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Equipment Demonstration

VIDEO SURVEILLANCE UNIT

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ABSTRACT

The Video Surveillance Unit (VSU) has been designed to provide a flexible, easy to operate video surveillance and recording capability for permanent rack-mounted installations. The system consists of a single rack-mountable chassis and a camera enclosure. The chassis contains two 8 mm video recorders, a color monitor, system controller board, a video authentication verifier module (VAVM) and a universal power supply. A separate camera housing contains a solid state camera and a video authentication processor module (VAPM). Through changes in the firmware in the system, the recorders can be commanded to record at the same time, on alternate time cycles, or sequentially. Each recorder is capable of storing up to 26,000 scenes consisting of 6 to 8 video frames. The firmware can be changed to provide fewer recordings with more frames per scene. The modular video authentication system provides verification of the integrity of the video transmission line between the camera and the recording chassis.

INTRODUCTION

The Video Surveillance Unit (VSU) has been designed to provide a flexible, easy to operate video surveillance and recording capability for permanent rack-mounted installations. The system consists of a single rack-mountable chassis and a camera enclosure (See Figures 1 & 2). The chassis contains two 8mm video cassette recorders, a color monitor, system controller board, a video authentication verifier module (VAVM), a universal power supply, and a solid-state switch and timer that provides power to the video monitor for a specified time (See Figure 3). The separate camera enclosure contains a solid-state CCD camera and a video authentication processor module (VAPM). Through changes in system firmware, the recorders can be commanded to record simultaneously, on alternate time cycles, or sequentially. Each recorder is capable of storing up to 26,000 scenes consisting of 6 to 8 video frames. The system firmware can be modified to provide fewer recordings with more frames per scene, and, depending on the application, will generate a recording via the activation on any of the 8 external triggers or provide recordings at a selected interval. The modular video authentication system provides verification of the integrity of the video transmission line between the camera and the recording chassis.

The following is a brief description of a current application of the VSU. The system is installed at a facility in Japan and interfaces to a computer/radiation detection equipment, designed by Los Alamos National Laboratories. The overall system is designed to detect the presence of a canister, with material, as it enters a glove box, and generate a video recording of the canister. The Los Alamos system detects the presence of a canister in the glove box and sends a signal to the VSU which generates real-time video recordings of the canisters. The recording length is determined by the recording time that is programmed into the system by the IAEA inspector. The canisters are serial numbered for identification. A proper camera position and lens was selected to allow for the reading of the canister numbers. No additional recordings are generated until the next time a record command signal is received from the radiation counter computer.

System Design

Controller Board

The authenticated video signal from the verifier module enters the controller's video processing circuitry, where the insertion of the vertical interval data and the characters into the video signal occur. The vertical interval data is the information required for automatic review. The character display shows the date/time, any tamper information, and the programming instructions (program mode only). The video with inserted signals is routed to both recorders where it will be recorded whenever the controller module issues a record command.

The control of the system is accomplished with an 87C51 CMOS microcontroller. The microcontroller controls and reads the clock integrated circuit, which has a built-in battery backup to prevent the loss of date/time when there is an extended loss of power. The output of the clock circuit is constantly displayed in the video by sending the time information to a CMOS character generator integrated circuit. The character generator has an internal sync generater that allows date/time characters to be displayed in the case when video is missing from the camera. The characters are annotated onto a blue background. The positioning of these characters on the screen are fixed by the software program and are not field programmable, since it is believed that most of the time the characters are best utilized when placed at the bottom of the screen.

The system has some self-monitoring features such as high and low temperature sensors, and loss of camera sync. These features are anotated on the video in the following manner ; **HI** - High Temperature, **LO** - Low Temperature, **VID** - Sync Loss.

The microcontroller also sends the commands to the Sony serial data integrated circuit that communicates constantly with the video recorders. This system sends the commands to the recorders to execute a video recording in real-time. In between the recording time the recorders are not active and all power to the recorders is turned off.

Power Supply

Power for the VSU is supplied from a universal power supply that allows input voltages from 90v to 260v AC, 44 to 440 Hz, and outputs 12v DC. The output from the power supply furnishes all the voltages required for system operation.

