



# MUX-1602C

Color screen multiplexer

User's Guide



**WARNING: TO REDUCE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.**



**WARNING!  
RISK OF ELECTRICAL SHOCK  
DO NOT OPEN!**



**WARNING: TO REDUCE RISK OF ELECTRIC SHOCK,  
DO NOT REMOVE COVER.  
NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING  
TO QUALIFIED SERVICE PERSONNEL.**



The lightning flash, with the arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of a shock hazard within the product's enclosure.



The exclamation point, within an equilateral triangle, is intended to alert the user to the presence of important and maintenance (servicing) instructions in the literature accompanying the appliance.



### CAUTION

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to subpart B of part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This digital apparatus does not exceed the Class A limits for radio noise emissions as set out in the Radio Interference Regulations (ICES-003) of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables de la class A prescrites dans le Règlement (ICES-003) sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

## ABOUT THE MUX-1602C

The XtendLan MUX-1602C multiplexer represents the latest advance in digital picture processors. It lets you record pictures from multiple video cameras while simultaneously displaying one or more cameras.

The time-lapse VCR is a proven and valuable tool for documenting visual events captured by a single camera. Applications employing multiple cameras require additional VCRs, sequential video switchers or quad picture processors. Each solution has tradeoffs. The VCR is an expensive piece of equipment which requires maintenance. The video switcher reduces the rate at which each camera is recorded. The quad picture processor reduces the quality of the recorded image. For many applications, none of these solutions is satisfactory. MUX-1602C multiplexers address the requirement to view and record multiple cameras through the application of digital video multiplexing, Dynamic Time Division (DTD) and Vertical Interval Signal (VIS) technology.

Using proprietary DTD technology, MUX-1602C multiplexers continuously analyze the motion content of all camera pictures. They determine camera priority based on picture activity and output pictures to the screen and to tape. Maximum efficiency is achieved by dedicating greater recording time to those cameras at which activity is detected. VIS technology is employed to code every picture sent to the VCR with the camera number, camera name, alarm status, time and date.

Each MUX-1602C multiplexer displays camera pictures on screen in one of several selectable formats: full-screen, Picture-In-Picture (PIP), 2x roving zoom, 2 x 2 pictures, 3 x 3 pictures. All formats are available while viewing live or taped pictures. During tape playback, pictures are displayed with full screen quality in the selected format. Pictures have 512 x 464 (512 x 512 PAL) resolution, up to 256 gray levels and 16million colors.

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SECURITY MEASURES

NOTE: This page describes how to access security sensitive MUX-1602C series features. You may wish to remove this page from the manual and place it in a secure place.

Accessing Setup Menus

To access the setup menu system, press and hold the function button and press the zoom button (function+zoom). The first setup menu appears on screen. Use the zoom and arrow buttons to navigate through the menu system. See MUX-1602C Setup for details.

To exit the setup menu system, press function+zoom again. The menu disappears and the MUX-1602C resumes normal operation.

The Security Lock Feature

NOTE: Security Lock protects the MUX-1602C against unauthorized use by disabling all front panel controls except the FUNCTION and ZOOM buttons. Once engaged, Security Lock can be released only after placing the MUX-1602C in Setup mode.

To Engage or Release Security Lock

1. Select the operating mode in which the unit is to be locked.
2. Press and hold the function button and press the zoom button. The MUX-1602C enters Setup mode and displays the first setup menu.
3. Press the zoom button repeatedly until the Security Lock menu appears.
4. Press the up arrow or down arrow to engage (ON) or release (OFF) the Security Lock.
5. Press function+zoom to exit Setup mode. The MUX-1602C resumes normal operation.

Resetting the MUX-1602C

The MUX-1602C can be reset to the factory default state. Upon reset, all programmable features return to the factory settings. The reset feature is normally used for diagnostic purposes but may be used if you wish to "start from scratch" during system setup.

To Reset the MUX-1602C button.

Press and hold the function button and press the up arrow

A warning appears, asking you to confirm the reset. Press the live button to cancel the reset or function+up arrow to complete the reset and return to the factory default state.

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**MUX-1602C FEATURES**

- Compatible with color and B&W video cameras or other NTSC/EIA (PAL/CCIR) standard compatible video sources. Video synchronization is not required. Selectable termination.
- Full duplex operation allows video recording while viewing live video or video playback.
- Dynamic Time Division (DTD) multiplexing allocates camera recording time based upon picture motion content.
- Motion sensing for each camera input is programmable via a 192 motion target grid (16 wide by 12 high).
- Independent Main and Call Monitor outputs allow simultaneous multicamera and full screen viewing.
- Video inputs and outputs provided for both standard and Super VHS video cassette recorders.
- On-screen display includes date, time, alarm status, video loss and 10-character camera titles.
- Live or tape playback views include: full-screen with 2x zoom, Picture-In-Picture (PIP), 2 x 2, 3 x 3 and 4 x 4.
- SELECT feature allows any camera to be assigned to any window format.
- Outstanding picture quality provided by a 512 x 464 (512 x 512 PAL) pixel display with 256 gray levels and 16 million colors.
- On-screen menus simplify system setup.
- Alarm features include one contact closure and TTL/CMOS sensitive alarm input for each camera, alarm hold input and alarm output. Alarm input polarity is selectable.
- Nonvolatile program memory protects all programmable features against power loss.

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## TECHNICAL OVERVIEW

- Video Input and Output** The MUX-1602C is available configured for either the NTSC/EIA or PAL/CCIR video standard. The units feature video camera inputs with a passive looping output for each. Camera input termination is programmable via an on-screen menu. Synchronization or phasing of cameras is not required.
- Video recording and playback is supported by VCR connections for both composite and S-Video signal formats. The MUX-1602C automatically determines the format used during tape playback.
- Two monitor outputs allow viewing of live camera or videotaped pictures on standard monitors. The Main Monitor displays selected cameras in any available display format. The Call Monitor displays live camera images full screen, including images from alarm cameras.
- Motion Detection** The MUX-1602C continuously monitors all camera inputs for motion. When motion is detected, the MUX-1602C increases the frequency with which that camera is recorded and displayed. In this way, recording and display time are dynamically allocated according to the scene activity. Motion sensitivity for each camera input can be set via a 16 x 12 target graphic overlay. Targets can be turned on or off as required. Target sensitivity is fixed.
- Video Display** The MUX-1602C monitor displays live camera pictures or pictures recalled from tape. The display is based on a 512 x 512 x 16 bit digital video memory containing two interlaced video images. As many as 256 gray shades and 16 million colors can be displayed in six screen formats including full screen, 2x zoom, Picture-In- Picture (PIP), 2 x 2, 3 x 3 and 4 x 4.
- Color demodulation is based on luminance and color difference processing. Demodulation circuitry operates on a line by line basis and will correctly demodulate the chroma information in video conforming to either the NTSC or PAL standard unless horizontal sync cannot be correctly detected.
- A graphic generator with two interlaced bit-mapped pages provides the alphanumeric and graphic overlays required for on-screen menus, camera titles and system messages.

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**Encoder Output** The video encoder produces a single video signal containing field by field samples from all camera inputs. The signal is provided in both composite and S-Video formats for connection to a video recorder. Encoder operation is continuous and independent of display and decoder functions. All inputs are sampled in camera number order until motion is detected, when sampling is weighted in favor of the active cameras.

The encoder uses Vertical Interval Signaling (VIS) techniques to encode system information onto video output to the VCR. Time, date, camera title, camera number, and alarm status information are placed on the 16 horizontal lines preceding the first active video line. This technique can improve vertical sync recovery and can also eliminate the degraded graphics associated with poor tape recorder performance.

**Decoder Output** The video decoder processes the video output by the VCR during playback, recovering the video from each camera originally recorded. The decoder digitizes the playback video and recovers the VIS information encoded onto each field. If the recovered field is to be displayed, it is written to the video display memory.

