VPR-3

VIDEO PRODUCTION RECORDER

PRODUCT DESCRIPTION

1809630-01

AMPEX

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PREFACE

The VPR-3 is the latest addition to the Ampex family of video tape recorders. The culmination of over 25 years of broadcast video experience, the VPR-3 is the most time-efficient and versatile VTR available for today's demanding production work. The VPR-3 is ideal for teleproduction houses, networks, TV stations and any other production environment where fast, precise tape handling is a necessity.

At the heart of the VPR-3 is its revolutionary tape handling system. An air-guided tape path, a vacuum capstan, and constant-tension reel servos are combined in an interactive system which delivers the best acceleration, parking accuracy, and lockup times of any helical recorder in the industry.

Automatic Scan Tracking (AST*) provides a distortion-free picture, whether the VPR-3 is operating at variable speed or in freeze frame. Transport speed is variable from stop to ±50 times play speed, enabling the operator to rapidly move tape to a desired location and then view the area a frame at a time.

Comprehensive and easy-to-read control panel indicators, including a built-in subcarrier to horizontal phase meter (ScHΦ), provide the information necessary to make correct editing decisions quickly and easily. Six soft keys place virtually all editing and control functions at the operator's fingertips. Key functions are assigned through the menu system, allowing a single key to perform a variety of functions. A dot matrix display supplies constantly updated status, positional, and diagnostic information.

The VPR-3 features Z80-based control and input/output systems. Microprocessor control allows data, ranging from audio record parameters to entire editing sequences, to be stored in memory and instantly recalled at a later time. Microprocessor-controlled RS422 serial communications ports ensure a simple, plug-compatible interface with any editing system conforming to the SMPTE serial communications concept.

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*Trademark, Ampex Corporation

OPERATIONAL DESCRIPTION

This section summarizes the standard features of the VPR-3. Transport components are described, as well as operator controls and menu system. Additional performance enhancements are detailed under *Optional Features*.

Standard Features

Air Guides

Based on the latest developments in gas film technology, a series of air guides creates a virtually frictionless tape path. Supplemented by precision rotary and fixed guides, this transport system allows extremely rapid speed and directional changes regardless of tape type or environmental conditions. Elimination of the friction buildup common to Type C format video recorders ensures that the tape will be handled efficiently and gently.

Vacuum Capstan

By employing a vacuum capstan, the VPR-3 achieves optimum coupling while eliminating the pinch roller and its attendant flutter. A low-inertia, high-speed dc servo motor assembly allows the capstan to accelerate from a stop to a maximum speed of 500 ips in less than one second. Acceleration is controlled by a coupling servo, which monitors both tension arms and adjusts acceleration with respect to the reel servos. Capstan speed is monitored by an optical tachometer with resolution high enough to specify tape location in terms of lines rather than fields, giving the VPR-3 the highest degree of parking accuracy of any Type C format VTR.

Reel Servos

With equal delicacy and precision, the VPR-3 handles reel diameters ranging from 3-hour reels, containing 9200 feet of tape, down to 15-second spot reels. Constant tension servos at the supply and takeup reels lock to the capstan servo in order to minimize any distortion of the tape. Reel servo gains are set to correspond to hubs having a high peripheral mass, which means that the inertia presented by various reel sizes is negligible in relation to the anticipated mass. Thus, the VPR-3 is indifferent to reel size.

In case of a power failure, the servo system will bring the reels to a controlled stop with no danger of damage to the tape. The instant power fails, the energy produced by reel rotation is transmitted to the servos, which dynamically brake the reels to a safe stop. Dynamic braking eliminates the "parking brakes" commonly associated with this kind of transport, significantly reducing transport complexity as well as the potential for tape damage. See Figure 1-1 for an illustration of the VPR-3 tape path.

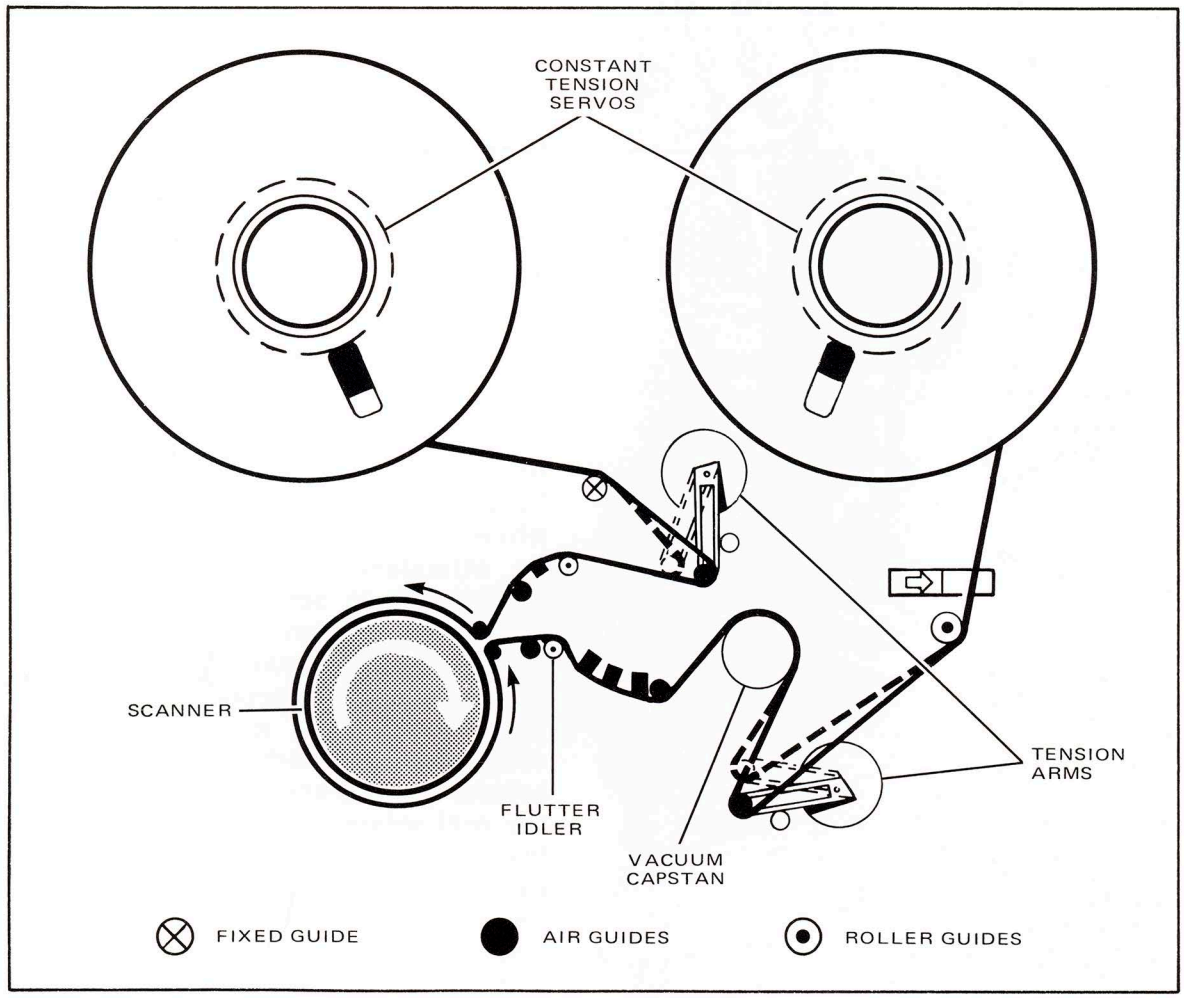


Figure 1-1. VPR-3 Tape Path

Automatic Scan Tracking (AST)

AST guarantees a broadcast-quality picture from three times forward play speed to one times reverse play speed. With the addition of the Ampex TBC-3 Time Base Corrector, tape may be viewed in slow motion or as a still picture with no degradation of picture quality.

When tape speed slows, the fixed head of a conventional VTR cannot stay in alignment with the long helical track. This misalignment results in the familiar noise bar moving through the picture. AST utilizes a special video head which can be constantly repositioned. Using the amplitude of the rf envelope and the capstan tachometer as precision references, the AST head adjusts to maintain optimum track alignment. The incredible one-field lockup specification demonstrates the efficiency of this system.

The resulting high level of still picture accuracy allows control of tape movement from frame to frame, enabling the operator to jog the tape while editing. Edit entrance and exit points are selected with complete precision by viewing any number of adjacent frames, one at a time. The improved tracking system also reduces the AST head dither levels by 80%, resulting in a much cleaner video signal.

Interface Capabilities

The VPR-3 is designed to be easily interfaced with any studio environment. An audio processing port is available for use with popular noise reduction and time expansion/compression equipment, such as Dolby, DBX and Lexicon. Dual RS422 serial communications ports allow the VPR-3 to be connected to any editing system conforming to the SMPTE serial communications concept.

The input cable equalizer provides input video signal conditioning. This feature eliminates signal losses caused by excessive cable lengths or use of inferior cable.

Multichannel Audio

The VPR-3 offers high-fidelity sound reproduction on as many as four audio channels. Confidence monitoring is provided for each channel. Software control of the audio circuitry allows the operator to mix channels 1 and 2, route the channel output to an audio processor (Dolby, Lexicon), or assign channel 4 as either an additional audio channel or as the sync channel (on 625-line systems).

The VPR-3 will automatically optimize the record parameters for up to three different tape types. The operator can manually or automatically adjust the record current, bias, equalization, and predistortion values of the audio channels and the record current value of the video and sync channels for each specific type of tape. This setup information is then stored in the VPR-3's memory. Prior to recording, all the operator need do is identify the type of tape being used and the setup parameters for that particular tape are recalled from memory. The VPR-3 will then use those parameters to automatically preset the record circuitry.

Internal audio monitoring is provided by 1.5W-per-channel amplifiers and speakers for VPR-3s in either the tabletop or rack mount configuration. Console-mounted VPR-3s may use an optional high-fidelity power amplifier and speaker system.

Dual Microprocessor Control

Dual Z80 microprocessors control VPR-3 operation. One Z80 is responsible for system control while the second Z80 manages the serial I/O interface.

The system control microprocessor coordinates the operation of the reel, scanner and capstan servos, the control panel display and soft keys, and the audio circuitry. The serial I/O microprocessor controls data transfers between the VPR-3 and any device attached to its serial interface.

Variable Speed Shuttle

The transport control knob moves tape through the transport at several rates, from one field at a time to a maximum of ±50 times play speed. An internally mounted tachometer and magnetic detenting allow this control to operate in a number of modes, which are selected by either front panel controls or through the software. End-of-tape protection is provided by sensors which monitor the reels and automatically slow the capstan when approaching the end of the tape. Even when the VTR is operating in full speed shuttle mode, tape cannot be accidently run off the scanner.

Display, Keypad and Soft Keys

The operator can quickly and accurately control VTR operation using the VPR-3's fluorescent display, numeric keypad, and six soft keys.

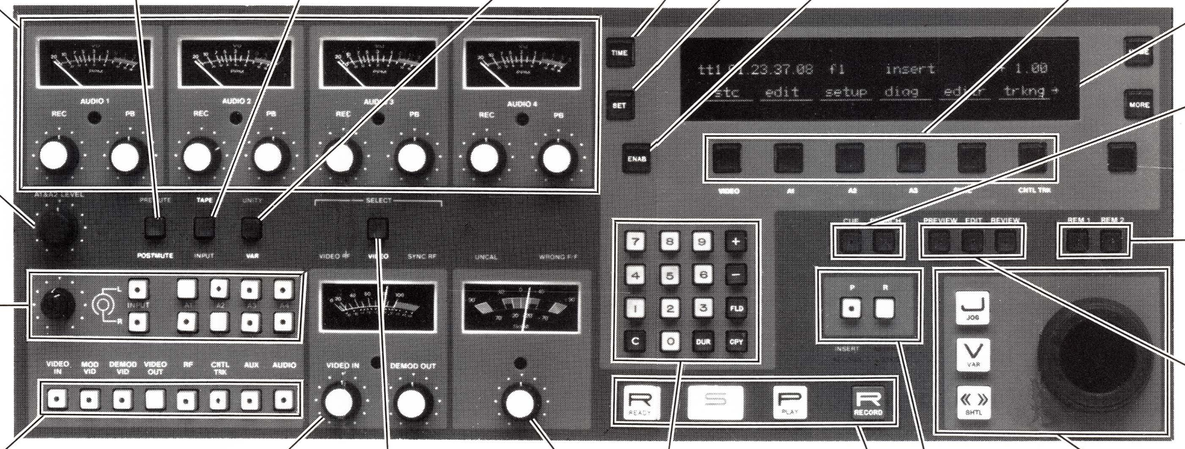
The 26- x 256-dot matrix display presents the operator with continually updated position, status, and diagnostic data. In addition to standard alphanumeric characters, the display also has graphics capabilities. Graphic representations of several setup adjustments may be viewed, allowing record and playback parameters to be easily set.

Control and operational information is entered via the numeric keypad and the six soft keys. The numeric keypad includes the digits 0 through 9, as well as six control keys. Soft key functions are assigned by the menu system. See Figure 1-2, VPR-3 Menu System.

The VPR-3's multilevel menu system is entered through the home menu which is displayed whenever the VPR-3 is powered-up. The home menu allows the operator to select a second menu supporting either the edit, variable speed, search-to-cue, or setup operations. Each of these menus, in turn, provides access to additional menus which more specifically support the selected operation. When finished with a particular menu, the operator presses HOME to return the home menu to the display.

OPERATOR CONTROLS AND INDICATORS

THE VPR-3 OFFERS THE OPERATOR A COMPREHENSIVE ARRAY OF CONTROLS AND INDICATORS:



TAPE/INPUT

CONTROLS AUDIO MONITORING IN THE RECORD MODE.

AUDIO LEVEL CONTROLS AND INDICATORS

THREE STANDARD AUDIO CHANNELS WITH OPTIONAL FOURTH CHANNEL AVAILABLE. UNITY DETENTED INPUT AND OUTPUT LEVEL CONTROLS. DUAL SCALE METERS WITH TRUE SELECTABLE PEAK OR VU RESPONSE.

PREMUTE/POSTMUTE

ALLOWS THE AUDIO MONITORING SYSTEM INPUT TO BE TAKEN EITHER BEFORE OR AFTER THE SHUTTLE MODE MUTING.

UNITY/VARIABLE

THIS MASTER CONTROL ALLOWS ALL VARIABLES TO BE INSTANTLY SET TO UNITY POSITION, PROVIDING FAST SYSTEM STATUS VERIFICATION.

TIME

SELECTS TAPE TIME SOURCE (TT1, TT2 OR TCG).

SET

SETS TAPE TIME TO VALUE DISPLAYED IN THE HOME MENU.

ENAB

CALLS UP AUDIO/VIDEO CHANNEL SELECT MENU.

SOFT KEYS

SIX CONTROLS WHOSE FUNCTIONS ARE ASSIGNABLE THROUGH THE MENU SYSTEM.

DISPLAY WINDOW

DOT-MATRIX DISPLAY GENERATES ALPHANUMERIC CHARACTERS AND GRAPHIC ELEMENTS.

A1 AND A2 LEVEL

MASTER GAIN CONTROL FOR AUDIO CHANNELS 1 AND 2.

AUDIO MONITORING CONTROLS

MONITOR SPEAKER LEVELS ARE CONTROLLED AND ANY COMBINATION OF AUDIO CHANNELS MAY BE DIRECTED TO EITHER RIGHT OR LEFT SPEAKER.

VIDEO MONITORING CONTROLS

SELECTED SIGNAL MAY BE ROUTED TO VIDEO WAVEFORM MONITOR AND, IF APPLICABLE, TO PICTURE MONITOR. THE SIGNAL MAY BE MONITORED EITHER BEFORE OR AFTER INPUT PROCESSING. VARIOUS AUXILIARY SIGNALS MAY BE SELECTED FOR DIAGNOSTIC FUNCTIONS.

VIDEO LEVEL CONTROL AND INDICATOR

THE VIDEO METER FUNCTION IS INDICATED BY ILLUMINATED LABELS ABOVE METER. LEVEL CONTROL IS PROVIDED FOR VIDEO-IN AND DEMODULATOR-OUT SIGNALS.

SELECT

ASSIGNS VIDEO METER FUNCTION. VIDEO RF, VIDEO LEVEL OR SYNC RF MAY BE SELECTED FOR DISPLAY.

SCH PHASE METER AND CONTROL

DISPLAYS SUBCARRIER PHASE RELATIVE TO SYNC. DURING FRAME MATCH EDITING, OFF-TAPE SIGNAL IS COMPARED TO INPUT SIGNAL.

KEYPAD

TEN NUMERIC KEYS AND SIX CONTROL KEYS.

MAIN CONTROL KEYS

READY, STOP, PLAY AND RECORD.

P AND R

SELECTS THE VPR AS EITHER THE PLAY MACHINE OR THE RECORD MACHINE DURING EDITS.

CUE

SHUTTLES TAPE TO SELECTED CUE MINUS PRE-ROLL VALUE.

