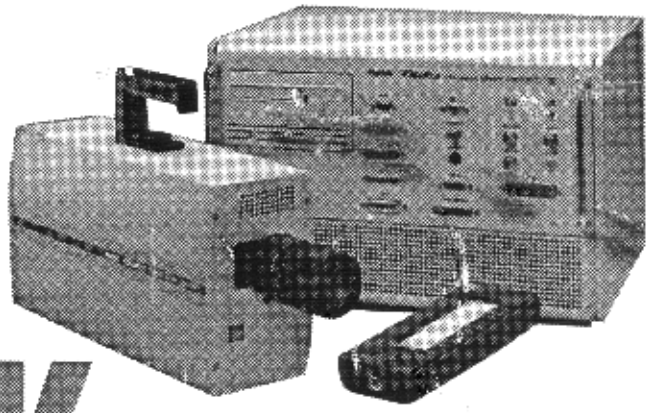
USER'S MANUAL
MODEL 1000 HRC



KODAK EKTAPRO Motion Analyzer

MOTION ANALYSIS SYSTEMS

CHAPTER

1 Introduction

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Chapter One: Introduction

Chapter Two: Controls and Connectors

Chapter Three: Getting Started

Chapter Four: Keypad Operation

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Contents

Introduction

The Motion Analyzer is designed to be a valuable addition to the engineer's or scientist's problem solving instrumentation kit. The handheld keypad, framing rates and instant video playback make evaluating your most difficult motion related problems simple.

The live setup feature allows the user to be sure that the image is exactly what is required to solve the problem. There is no guesswork about exposure levels or image composition. What the user sees on the video display is what will be captured in memory when the RECORD key is pressed.

The information in this manual will teach you how to operate the Motion Analyzer.

How to Use This Manual

Definition of Terms

You will notice as you read this manual that some of the information is presented as a WARNING, CAUTION or NOTE. It is important that you understand the significance of these three terms.

WARNING

A warning is important to the safety of anyone operating the Motion Analyzer and should not be disregarded under any circumstances.

CAUTION

A caution is intended to warn you that a certain operation or condition may cause harm to your Motion Analyzer.

NOTE

A note contains information that we wish to emphasize regarding the operation of your Motion Analyzer.

How to Use This Manual

Chapter One, Introduction

Contains the introduction, how to use this manual, warranty and precautions.

Chapter Two, Controls and Connectors

An introduction to the components of your Motion Analyzer. Explains the use of each connector and control on the Imager and the Processor.

Chapter Three, Getting Started

Explains the use of each of the dedicated keys, how to move between the menu pages and how to use the softkeys.

Chapter Four, Keypad Operation

Details how to connect and operate the Motion Analyzer. The step by step instructions in chapter four organize your first recording session, from component connection to playback.

Chapter Five, Recording Strategies

Provides a model for understanding how a solid state recorder works and also provides background information to aid in selecting an appropriate record mode.

Chapter Six, Routine Care

Contains information about caring for lenses, cleaning the air filters and how to get in touch with your service engineer should you need assistance with your Motion Analyzer

Chapter Seven, Specifications

Peformance specifications for the Imager and Processor.

If you require additional information not included in this manual regarding the care, technical service and operation of your Motion Analyzer please contact our service department in San Diego by calling:

800 - 854 - 7006

The San Diego office is open from 7:00 a.m. to 5:00 p.m., Pacific time, Monday through Friday (excluding holidays).

Warranty

NEW EQUIPMENT WARRANTY
Motion Analyzer

EASTMAN KODAK COMPANY, MOTION ANALYSIS SYSTEMS DIVISION, WARRANTS THIS MOTION ANALYZER AND ACCESSORIES MANUFACTURED BY EASTMAN KODAK COMPANY, TO FUNCTION PROPERLY FOR ONE YEAR FROM THE DATE OF SHIPMENT.

Kodak agrees to perform the following equipment warranty services in the United States.

1. **Repair service:** If shipped to us, repairs will be made at no charge.
2. **Parts replacement:** Replacements parts installed under warranty will be provided at no charge.

THIS WARRANTY DOES NOT APPLY UNDER THE FOLLOWING CONDITIONS:

Failure to operate the KODAK EKTAPRO Motion Analyzer, Model 1000HRC, in accordance with Kodak's written instructions, including environmental specifications listed in the User's Manual.