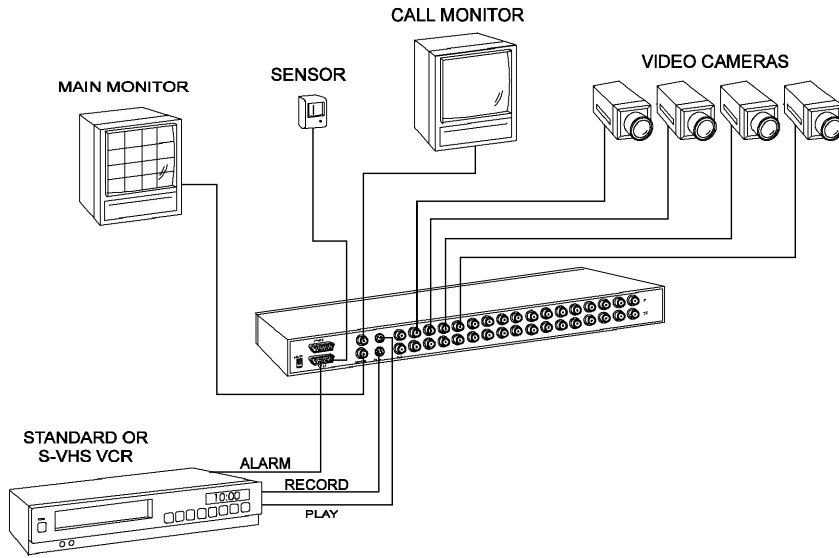


Figure 1 — Basic MUX-1602C System

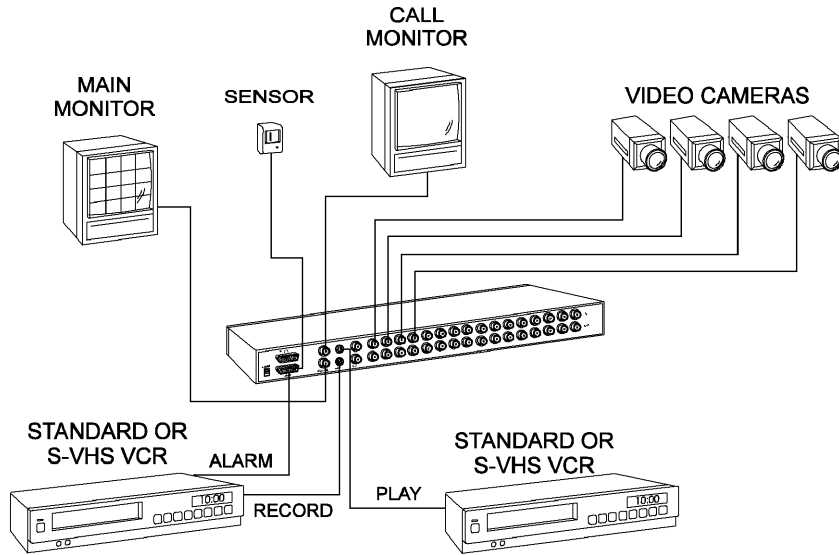


Figure 2 — MUX-1602C System with Two VCRs

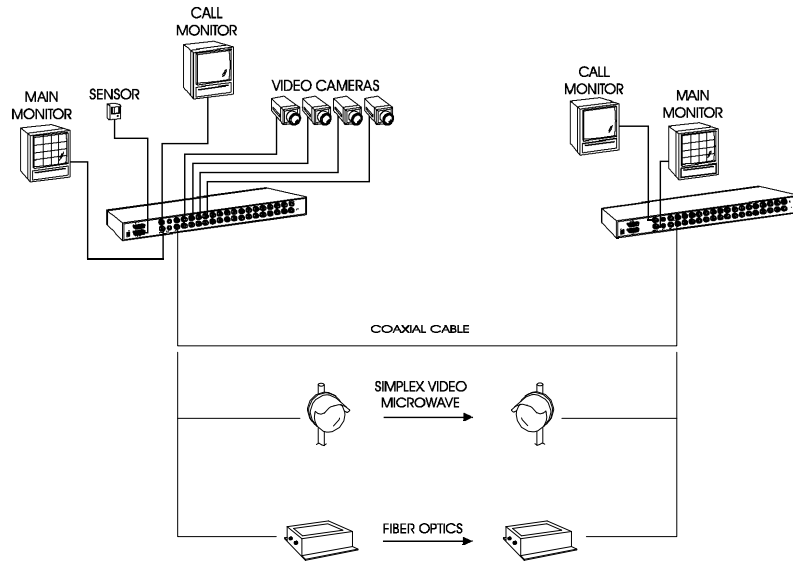


Figure 3 — One-Way Multiplexed Video Transmission

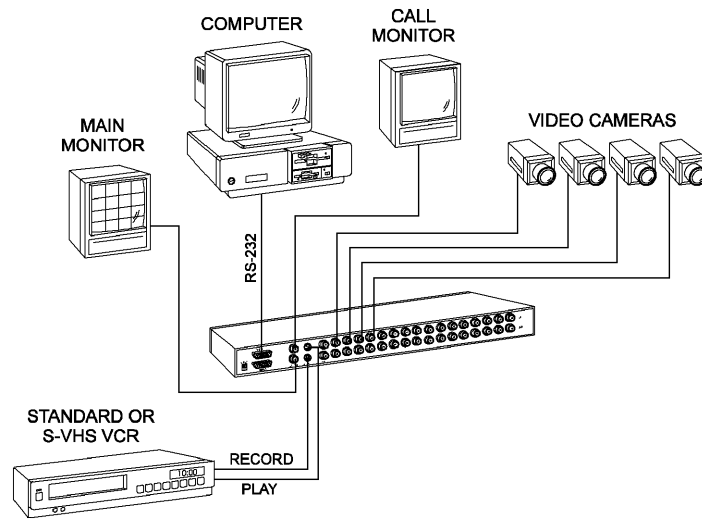


Figure 4 — MUX-1602C System with RS-232 Control

## THE FRONT AND REAR PANELS

This section briefly describes the multiplexer front and rear panels. Refer to MUX-1602C Setup and Using the MUX-1602C for a detailed discussion of MUX-1602C features and panel functions. See Figure 5

— MUX-1602C Controls and Indicators for the location of panel controls. Each button is described by name and function in the following paragraphs.

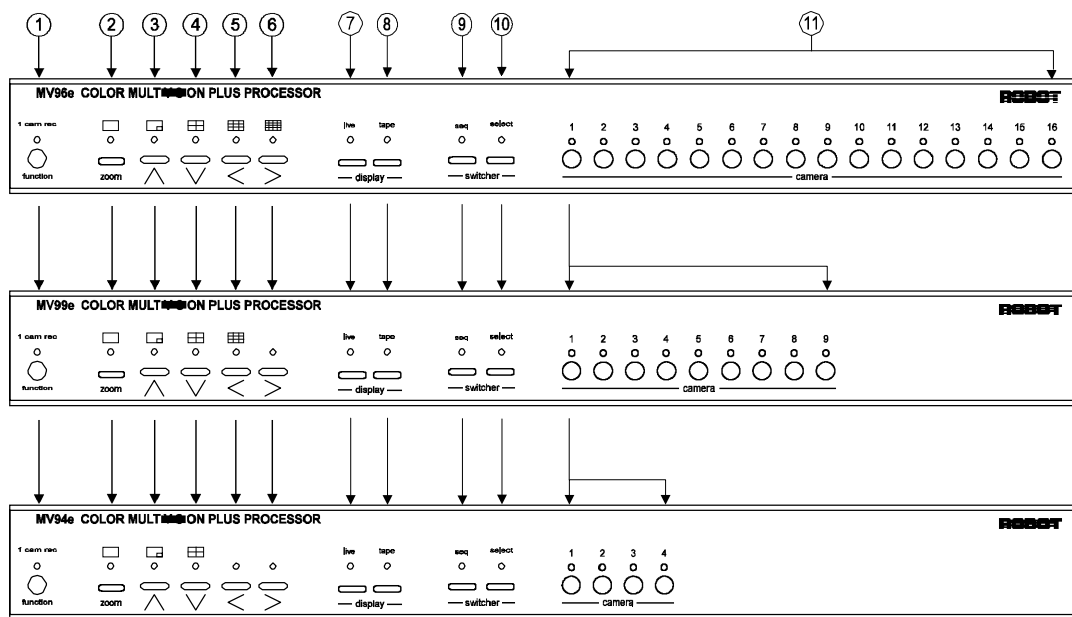


Figure 5 — MUX-1602C Controls and Indicators

## THE FRONT PANEL

Some front panel buttons have dual functions. In the descriptions below, the primary button function is listed first, followed by the secondary function in parentheses. Indicator lights are located above each button.

1. function (1 cam rec) — Used in combination with other buttons, it allows access to the system setup menus and other special functions.
2. full screen (zoom) — Displays the currently selected camera in the full screen format. Press full screen again to view a 2x zoom of the selected camera.

3. Picture-In-Picture [PIP] (up arrow) — Displays the currently selected camera in the full screen format, inset with a 1/16 size picture of one other camera. The inset picture can be selected or sequenced. This button functions as an “up” control in the Zoom and Setup modes.
4. 2 x 2 (down arrow) — Displays up to four cameras in the 2 x 2 format. Cameras can be sequenced in the lower right window. This button functions as a “down” control in the Zoom and Setup modes.
5. 3 x 3 (left arrow) — Displays up to nine cameras in the 3 x 3 format. Cameras can be sequenced in the lower right window. This button functions as a “left” control in the Zoom and Setup modes.
6. 4 x 4 (right arrow) — Displays up to 16 cameras in the 4 x 4 format. This button functions as a “right” control in the Zoom and Setup modes. Press function+right arrow to toggle the time/date display.
7. live — Displays the camera inputs in the current format. This button is also used during setup to turn on all motion detection targets on the cursor line.
8. tape — Selects the VCR input for viewing. During tape playback, press this button to display recorded video in the current format. During tape recording, press this button to monitor VCR output. This button is also used during setup to turn off all motion detection targets on the cursor line.
9. seq (sequence) — Starts automatic switching of cameras. This button is also used during setup to turn on all motion detection targets.
10. select — Used with camera buttons to select cameras for display in the full screen, PIP, 2 x 2, 3 x 3 and 4 x 4 formats. This button is also used during setup to turn off all motion detection targets.
11. camera (1–16) — Used with the select button to position cameras on screen in the PIP, 2 x 2, 3 x 3 and 4 x 4 formats. These buttons are also used during setup to toggle motion detection targets on the cursor off or on.