SEARCH

SHUTTLES TAPE TO SELECTED CUE.

REMOTE 1

SELECTS EITHER A PARALLEL OR SERIAL REMOTE.

REMOTE 2

SELECTS A SECOND SERIAL REMOTE.

PREVIEW

INITIATES MULTIPLE MACHINE PREVIEW OF SELECTED EDIT.

EDIT

INITIATES EITHER SELECTED EDIT MODE OR A MANUAL EDIT.

PREVIEW

RECORD MACHINE WILL REPLAY LAST EDIT PERFORMED.

TRANSPORT CONTROL KNOB

SINGLE CONTROL KNOB HAS INTERNAL TACHOMETER AND MAGNETIC DETENTING. SPEED RANGE CONTROLLED BY THE KNOB IS SELECTED BY MODE BUTTONS: JOG, VARIABLE AND SHUTTLE. IN JOG (J), FOUR REVOLUTIONS OF KNOB PRODUCE ONE CAPSTAN REVOLUTION.(A 1-REVOLUTION OF KNOB TO 1-REVOLUTION OF CAPSTAN RATIO MAY BE JUMPER SELECTED). VARIABLE (V), ALLOWS SPEEDS OF -1X PLAYSPEED TO 3X PLAYSPEED TO BE CONTROLLED. SHUTTLE (≪ SHT ≫) PROVIDES A SPEED RANGE OF ±50X PLAYSPEED.

CONTROL KNOB PERFORMS ADDITIONAL FUNCTIONS AS ASSIGNED BY MENU SYSTEM.

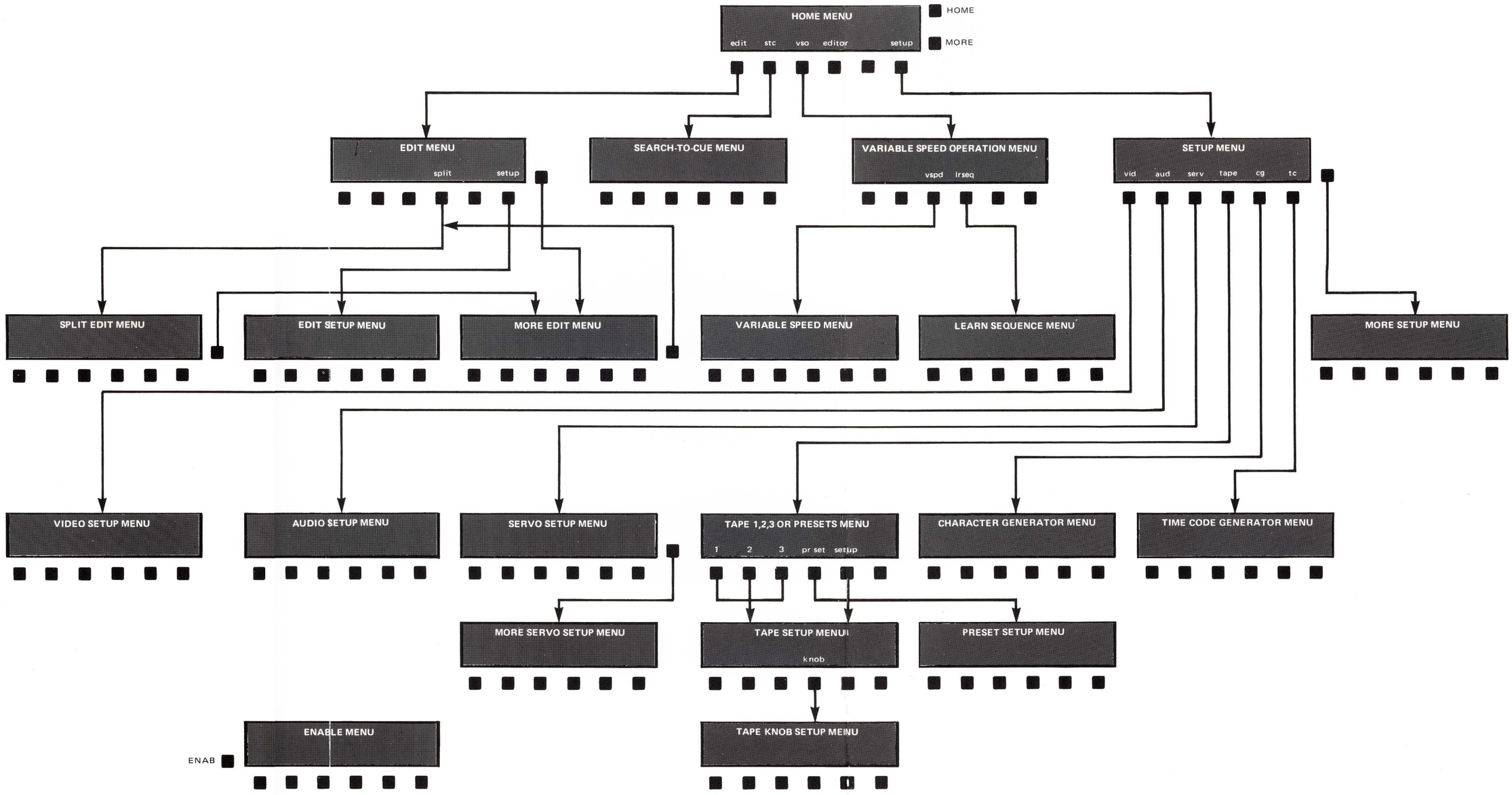
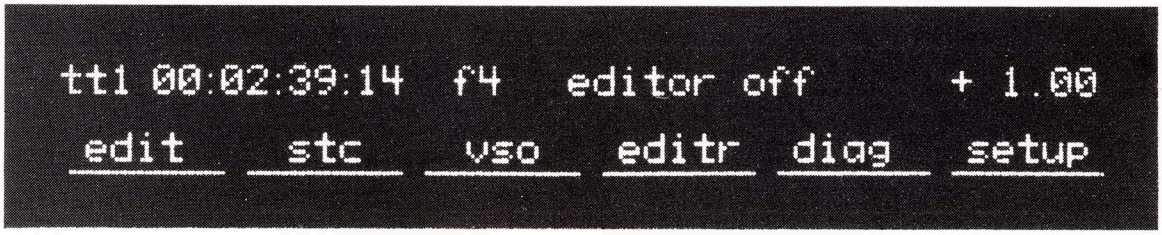
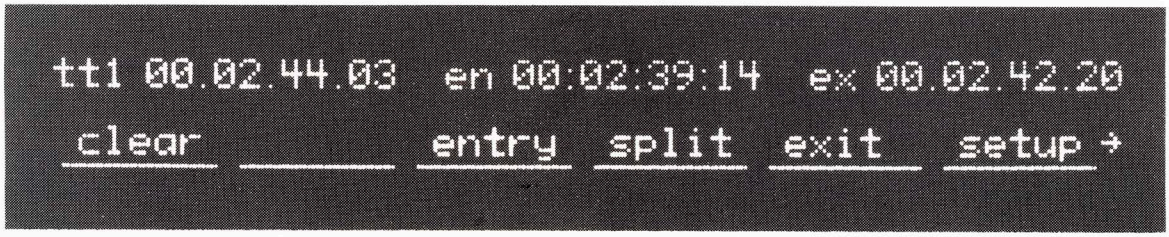


Figure 1-2.
VPR-3 Menu System



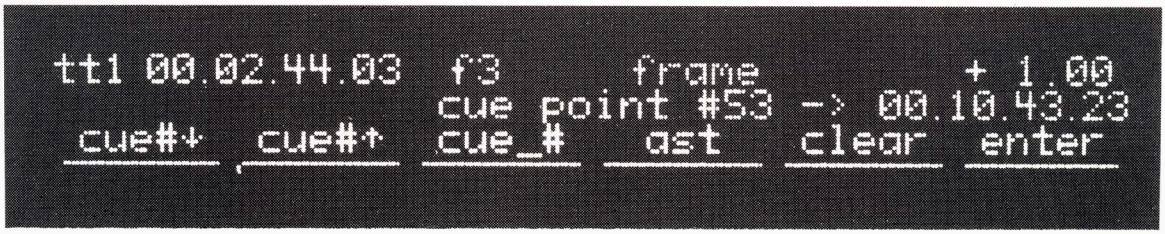
16449-8

Home Menu. The home menu appears whenever the VPR-3 is powered-up or when HOME is pressed. The top line displays the tape time, the tape-time source, the field on which the tape is parked, the current edit mode, and the selected tape speed. Values entered with the keypad are displayed on the second line of the menu, in the keypad register display field. While in this menu, the operator may change tape times, tape time sources, and edit modes, as well as turn the editor on and off. The bottom line displays access to four additional menus: edit **(edit),** search-to-cue **(stc),** variable speed operation **(vso)** and setup **(setup).** The diagnostics menu **(diag)** is not used at present.



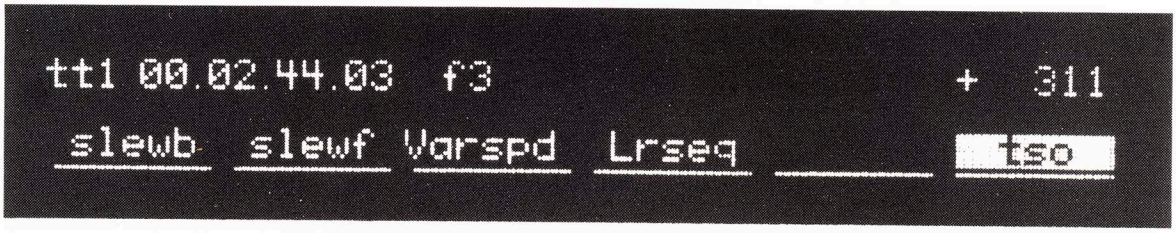
16449-9

Combined Edit Menu. This menu allows the operator to enter new edit entrance and exit points, using either tape timer or keypad values. Additionally, all previous edit points may be cleared. The split edit, edit setup or more edit menu is selected by pressing **split, setup** or MORE respectively.



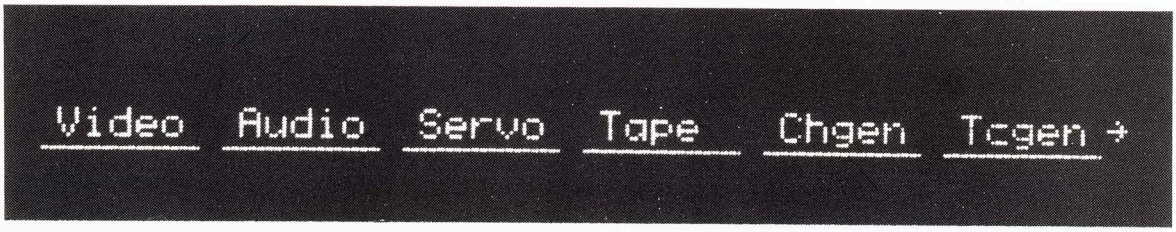
16449-3

Search-to-Cue Menu. While in this menu, the operator may enter a maximum of 100 cue points into the VPR-3's cue memory. The search-to-cue function allows a specific cue point to be located in memory or the entire cue memory may be reviewed by scrolling up and down through the cue point numbers.



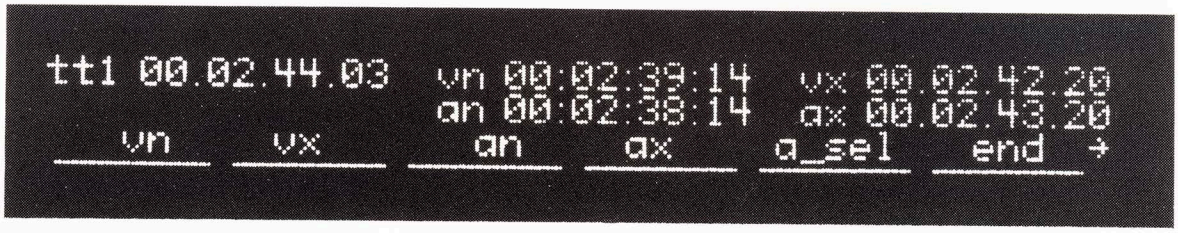
16449-2

Variable Speed Operation Menu. Playback position is stepped forward or backward, one frame at a time, in order to synchronize sources. The tape speed override function **(tso)** enables the operator to deviate tape speed ±511 seconds per hour from normal playspeed. The variable speed and learn sequence menus are accessed via **Varspd** and **Lrseq** respectively.



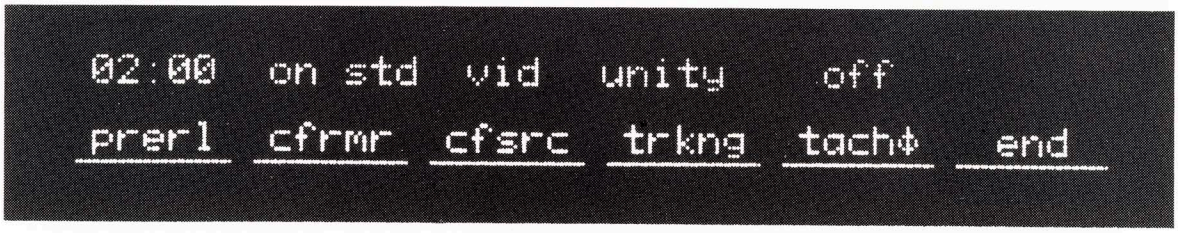
16449-15

Setup Select Menu. This menu provides access to the following system setup menus: video setup **(Video),** audio setup **(Audio),** servo setup **(Servo),** tape setup **(Tape),** character generator **(Chgen)** and time code generator **(Tcgen).**



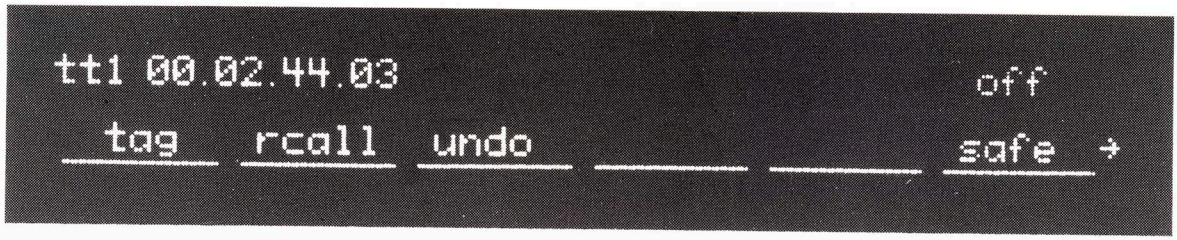
16449-16

Split Edit Menu. The split edit menu allows video and audio tracks to be edited separately. Pressing MORE accesses the edit more menu.



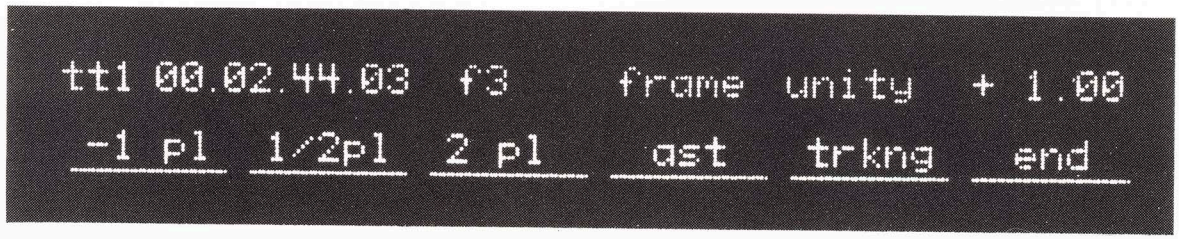
16449-18

Edit Setup Menu. This menu allows the operator to modify preroll and postroll times, turn the color framer on or off, and select the color framer reference source. Tracking is adjusted using the transport control knob. Video phasing interchange errors are compensated for by enabling the tach phase function.



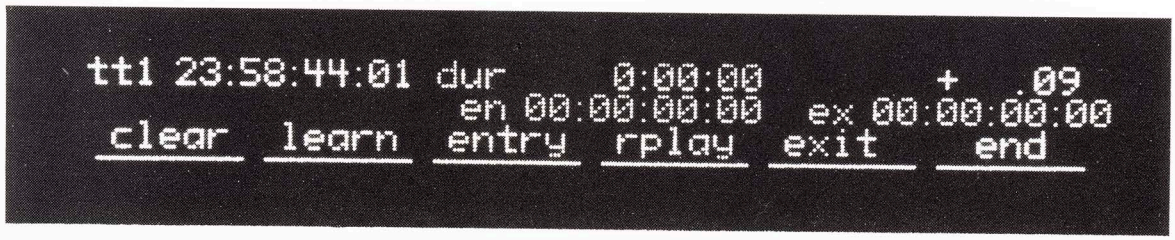
16449-6

Edit More Menu. This menu is an extension of the combined edit and split edit menus. During back-to-back edits, the exit point of one edit sequence can be used as the entrance point of the succeeding edit. A record lockout feature can be enabled to prevent accidental erasure of material during editing.