EVO-210 8mm Video Recorders

There are two recorders in the VSU chassis. If the recorders operate in a parallel mode (hence, they record the same information at the same time), the user of the system would only have to review the data from one recorder. The second recorder would serve only as a redundant back-up recorder. The two recorder concept increases the reliability of the system. Figure 4 shows the location of the EVO-210 recorder controls. The recorder can be operated, e.g., change tapes, review data, when mode switch is set to "Review".

Video Monitor

The monitor, which has a 140 mm screen size, operates on 12v DC that is provided by the power supply. The monitor must be "powered on" when the "program" mode is selected. The programming instructions are annotated on the video image. The monitor can be utilized during system verification of camera field of view or during review of the tape from the recorder. This is accomplished by depressing the **monitor power switch**, setting mode switch to "Review", selecting "REC 1" or "REC 2" and operating the corresponding recorder. Utilizing the monitor for data review may not be optimum due to the small screen size. It may be preferable for the tapes to be removed for review at another location utilizing an 8mm recorder and a large screen monitor. To prevent the monitor from being powered on indefinitely, an external timer will automatically turn power off to the monitor approximately 6 minutes after the monitor power switch is depressed.

Video Authenticaion Verifier Module

The video signal from the camera enters the video authentication verifier module. The verifier module contains an automatic video bypass circuit to switch the input directly to the output if the video circuitry should fail. The output of the verifier module annotates the video with characters in the upper left hand corner of the screen to indicate the status of the video authentication system. The authenticated video signal is fed to the controller board, processed and annotated with date/time information before it is recorded on the video tape.

Camera Enclosure

The video signal from the camera is routed through the video authentication processor module where authentication signals are added. The processor module contains an automatic bypass circuit that switches the signal input directly to the output in the event that the internal video circuitry fails. The output of the processor module is sent to the VSU chassis and enters the video authentication verifier module where the camera video signal is authenticated.

I. FUNCTIONAL CONTROLS AND INDICATORS

A detailed description of all controls and indicators on the front panel of the VSU chassis will be pesented (See Figure 5), followed by a description of the connectors of the back of the chassis. The functional controls on the EVO-210 video recorders are also presented.

1. Review, Run ad Program Switch - This three position rotary switch is also refered to as the "Mode" switch. It selects the mode of operation of the system.

Review - This mode of operation allows the inspector to review the data on the video tapes or verify camera field of view. Power to the recorders is turned on automatically.

Run - This is the normal mode of operation. The switch **"must be"** in this position for the system to function properly. Depending on the application, the system is in an idle mode waiting for an external trigger activation, a command to do interval surveillance recording, or both. If the system expects an external trigger, the instant a signal is received the system generates a video recording. The duration of the recording is programmable from 1 - 99 seconds.

Program - This mode allows the user to program the date/time and recording duration, 1 - 99 seconds, of the VSU system. The video monitor **"must be"** turned on during the programming of the system. The simple programming instructions are annotated onto the video signal and displayed on the video monitor.

2. Enter, +, -, Momentary Pushbuttons - These pushbuttons are functional only if the system is in the "Program mode". The "+" and "-" pushbuttons allow for counting up and down when programming the date/time and selecting the recording duration. The "Enter" button confirms the current value that is blinking and selects the next value that must be programmed.

3. DC Power and L.E.D - This switch applies the 12v DC that is utilized by every component in the system. The L.E.D. shines bright red when power is present.

4. Monitor Power - This bushbutton switch turns on the video monitor. Power is automatically turned off after 6 minutes. This switch must be activated during "Program" mode and "Review" mode if the video tapes are reviewed with the VSU system.

5. REC 1, CAMERA, REC 2 - The position of this rotary switch is "not important" during the normal operation of the system. This switch selects the video source that will be displayed on the video monitor. Hence, the appropriate recorder must be selected if the system is utilized for reviewing the video tapes, and the "camera" position can be used to ascertain the appropriate field-of-view during set-up.