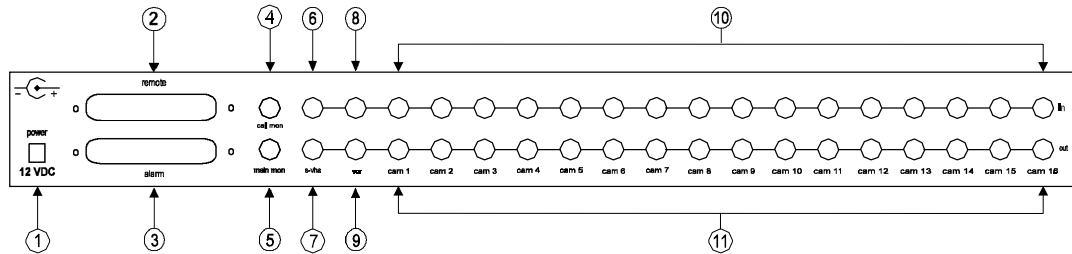


Figure 6 — MUX-1602C Rear Panel Connectors (16-Camera Model Shown)

#### THE REAR PANEL

1. **power** — This 2.1 mm pin jack accepts the MUX-1602C series power module plug or other center positive source of 12 VDC at 1.5 ampere.
2. **remote** — This DB25-S connector allows remote control of MUX-1602C via RS-232 data or optional remote control panel.
3. **alarm** — This DB25-S connector allows alarm activation via contact closure or TTL/CMOS alarm inputs. It includes the Alarm Hold Input and Alarm Output relay contacts.
4. **call mon** — This BNC connector provides a composite video signal to the Call Monitor in the full screen format. Either one live camera or one or more alarm cameras may be displayed.
5. **main mon** — This BNC connector provides a composite video signal to the Main Monitor for the display of all cameras in the selected format.
6. **s-vhs in** — This S-type connector accepts the S-Video playback signal from a Super VHS video recorder.
7. **s-vhs out** — This S-type connector outputs an S-Video signal which may be recorded on a Super VHS video recorder.
8. **vcr in** — This BNC connector accepts the composite video playback signal from a standard or time-lapse video recorder.
9. **vcr out** — This BNC connector provides a composite video signal to record input of a standard or time-lapse video recorder.

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10. **cam in** — These BNC connectors accept the composite video output of color or B&W cameras. Camera input termination is selectable.
  11. **cam out** — These BNC connectors provide looping camera video from the corresponding camera input.

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**INSTALLING THE MUX-1602C**

Select a location for the product that is clean and dry and has AC power. Find an environment where temperature and humidity extremes do not exceed the product specifications (see Technical Specifications). Failure to do so can result in equipment failure and loss of warranty protection.

**Required Connections**

**Cameras** Connect each cam in to the video output of a camera or other composite video source. MUX-1602C camera input termination is selectable. The default state is terminated (75 ohms). See MUX-1602C Setup for camera termination selection information.

**Main Mon (Monitor)** Connect main mon to the video input of an NTSC/EIA (PAL/CCIR) compatible video monitor. This monitor displays selected live or recorded cameras in any available format. This output must be properly terminated.

**Power** Connect the MUX-1602C power module or other center positive source of 12 VDC at 1.5 ampere to power.

**Optional Connections**

**Call Mon (Monitor)** Connect this output to the video input of an NTSC/EIA (PAL/CCIR) compatible video monitor. The call mon connector provides video in the full screen format and must be terminated. Either one live camera or one or more alarm cameras may be displayed.

**VCR In** Connect this input to the composite video output (play) of an NTSC/EIA (PAL/CCIR) compatible VCR. The vcr in connector accepts composite video from a VCR.

**VCR Out** Connect this output to the composite video input (record) of an NTSC/EIA (PAL/CCIR) compatible VCR. The vcr out connector provides composite video to a VCR.

- 
- S-VHS In**    **NOTE:** Do NOT connect both S-VHS IN and VCR IN at the same time. The MUX-1602C will not function properly with both inputs connected.
- Connect this input to the S-Video output (play) of an NTSC/EIA (PAL/CCIR) compatible Super VHS video recorder. The s-vhs in connector accepts S-Video from a Super VHS VCR.
- S-VHS Out**    **NOTE:** Do NOT connect both S-VHS OUT and VCR OUT at the same time. The MUX-1602C will not function properly with both outputs connected.
- Connect this output to the S-Video input (record) of an NTSC/EIA (PAL/CCIR) compatible Super VHS video recorder. The s-vhs out connector provides S-Video to a Super VHS VCR.
- Alarm**    The alarm connector includes pins for mechanical or TTL/CMOS standard Alarm Inputs, the Alarm Hold Input, and the Alarm Output. These connections allow the MUX-1602C to be completely integrated with security systems. See Alarm Response for details.
- Alarm Inputs**    MUX-1602C Alarm Inputs accept a contact type or TTL/CMOS alarm signal. Connect alarm pins 1 through 16, as required, to one side of a contact type or TTL/CMOS compatible alarm device. Connect the remaining side of each device to ground (alarm pins 18, 19 or 20). MUX-1602C alarm input polarity is menu selectable and defaults to normally open (NO) or TTL/CMOS active low.
- Alarm Hold Input**    The Alarm Hold Input accepts an active high contact type or TTL/CMOS alarm signal. Connect alarm pin 22 to the alarm hold output of the VCR or other device. Connect the remaining side of the output to ground (alarm pins 18, 19 or 20). Not normally used. See Alarm Recording Control for more information.
- Alarm Output**    The Alarm Output is a contact type signal between alarm pin 24 (common) and either pin 23 (normally closed) or pin 25 (normally open). Connect the appropriate pins to the alarm input of the VCR or other device.

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Remote	The remote connector provides input pins for RS-232 control commands and the RP1090 series Remote Control Panel. See MUX-1602C Remote Control for details.
RS-232 Control Input	Connect remote pin 25 to the output of a compatible source of RS-232 control data. Connect the remaining side of the source to ground (pin 13, 14 or 15). See Remote Connector for details.
Remote Control Panel	Connect the local-end adapter provided with the RP1090 series Remote Control Panel to the remote connector. The remote panel and the MUX-1602C front panel operate identically and may be used at the same time.

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**SYSTEM CHECKOUT**

MUX-1602C system operation can be checked immediately after installation with the MUX-1602C in the factory default state. While the MUX-1602C itself requires no adjustment, system components such as the monitor, cameras and video recorder should be checked for proper operation and adjustment. The system checkout procedure involves three steps: monitor calibration, a camera check, and a video recorder check. At least two video cameras are required to check system operation.

Refer to Figure 1 — Basic MUX-1602C System. Review all system connections. Make certain that all required connections are in place. Apply power to all system equipment.

**Monitor Calibration**

This process involves adjusting monitor display brightness, contrast, hue and saturation based on the standard color bar pattern generated by the MUX-1602C. The procedure is as follows:

1. Press function+down arrow. Internally generated color bars appear on the Main Monitor.
2. Turn off any automatic color control features on the monitor that might interfere with manual adjustment.
3. Turn the monitor's color level (saturation) control all the way down. The display is now black and white.
4. Adjust the monitor's contrast and brightness controls so that the eight bars progress evenly from white to black.
5. Turn the monitor's color level control to its midpoint.
6. Adjust the monitor's tint (hue) control until the colors are correct. The correct sequence of colors from left to right is white, yellow, cyan, green, magenta, red, blue and black.

The Main Monitor is now correctly calibrated to the output of the MUX-1602C. To calibrate the Call Monitor, temporarily connect its video cable to the main mon output and perform steps 2 through 6 again.

While monitor adjustments can be changed to suit the viewer, calibrate the monitor before you adjust any cameras or investigate a display or video quality problem.

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**Camera Check** The MUX-1602C multicamera display capability makes checking camera performance as simple as comparing two pictures on one screen. This method is preferable to the direct camera to monitor technique because it allows precise adjustment of each camera against a chosen reference camera. In this way, differences between cameras are minimized and picture quality is optimized.

**NOTE:** Before performing a camera check, complete the monitor calibration procedure described above. This is important! There is little advantage in optimizing system cameras using a monitor that is out of adjustment.

The camera check procedure is as follows:

1. Complete the monitor calibration procedure.
2. Connect all system cameras directly to the MUX-1602C camera inputs. Remove all connections to the looping (lower) camera outputs.
3. Make sure the MUX-1602C is configured for 75-ohm termination (the default state).
4. Select the format (2 x 2, 3 x 3 or 4 x 4) which can display all of the attached cameras.
5. Pick the best looking picture and use that camera as a reference. If necessary, adjust this camera for an optimum picture. Do NOT adjust the monitor.
6. Adjust each remaining camera, in turn, for an optimum picture. Try to obtain the same picture quality as the reference camera.

The cameras are now correctly adjusted with respect to the calibrated monitor and each other. You may now adjust the monitor for the best overall display. If you choose to make further monitor adjustments, it is best to do so with all cameras displayed.

**Making a Test Tape** The easiest way to verify MUX-1602C system operation is to make a test recording and play it back. This process effectively tests every piece of equipment in the system.

Before proceeding with the test tape, complete both the monitor calibration and camera check procedures. Make sure the MUX-1602C monitor and all system cameras are correctly adjusted. This helps ensure the best results during the tape test.

The tape test procedure is as follows:

1. Place the VCR in the record mode at the 24-hour speed. (This is the MUX-1602C's default VCR record speed and can be changed.) The VCR begins recording multiplexed camera video. You may select any viewing mode or display format while recording. This will not affect the tape because camera recording and display are independent operations.
2. After several minutes, stop the VCR and rewind the tape.
3. Place the VCR in the play mode.
4. Press the tape button on the MUX-1602C.

When the MUX-1602C detects the encoded VCR signal, it configures itself for tape playback and displays all recorded cameras in the multicamera format. To view one camera full screen, press the corresponding camera button. To view multiple cameras, press the desired display format button (PIP, 2 x 2, 3 x 3, 4 x 4). If the camera or cameras do not appear, check VCR operation and review all video connections.

This completes the tape test. If the test is not successful, repeat the steps outlined above. If you still have problems, see Appendix C — In Case of Trouble.

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**MUX-1602C SETUP**

MUX-1602C features can be configured to suit the requirements of most video installations.