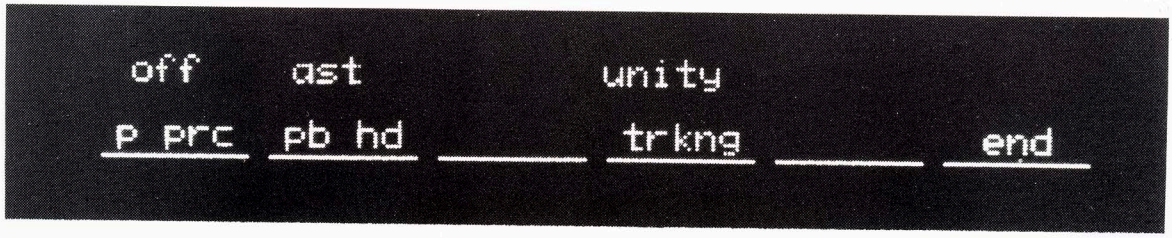
16449-22

Variable Speed Menu. This menu provides access to control-track-locked playback operation at 1/2 forward speed, 2x forward speed or 1x reverse speed. Either the field mode or true frame mode of slow motion playback may be selected. Tracking is adjusted via the transport control knob.



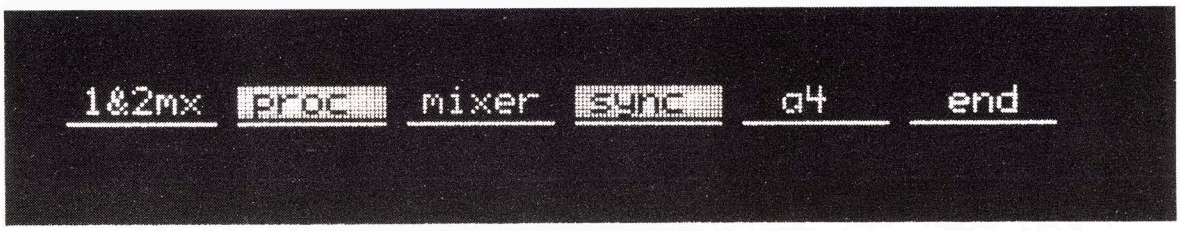
16519-R3-8

Learn Sequence Menu. A variable speed playback sequence can be entered into the VPR-3's memory and executed at a later time. The operator is also able to trim sequence entrance and exit points.



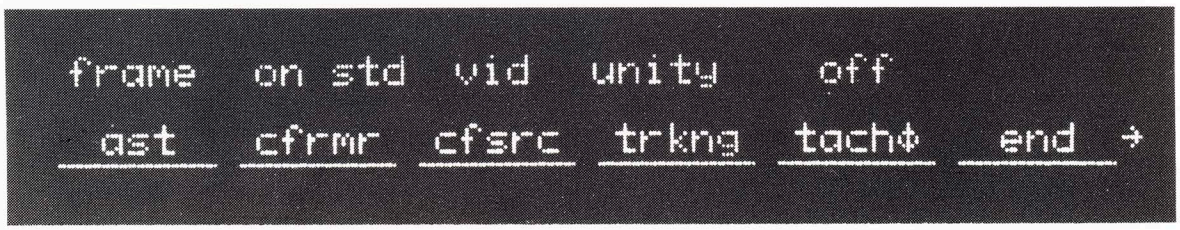
16519-R3-12

Video Setup Menu. This menu allows the operator to enable video preprocessing via the time base corrector. The playback head may be selected from either the AST head or the record head.



16519-R1-1

Audio Playback Options Setup Menu. While in this menu, the operator is able to mix audio channels 1 and 2, as well as assign the optional fourth audio channel to carry audio or sync information.

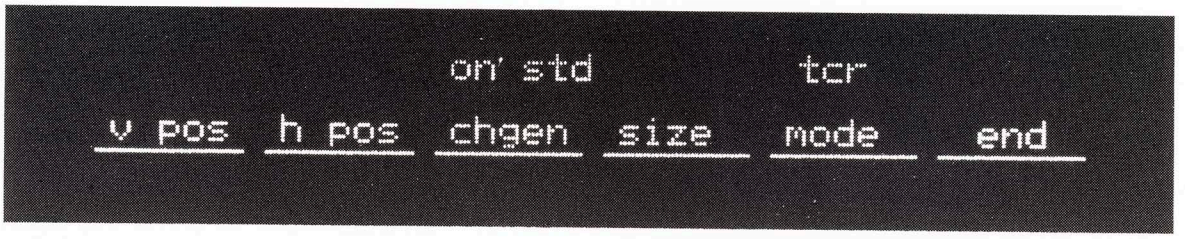


16449-11

Servo Setup Menu. The color framer may be turned on or off and its reference source selected from either video, time code, or control track. The AST head may be instructed to operate in either the field or true frame mode of variable playback. Video and machine reference timing are synchronized and tape tracking is adjusted by the transport control knob. The servo setup more menu is entered by pressing MORE.

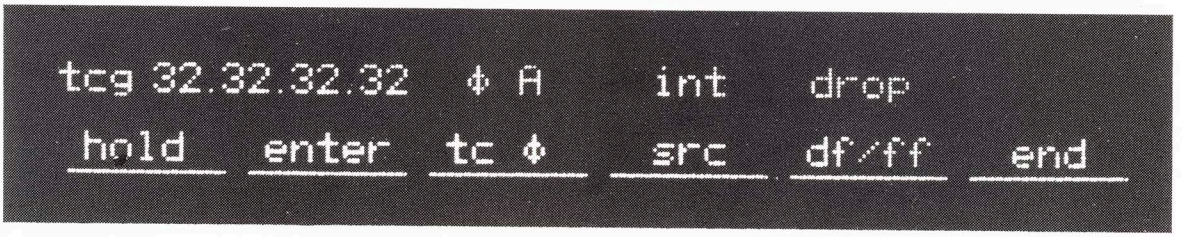
16449-24

Tape Setup Menu. Record setup parameters for any of three tape types can be recalled from memory using this menu. The VPR-3 uses the recalled values to set record parameters for the record circuits. Preset record parameters can also be selected. This menu provides access to the automatic tape optimization and preset setup menus.



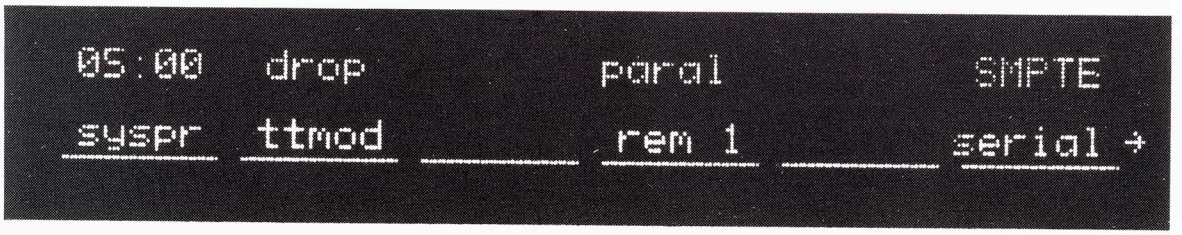
16519-R2-8

Character Generator Menu. This menu allows the operator to control the position, size, display background, and mode of the character generator display as it appears on the video monitor.



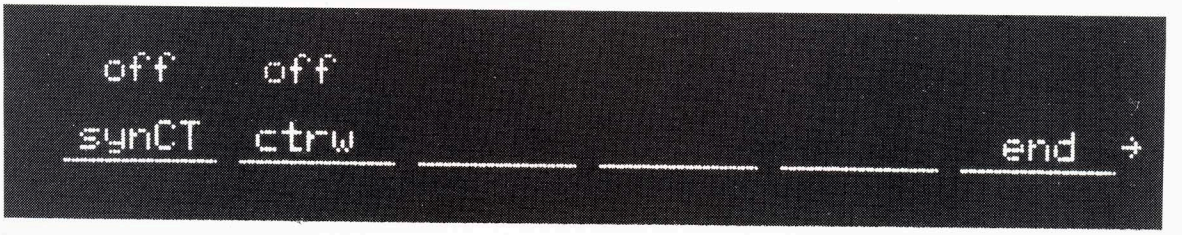
16449-5

Time Code Generator Menu. This menu allows the operator to setup and enable the optional Time Code Reader/Generator PWA.



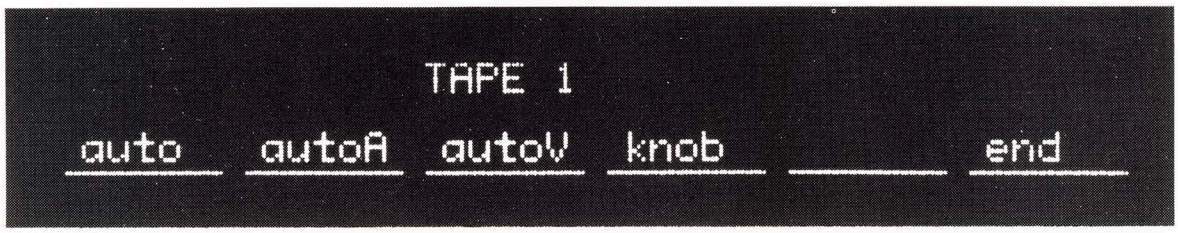
16449-20

Setup Select More Menu. System preroll and post-roll times are set, the tape timer is set to operate in either drop-frame or full-frame mode, and either parallel or serial communication with additional equipment is selected with this menu.



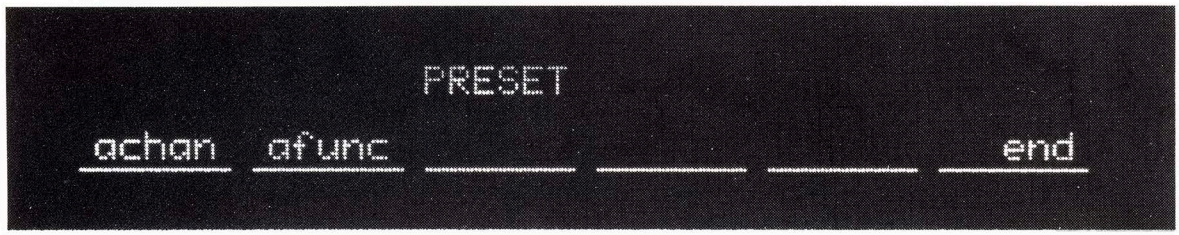
16449-17

Servo Setup More Menu. This menu allows the operator to enable synthetic control track playback.



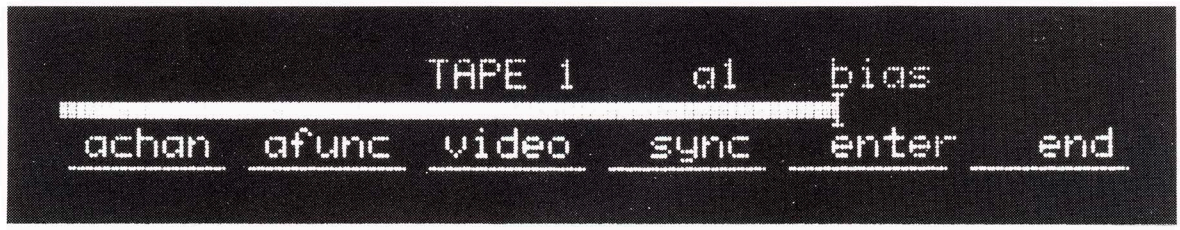
16449-7

Automatic Tape Optimization Menu. Record parameters for a maximum of three tape types can be optimized and the resulting values stored in memory. This menu provides access to the knob-controlled record optimization menu.



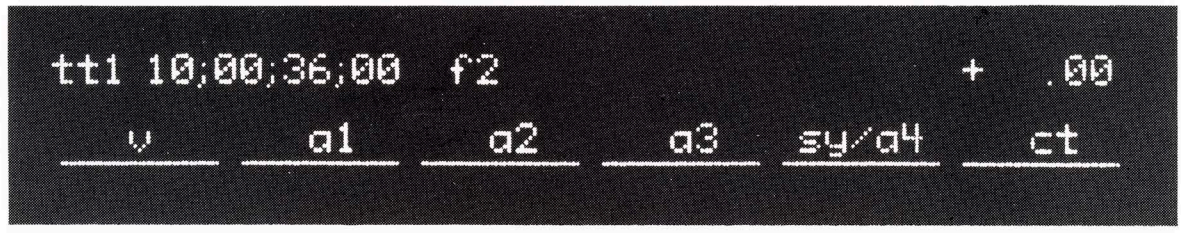
16519-R2-5

Preset Setup Menu. Individual audio record parameters are adjusted via potentiometers located on the Audio Control PWA.



16449-12

Knob-Controlled Record Optimization Menu. Individual record parameters are recalled from memory and adjusted with the transport control knob. The modified parameters are then entered back into memory.



16449-1

Enable Menu. The Enable Menu allows the operator to either enable or inhibit recording on the video, audio (A1, 2, 3, 4/SYNC), and control track channels. This menu may be entered at any time using the ENAB key.

Ease of Maintenance

All of VPR-3's electronics and subassemblies are easily accessible. Most of the machine's printed wiring assemblies (PWAs) are located in a card cage directly behind the operator control panel. The control panel swings down and out of the way to provide access to the card cage (See Figures 1-3 and 1-4). This configuration allows the PWAs to be removed or tested on an extender card, all from the front of the machine. The control panel remains operational in its down-and-locked position, allowing the PWAs to be dynamically tested without sacrificing accessiblity.

The servo and power supply card cage is hinged at the rear of the VPR-3. Swinging the card cage down provides access to the rear of the transport and to the air system. See Figures 1-5 and 1-6.