Connectors on the back of VSU Chassis

There are four connectors and a switch on the back of the VSU chassis: a connector for AC mains input with a built in switch and fuse; a six-pin circular connector that provides power to the camera enclosure; a BNC video connector that provides the input for the camera signal; and a DB-25 pin connector that provides the interface for the external triggers.

Video Recorder Controls and Indicators

Figure 6 shows the location of the controls and indicators on the Video Recorder.

1. **Power Switch** - Turns power on/off to the recorder.

2. **Power L.E.D.** - This light indicates recorder power is on.

3. **Eject Button** - This button is blue in color. When activated, an orange L.E.D. will illuminate and cause the video tape to unload and open the tape compartment for tape removal or insertion of a tape if compartment is empty.

4. **Rewind Button** - This button causes the tape to rewind to beginning of tape.

5. **Play Button** - This button causes the tape to play at normal speed.

6. **Fast Forward** - This button advances the tape at a high speed.

7. **Pause Button** - Press this button to freeze the scene on the monitor. The pause light will illuminate when recorder is in the pause mode.

8. **Stop Button** - This button causes the tape to stop motion. This button stops all other modes of operation on the recorder.

9. **Record Button** - Activation of this button causes the recorder to record in real-time until the stop button is pressed.

10. **Tape Count LCD Display** - A counter that indicates that the tape is in motion.

III. VSU Operational Features

The programming of the VSU is straight-forward and simple. The function controls are accessible on the front panel. These controls are part of the controller module of the VSU.

The programming is accomplished by rotating the mode switch on the controller module to the "PROGRAM" position. The unit will begin an automatic sequence to annotate on the video the instructions relating to the selection of date and time, and the recording duration, hence the video monitor must be turned on. By pressing the "+" and "-" buttons the appropriate information can be selected. Once each digit is correct on the video screen, pressing the "ENTER" button confirms the selection. The system is placed in the operational mode by rotating the mode switch to the position "RUN". Depending on the firmware, the system will immediately begin waiting for an external trigger, commence interval surveillance recordings or both. The system records the authenticated camera signal and returns to the idle mode waiting for the next recording command. Each time the "RUN" mode is selected, the system will generate an initial recording of 8 seconds to verify that the system is operational.

Review functions are performed by rotating the mode switch to the "REVIEW" position. When the switch is in this position, power is applied to the video recorders and the normal controls on the recorder can be operated to play back the recorded video through the small video monitor. The tapes can also be removed from the recorders at this time.

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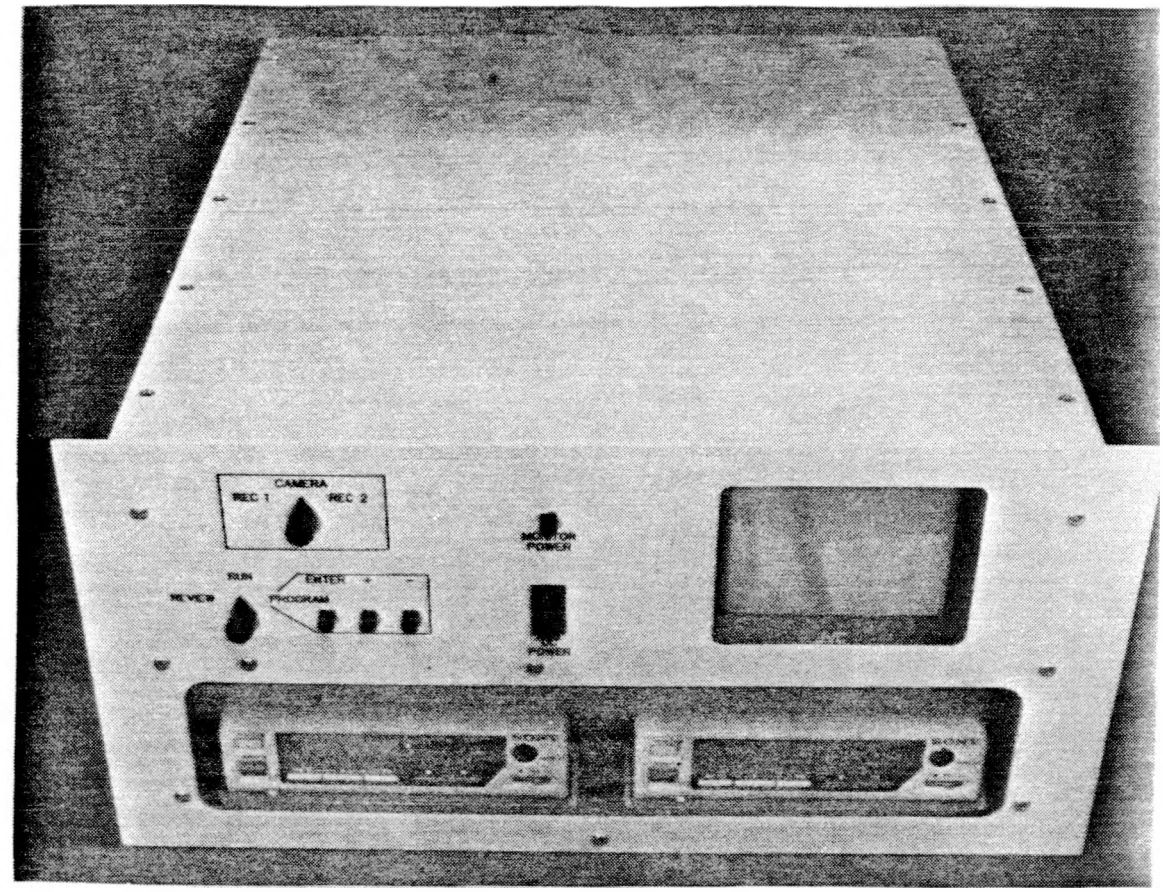