**The Setup Menu System**

A convenient system of on-screen menus allows you to set up key features such as time and date, VCR record time, sequencer dwell time, video termination, video loss alarm, camera titles, motion detection, and system security. All setup data is stored in nonvolatile memory where it is protected against loss due to power failure.

**NOTE:** To perform MUX-1602C setup, you must first gain access to the on-screen menu system. Refer to "Security Measures" for instructions.

Once inside the menu system, MUX-1602C setup involves three basic operations:

1. Selecting the menu.
2. Positioning the flashing highlight.
3. Setting the option.

**Selecting a Menu**

Press zoom to go to the next setup menu. The next menu appears with the flashing highlight at the first option. You can only jump forward through the setup menus. If you press zoom at the last menu (Security Lock), the MUX-1602C exits the setup mode and returns to normal operation.

**Positioning the Highlight**

Use the arrow buttons to position the menu highlight. Press right arrow to move the highlight to the next character or option. Press left arrow to move the highlight to the previous character or option. When you reach one end of the menu, the highlight appears at the other.

**Setting an Option**

Press up arrow to scroll up through the available characters (0-9, A-Z, :, /, +, -, space).

Press down arrow to scroll down through the available characters. When you reach the first or last character, the sequence begins again.

Some menu options have only two values. Press up arrow or down arrow to change the setting under the flashing highlight.

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**SETUP MENUS**

There are seven menus in the Setup menu system. The following paragraphs take you through the menu system step-by-step, describing each menu's purpose and options.

**Menu 1 — System Time/Date**

Menu 1 displays the system time and date (maintained by the MUX-1602C's internal clock/calendar), the product firmware revision number and revision date.

The MUX-1602C encodes the system time and date onto each field of video sent to the VCR. In the Live mode, the unit displays the system time and date at the top of the Main Monitor. In the Tape mode, the unit displays the time and date encoded on the tape (not the current time/date).

**NOTE:** Be sure to turn off the VCR's time/date display feature. If it is turned on, the time and date will also appear in each window of the display during tape playback. You can check this by pressing the TAPE button when the VCR is in the stop or record mode. The MUX-1602C displays the output of the VCR — with the time/date graphic if it is turned on.

To set the time and/or date, use the arrow buttons to position the flashing highlight over each character and set it. Enter the time in HH:MM:SS 24-hour format. Enter the date in MM/DD/YY format (DD.MM.YY format in the PAL version). The clock starts running when you move the highlight into the date field.

When finished, press the zoom button to go to Menu 2 or function+zoom to save all changes and leave the setup system.

**NOTE:** You can turn the time/date display off and on at any time. Press FUNCTION+RIGHT ARROW to toggle this option.

- 
- Menu 2 — Toggle Options** Menu 2 allows you to review and set each of the MUX-1602C “toggle” options. Toggle options have only two settings. To change a setting, position the highlight over it and press the up arrow or down arrow. The alternate setting appears.
- Alarm Message Display** The Alarm Message Display option enables or disables the on-screen display of the ALARM message. It toggles as follows:
- ON – Alarm messages are displayed on the Main Monitor.
  - OFF – Alarm messages are not displayed on the Main Monitor.
- The default Alarm Message Display setting is ON.
- Alarm Message Latch** The Alarm Message Latch option determines how long the ALARM and VIDLOSS messages remain on screen. It toggles as follows:
- ON – All messages remain on screen until manually cleared. Press the function button to remove messages for all expired alarm events (messages for current alarm events remain on screen).
  - OFF – Each message remains on screen until the Alarm Duration time expires or until the corresponding alarm event clears, whichever is longer.
- The default Alarm Message Latch setting is OFF.
- Video Loss Alarm** The Video Loss Alarm option controls the MUX-1602C video loss detection feature. It toggles as follows:
- ON – The MUX-1602C responds to loss of camera video as an alarm event and displays the message VIDLOSS in place of the camera’s picture.
  - OFF – The MUX-1602C does not respond to loss of camera video as an alarm event. Refer to Video Loss Alarms for more information.
- The default Video Loss Alarm setting is ON.

- 
- Audible Alarm**    The Audible Alarm option controls the MUX-1602C alarm tone. It toggles as follows:
- ON** – The MUX-1602C sounds an alarm tone when it detects a mechanical alarm or loss of video. Press any button to turn the alarm tone off.
- OFF** – The MUX-1602C is silent when it detects a mechanical alarm or loss of video.
- The default Audible Alarm setting is OFF.
- Alarm Input Polarity**    The Alarm Input Polarity option allows you to set the polarity of all MUX-1602C alarm inputs. It toggles as follows:
- ACT LOW** – Active alarm inputs are “low”. The MUX-1602C recognizes a contact closure or TTL/CMOS logic low as an alarm event.
- ACT HI** – Active alarm inputs are “high”. The MUX-1602C recognizes a contact opening or TTL/CMOS logic high as an alarm event.
- The default alarm input polarity setting is ACT LOW.
- Input Impedance**    The Input Impedance option allows you to set the termination status of all MUX-1602C camera inputs. This option toggles between 75 OHMS and HI-Z. Set the impedance based on whether camera video must be terminated at the MUX-1602C camera input connectors.
- If another device is to be connected to an MUX-1602C camera out connector, you must do the following:
1. Set the MUX-1602C's input impedance to HI-Z.
  2. Place a 75-ohm terminator on the camera out connector of each camera not connected (looped) to another device.
  3. Configure each device connected to a camera out connector for 75-ohm video termination.
- It is very important that each camera be correctly terminated in this way. Check your installation carefully to avoid either unterminated or double-terminated cameras.
- The default Input Impedance setting is 75 OHMS.

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Number of VCRs	<p>The Number of VCRs option tells the MUX-1602C how many VCRs are connected. It toggles as follows:</p> <p style="padding-left: 40px;">ONE – One VCR is connected to the MUX-1602C. It is used for both recording and playback.</p> <p style="padding-left: 40px;">TWO – Two VCRs are connected to the MUX-1602C. One is used for recording. The other is used for playback.</p> <p>The Number of VCRs option allows the MUX-1602C to optimize system performance during advanced VCR operations such as index search.</p> <p>The default setting for Number of VCRs is ONE.</p> <p>When finished, press the zoom button to go to Menu 3 or function+zoom to save all changes and leave the setup system.</p>
Menu 3 — VCR Record Time	<p>Menu 3 allows you to enter the VCR's normal and alarm recording speeds. Use the up and down arrows to set each speed.</p> <p>NOTE: If the MUX-1602C alarm output will not be connected to the VCR's alarm input, VCR Record Time and VCR Alarm Record Time should be set to the same value.</p>
VCR Record Time	<p>This setting controls the VCR's normal (nonalarm) operating speed.</p> <p>Set the VCR Record Time in hours using the up and down arrow buttons. You may enter any setting between 2 and 999 hours.</p> <p>The default setting for VCR Record Time is 024 HRS (hours).</p>
VCR Alarm Record Time	<p>This setting controls the VCR's alarm recording speed. The VCR changes to this speed when alarm input is received.</p> <p>Set the VCR Alarm Record Time in hours using the up and down arrow buttons. You may enter any setting between 2 and 999 hours.</p> <p>The default setting for VCR Alarm Record Time is 024 HRS (hours).</p> <p>When finished, press the zoom button to go to Menu 4 or function+zoom to save all changes and leave the setup system.</p>

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**Menu 4 — Alarm Duration** Menu 4 allows you to set the minimum MUX-1602C alarm time. The Alarm Duration setting determines how many seconds the MUX-1602C remains in the alarm state after an alarm event occurs.

Set the Alarm Duration time in seconds using the up and down arrow buttons. You may enter any setting between 2 and 999 seconds.

The default Alarm Duration setting is 004 SECS (seconds).

When finished, press the zoom button to go to Menu 5 or function+zoom to save all changes and leave the setup system.

**Menu 5 — Global Dwell** Menu 5 allows you to set the camera switching rate. The Global Dwell setting determines the rate at which the MUX-1602C sequences cameras in the lower right window of the display (or full screen) when seq is selected. It also determines the rate at which the Call Monitor switches cameras during multiple alarm events.

Set the Global Dwell time in seconds using the up and down arrow buttons. You may enter any setting between 1 and 99 seconds. This setting applies to all cameras.

**NOTE:** The Global Dwell setting affects on-screen camera display only. It does NOT affect the rate at which the MUX-1602C switches cameras at the VCR output connector.

The default Global Dwell setting is 02 SECS (seconds).

When finished, press the zoom button to go to Menu 6 or function+zoom to save all changes and leave the setup system.

**Menu 6 — Camera Titles** Menu 6 allows you to assign an alphanumeric title to each MUX-1602C camera input. It also provides access to the motion detection setup screen, which is described below.

Initially, each title is the camera number. To change a title, use the arrow buttons to position the flashing highlight on each character and set it. A title can contain up to 10 characters selected from the following: 0-9, A-Z, :, /, +, -, space.

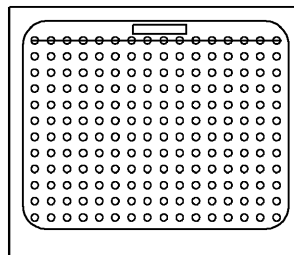
When you're finished setting a title, do one of the following:

- Press function to display the motion detection screen (described below) for the current camera.
- Press zoom to set the next camera title. If the Camera Titles menu for Camera 16 is displayed, press zoom to go to Menu 7.
- Press a camera button to set that camera's title.
- Press function+zoom to save all changes and leave the setup system.

