphical presentations where relief of software burdens in this area may be especially desired. Alternatively, grid lines may be programmed as vectors through use of the Vector Generator.

The magnetic-core Video Memory stores in digital form the display image for the channel currently being processed. The contents of this memory represent a bit-for-dot map of the TV output presentation, where each line on the TV display is composed of closely spaced bright or dark spots. By performance of a sequence of instructions involving the Character, Vector, and/or Grid Generators, a dot-matrix graphic image is synthesized step-by-step and stored in the Video Memory, or an image already in the Video Memory is updated by additions and/or deletions.

For a single-channel system, the contents of the Video Memory are scanned out continuously in proper sequence for conversion to a video bit stream. If more than one display image is to be available for viewing at a given time, a multi-track magnetic disc is used to supply the desired number of channels of Refresh Memory. The selected channel is posted by transfer of the entire contents of the Memory disc, with gaps inserted to provide for horizontal and vertical blanking during the continuous real-time conversion of the channel output to TV video. The readout sequence is compatible with the TV requirement for two interlaced fields per frame. Each of the two fields to be

interlaced occupies a  $180^\circ$  sector on the disc, which rotates at 30 revolutions per second. During every disc revolution, a complete TV frame is scanned.

So that the required 20-million-bit-per-second video output rate is achieved, each Refresh Memory channel occupies a set of disc tracks. As each successive multi-bit word is read out from this set of tracks, it is converted by an Output Buffer to a portion of the bit stream representing the video data in the TV output. Synchronization from the TV Sync Generator is mixed with this data bit stream to provide composite video output which meets Electronic Industries Association (EIA) standards for television signals.

When the image stored in a Refresh Memory channel is to be modified, the contents of that channel are read (non-destructively) to the Video Memory. Additions or deletions are made as called for by the incoming instructions from the computer or a Display Editor. After the last instruction is processed in a sequence relating to that channel, the Video Memory contents are transferred to the Refresh Memory channel where they replace the previous contents by over-writing.

Where peripheral television equipment may be involved in a system, it may be slaved to the synchronizing signals from the MONITOR 8500. If this mode is not feasible, the optional servo drive may be employed for the Refresh Memory disc, so that the 8500 may be slaved to external sync.

## INSTRUCTION REPERTOIRE

**LOAD CHARACTERS (Initialize) (LCI).** Provides for acceptance of block transfer of  $60 \times 24 = 1440$  successive 16-bit computer words representing 60 characters, each a  $24 \times 16$  dot matrix (optionally  $24 \times 32$ ) or special size.

**LOAD PITCH (Initialize) (LPI).** Specifies inter-character and inter-linear pitch for sequential-character "typewriter" operation. Permits adaptation to actual programmed size and aspect ratio of characters.

**CHANNEL SELECT (CHS).** Causes non-destructive transfer of selected Refresh Memory channel to Video Memory for updating by subsequent instructions.

**UPDATE COMPLETE (UDC).** Causes replacement of previously selected Refresh Memory channel by updated contents of Video Memory.

**CLEAR VIDEO MEMORY (CVM).** Clears Video Memory in preparation for synthesis of new display image as opposed to updating of an image stored in the Refresh Memory (see CHS).

**CHARACTER, RANDOM POSITION (CRP).** Identifies selected character, non-destructively reads pre-stored dot matrix from Character Font Memory and transfers it to Video Memory register at locations corresponding to the stated X-Y position in the display image. The transferred dot matrix may either overwrite existing data or replace it

(blank character causes erasure). Boundaries of the locations replaced are defined by the prestored pitch values.

**CHARACTER, SEQUENTIAL POSITION (CSP).** Like CRP except that locations in the Video Memory are established automatically by "typewriter" logic.

**CURSOR ON (CON).** Specifies a channel and enables a cursor (short horizontal line) on that channel to provide operator(s) with position reference for input and editing with the MONITOR 8540.

**VECTOR START (VST).** Establishes starting coordinate of a vector.

**VECTOR STOP (VSP).** Establishes ending coordinates of a vector, initiates synthesis of best straight line to this point from previously specified Vector Start location (see VST) and stores dots in corresponding Video Memory locations.

## SPECIFICATIONS

### INSTRUCTIONS FROM COMPUTER:

16-bit parallel data transfer. Request-acknowledge control. Levels 0 and +5 volts. 8-bit byte inputs optional. Asynchronous transfer at rates to 500 K instr./sec.

### INSTRUCTIONS FROM DISPLAY EDITORS:

Optionally, inputs from one to four MONITOR 8540 Display Editors (see separate brochure) can be received directly by hard wiring or from remote locations via common-carrier communication links. (Normal Editor input is indirect, through computer, permitting computer control of queing and retention of edit instructions for subsequent use.)

### TV SIGNALS:

Up to 20, as ordered, simultaneously available EIA RS-170 525-line standard composite video signals. Each output on separate 75-ohm coax. Additional groups of 20 optional. 512 elements/line. Optionally 729, 945, 1029, or 1125 line TV.

### TV MONITORS:

Number, size, and connections as required by order.

### TV SYNC:

Horizontal sync, vertical sync, composite blanking, and composite sync available on separate 75-ohm coax for use by external CDTV system elements. Optionally, the 8500 may be slaved to an external TV sync.

### CHARACTER REPERTOIRE:

60 characters per set; one set standard, additional sets optional. Code as ordered (ASCII, IBM, EBCDIC).

### CHARACTER SIZE:

Each character can be programmed to be any size within a 16 x 24 (optionally 32 x 24) dot matrix. Aspect ratio multiplier 1.3 x 1. (Other maximum matrix dimensions on special order). On a 19" tube 525-line

monitor, a 16 x 24 bit character is 3/8" x 1/2".

### VECTORS:

Automatically synthesized between program-specified end points using optional Vector Generator.

### GRIDS:

Specifications for Optional Grid Generator available.

### CURSOR:

Short horizontal line usable as position reference. May be slewed by operator. Automatically denotes next character locations in "typewriter" mode.

### DISPLAY PROCESSING TIME:

Approximately 0.1 second for processing of the complete dating of a typical display image, including Refresh Memory transfers. No interruption of TV Channel output occurs during this time. Changeover to new image occurs abruptly.

### TECHNOLOGY:

High-reliability integrated circuits on field-proven logic cards. Sliding drawers permit front access. See separate brochure on MONILOGIC.

### POWER INPUT:

Commercial mains; nominal 115 volts, 60 Hz, less than 30 amperes.

### ENVIRONMENT:

Ambient temperature 50°F to 100°F. Relative humidity to 95%, without condensation. Other ranges on special order.

### COOLING:

From sub-floor ducts; optionally, with integral blowers.

### SIZE:

52" wide x 72" high x 32" deep with all options, for 20 channels of 525-line TV. 1200 lbs. approximately.