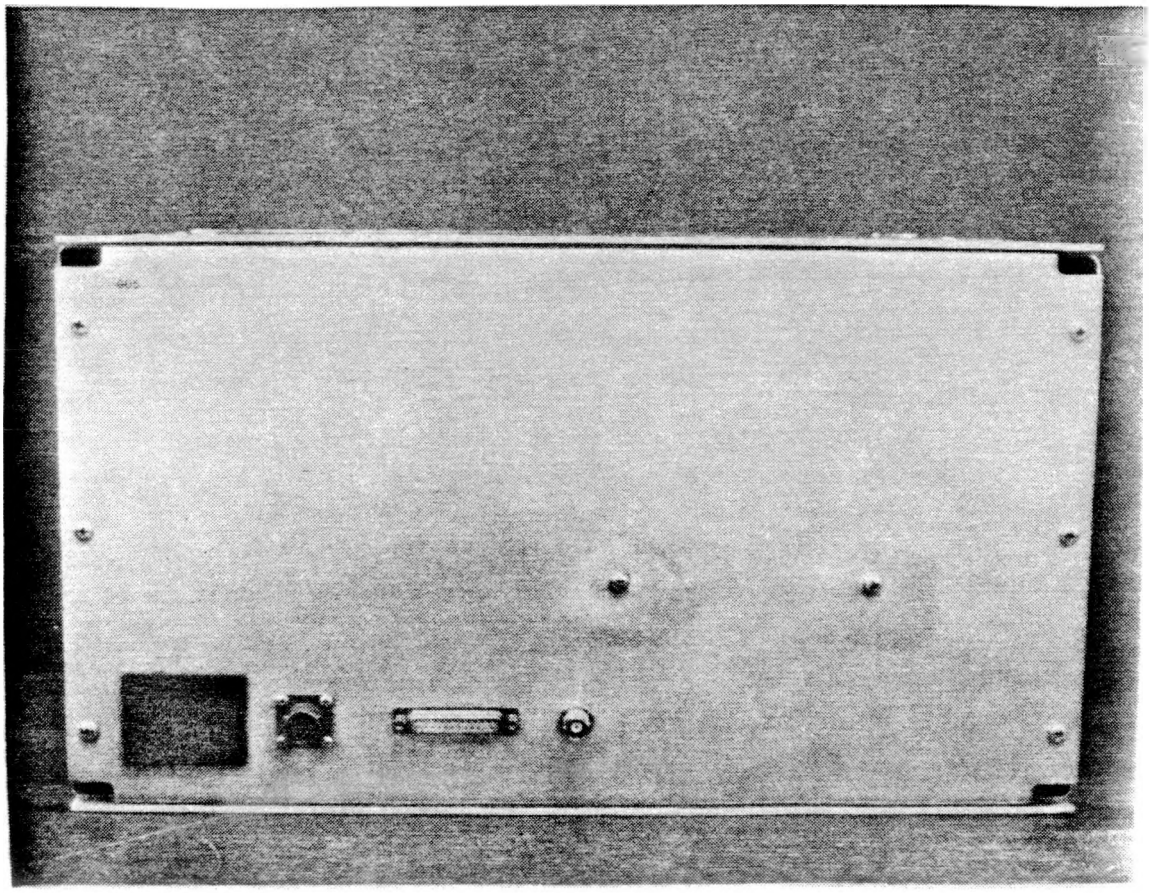


Figure 1: VSU Chassis (Front and Back)