**Motion Detection Setup Screen** The Motion Detection Setup screen allows you to define motion detection targets in the camera's field of view. To access it, press function while in the Camera Titles menu (see above).

The motion detection screen displays the current camera picture overlaid with a special graphic. The graphic consists of a 16 wide by 12 high matrix of motion targets, a target cursor and a motion bar.

The default MUX-1602C motion detection screen looks like this:



The target cursor line is initially positioned in the first row of targets. Active targets are circled. Inactive targets are not circled. Targets can be turned on or off individually, by row or by screen. Use the following front panel buttons to set up the targets:

up arrow – moves the target cursor up one row at a time.

down arrow – moves the target cursor down one row at a time.

left arrow – moves the target cursor to the left.

right arrow – moves the target cursor to the right.

live – turns ON all targets on the cursor line.

tape – turns OFF all targets on the cursor line.

seq (sequence) – turns ON all targets.

select – turns OFF all targets.

camera – toggles the corresponding target on the cursor line.

function – saves current motion target setting and returns to the Camera Titles menu.

Using the buttons above, define those areas of the picture in which motion is to be detected. See Video Motion Detection for a detailed description of the MUX-1602C motion detection feature.

The motion bar appears at the top center of the motion setup screen. It is visible only when the MUX-1602C detects motion and can be used to verify detection of activity in a specific area.

When finished, press function to save the target setting and return to the Camera Titles menu.

Menu 7 — Security Lock Menu 7 controls the MUX-1602C front panel security lock feature. When this feature is on, the MUX-1602C locks all front panel buttons except those required to reenter the setup mode. Press the up or down arrow to change this option. The new security lock setting takes effect when you exit the setup system.

When finished, press zoom or function+zoom to save all changes and leave the setup system.

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**USING THE MUX-1602C**

The MUX-1602C series is tremendously flexible and very easy to use. No setup is required to use the basic features, yet the unit can be adapted to meet the display and recording requirements of most multicamera security systems.

This section describes how to operate the MUX-1602C. It is organized by operating task and product feature.

**Operating Modes** The MUX-1602C has three basic operating modes: Live, Tape, and Setup.

**Live Mode** Live mode lets you view images from one or more cameras on the Main and/or Call Monitor. Live camera viewing does not affect camera video output to the Call Monitor or the VCR. Camera recording is an independent operation which is not affected by operator actions at the front panel.

Press the live button to view live camera video. The live light comes on indicating the Main Monitor is displaying camera input video. Cameras may be displayed on the Main Monitor in any order, in any of the available views.

The MUX-1602C samples cameras every 1/60 of a second (1/50 of a second PAL/CCIR). The rate at which it displays individual cameras is determined by three factors:

1. The number of cameras connected to the MUX-1602C.
2. Motion in the field of view of any camera configured for motion detection.
3. The number of display windows occupied by the camera.

**Tape Mode** Tape mode lets you view the video sent to or returning from the VCR. It does not affect camera video output to the VCR. Recording camera video at the MUX-1602C vcr out connector is an independent operation. This allows full duplex operation when the MUX-1602C is connected to two VCRs. See Simultaneous Record and Play for details about two VCR operation.

**Tape Preview** To view what is being sent to the VCR, place the VCR in the record mode (or any mode other than playback) and press the **tape** button. The live and tape lights are now on. This indicates that the MUX-1602C is displaying encoded video – full screen camera pictures, sequenced in camera number order, at the rate set on the VCR Record Time menu. You cannot select individual cameras in this mode.

**Tape Review** To view what has been recorded, place the VCR in the play mode and press **tape** on the MUX-1602C. When the MUX-1602C detects the encoded VCR signal, it configures itself for tape playback and displays all recorded cameras in the multicamera format. To view one camera in the full screen format, press the corresponding camera button. To view multiple cameras, press the appropriate multicamera button (PIP, 2 x 2, 3 x 3, 4 x 4). Cameras may be displayed in any order, in any of the available views. Tape playback and live camera viewing work identically in all respects.

The MUX-1602C detects recorded alarm events during tape playback by monitoring the VIS information returned from tape. Each field of recorded video is encoded with alarm status information, camera number, camera title, time and date. The MUX-1602C uses this information to identify camera related alarm events.

When the MUX-1602C detects an alarm event on tape, it displays the alarm camera overlaid with an alarm message. Recorded alarms do not interfere with the detection of mechanical alarms, so the MUX-1602C can process both types of alarm event at the same time. See Recorded Alarms for more information about recorded alarms.

**Setup Mode** Setup mode allows you to customize MUX-1602C operation to suit a specific application. To enter the setup mode, press the buttons required to access setup system menus (see Security Measures for instructions). See MUX-1602C Setup for a description of the setup menu system.

### Viewing One Camera

- Main Monitor** The Main Monitor can display any live or recorded camera in the Full Screen format.
- It can also display a movable 2x zoom of any camera.
- Full Screen** Press any camera button when the select light is NOT lit. The MUX-1602C displays the selected camera full screen.
- Alternately, you can press the full screen button to switch to the full screen format. The Main Monitor displays the last camera selected in this format.
- The 2x Zoom** Press the zoom button while viewing full screen to zoom the Main Monitor display. The MUX-1602C displays a 2x zoom picture with a zoom window insert.
- The zoom window contains a one-quarter sized view of the current camera, overlaid with a movable zoom pointer. The zoom pointer indicates the picture area being zoomed and can be moved to any area of the picture.
- Zoom Control**
1. Display the desired camera in the Full Screen format.
  2. Press the zoom button to display the zoom window.
  3. Press the up, down, left and right arrow buttons to move the zoom pointer. The MUX-1602C pans the 2x display accordingly.
- The zoom window disappears two seconds after the last button press to provide a clear view. Press any arrow button to recall the zoom window.
- To return to the Full Screen format, press the zoom button again or press any camera button.
- The MUX-1602C remembers the selected camera and the position of the zoom window between zoom operations.

Call Monitor In addition to displaying alarm cameras, the Call Monitor can display any live camera in the full screen format. To select a camera for full screen display on the Call Monitor:

1. Press the select button two times quickly. The select button light flashes, indicating the MUX-1602C is in the Call Select mode. If the select light comes on but does not flash, the MUX-1602C is in the Main Select mode. Press the select button again to turn the light off and start over.
2. Press any camera button. The Call Monitor displays the selected camera.

To exit the Call Select mode, press the select button one time. The MUX-1602C resumes normal operation.

Viewing Multiple Cameras The Main Monitor can display multiple cameras in several formats: Picture-In-Picture (PIP), 2 x 2, 3 x 3 and 4 x 4. Each display can be composed by selecting the cameras and their location on screen.

Cameras not already displayed can be sequenced in the lower right window of any multicamera format. See Sequencing Cameras for details.

Picture-In-Picture The Picture-In-Picture (PIP) format displays a full screen "background" picture with a 1/16 screen sized picture "inset." A camera can be selected for display in either location and cameras can be swapped instantly between the background and the inset. Cameras in the inset can also be sequenced.

There are two methods of selecting cameras for display in the PIP format. One method begins in the Full Screen format. The other method uses the PIP "swap" feature.

Full Screen Method:

1. Press the camera button for the desired background camera. The selected camera appears full screen.
2. Press the PIP button. The MUX-1602C displays the PIP inset.
3. Press the select button. The select light comes on.

4. Press the camera button for the desired PIP inset camera. The selected camera appears in the PIP inset.

PIP "Swap" Method:

1. Press the PIP button. The MUX-1602C displays the current camera and the last selected PIP inset camera.
2. Press the select button. The select light comes on.
3. Press the camera button for the desired background camera. The selected camera appears in the PIP inset.
4. Press the PIP button again. The MUX-1602C swaps the two cameras. The MUX-1602C remembers the PIP camera selection and will recall it the next time the PIP format is displayed.

**2 x 2 Format** The 2 x 2 format is the familiar "quad" display. It displays four pictures at one time. Cameras can be selected for display in any window. Cameras not already displayed can be sequenced in the lower right window.

Selecting 2 x 2 Cameras:

1. Press the 2 x 2 button. The MUX-1602C displays the 2 x 2 format with the cameras last selected for 2 x 2 display.
2. Press the select button. The select light comes on.
3. Press the camera button for the camera desired in window #1. Continue pressing camera buttons until each window contains the desired camera.
4. Press the select button again. The select light goes out.

The MUX-1602C remembers the 2 x 2 camera selection and will recall it the next time the 2 x 2 format is displayed.

**3 x 3 Format**

The 3 x 3 format displays nine pictures at one time. Cameras can be selected for display in any window. Cameras not already displayed can be sequenced in the lower right window.

Selecting 3 x 3 Cameras:

1. Press the 3 x 3 button. The MUX-1602C displays the 3 x 3 format with the cameras last selected for 3 x 3 display.
2. Press the select button. The select light comes on.
3. Press the camera button for the camera desired in window #1. Continue pressing camera buttons until each window contains the desired camera.
4. Press the select button again. The select light goes out.

The MUX-1602C remembers the 3 x 3 camera selection and will recall it the next time the 3 x 3 format is displayed.

**4 x 4 Format**

The 4 x 4 format displays 16 pictures at one time. Cameras can be selected for display in any window.

Selecting 4 x 4 Cameras:

1. Press the 4 x 4 button. The MUX-1602C displays the 4 x 4 format with the cameras last selected for 4 x 4 display.
2. Press the select button. The select light comes on.
3. Press the camera button for the camera desired in window #1. Continue pressing camera buttons until each window contains the desired camera.
4. Press the select button again. The select light goes out.