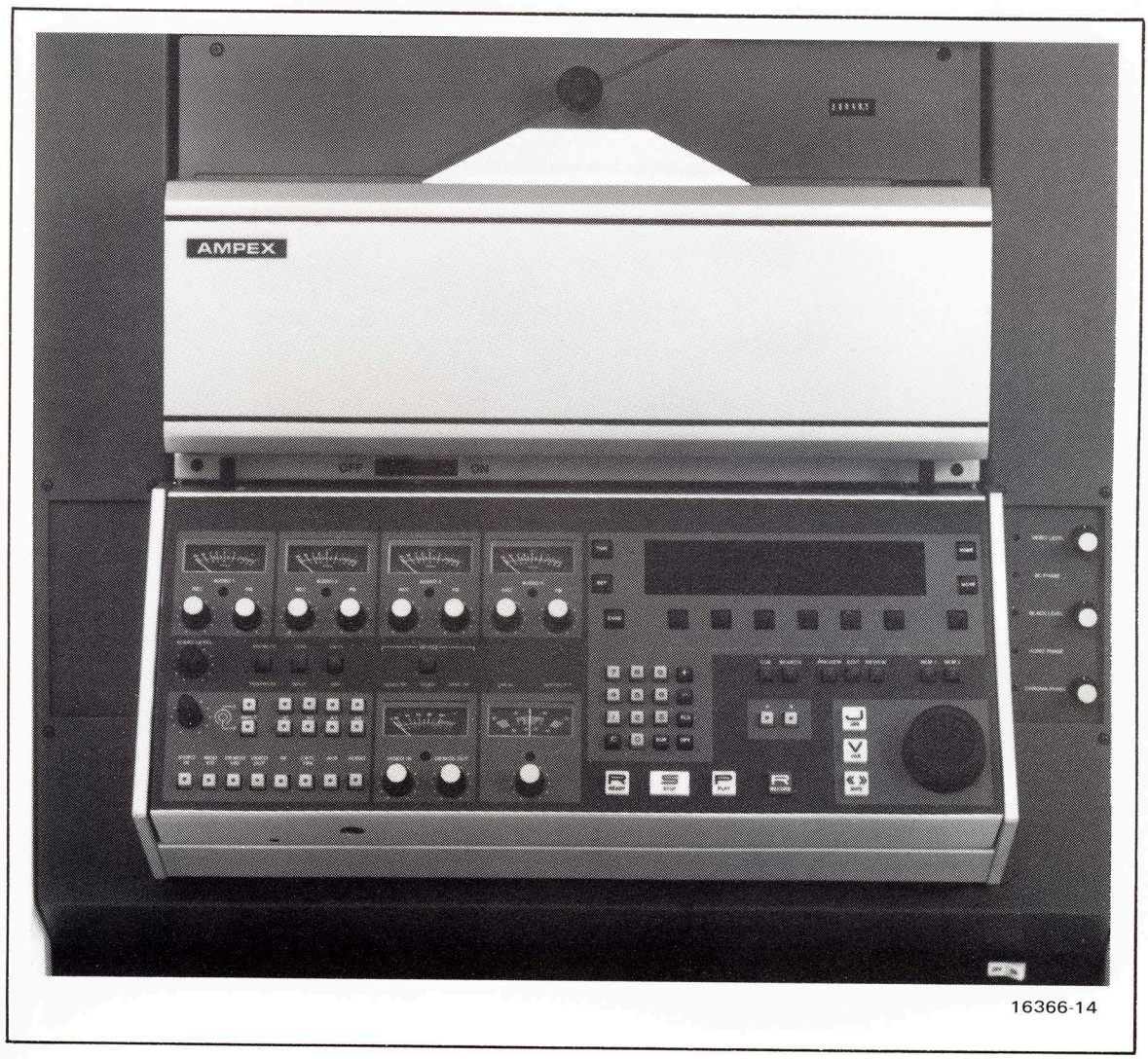


Figure 1-3. VPR-3 with Control Panel in Place

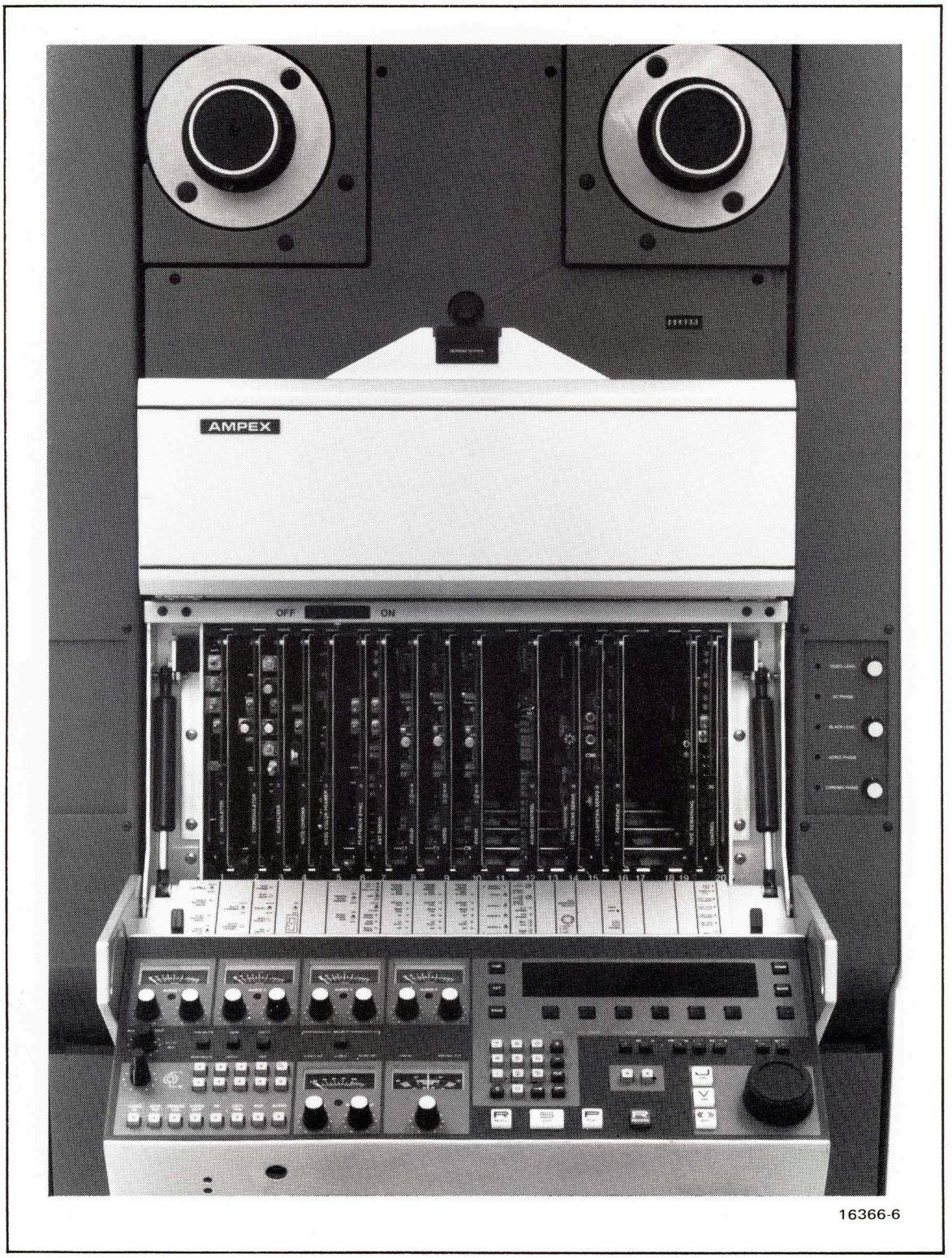
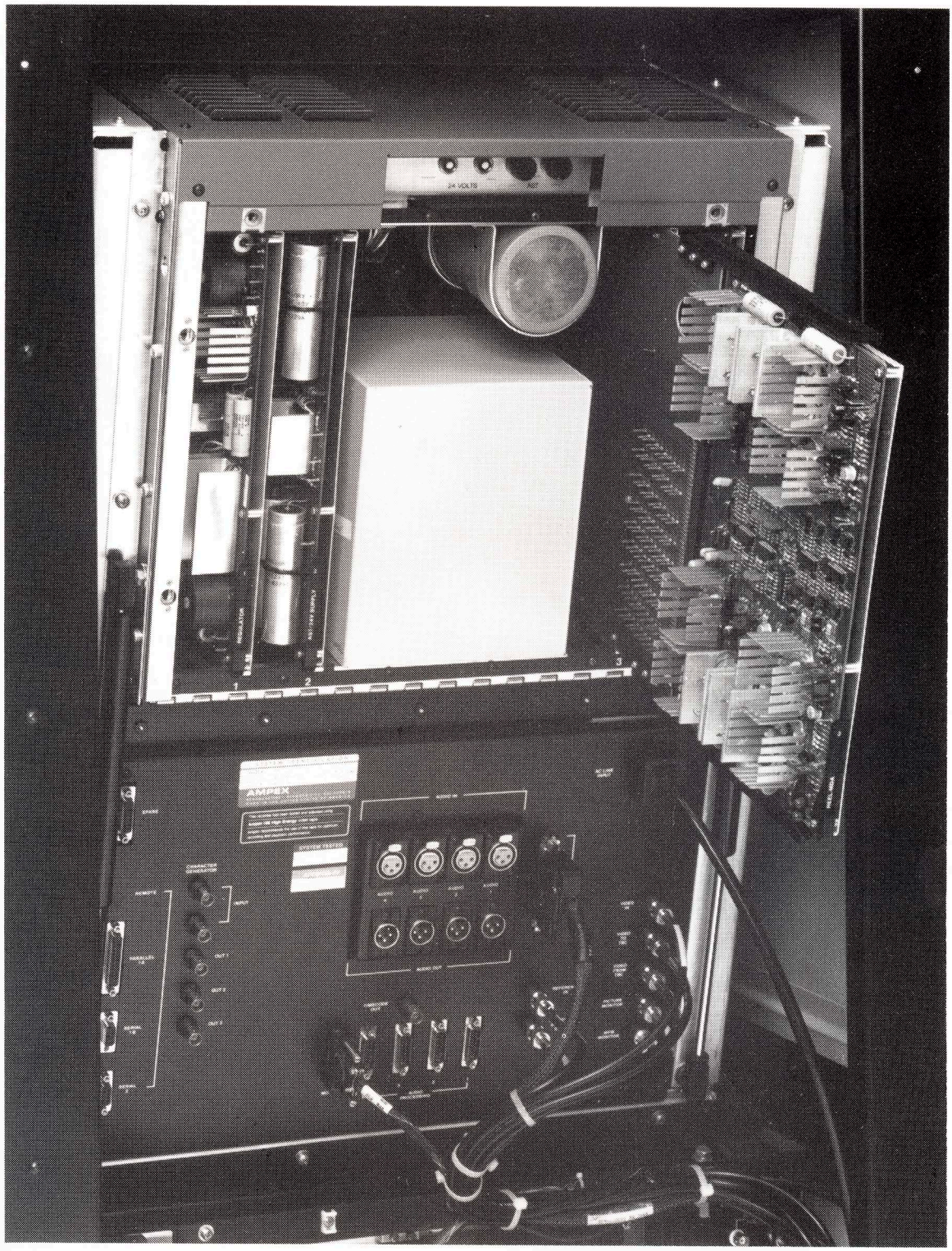


Figure 1-4. VPR-3 with Control Panel Swung Down for Servicing



16366-16

Figure 1-5. Servo and Power Supply Card Cage in Place

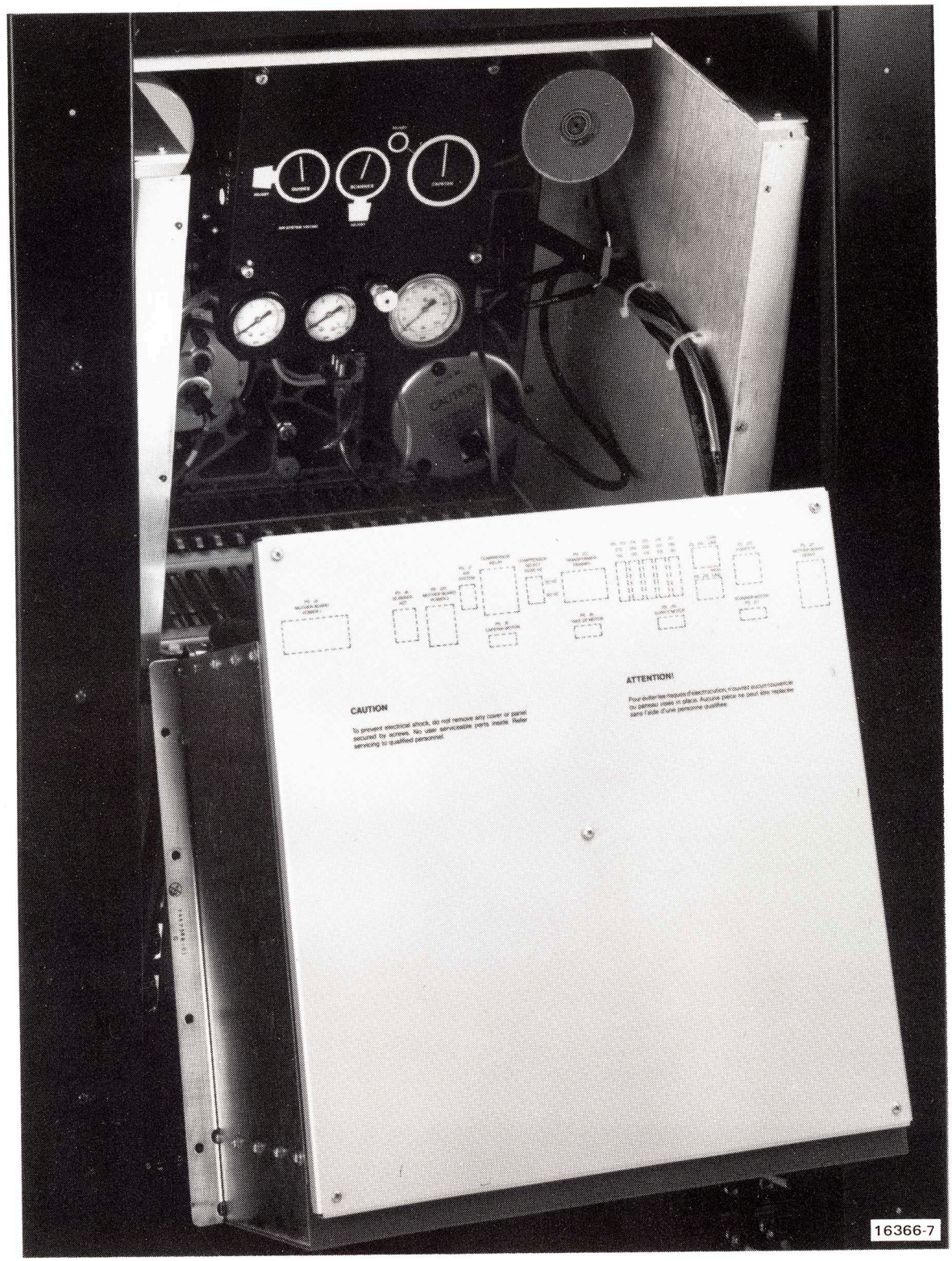


Figure 1-6. Servo and Power Supply Card Cage Swung Down for Servicing

Optional Features

TBC-3 Time Base Corrector

The TBC-3 Time Base Corrector provides the VPR-3 with full color, broadcast-stable, variable playback from -1x reverse to +3x forward speed. The operator may view pictures at full shuttle speed (±50x play speed), ensuring time-efficient editing decisions. Twenty horizontal lines of digital picture memory on the 625-line standard and sixteen horizontal lines of memory on the 525-line standard guarantee a disturbance-free picture, regardless of the time base error.

Time Code Reader-Generator/Character Generator

The Time Code Reader-Generator/Character Generator is a single-PWA option that is easily installed in the VPR-3 card cage. This option provides characters for the monitor screen, as well as generating and reading time code on either audio channel 3 or in the vertical interval. Installation of this option is recommended if the VPR-3 is to be interfaced to an editing system.

Digital Line-by-Line Autochroma

This single-PWA option enhances the standard field-rate autochroma circuitry. Chroma errors are corrected on a line-by-line basis within a field, providing better quality multiple-generation tape duplication. This option all but eliminates equalization adjustments when changing tapes.

Four-Channel Audio

The installation of an additional audio PWA provides the VPR-3 operator with four-channel sound capability. All necessary meters, controls, and indicators are present, and only insertion of the fourth audio PWA and four-channel head assembly is required to enable this option (EBU Type C only).

Audio Mixer

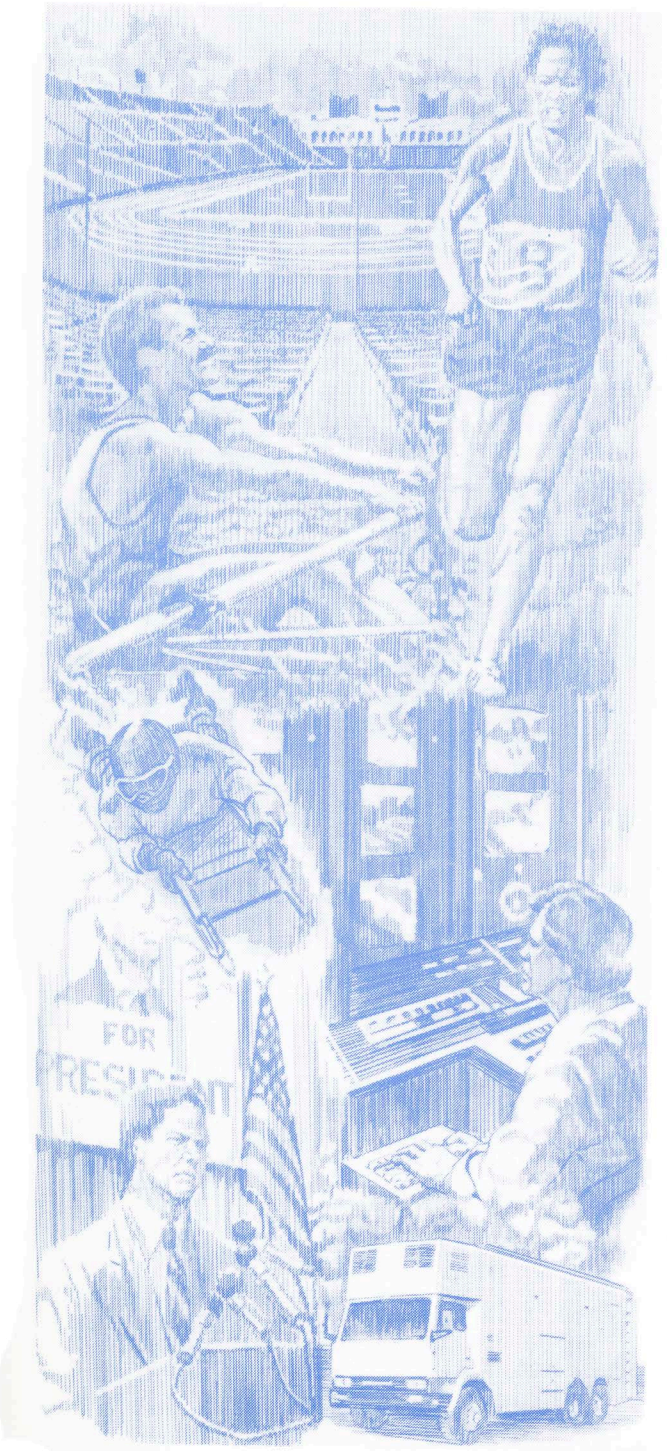
The Audio Mixer PWA allows output from all audio channels to be mixed into a single monaural signal. The Audio Mixer cannot be used with the four-channel audio option because the fourth Audio PWA and the Audio Mixer PWA share the same card cage location.

High-Fidelity Audio Monitoring

VPR-3s in the console configuration can be fitted with optional high-fidelity speakers and a 15W per channel amplifier.

Sync Channel

The sync channel option allows the user to record sync information in the track space otherwise allotted to a fourth audio channel (Option II of the SMPTE/EBU Type C Format Specification).