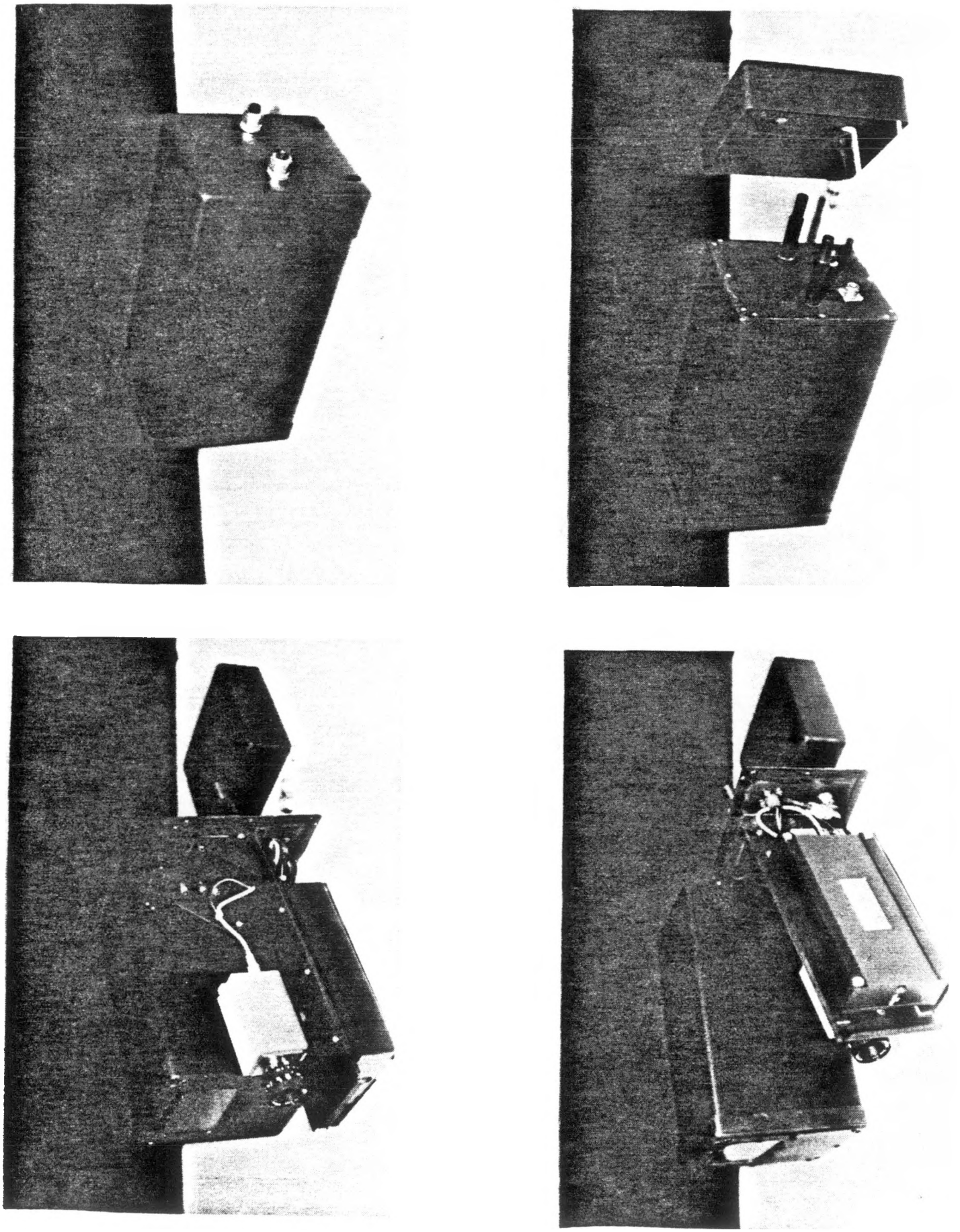


Figure 2: Camera