The MUX-1602C remembers the 4 x 4 camera selection and will recall it the next time the 4 x 4 format is displayed.

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**Sequencing Cameras** The MUX-1602C allows sequential display of cameras on the Main Monitor in any available format. In the full screen format, all cameras can be sequenced full screen. In multicamera formats, cameras not already displayed can be sequenced in the lower right window. Cameras are sequenced in camera number order at a rate determined by the Global Dwell Time setting (see MUX-1602C Setup).

To Start Camera Sequencing:

1. Select the desired format.
2. Press the seq button. The seq light comes on. The MUX-1602C switches cameras in the lower right window of the display (or full screen) at the current Global Dwell Time rate.

To Stop Camera Sequencing:

Press the seq button again. The seq light goes out. Sequencing stops with the current camera displayed in the lower right window (or full screen).

**Videotape Operations** The MUX-1602C allows recording of multiple cameras onto a single videotape. This “encoding” function is performed in the background, and does not interfere with other operations. All MUX-1602C features remain available while a recording is being made. Likewise, tape playback does not affect recording. It is possible to review a previously recorded tape while recording continues on a second VCR. See Simultaneous Record and Play for details.

**VCR Setup** For optimum tape recording and playback, the MUX-1602C must be correctly configured for use with the VCR. This is done by changing settings in the setup menu system.

Three setup options affect camera recording:

- VCR Record Time
- VCR Alarm Record Time
- Number of VCRs

Refer to MUX-1602C Setup for a description of VCR related menus and their use.

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Tape Recording	Refer to Figure 1 — Basic MUX-1602C System. Make sure the video input of the VCR is connected to the vcr out connector on the MUX-1602C.
Multicamera Recording	<p>Multiple camera recording involves placing the VCR in the record mode. All cameras connected to the MUX-1602C are encoded onto tape. No action is required at the MUX-1602C.</p> <p>NOTE: Several factors affect the order and rate at which cameras are recorded. See “Tape Mode” to review the factors affecting multicamera recording.</p>
Single Camera Recording	<p>The MUX-1602C can be directed to record a single “priority” camera exclusively. This feature can be turned on or off at any time.</p> <p>To Start Single Camera Recording:</p> <ol style="list-style-type: none"><li>1. Press and hold the 1 cam rec (function) button.</li><li>2. Press the camera button for the camera to be recorded. The MUX-1602C displays the selected camera and flashes the 1 cam rec light to indicate the system is in the single camera record mode.</li></ol> <p>Press the tape button to preview the camera video being recorded. Press the live button to resume live camera viewing.</p> <p>To Stop Single Camera Recording:</p> <ol style="list-style-type: none"><li>1. Press and hold the 1 cam rec button.</li><li>2. Press the live button.</li></ol> <p>The 1 cam rec light stops flashing and the MUX-1602C resumes multicamera recording.</p> <p>NOTE: When the 1 CAM REC light is flashing, only the selected camera is recorded. You must stop single camera recording to resume recording all cameras.</p>

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Tape Playback	<p>To review tape recording with the MUX-1602C, press the tape button and place the VCR in the play mode. The MUX-1602C decodes the video signal at the vcr in connector and displays it in the current format. Cameras appear in the order they were recorded.</p> <p>MUX-1602C operation during videotape playback is the same as when viewing live cameras. All front panel buttons have the same effect. The difference is that the VCR is the source of video.</p>
VCR Special Effects	<p>Most special video playback features can be used while reviewing an MUX-1602C recording. Field oriented features such as field advance or still field should work, provided the VCR reproduces each video field accurately.</p>
Alarm Response	<p>The MUX-1602C detects and responds to three types of alarm events: mechanical alarms, video loss alarms and recorded alarms. A mechanical alarm event occurs when there is a contact closure at any MUX-1602C alarm input. A video loss alarm occurs when the MUX-1602C detects the loss of video at an active camera input. A recorded alarm event occurs when the MUX-1602C detects an "alarm" encoded field during tape playback.</p> <p>This section describes how the MUX-1602C responds to alarm events and what can be done when an alarm occurs.</p>
Mechanical Alarms	<p>The MUX-1602C alarm connector provides one mechanical alarm input for each camera input. These inputs can be connected to any security device equipped with either a contact closure or TTL/CMOS standard alarm output. Alarm polarity is selectable via MUX-1602C setup menus. See Alarm Input Polarity for details.</p> <p>Each alarm input requires two wires. One wire connects to the desired alarm input pin. The second wire connects to any available ground pin. See Table 2 — Alarm Connector Pin Assignments for details.</p> <p>The MUX-1602C responds to mechanical alarms at all times. However, that response depends upon its mode (Live or Tape) when the alarm occurs.</p>

Live Mode Alarm Response    When a mechanical alarm occurs in Live mode, the MUX-1602C alerts the operator and performs tasks required to record the alarm event on videotape.

When the initial alarm is detected in Live mode, the MUX-1602C does the following:

1. Flashes the associated camera button light.
2. Sounds the alarm buzzer if the Audible Alarm option is set to ON.
3. Energizes the alarm relay.
4. Displays the alarm camera on the Call Monitor, overlaid with the ALARM message. If there are multiple alarms, the alarm cameras will display in sequence on the Call Monitor.
5. Switches the Main Monitor to the highest multicamera format if the alarm camera is not already on display.
6. Overlays the alarm camera with the ALARM message.
7. Switches to the VCR Alarm Record Time encoding rate.
8. Encodes the camera as "alarm" and sends it to the VCR on a priority basis.

The MUX-1602C remains in the alarm state until ALL of the following occur:

- All mechanical alarms are released.
- The Alarm Duration time elapses.
- The Alarm Hold Input is released.

Multiple alarms are processed in the order in which they occur. Alarm cameras are identified by flashing camera button lights and receive priority for output to the VCR.

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**Tape Mode Alarm Response** When a mechanical alarm occurs in Tape mode, the MUX-1602C processes the event in the background. It performs tasks required to record the alarm event on videotape but does not indicate the alarms to the user. This allows alarm recording during tape playback. See Simultaneous Record and Play for details.

When the initial alarm is detected in Tape mode, the MUX-1602C does the following:

1. Energizes the alarm relay.
2. Switches to the VCR Alarm Record Time rate.
3. Encodes the camera as "alarm" and sends it to the VCR on a priority basis.

The MUX-1602C remains in the alarm state until ALL of the following occur:

- All mechanical alarms are released.
- The Alarm Duration time elapses.
- The Alarm Hold Input is released.

Multiple alarms are processed in the order in which they occur. Alarm cameras are identified by flashing camera button lights.

**Video Loss Alarms** The MUX-1602C detects loss of video at any connected camera input by monitoring the camera's video sync signal. The Video Loss Alarm option controls this feature. When this option is ON (the default), the MUX-1602C responds to loss of camera video by alerting the operator and performing tasks required to record the alarm event on videotape.

The MUX-1602C does the following when it detects loss of camera video:

1. Flashes the associated camera button light.
2. Energizes the alarm relay.
3. Switches the Call Monitor to the lost camera input and displays the VIDLOSS message. If multiple cameras lose camera input, those camera titles will be displayed in sequence on the Call Monitor.
4. Switches the Main Monitor to the multicamera format, if the alarm camera is not already displayed, and displays the VIDLOSS message, if the Video Loss Alarm option is set to ON (the default).
5. Switches to the VCR Alarm Record Time encoding rate.
6. Encodes the camera as "video lost" and sends it to the VCR.

The MUX-1602C remains in the alarm state until ALL of the following occur:

- No video loss is detected.
- The Alarm Duration time elapses.
- The Alarm Hold Input is released.

Multiple alarms are processed in the order in which they occur. Alarm cameras are identified by flashing camera button lights and receive priority for output to the VCR.

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**Recorded Alarms** The MUX-1602C detects recorded alarm events by monitoring the VIS information returned from tape. Each field of recorded video is encoded with alarm status information, camera number, camera title, time and date. The MUX-1602C uses this information to identify camera related alarm events.

The MUX-1602C must be in Tape mode to display and process recorded alarms. When the MUX-1602C detects an alarm event on tape, it responds by alerting the operator in a manner identical to that of a live alarm. Since recorded alarm processing and live mechanical alarm processing are independent functions, the MUX-1602C can perform both tasks at the same time.

If the MUX-1602C detects a recorded alarm while in Tape mode, it does the following:

1. Flashes the associated camera button light.
2. Displays the alarm camera on the Call Monitor, overlaid with the ALARM message.
3. Overlays the alarmed camera with the ALARM message if that camera is currently displayed.

The MUX-1602C remains in the alarm state until all of the following occur:

- No recorded alarms are detected.
- The Alarm Duration time elapses.

Multiple alarms are processed in the order in which they occur. Alarm cameras are identified by flashing camera button lights.

The MUX-1602C detects recorded alarm events at any playback speed (including forward and reverse search on many VCRs). When a tape is played at the speed it was recorded, the duration of each alarm is the same as the original event. Other tape speeds can speed up or slow down alarm playback; however, the minimum alarm time remains 4 seconds.

- 
- Video Motion Detection** The MUX-1602C detects changes in camera video (motion) at any connected camera inputs. It responds to motion by increasing the rate at which that camera is recorded and displayed.
- The goal of motion detection is to prioritize cameras for display and recording. The MUX-1602C gives priority to “motion” cameras by sampling them more frequently. The result is that cameras with motion update faster, both on screen and on tape. This technique allows the MUX-1602C to operate at highest efficiency while ensuring that important events are displayed and captured on videotape.
- How Motion Detection Works** The MUX-1602C continuously scans each camera input for video. When video is detected, the unit captures one video field in digital memory. It then measures the value of up to 192 “target” pixels in the picture and stores the results for reference. During the next scan, the MUX-1602C measures the target pixels again. Then it compares the new and old target values. If the values differ significantly, the MUX-1602C assumes that motion has occurred.
- Motion Detection Setup** By default, all 192 motion detection targets are turned on for each camera input. You can tailor motion detection for each camera input by turning targets off or on at the motion detection setup screen. See Motion Detection Setup Screen for details.