TECHNICAL DESCRIPTION

This section contains a description of VPR-3's audio and video signal subsystems, as well as the bus structure of the microprocessor-based control logic.

Microprocessor Control Structure

Dual Z80 microprocessors provide system control of the VPR-3. Both microprocessors are located on the Transport Control PWA. Each Z80 and its supporting logic is referred to as a "kernel". One kernel controls the audio circuitry, control panel, transport servos, and sensing mechanisms. The second kernel manages all serial interface operations.

The transport control kernel is composed of the following elements:

- The Z80 microprocessor.
- 57K of program storage (EPROM).
- 6K of scratch pad memory (RAM).
- A parallel input/output controller which is used to transmit and receive machine status during multi-machine editing.
- Various supporting logics (address decoders, counters, data buffers).

Figure 2-1 is a block diagram of the transport control kernel.

The transport control microprocessor generates a 16-bit address which is transmitted to other elements of the kernel via the system address bus. This bus also routes Z80-generated addresses off-board to the Servo, Audio Control, Tape Remaining, and Reference Generator PWAs, as well as to the control panel.

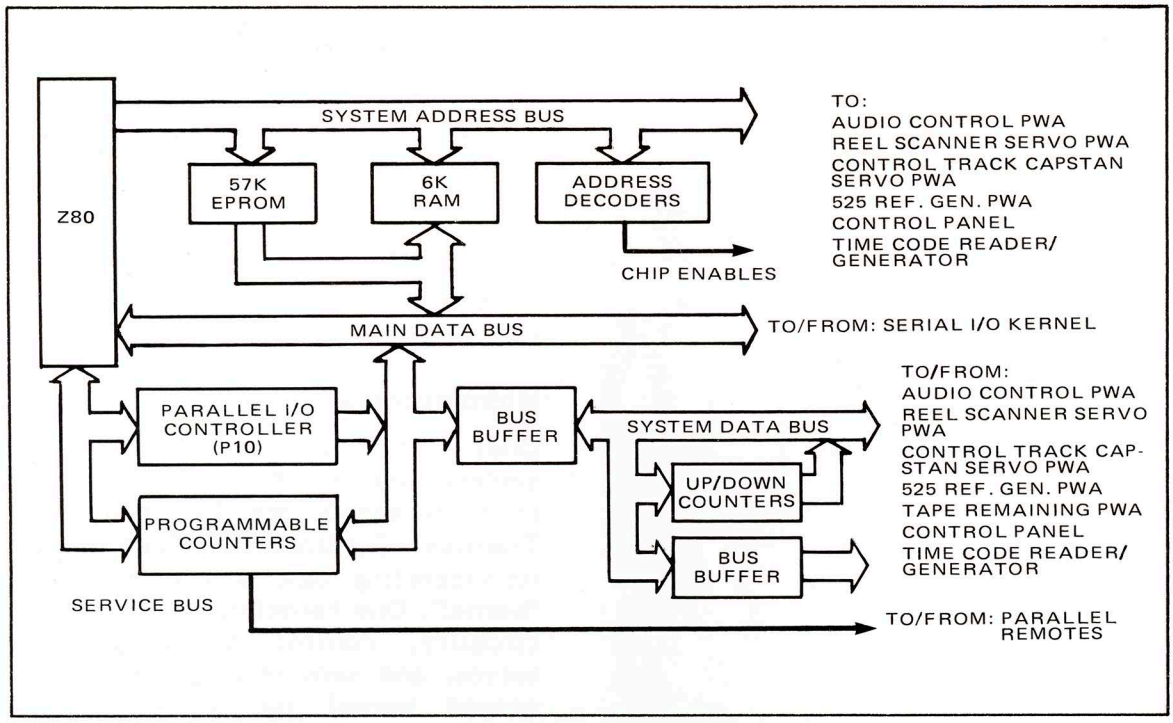


Figure 2-1. Transport Control Kernel Block Diagram

The 8-bit main data bus provides the kernel's internal data path and also supplies a data link to the serial I/O kernel. A programmable first-in first-out (FIFO) register acts as the data interface between the kernels. Off-board data from the main data bus is buffered and transmitted via the system data bus. This bus directs data to the Servo, Audio Control, Tape Remaining, and Reference Generator PWAs. Data is also sent to and from the control panel and the parallel remotes.

The serial I/O kernel consists of the following elements:

- The second Z80 microprocessor
- 16K of program storage (ROM).
- 2K of scratch pad memory (RAM).
- A second parallel input/output controller used to transmit the values set by the SMPTE machine ID switches.
- A dual asynchronous receiver transmitter used to provide a programmable interface for serial I/O data).
- Various supporting logics.

Figure 2-2 is a block diagram of the serial I/O kernel.

The serial I/O kernel is the communications link between the transport control kernel and the serial I/O ports. Kernel logic is addressed via a Z80-generated 16-bit address transmitted on the address bus.

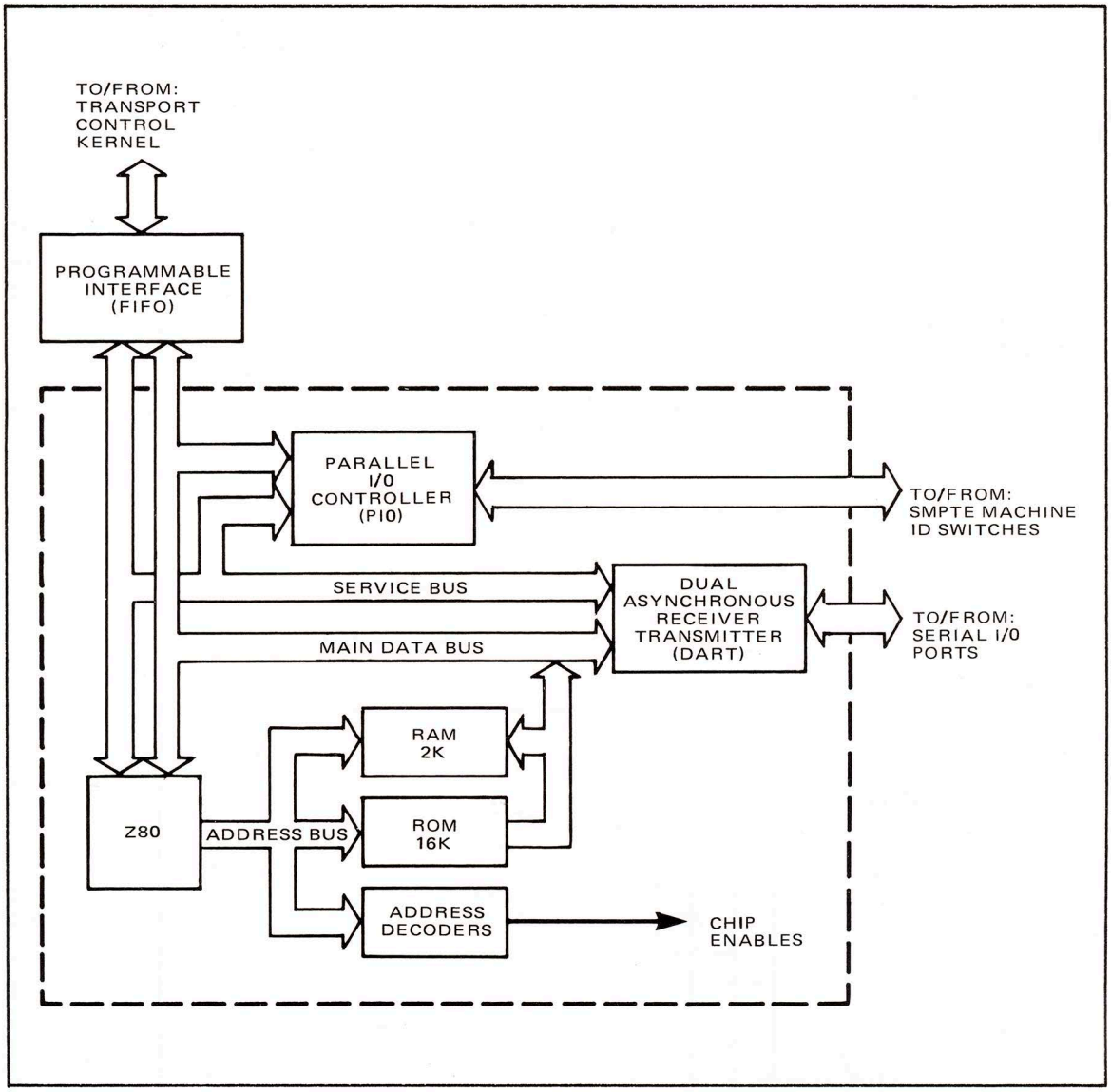


Figure 2-2. Serial Input/Output Kernel Block Diagram

The 8-bit main data bus provides a path for internal data transfers within the kernel, as well as supplying a data path between the transport control kernel and and the input/output ports. Data transmitted between kernels passes through the FIFO interface. Incoming and outgoing serial I/O data is buffered by the dual asynchronous receiver transmitter (DART).

Audio Signal Subsystem

The VPR-3 audio signal subsystem provides the signal processing neccessary for the recording, playback, and monitoring of up to four channels of audio. Record parameters (equalization, predistortion, bias, and record current level) for each channel may be set manually or automatically.

The audio subsystem, in its standard configuration, is composed of an Audio Control PWA and three identical Audio PWAs (one for each channel). An additional slot in the card cage allows for installation of either the optional Audio Mixer PWA or a fourth Audio PWA. Figure 2-3 is a block diagram of the audio signal subsystem.

The Audio Control PWA receives addresses and data from the transport control logic, via the system address and system data buses. The bus addresses are decoded to generate clock and enable signals for a series of data registers. Register data provides erase signals for the video, sync and control track heads, addressing for the on-board RAM, and audio monitor switching, as well as various video system control signals.

The RAM stores record parameter values used during tape setup operations. Values may be entered into the RAM in one of two ways: manually, using the transport control knob, or automatically, using the automatic tape optimization function.

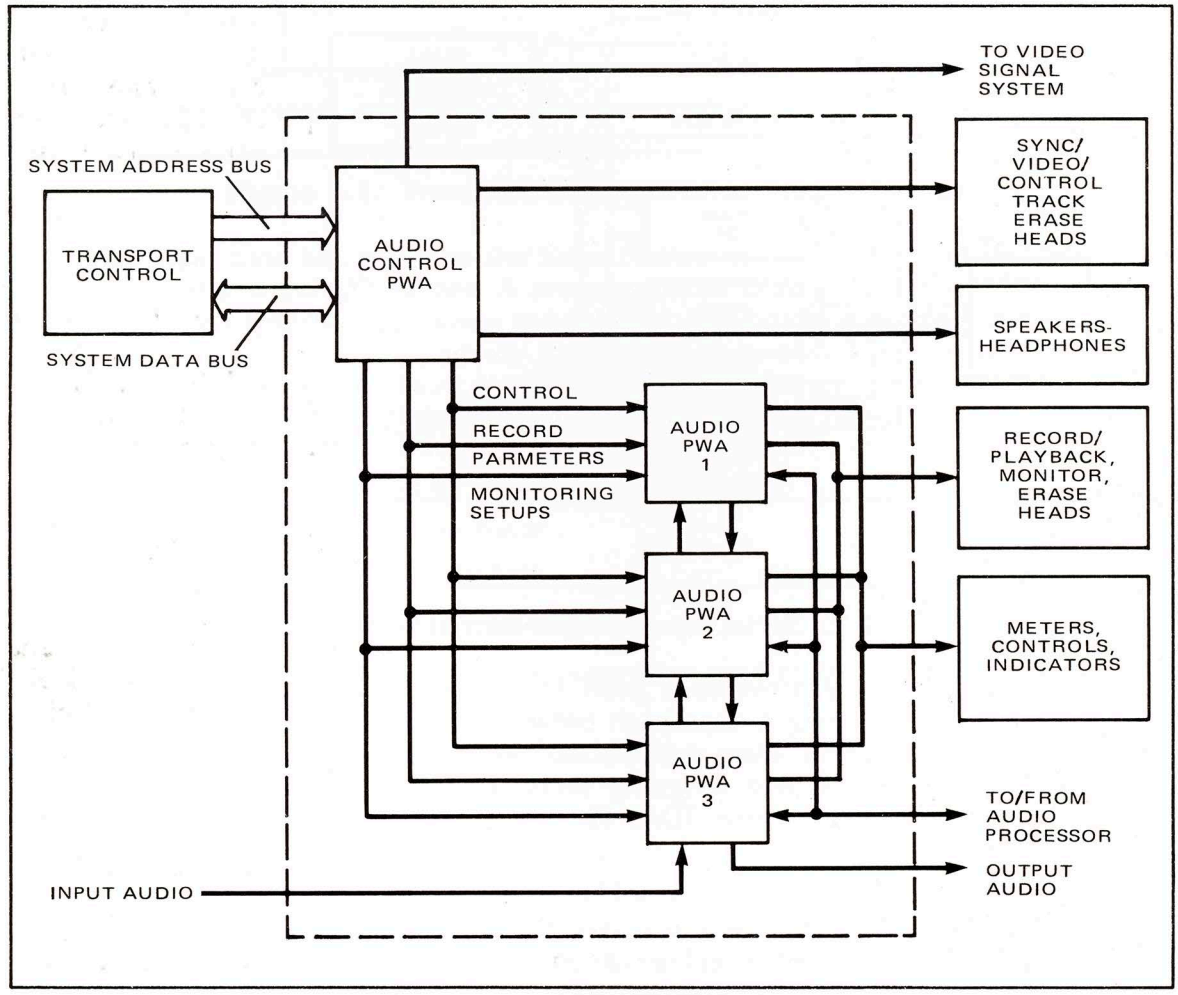


Figure 2-3. Audio Signal Subsystem Block Diagram

During automatic optimization, the VPR-3 incrementally varies the record parameter values while generating a test frequency. The Audio PWAs respond with feedback information, allowing the system to determine the optimum record values. These values are then transmitted back to the Audio Control PWA, where they are digitized and stored in memory. The optimized record parameters are read from memory and sent to the individual Audio PWAs.

Each Audio PWA receives incoming audio signals from either an external source or the playback head, as well as control and setup information from the Audio Control PWA. Data from the Audio Control PWA is decoded to provide the record parameter values and control signals neccessary to optimize the incoming audio signals.

Incoming audio passes through a transformerless differential input and is routed to the record signal processing circuitry. The signal is optimized using the decoded record parameter values and sent to the record head.

During playback, the playback signal processing circuitry receives the incoming signal from the playback head. The processed signal is sent either to the output circuitry for transmission to both an audio output port and the control panel, or to the audio processor port. The audio processor port allows the processed signal to be interfaced with external noise reduction or time compression/expansion equipment. This PWA also contains the monitor and erase head circuitry.

Video Signal Subsystem

The VPR-3 video signal subsystem provides the processing neccessary for recording, playback, and monitoring of a composite video signal. The video subsystem is composed of the following PWAs: Modulator, Demodulator, Equalizer, Record Amplifier Sync, Video Preamp, Edit Erase Oscillator, Auto Chroma (optional) and Color Framer. See Figure 2-4 for a block diagram of the video signal subsystem.

The Modulator PWA is the entry and exit point for all system video signals. Input video may be received from either the video input port (INPUT VIDEO) or from the time base corrector (TAPE VIDEO OUT). Signals derived from either of these sources are frequency modulated with a modulator-generated carrier signal and transmitted to either the TBC (TAPE VIDEO IN), the scanner assembly (REC RF OUT), the waveform monitor or the picture monitor. Signals controlling monitor selection are received from the VPR-3 audio system.

Record level control is provided by variable gain amplification of the input video, with the gain adjusted from the operator's control panel. The cable equalizer circuitry supplies jumper-selectable equalization values.

The Demodulator PWA receives either off-tape rf signals (from the Equalizer PWA) or electronics-to-electronics rf (from the Modulator PWA). The incoming signal is demodulated, amplified, and routed to the Modulator PWA for transmission.