Enclosure with Video Authentication

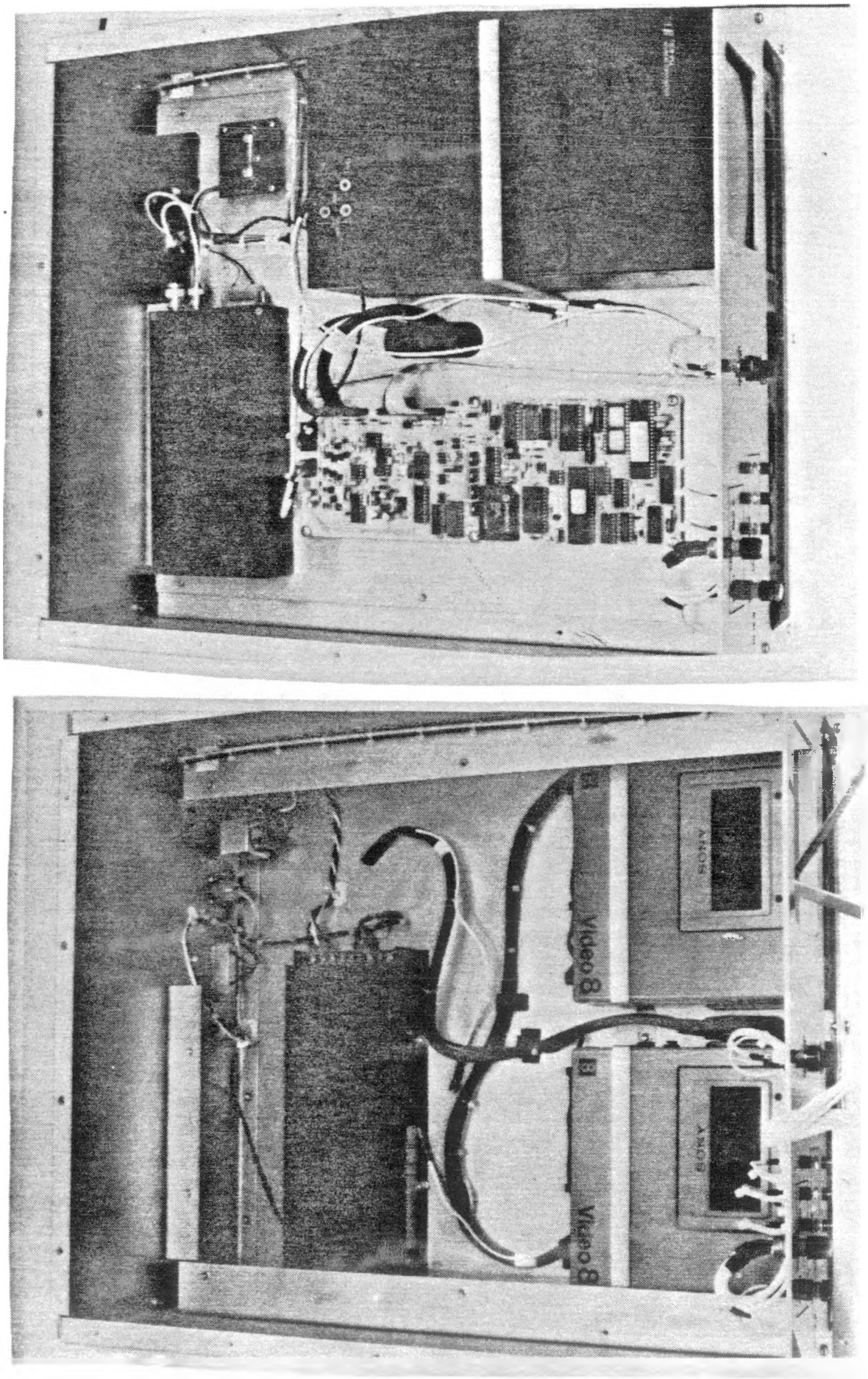