**Alarm Counter** The MUX-1602C counts the number of mechanical alarm events that occur at each camera input. It maintains a total count for each camera until the alarm counter is cleared.

The maximum alarm count per camera is 999. Once the counter reaches 999, it does not change until it is cleared.

To Display the Alarm Counter Screen:

Press function+left arrow. The MUX-1602C displays the alarm count for each camera input and the time/date on which the count was last cleared.

To Exit the Alarm Counter Screen:

Press the live button to exit the alarm counter screen. The MUX-1602C removes the Alarm Counter from the screen and resumes normal operation. Alarm counts are NOT cleared and counting continues without interruption.

To Clear the Alarm Counter:

Press function+left arrow to display the alarm counter screen. Then press the select button to clear the alarm counter. The MUX-1602C resets the Alarm Counter (sets all counts to 000) and updates the ALARM COUNT SINCE date and time. Alarm counting begins immediately.

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**SPECIAL APPLICATIONS**

The features and flexibility of the MUX-1602C make it a powerful tool in special applications where unique capabilities are required. This section describes several ways to use the MUX-1602C.

**Simultaneous Record and Play**

The MUX-1602C encode and decode circuits operate simultaneously. This is referred to as “full duplex” operation. The unit can encode camera video to one VCR while it decodes and displays video played on a second VCR. The two operations do not interfere with each other. Without this capability, camera video recording must stop while a previously recorded tape is viewed.

Full duplex capability is most important in applications that demand continuous video recording of multiple cameras. It allows an operator equipped with a second video recorder to review MUX-1602C tapes without interrupting the recording process.

Refer to Figure 2—MUX-1602C System with Two VCRs. To add a second VCR to a standard MUX-1602C installation, perform the following steps:

1. Disconnect the cable at the video input of the existing VCR. (Leave the other end of this cable connected to the MUX-1602C vcr out connector.) This VCR is now dedicated for tape playback.
2. Reconnect the loose end of the cable above to the video input of the second VCR. This VCR is now dedicated for tape recording.
3. Set the MUX-1602C's Number of VCRs toggle option to TWO.

The MUX-1602C operates exactly the same way when

connected to two VCRs. The only difference is that recording and playback are performed by different machines.

**Multiplexed Video Transmission** Two MUX-1602C multiplexers can be employed to transmit video from multiple cameras over a single video communication link. The link may be coax cable, a microwave channel, or any other medium that supports real-time video. Where two communication links are available, simultaneous two-way video communication is possible. Multiplexed video transmission requires that one MUX-1602C be installed at each location. See Figure 3 — One-Way Multiplexed Video Transmission.

A multiplexed video link allows users at each end to display either local or remote cameras. MUX-1602C operation is normal except that you press the function+tape buttons to display the remote cameras.

**One-Way Video Transmission** One-way multiplexed video transmission requires two MUX-1602C's and one video quality communication link. The link joins the vcr out connector at Site A to the vcr in connector at Site B. Both Site A and Site B can view the cameras located at Site A. Site B can view either local cameras (press live) or the cameras located at Site A (press function+tape).

**Two-Way Video Transmission** Two-way multiplexed video transmission requires two MUX-1602C's and two video quality communication links. The communication links cross connect the VCR connectors at these sites. Connect vcr out at Site A to vcr in at Site B and vice versa. Both sites can view either local cameras (press live) or the cameras located at the other site (press function+tape).

To establish a multiplexed video transmission link:

1. Connect two MUX-1602C's as described above (also see Figure 3 — One-Way Multiplexed Video Transmission).
2. Set the VCR Record Time on both MUX-1602C's to 002 HRS.
3. Set the Number of VCRs option on both multiplexers to TWO.
4. Press function+tape on each MUX-1602C. The MUX-1602C enters the video transmission mode and displays all remote cameras.

The link is now established. Press the live button to view local cameras. Press function+tape to view remote cameras.

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MUX-1602C Remote Control	The MUX-1602C provides two methods of remote control, RS-232 data and a remote panel option. Both methods use the rear panel remote connector.
Remote Control Panel product	<p>A remote control panel is available for each MUX-1602C series as follows. The panels are designated the RP1094, RP1099 and RP1096 respectively. Each consists of a front panel assembly, a desktop stand, rack mount brackets, a 50' cable and a local-end adapter. The local-end adapter connects the panel to the remote connector. Remote panel operation is identical to that of the local panel and control can be exercised from either panel.</p> <p>For more information about this option, contact your Robot dealer or Factory Technical Support.</p>
RS-232 Data	<p>The RS-232 remote feature allows the MUX-1602C to be controlled from a computer or ASCII communications terminal (see Figure 4 — MUX-1602C System with RS-232). The MUX-1602C recognizes special three character groups as remote button press commands. Each command represents a single or combination (function+button) button press. Because RS-232 control works by emulating button presses, any operation that can be performed at the front panel can be performed remotely.</p> <p>The RS-232 remote connection requires two wires. One wire connects to the RS-232 pin (pin 25) and the other connects to a ground pin (pin 13, 14 or 15). The communication protocol supported by the MUX-1602C is as follows:</p> <p style="margin-left: 40px;">Data Rate: 1200 bps</p> <p style="margin-left: 40px;">Characters: 8</p> <p style="margin-left: 40px;">Parity: none</p> <p style="margin-left: 40px;">Stop bits: 1</p> <p>The RS-232 remote pin is an input only. The MUX-1602C does not echo commands or output data of any type. See Remote Connector for more information.</p>

RS-232 Remote Command Set RS-232 remote commands consist of three ASCII characters. All commands begin with the forward slash “/” character. The two characters following the slash identify the command. Table 1 — RS-232 Remote Command Set lists each valid RS-232 command and the button it represents.

It is important to remember that most MUX-1602C front panel buttons have multiple functions. The effect of a button press is determined by the current status of the unit. Determine the status of the MUX-1602C before issuing remote commands because inappropriate commands will be ignored.

RS-232 COMMAND	EQUIVALENT BUTTON PRESS
/AT	function
/FZ	full screen / zoom
/PP	PIP / up arrow
/22	2 x 2 / down arrow
/33	3 x 3 / left arrow
/44	4 x 4 / right arrow
/LV	live
/TP	tape
/SQ	seq (sequence)
/SL	select
/01— /16	cameras 1-16
/AF	function + zoom
/AL	function + left arrow
/AR	function + right arrow
/AU	function + up arrow
/AD	function + down arrow
/S1— /9	1 cam rec (cameras 1-9)
/SA—/SG	1 cam rec (cameras 10-16)

Table 1 — RS-232 Remote Command Set

## APPENDIX A CONNECTOR PIN ASSIGNMENTS

**Alarm Connector** The Alarm connector is a DB25-S. It accepts a DB25-P mating connector (not provided).

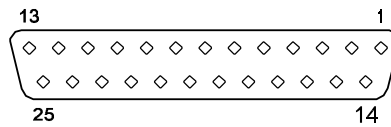


Figure 7 — Alarm Connector

PIN NO.	PIN ASSIGNMENT	PIN NO.	PIN ASSIGNMENT
1	Alarm input 1	14	Alarm input 14
2	Alarm input 2	15	Alarm input 15
3	Alarm input 3	16	Alarm input 16
4	Alarm input 4	17	Reserved
5	Alarm input 5	18	Ground
6	Alarm input 6	19	Ground
7	Alarm input 7	20	Ground
8	Alarm input 8	21	Reserved
9	Alarm input 9	22	Alarm hold input
10	Alarm input 10	23	Alarm output NC
11	Alarm input 11	24	Alarm output common
12	Alarm input 12	25	Alarm output NO
13	Alarm input 13		

Table 2 — Alarm Connector Pin Assignments

Remote Connector The Remote connector is a DB25-S. It accepts a DB25-P mating connector (not provided).

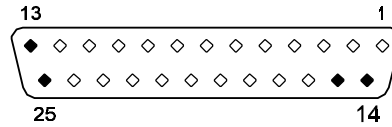


Figure 8 — Remote Connector

NOTE: The RS-232 input wire connects to pin 25. The ground wire connects to one of the ground pins, either pin 13, 14 or 15.

PIN NO.	PIN ASSIGNMENT	PIN NO.	PIN ASSIGNMENT
1	Remote panel	14	Ground
2	Remote panel	15	Ground
3	Remote panel	16	Remote panel
4	Remote panel	17	Remote panel
5	Remote panel	18	Remote panel
6	Remote panel	19	Remote panel
7	Remote panel	20	Remote panel
8	Remote panel	21	Remote panel
9	Remote panel	22	Remote panel
10	Remote panel	23	Remote panel
11	Remote panel	24	Remote panel
12	Remote panel	25	RS-232 input
13	Ground		

Table 3 — Remote Connector Pin Assignments

## APPENDIX B ALARM RECORDING CONTROL

Most MUX-1602C installations require that alarm events be documented on videotape. The MUX-1602C provides all of the necessary connectors and signals to accomplish this and is flexible enough to satisfy most video documentation requirements.