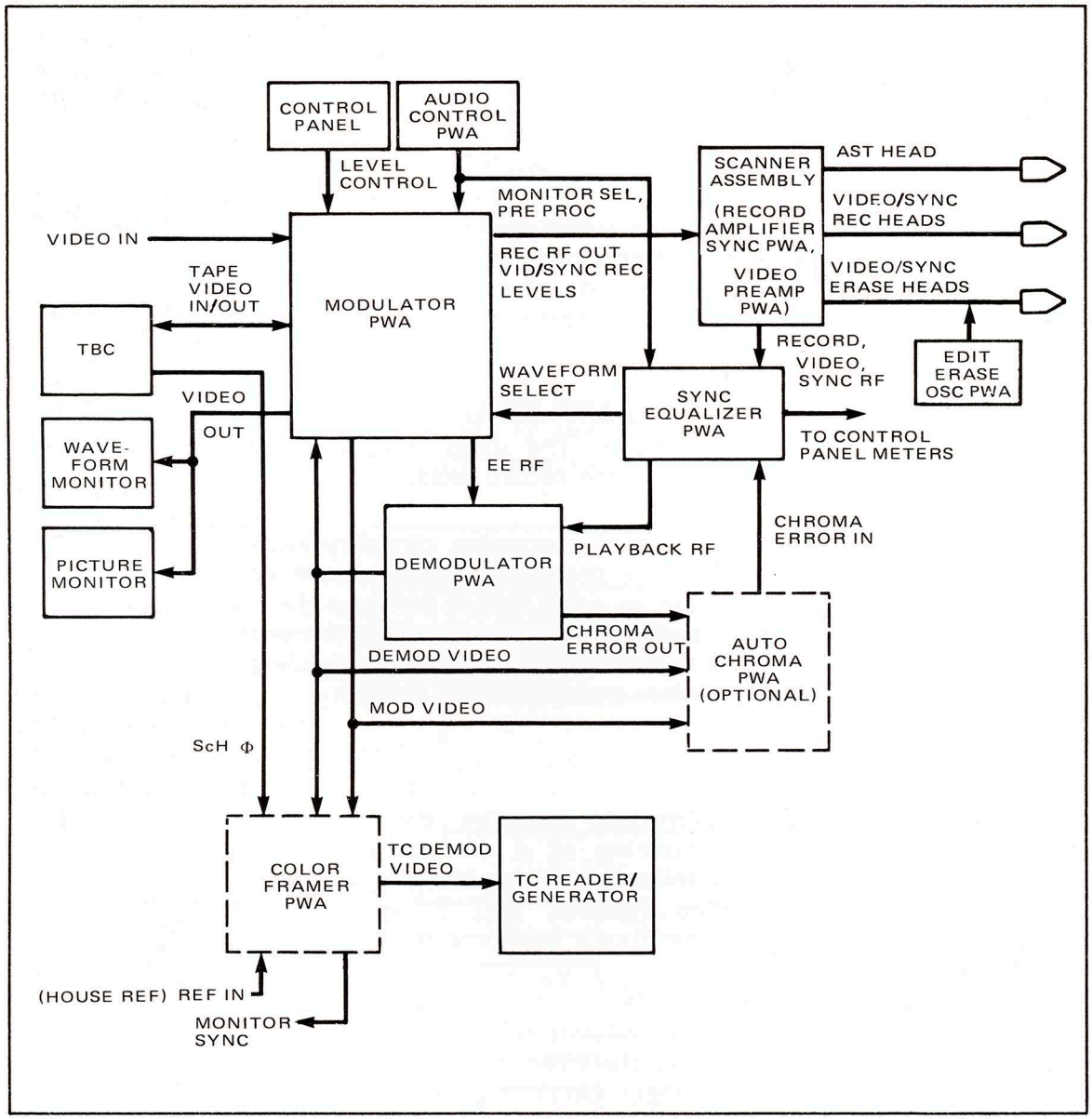


Figure 2-4. Video Signal Subsystem Block Diagram

The standard field-rate auto chroma circuitry is located on the Demodulator PWA. This circuitry generates an error signal (AUTO CHROMA ERROR), which is sent to the Equalizer PWA.

Video inputs to the Equalizer PWA are generated by the playback sync, playback video, and record playback heads (P/B SYNC RF, P/B VIDEO RF and REC HD P/B RF respectively). These signals are routed from the playback heads by the scanner assembly circuitry. The input signals are filtered to remove the distortion produced during the record/playback process and output to the Demodulator PWA as PLAYBACK RF.

The Equalizer PWA utilizes waveform and monitor select signals (from the audio and servo systems) to produce the WAVEFORM SELECT line. This line is directed to the Modulator PWA and is used to select waveforms for viewing on the waveform monitor. The auto chroma error signal from the Demodulator PWA controls equalization.

The Scanner Assembly contains the Record Amplifier Sync PWA and the Video Preamp PWA. These PWAs are located in the lower and upper portions of the scanner assembly, respectively.

The Record Amplifier Sync PWA, when in record mode, amplifies the rf signal from the Modulator PWA (REC RF OUT). The amplified signal is then directed to the video record head and to the sync record head (if installed). When in edit/play mode, the rf signal is received from the video record head, amplified and sent to the Sync Equalizer PWA.

The Video Preamp PWA contains two channels of preamplification: one for the video playback head rf signal and one for the sync playback head (if installed). The playback signals are amplified and routed to the Sync Equalizer PWA.

The Edit Erase PWA provides erase current for the video erase and sync erase heads. This PWA is mounted on the tape transport.

The optional Auto Chroma PWA receives modulated and demodulated video signals from the Modulator and Demodulator PWAs respectively. Alteration of the playback equalization values provides line-by-line chrominance correction for the selected rf signal. The auto chroma error signal controls this correction from the Demodulator PWA. The chrominance-corrected output is sent to the Equalizer PWA.

The Color Framer PWA determines the transport's precise parking location by identifying the exact field on which the tape is stopped. The Color Framer PWA receives modulated and demodulated video signals, the house reference signal (REF IN), as well as a signal from the TBC which provides the phase relationship between the subcarrier and horizontal sync (ScHΦ). Outputs are a video signal to the time code reader/generator and a sync signal to the monitors.

SYSTEM OVERVIEW

This section describes additional Ampex audio and video equipment designed to support and complement the VPR-3, and how this equipment functions as a system.

In addition to its impressive stand-alone capabilities, the VPR-3 is designed to operate as an integral part of a complete Ampex audio/video system. The VPR-3 may be effectively combined with the following Ampex equipment in either a postproduction or on-air environment:

- The **Ampex Computerized Editor (ACE)** provides complete, centralized control of the postproduction system. ACE is used to operate a special effects generator, a production switcher, and up to 16 video tape recorders from a remote location. ACE also simplifies the editing process by repairing edit overlaps and filling in gaps automatically.

- **Ampex Digital Optics (ADO)** allow video images to be modified and manipulated at real-time video rates. Pictures may be rotated around any combination of axes in three dimensions and displayed with true perspective in the third dimension.

- **Ampex 4100** and **AVC** production switchers bring multilevel mix effects capabilities to the studio. These switchers combine a high degree of video performance with ease of operation.

- The **SMC-100 Slow Motion Controller** is used in a live video context to provide remote speed control for the VPR-3. This unit can control transport speed modes from freeze frame to variable speed shuttle.

- The **Electronic Still Store** system **(ESS-3)** holds from 100 to 6400 still pictures on disk for immediate use by the studio. Video processing techniques, specifically designed for still images, yield playback pictures whose quality often exceeds that of the originals.

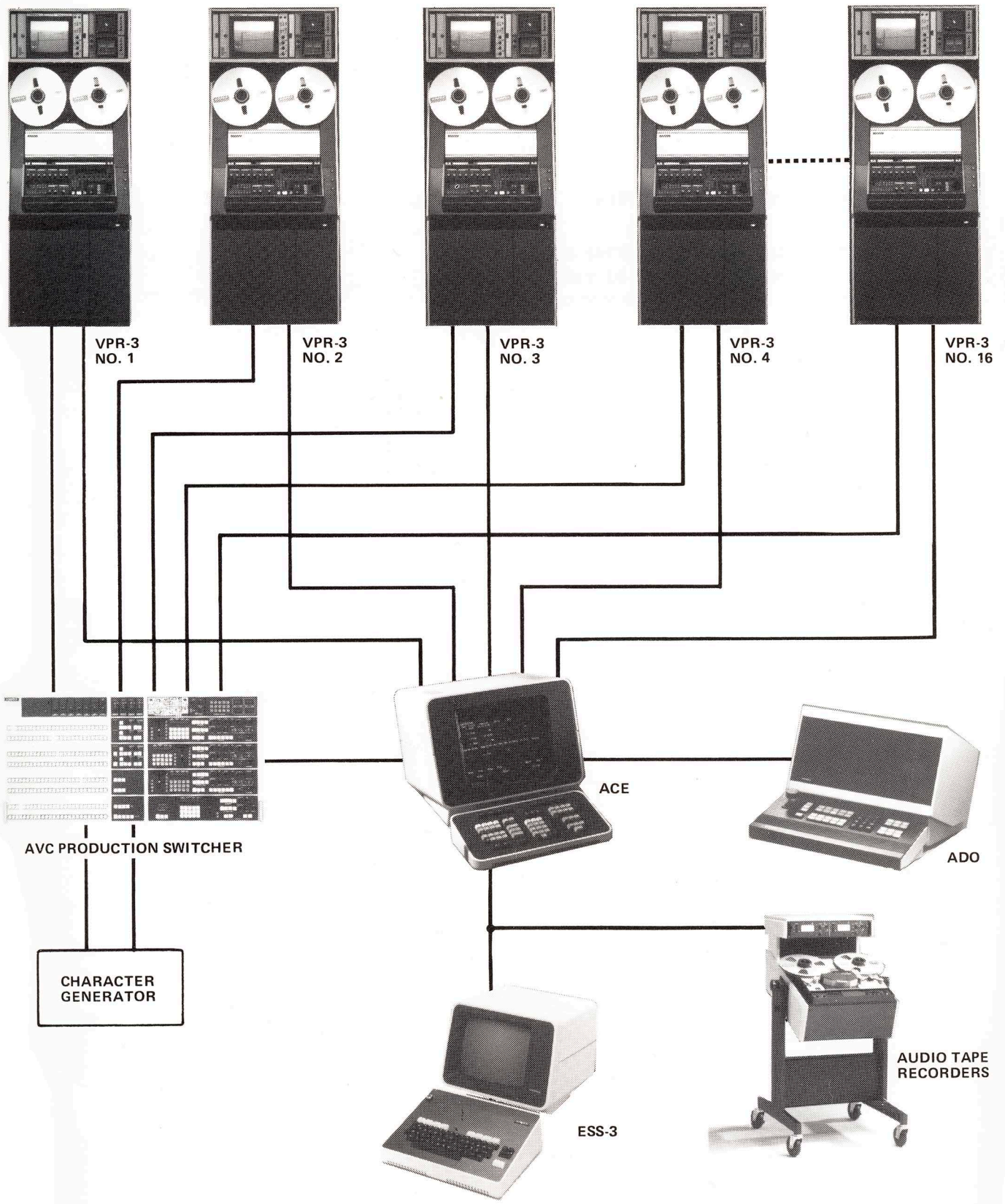


Figure 3-1. Typical Post Production Studio

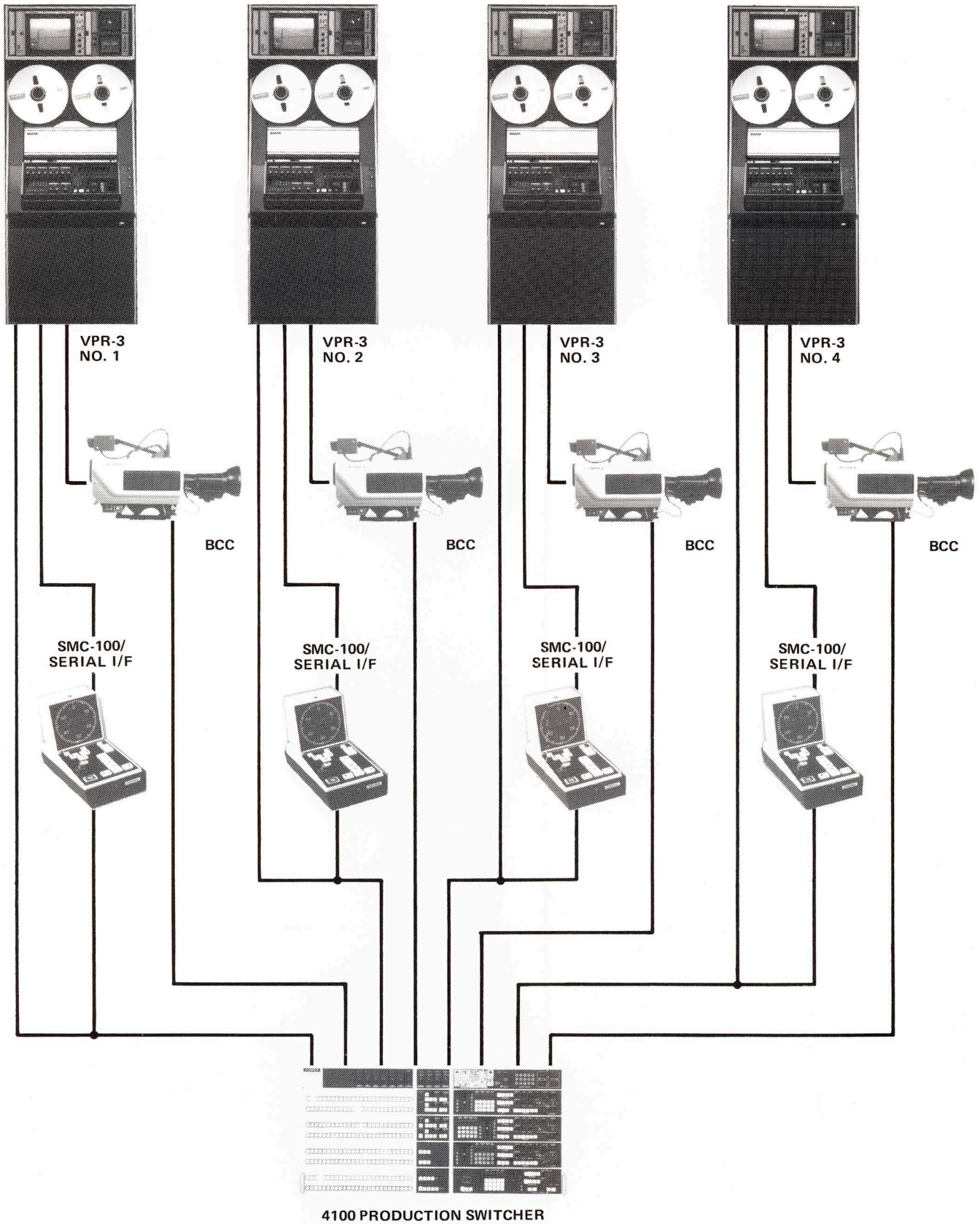
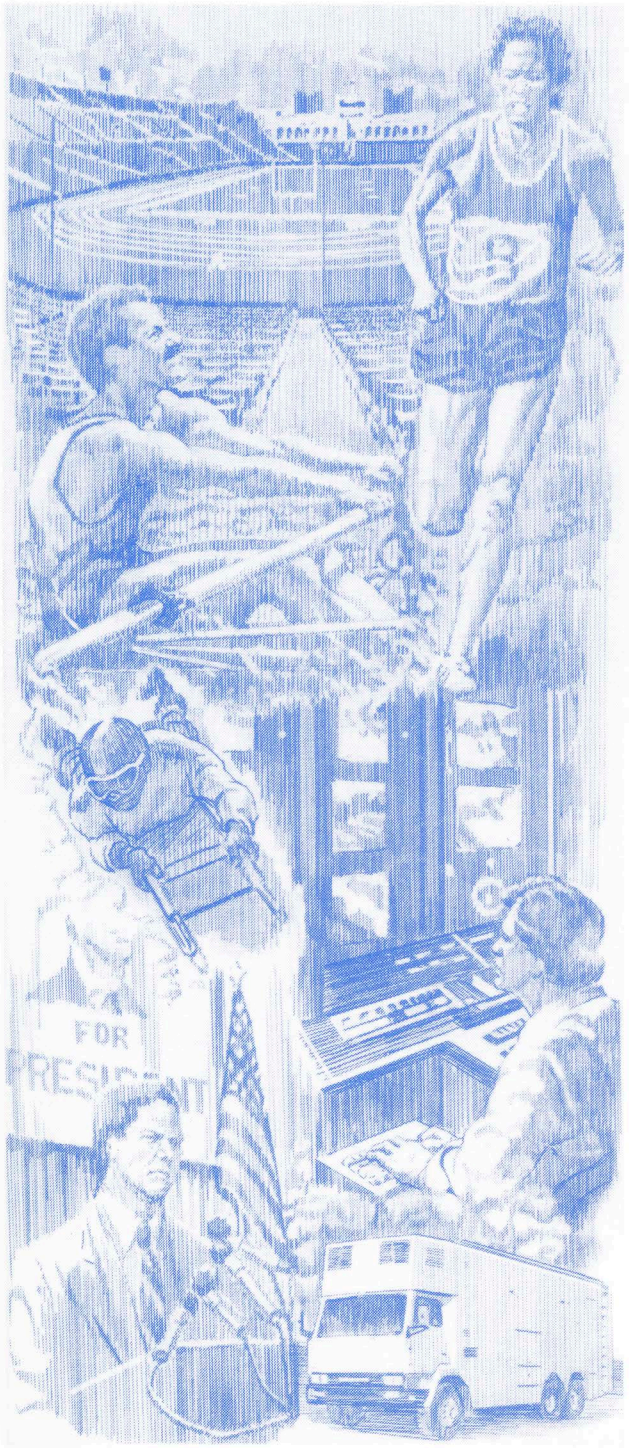


Figure 3-2. Typical Mobile (On-Air Studio)



PHYSICAL DESCRIPTION

This section includes information necessary to install and interface a VPR-3 into any existing studio environment.