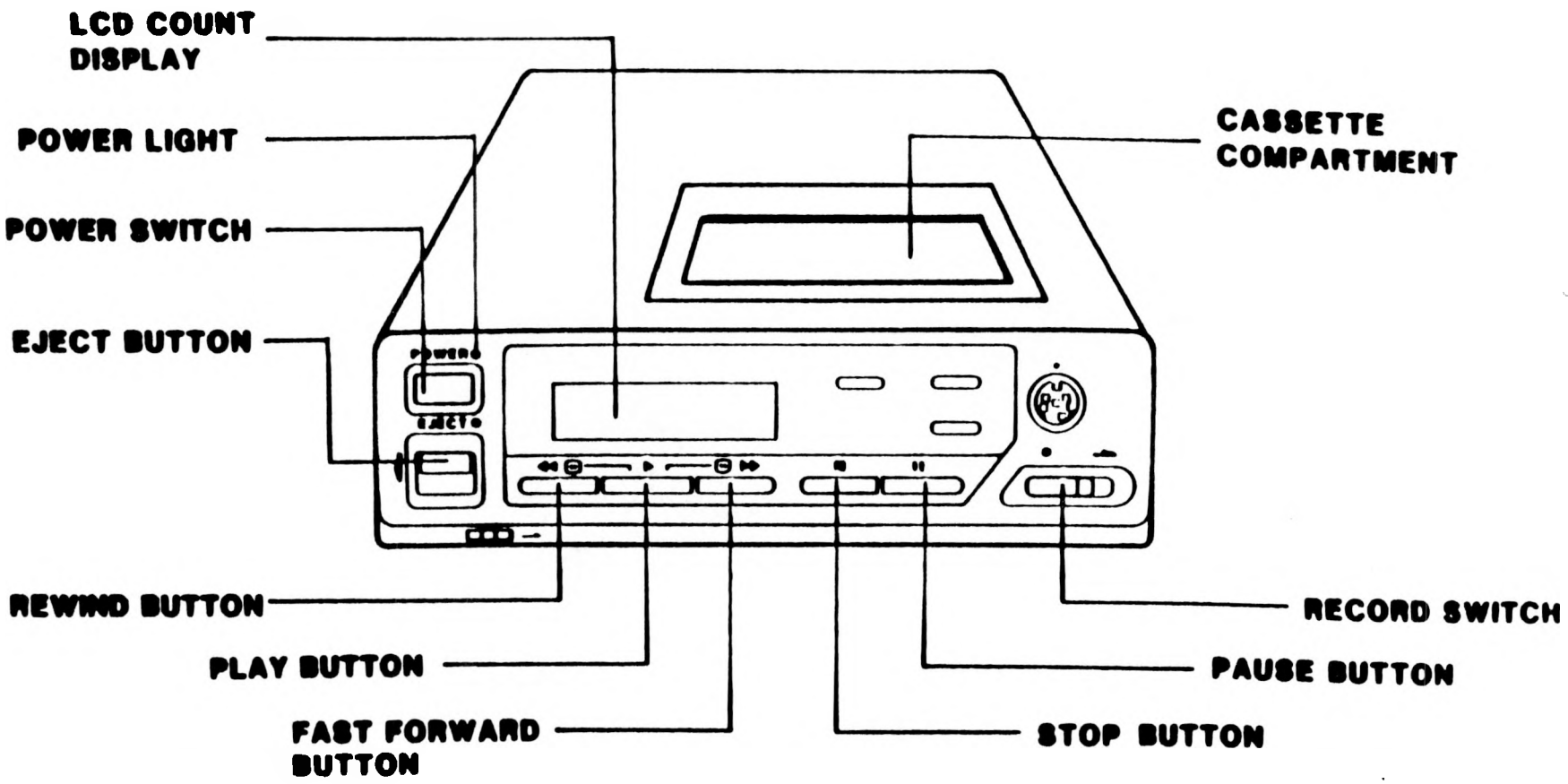