An MUX-1602C alarm event begins when the unit detects an alarm signal at the alarm connector. The sequence of events following alarm detection is determined by one or more of the following:

- MUX-1602C option settings.
- VCR programming.
- MUX-1602C to VCR interconnections.

The following paragraphs describe how to configure an MUX-1602C installation for either uncontrolled or controlled alarm recording.

### Uncontrolled Alarm Recording

When alarm recording is not controlled, the VCR records alarmed cameras as normal video. Recorder operation is not affected by alarm events. The VCR simply records alarm video output by the MUX-1602C at the set time-lapse speed. Uncontrolled alarm recording requires only video connections between the MUX-1602C and the VCR. Alarm connections are not required.

To set up the system for uncontrolled alarm recording:

1. Connect the MUX-1602C vcr in and vcr out connectors to the VCR's video output and video input respectively.
2. Set the MUX-1602C Alarm Duration option to the number of seconds you wish each alarm event to be recorded.
3. Set the VCR's time-lapse speed as desired.
4. Set the MUX-1602C VCR Record Time and VCR Alarm Record Time options to match the speed set at the VCR.

**Controlled Alarm Recording** When alarm recording is controlled by the MUX-1602C, the VCR responds to the alarm signal provided by the MUX-1602C. The recorder goes into the alarm recording mode and records at the alarm record speed. It remains in the alarm mode until released by the MUX-1602C.

Controlled alarm recording requires both video and alarm connections between the MUX-1602C and the VCR.

To set up the system for MUX-1602C controlled alarm recording:

1. Connect the MUX-1602C vcr in and vcr out connectors to the VCR's video output and video input respectively.
2. Connect a wire from the VCR ground to MUX-1602C alarm connector pin 24 (alarm output common).
3. Connect a wire from the VCR alarm input to MUX-1602C alarm connector pin 25 (if VCR alarm input polarity is active low) or pin 23 (if VCR alarm input polarity is active high).
4. Set the MUX-1602C Alarm Duration option to the number of seconds you wish each alarm event to be recorded.
5. Set the VCR's alarm duration option to "manual".
6. Set the MUX-1602C VCR Record Time option to match the VCR's normal recording speed.
7. Set the MUX-1602C VCR Alarm Record Time option to match the VCR's alarm recording speed.

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**APPENDIX C  
IN CASE OF TROUBLE**

When a problem arises, review the section of the manual that covers the activity during which the problem occurs. If necessary, consult the troubleshooting table on the following pages.

If the problem cannot be resolved, you may have to contact your dealer or the factory. When you call for support, the representative will ask you to provide specific information about the installation. To save time, spend a few minutes getting organized before you pick up the telephone.

Before calling your Robot dealer or Factory Technical Support, write down the following information:

- The serial number of your MUX-1602C.
- The make and model of each piece of hardware connected to the MUX-1602C.
- Approximate date of purchase and of installation.
- The symptoms, as you have observed them.

**NOTE:** Please do NOT return any product to the factory without first obtaining a Return Authorization (RA) number. Failure to do so can result in a significant delay in processing your repair. To obtain an authorization number, contact Factory Technical Support.

TROUBLESHOOTING GUIDE		
PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
Video Problems in Live Mode		
All live pictures too bright, too dark or bad color.	MUX-1602C camera termination option	Change MUX-1602C camera termination setting.
	Monitor not correctly adjusted.	Adjust monitor using MUX-1602C color bars.
Some live pictures too dark.	Some cameras are double terminated.	Remove second termination from affected cameras.
	Camera iris is not correctly adjusted.	Adjust camera iris using calibrated monitor.
Some live pictures too light.	Some cameras are not terminated.	Correctly terminate affected cameras.
	Camera iris is not correctly adjusted.	Adjust camera iris using calibrated monitor.
Black horizontal lines through picture or picture not stable.	Camera is double terminated.	Remove second termination from camera.
	Faulty camera sync or video output.	Replace faulty camera with one that provides good images.
Video Problems in Tape Mode		
Poor pictures, poor color or pictures not stable.	VCR faulty or requires maintenance.	Perform periodic maintenance and test VCR performance.
Motion Detection Problems		
Important camera motion not detected.	Required camera motion targets turned off.	Perform motion detection setup. Turn on required motion targets.
Unimportant camera motion detected.	Unnecessary motion targets turned on.	Perform motion detection setup. Turn off required motion targets.
Motion is detected when no motion occurs.	Either camera is random interlace type, or video is unstable.	Replace camera or substitute with another model.

PROBLEM	POSSIBLE CAUSE	SUGGESTED ACTION
<b>Alarm Processing Problems</b>		
Continuous alarm when alarm input is connected.	Alarm device polarity and MUX-1602C alarm input polarity do not match.	Change alarm device polarity or MUX-1602C alarm input polarity.
<b>Remote Control Problems</b>		
No response to RS-232 remote input.	Serial communications protocol not correct.	Configure remote device for 1200 bps, 1 start bit, 8 data bits, 1 stop bit, no parity.
	Data and data ground connections reversed.	Reverse data and data ground connections.
No response to remote control panel.	Local-end adapter from remote panel plugged into alarm connector.	Plug local-end adapter into remote connector.
	Remote panel data connections loose.	Check remote panel data connections.
	Remote panel power cable loose or not connected.	Check remote panel power cable connection.

APPENDIX D  
TECHNICAL SPECIFICATIONS

The following specifications apply to Robot MUX-1602C series products only. Robot reserves the right to revise and improve its products. All specifications are therefore subject to change without notice.

Operating Defaults	Format	Largest multicamera format
	Display	Live
	Switcher	Select and Sequence off
	VCR Record Time	24 hours
	VCR Alarm Record Time	24 hours
	Alarm Duration	4 seconds
	Global Dwell	2 seconds
	Alarm Message Latch	Off
	Video Loss Alarm	On
	Audible Alarm	Off
	Alarm Input Polarity	Active low
	Input Impedance	75 ohms
	Number of VCRs	One
	Camera Titles	Camera number
	Motion Setup Screen	All targets selected
	Security Lock	Off
Video Format	NTSC/PAL color	
	EIA/CCIR B&W	
Video Level	Camera Inputs	1.0 V p-p, 75 ohms
	Camera Outputs	1.0 V p-p, 75 ohms
	VCR Inputs: Composite	1.0 V p-p, 75 ohms

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	VCR Inputs: S-Video	Luma 1.0 V p-p, 75 ohms Chroma (burst) 285mV p-p, 75 ohms
	VCR Outputs: Composite	1.0 V p-p, 75 ohms
	VCR Outputs: S-Video	Luma 1.0 V p-p, 75 ohms Chroma (burst) 285mV p-p, 75 ohms
Alarm	Camera Alarm Input	One input per camera. Activated by contact closure or TTL/CMOS signal. Polarity selectable.
	Alarm Hold Input	+5 to +15 VDC or TTL/CMOS Active High signal.
	Alarm Duration	4 second default. Menu selectable from 2 to 999 seconds.
	Alarm Output	Normally open (NO) and normally closed (NC) contacts with shared common: 2.0 A at 30 VDC (resistive only) 1.0 A at 125 VAC (resistive only)
Display	Color Palette	16,777,216 colors (24 bits)
	Gray Shades	256 (8 bits)
	Full Screen Format (pixels)	512 x 464 (512 x 512 PAL)
	2 x 2 Format	256 x 232 (256 x 256 PAL)
	3 x 3 Format	170 x 154 (170 x 170 PAL)
	4 x 4 Format	128 x 116 (128 x 128 PAL)
	PIP Inset	128 x 116 (128 x 128 PAL)
	Zoom Display	Interpolated 512 x 464 (512 x 512 PAL)

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Controls	General	Soft touch, rubberized push buttons with indicator lights.
	1 Cam Rec (Function)	Used in combination with other buttons to access special functions.
	Full Screen (Zoom)	Selects full screen, 2x zoom display or program menu.
	PIP (Up Arrow)	Selects Picture-In-Picture display or UP function.
	2 x 2 (Down Arrow)	Selects 2 x 2 picture display or DOWN function.
	3 x 3 (Left Arrow)	Selects 3 x 3 picture display or LEFT function.
	4 x 4 (Right Arrow)	Selects 4 x 4 picture display or RIGHT function.
	Live	Selects camera inputs for viewing.
	Tape	Selects VCR input for viewing.
	Seq (Sequence)	Selects sequential camera display in full screen or lower right window.
	Select	Selects cameras for display.
Camera	Selects camera for viewing or single camera record. Turns motion targets on or off.	
Connectors	Power	2.1 mm pin-type female. Power input.
	Remote	DB25-S. Remote control via contact closure, TTL/CMOS or RS-232 data.
	Alarm	DB25-S. Alarm control via contact closure or TTL/CMOS signal.
	Call Mon	BNC. Video signal output to call monitor.

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	Monitor	BNC. Video signal output to main monitor.
	S-VHS In	S-Connector. S-Video input from VCR.
	S-VHS Out	S-Connector. S-Video output to VCR.
	VCR In	BNC. Composite video input from VCR.
	VCR Out	BNC. Composite video output to VCR.
	Camera In	BNC. Composite video input from camera.
	Camera Out	BNC. Composite video output from camera (passive loop through).
Electrical	Power Requirement	18 Watts (center positive 12 VDC)
Physical Characteristics	Dimensions	17" (432mm) Wide 12.25" (311mm) Deep 1.75" (44mm) High
	Shipping Weight	10 lbs. (4.54kg)
	Environmental Requirements	Temperature. 40—104° F (5—40° C) Humidity, 5—95% RH noncondensing Altitude (operating), 0—10,000 feet (0—3,048 meters)