Configurations and Dimensions

The VPR-3 is available in three configurations: table top, rack mount and console. The console configuration is designed to house the VPR-3, the TBC-3, a picture monitor, waveform and vector monitors and the optional high-fidelity audio system.

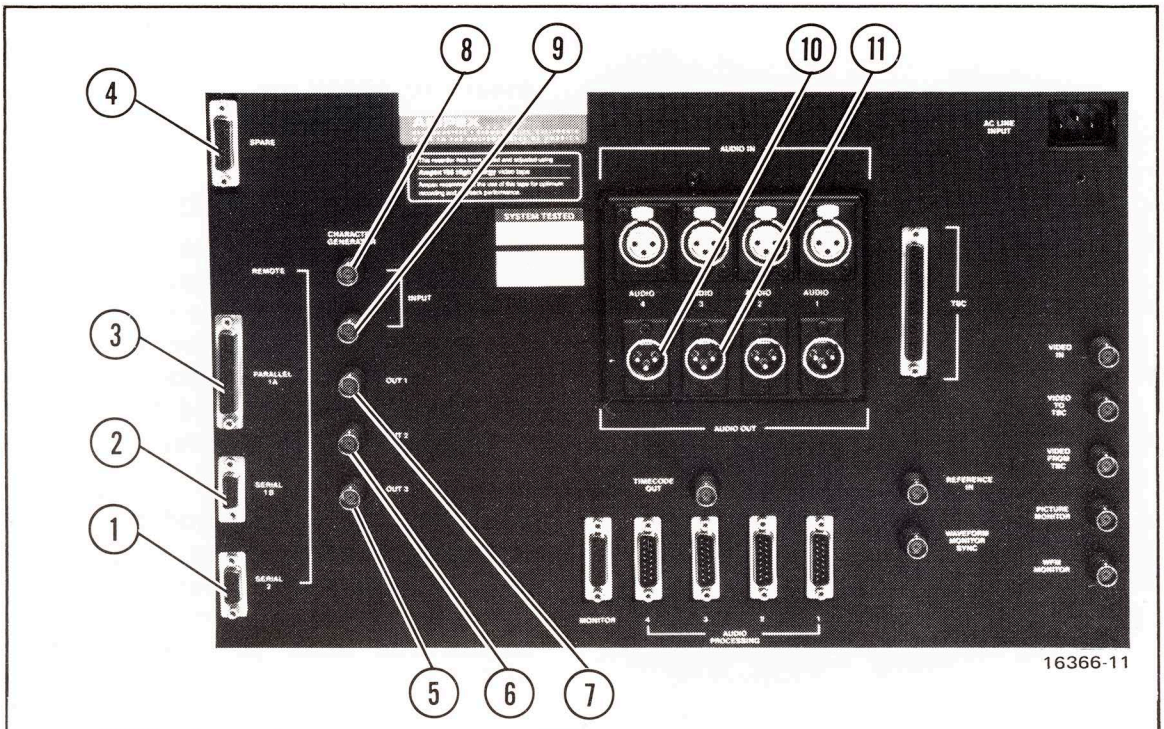
In order to accommodate various mounting configurations, reel motors have an adjustable mounting base. In the outer position, 14-in. reels may be fitted. The inner position allows the VPR-3 to be installed in a 19-in. equipment rack, with a maximum reel diameter of 11-3/4 in. A minor modification to the rack, available with the VPR-3 rack-mount kit, allows 14-in. reels to be used in the rack mount configuration. (See Figure 4-1.)

Installation Requirements

Install the VPR-3 in a well-ventilated area that is free from vibration. Ambient air should be dust-free with a temperature between 0°C and 45°C. The humidity range must fall between 0% and 90% (noncondensing). Do not locate the machine near any strong electromagnetic fields (some common sources of interference are fluctuating loads on high-current lines, heavy duty transformers, elevator motors, and radio/television transmitting equipment).

VPR-3 power requirements depend on the machine's configuration and its operational mode (e.g., a large current draw occurs when shuttle mode is initiated). The power supply operating ranges are from 95 Vac to 135 Vac and from 190 Vac to 270 Vac. These voltages are selectable in 10V increments.

Table 4-1. VPR-3 Signal Input/Output Connections



Index No.	Reference Designator	Name	Type	Description
1	J56	REMOTE SERIAL 2	9-socket receptacle	Provides RS-422A-compatible connection to serial control bus of microprocessor-based videotape editing system.
2	J55	REMOTE SERIAL 1B	9-socket receptacle	Provides RS-422A-compatible connection to serial control bus of microprocessor-based videotape editing system.

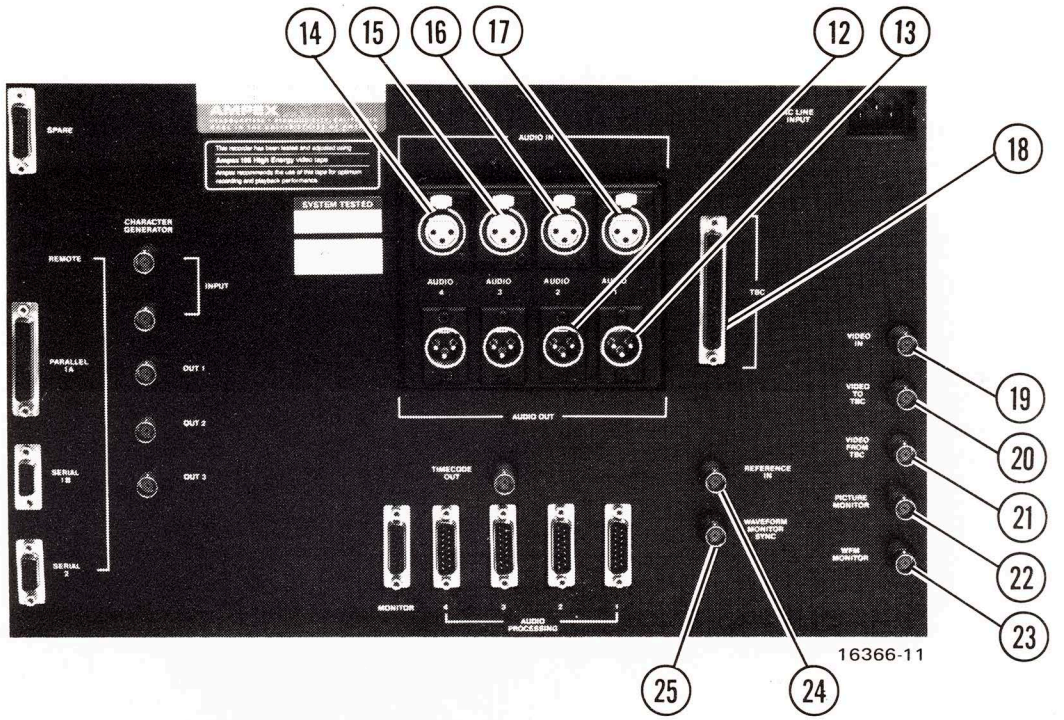
(Continued next page)

Table 4-1. VPR-3 Signal Input/Output Connections (Continued)

Index No.	Reference Designator	Name	Type	Description
3	J54	REMOTE PARALLEL 1A	25-socket receptacle	Primary machine controls (play, stop, shuttle, etc.) and auto play (MVC) capability
4	Spare	SPARE		
5	J61	CHARACTER GENERATOR OUT 3	Insulated (75Ω) BNC	Character generator output
6	J60	CHARACTER GENERATOR OUT 2	Insulated (75Ω) BNC	Character generator output
7	J59	CHARACTER GENERATOR OUT 1	Insulated (75Ω) BNC	Character generator output
8	J57	CHARACTER GENERATOR INPUT	Insulated (75Ω) BNC (terminated)	External video reference input
9	J58	CHARACTER GENERATOR INPUT	Insulated (75 Ω) BNC (terminated)	External video reference input
10	J46	AUDIO OUT AUDIO 4	XLR	Audio CH 4 line output (less than 50Ω impedance)
11	J44	AUDIO OUT AUDIO 3	XLR	Audio CH 3 line output (less than 50Ω impedance)

(Continued next page)

Table 4-1. VPR-3 Signal Input/Output Connections (Continued)



Index No.	Reference Designator	Name	Type	Description
12	J42	AUDIO OUT AUDIO 2	XLR	Audio CH 2 line ouput (less than 50Ω impedance)
13	J40	AUDIO OUT AUDIO 1	XLR	Audio CH 1 line output (less than 50Ω impedance)
14	J45	AUDIO IN AUDIO 4	XLR	Audio CH 4 line output (50 KΩ impedance)
15	J43	AUDIO IN AUDIO 3	XLR	Audio CH 3 line input (50 KΩ impedance)
16	J41	AUDIO IN AUDIO 2	XLR	Audio CH 2 line input (50 KΩ impedance)

(Continued next page)

Table 4-1. VPR-3 Signal Input/Output Connections (Continued)

Index No.	Reference Designator	Name	Type	Description
17	J39	AUDIO IN AUDIO 1	XLR	Audio CH 1 line input (50 KΩ impedance)
18	J36	TBC	37-socket receptacle	Connects TBC to VPR-3
19	J31	VIDEO IN	Insulated (75Ω) BCN	Connects external video to VPR
20	J32	VIDEO TO TBC	Insulated (75Ω) BNC	Connects VPR video to TBC. This will be VPR input video to be pre-processed by TBC before being recorded on tape, or off-tape playback video being routed to TBC.
21	J33	VIDEO FROM TBC	Insulated (75Ω) BNC	Timebase corrected video output
22	J34	PICTURE MONITOR	Insulated (75Ω) BNC	Video to picture monitor
23	J35	VIDEO OUT TO WAVE-FORM MONITOR	Insulated (75Ω) BNC	Video to waveform monitor
24	J37	REFERENCE IN	Insulated (75Ω) BNC	Video reference input
25	J38	MONITOR SYNC	Insulated (75Ω) BNC	Waveform monitor sync

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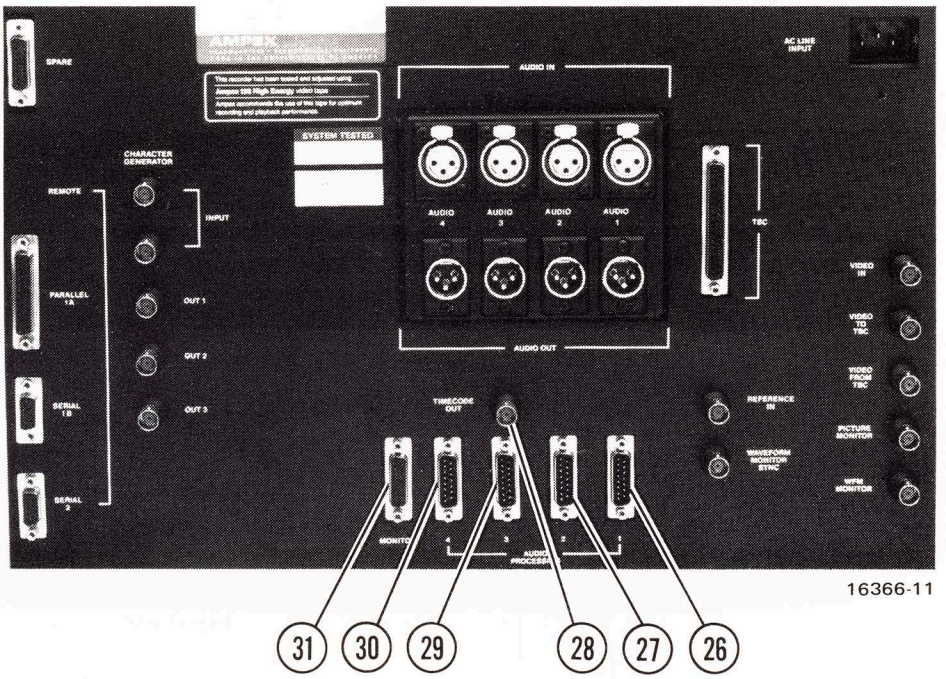
Table 4-1. VPR-3 Signal Input/Output Connections (Continued)



Index No.	Reference Designator	Name	Type	Description
26	J48	AUDIO PROCESSING 1	15-pin receptacle	Audio processing signals and control.
27	J49	AUDIO PROCESSING 2	15-pin receptacle	Audio processing signals and control.
28	J47	TIMECODE OUT	Insulated (75Ω) BNC	Time code output.
29	J50	AUDIO PROCESSING 3	15-pin receptacle	Audio processing signals and controls.

(Continued next page)

Table 4-1. VPR-3 Signal Input/Output Connections (Continued)

Index No.	Reference Designator	Name	Type	Description
30	J51	AUDIO PROCESSING 4	15-pin receptacle	Audio processing signals and controls.
31	J52	MONITOR	15-socket receptacle	Monitor bridge interconnect

Table 4-2. VPR-3 Pin Assignments

Reference Designation	Ampex P/N	Vendor/ P/N	Pin Assignment
J55,J56	140-736	Positronics MD-9F3300	1,9 ground 2 TRANSMIT A 7 TRANSMIT B 8 RECEIVE A 3 RECEIVE B
J54	140-738	Positronics MD-25F3300	25 +12V LAMP 13 ground 2 RECORD LAMP 14 RECORD SWITCH 3 READY LAMP 15 READY SWITCH 16 STOP LAMP 5 STOP SWITCH 17 PLAY LAMP 19 PLAY SWITCH 18 SHUTTLE LAMP 20 SHUTTLE SWITCH 7 REMOTE LAMP 21 SYSTEM FAULT LAMP

(Continued next page)

Table 4-2. VPR-3 Pin Assignments (Continued)

Reference Designation	Ampex P/N	Vendor/ P/N	Pin Assignment
J54 (Cont.)	140-738	Positronics MD-25F3300	23 REM SHUTTLE TACH A 24 REM SHUTTLE TACH B 8 EXT CMD AUDIO 10 MVC SEND 22 MVC CUE 11 MVC RCV 6 REM ANALOG VOLTS 12 VAR PLAY LAMP 9 VAR PLAY SWITCH 4 EXT CMD VIDEO 1 SPARE
J31,J32, J33, J34, J35, J37, J38,J47, J57,J58, J59,J60, J61	140-729	AMP 226993-6	
J40,J42, J44,J46,	140-670	Switchcraft Y3MPC	ground A OUT LO A OUT HI
J39,J41, J43,J45,	140-667	Switchcraft Y3FPC	A IN HI A IN LO ground
J52	140-737	Positronics MD-15F3300	1 MON CONSOLE L AUDIO 2 MON CONSOLE R AUDIO 9 MON CONSOLE OFF/ON 14, +24V SOLENOID 15 8 -WFM MON RELAY 3,4, ground 7,10

(Continued next page)

Table 4-2. VPR-3 Pin Assignments (Continued)

Reference Designation	Ampex P/N	Vendor/ P/N	Pin Assignment
J36	140-739	Positronics MD-37F3300	15 SYSTEM UNITY 33 ScHΦ 26 TBC PLAYBACK SYNC 31 TBC STEP FWD 1 32 TBC STEP FWD 2 20 TBC STEP BACK 1 21 TBC STEP BACK 2 28 TBC 2H GATE 25 TBC HDSW/VERT DO 30 SYNC HEAD PROCESS 23 SYNC RETARD 22 FRAME/FIELD 24 SPARE 6 FAST SHUTTLE 27 SLOW MOTION 9 ZERO OFFSET 29 TBC DO PULSE 34 RECEIVE A 35 RECEIVE B 36 SEND A 37 SEND B 5 EDIT MUTE 4 OLY ID/GND 1-3, ground 7,8,10,11,13,14,16-19
J48,J49, J50,J51,	140-735	Positronics MD-15M3300	6 -AUDIO CAP TACH 8,15, SPARE 9,10,13 7 PROC ENCODE SEND 5 PROC ENCODE REC 4 PROC DECODE REC 3 PROC DECODE SEND 2 ENCODE/DECODE 1 PROC BYPASS IN 11, ground 12,14

Table 4-3. VPR-3 Specifications (Using Ampex 196 Tape or Equivalent)

Characteristics	PAL/SECAM 625/50	NTSC/PAL-M 525/60
Video and Sync		
Bandwidth	flat to 5.0 MHz ±0.5 dB -3 dB at 6.0 MHz	flat to 4.2 MHz ±0.5 dB -3 dB at 5.0 MHz
Signal-to-noise (Rhode and Schwarz unweighted with bandpass filter) using TBC-3	-43 dB p-p video to RMS noise on interchange basis.	-46 dB p-p video to RMS noise on interchange basis.
LF linearity	2% blanking to white max	2% blanking to white max
Differential gain	4% blanking to white max	4% blanking to white max
Differential phase (40 IEEE units of subcarrier through TBC-3)	4° at 4.43 MHz off-tape max	4° at 3.58 MHz off-tape max
Chrominance/Luminance Delay	25 ns max	20 ns max
2T $\sin^2$ pulse and bar	1% K-factor max	1% K-factor max
Moire	-36 dB color bars 75% amplitude 4.43 MHz subcarrier	-40 dB color bars 75% amplitude 3.58 MHz subcarrier
Audio (CH 1, 2, and 3)		
Frequency response (400 Hz ref) 100 nWb/m reference level	±1 dB 200 Hz to 12 kHz ±2 dB 50 Hz to 18 kHz	±1 dB 200 Hz to 12 kHz ±2 dB 50 Hz to 18 kHz
Signal-to-noise (with respect to +8 dB above reference level) 20 Hz to 20 kHz	-56 dB audio 1 and 2, -54 dB for Audio 3(1)	-56 dB audio 1 and 2, -54 dB for audio 3(1)