Figure 3: VSU Components (Top and Bottom)



LOCATION OF EVO-210 VIDEO RECORDER CONTROLS

FIG. 4

DISCLAIMER

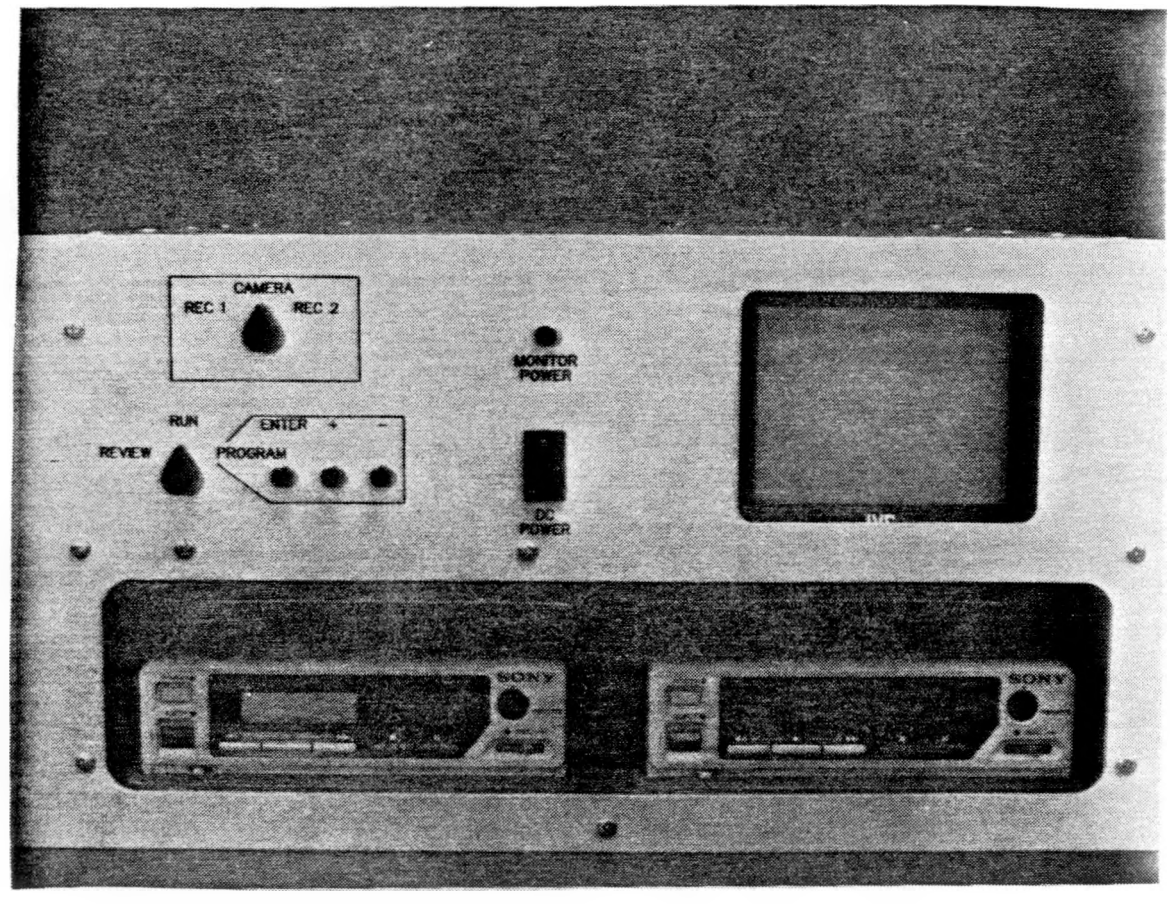


Figure 5: VSU Control Panel