(Continued next page)

Table 4-3. VPR-3 Specifications (Using Ampex 196 Tape or Equivalent) (Continued)

Characteristics	PAL/SECAM 625/50	NTSC/PAL-M 525/60
Audio (CH 1, 2, and 3) (Cont.)		
Distortion (measured at 1 kHz)(3 HD)		
@ 100 nWb/m reference	1% max	1% max
@ 251 nWb/m peak level	3% max	3% max
Predistortion at 200 nWb/m (+14 dBm)	1% max	1% max
Depth of erasure on its own recording	-70 dB	-70 dB
Wow and flutter	0.07% DIN weighted (R/P)	0.07% NAB unweighted (flutter tape)
Playback crosstalk (audio 1 and 2) 1 kHz referenced to +8 dBm or 100 nWb/m	-60 dB max	-60 dB max
General		
Record time	190 min nominal; 9200 ft of tape	190 min nominal; 9200 ft of tape
Shuttle time	less than 72s for 60-min tape, 3.6 min for a 3-hr tape.	less than 72s for 60-min tape, 3.6 min for a 3-hr tape.
Tape timer accuracy (control track updated)	±0.1 field with continuous control track	±0.1 field with continuous control track
Tape speed	239.8 ±0.5 mm/s; 9.44 ±0.02 in/s	244 ±0.5 mm/s; 9.606 ±0.02 in/s;
Video writing speed	842 in/s nominal	1009 in/s nominal
FM carrier frequencies	7.68 MHz blanking, 8.9 MHz peak white	7.9 MHz blanking 10.0 MHz peak white

(Continued next page)

Table 4-3. VPR-3 Specifications (Using Ampex 196 Tape or Equivalent) (Continued)

Characteristics	PAL/SECAM 625/50	NTSC/PAL-M 525/60
General (Continued)		
Audio equalization (time constants)	15 µs 3180 µs	15 µs
Lock-up time from ready mode	20 ms	20 ms
Signal Inputs		
Video input (75Ω BNC)	0.5V to 2 Vp-p	0.5V to 2 Vp-p
Ref video (75Ω BNC)		
Comp Video	0.5V to 2V	0.5V to 2V
Comp Sync	0.7V to 4V	0.7V to 4V
Audio line inputs	-24 dBm to +24 dBm, +8 dBm nominal	-24 dBm to +24 dBm, +8 dBm nominal
Impedance, transformerless, true differential	balanced; 65 KΩ resistive	balanced; 65 KΩ resistive
Signal Outputs		
Video output (75Ω) BNC	1.0 Vp-p	1.0 Vp-p
Audio line output, transformerless, true differential	+8 dBm nominal; balanced +24 dBm max(2)	+8 dBm nominal; balanced +24 dBm. max(2)
Impedance	less than 20Ω	less than 20Ω
Headphone audio Monitor	0 dBm to drive 600Ω	0 dBm to drive 600Ω
Power Input		
Power line frequency	50 Hz, single phase	60 Hz, single phase

(Continued next page)

Table 4-3. VPR-3 Specifications (Using Ampex 196 Tape or Equivalent) (Continued)

Characteristics	PAL/SECAM 625/50	NTSC/PAL-M 525/60
Power Input (Continued)		
Input voltages	190/210/230/250/270/ Vac, ±5%	95/105/115/125/135 Vac, ±5%
Input current (table top)	230 Vac, nominal 1.8A**	115 Vac, nominal 3.5A*
Input current (lowboy console TBC and color monitor bridge)	230 Vac, nominal 3.5A**	115 Vac, nominal 7.0A*
Temperature and Humidity		
Temperature	0° C to 45° C	0° C to 45° C
Humidity	10% to 90% RH (noncondensing)	10% to 90% RH (noncondensing)
	* Additional 12A, 1s shuttle start surge **Additional 6A, 1s shuttle start surge	

(1) Audio 3 channel has wide-band capability for Time Code (S/N WB-30 dB)
(2) Can be readjusted downward by 12 dBm.

Table 4-4. VPR-3 Physical Requirements

Physical Dimensions	Rack Mount	Table Top	Studio Console w/Monitor Bridge and TBC
Height	29.75 in. 75.56 cm	30.5 in. 77.47 cm	75.5 in. 191.77 cm
Width	19.0 in.* 48.26 cm	22.0 in. 55.88 cm	29.875 in. 75.86 cm
Depth	25.75 in. 65.4 cm	26.5 in. 67.31 cm	32.00 in ** 81.28 cm
Weight	270 lb 122.47 kg	275 lb 124.74 kg	650 lb 294.84 kg

* + 2 in. front mounting trim and control panel
**Removable control panel reduces depth to 27 in.

CONSOLE

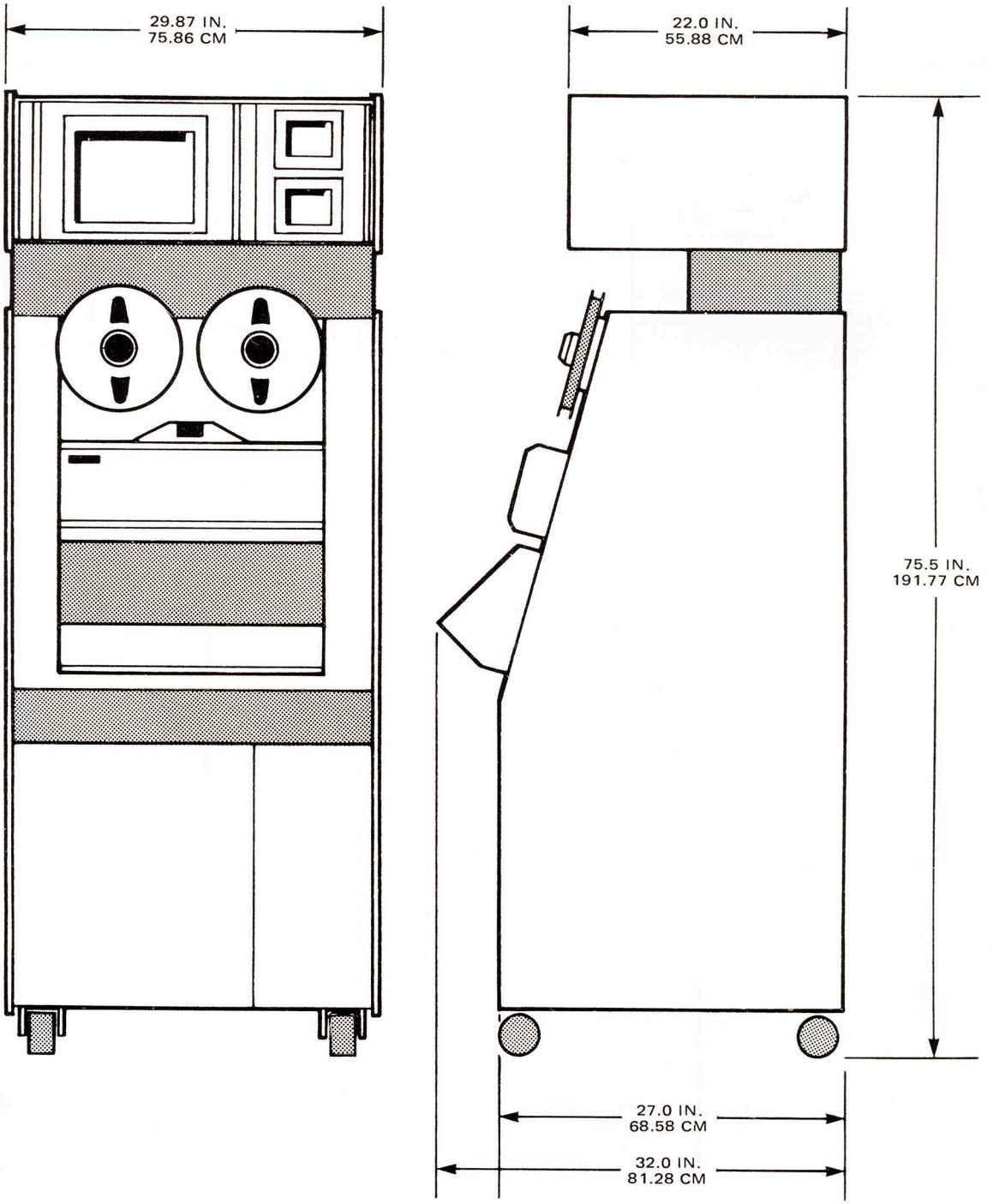
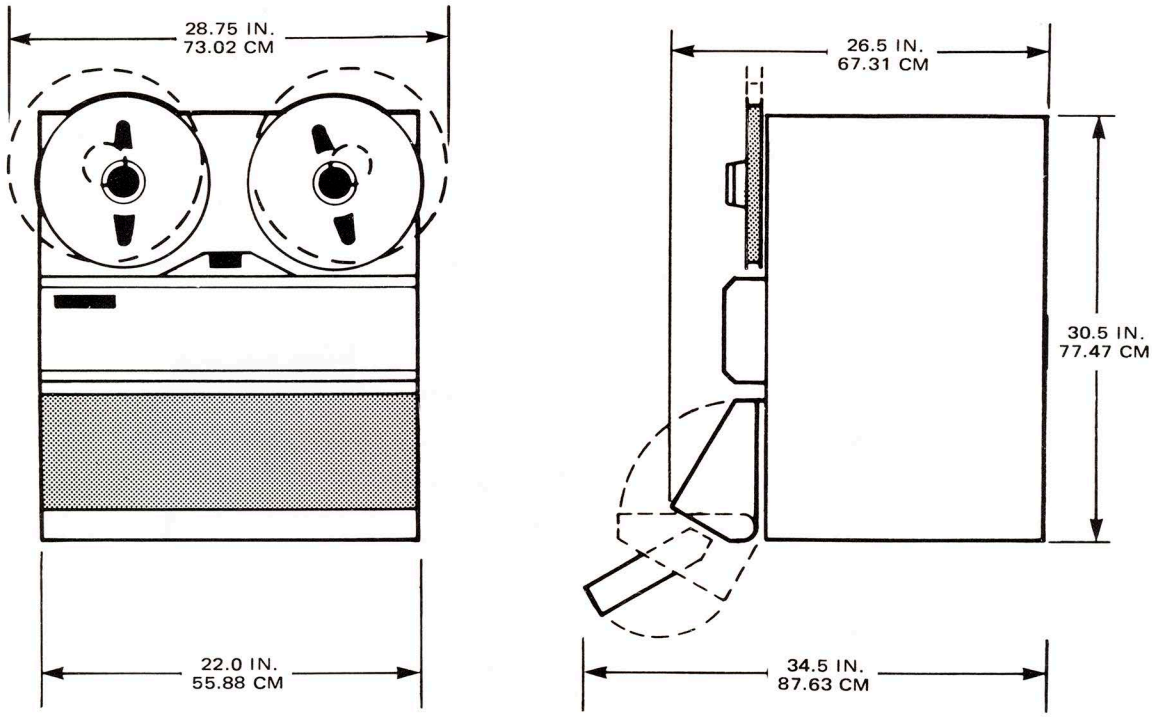


Figure 4-1. (1 of 3)

TABLE TOP



SELECTABLE REEL SIZE

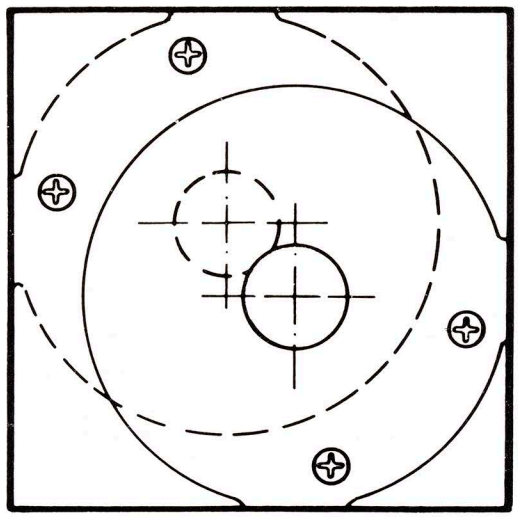
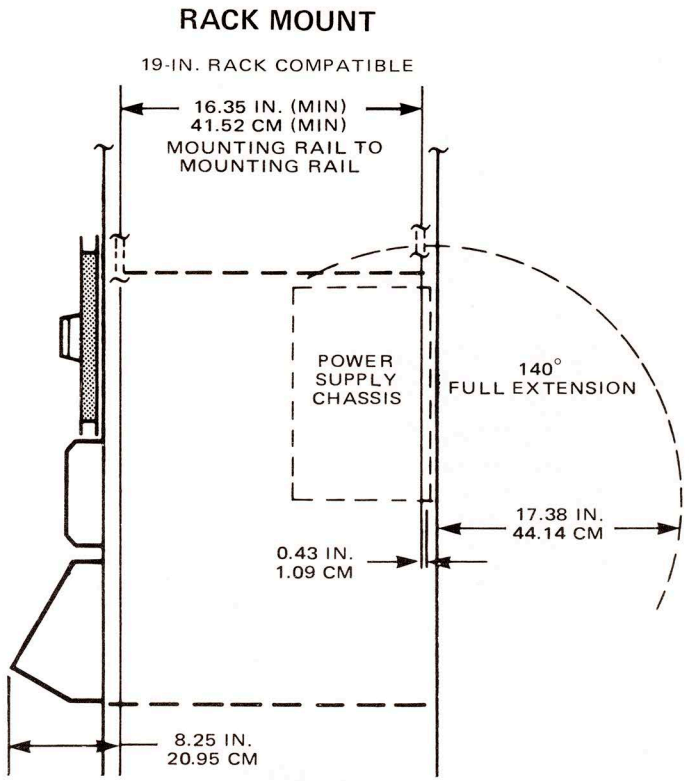


Figure 4-1. (2 of 3)



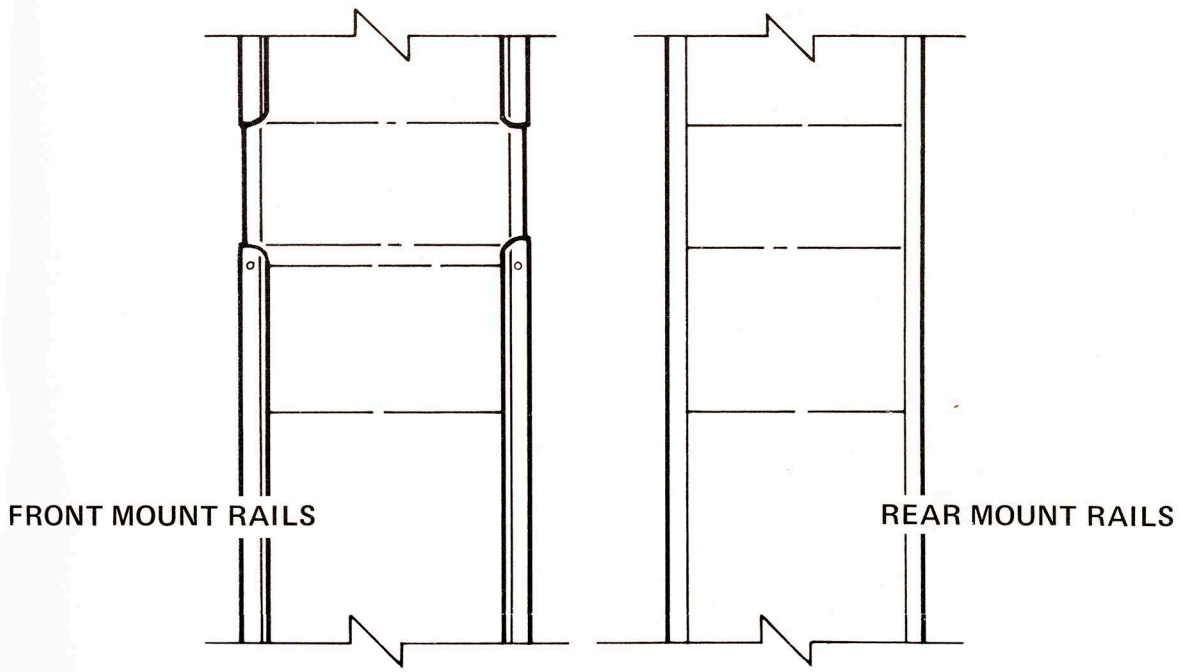


Figure 4-1. (3 of 3)

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