If there is evidence of the KODAK EKTAPRO Motion Analyzer, Model 1000HRC, being subjected to accidental damage, misuse or abuse.

If the KODAK EKTAPRO Motion Analyzer, Model 1000HRC, has been repaired or tampered with by persons other than Kodak personnel, customer personnel trained by Kodak or without permission of Kodak.

Shipping damage is not covered by this warranty. The purchaser has the responsibility to place a claim of damage in shipment with the carrier.

KODAK MAKES NO OTHER WARRANTIES, EXPRESS, IMPLIED, OR OF MERCHANTABILITY FOR THIS EQUIPMENT. IF THIS MOTION ANALYZER, DOES NOT FUNCTION PROPERLY DURING THE WARRANTY PERIOD, KODAK WILL REPAIR IT WITHOUT CHARGE ACCORDING TO THE TERMS STATED ABOVE. REPAIR WITHOUT CHARGE IS KODAK'S ONLY OBLIGATION UNDER THIS WARRANTY. KODAK WILL NOT BE RESPONSIBLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM THE SALE, USE OR IMPROPER FUNCTIONING OF THIS EQUIPMENT EVEN IF LOSS OR DAMAGE IS CAUSED BY THE NEGLIGENCE OR OTHER FAULT OF KODAK.

Manual Part Number 91000042-001 Rev. D. KODAK, EKTAPRO, DATA-FRAME and CAROUSEL are trademarks.

Precautions

Ventilation

Holes at the front and rear of the Processor and Imager are provided for proper ventilation. To protect from overheating, do not block or cover the holes and do not operate the Processor or Imager in a space that does not have proper ventilation.

Temperature

The KODAK EKTAPRO Motion Analyzer, Model 1000HRC, is designed to operate satisfactorily in an environment where the ambient temperature is between 0 and 45 degrees Centigrade (32 and 113 degrees Fahrenheit), and there is no water condensation present.

Storage

Do not store the equipment in an area where the temperature will drop below -20 degrees or exceed 70 degrees Centigrade (-4 to 158 degrees Fahrenheit). Ensure that moisture does not condense on the system.

Shipping

When shipping, use the shipping carton in which the unit was originally delivered. If you must frequently ship your motion analyzer, you may wish to purchase an accessory shipping case that has been designed for this purpose.

Do not ship the equipment in an area where the temperature will drop below -20 degrees or exceed 70 degrees Centigrade (-4 to 158 degrees Fahrenheit). Ensure that moisture does not condense on the system.

Precautions

FEDERAL COMMUNICATIONS COMMISSION STATEMENTS

WARNING: 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 the FCC Rules and VDE 0871 Class "B", 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 device complies with Part 15 of the FCC Rules and VDE 0871. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation.

WARNING

This product is grounded through the power cord. This protective ground connection is essential for safe operation of the equipment. Avoid electrical shock by plugging the power cord into a properly wired receptacle. A loss of the protective ground, for any reason, could result in electrical shock. Use the proper power cord and ensure that it is in good condition.

To avoid the risk of an explosion, do not operate this product in an explosive atmosphere.

CAUTION

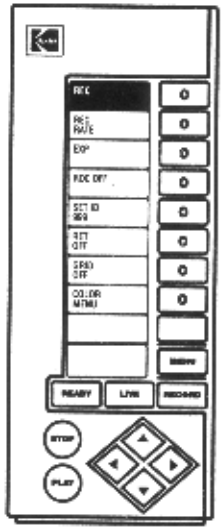
To avoid the risk of fire, use only the fuse specified for the equipment. The proper fuse is listed on the back panel of the equipment.

CHAPTER

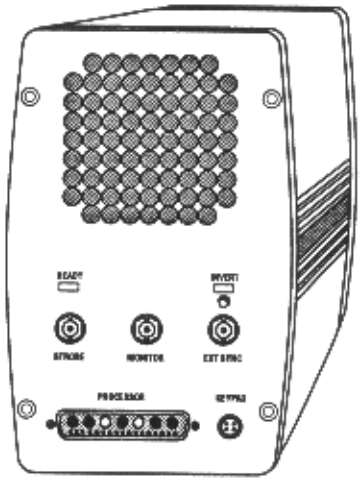
2 Controls and Connectors

Visual Introduction
Imager
Processor
Keypad
Video Display

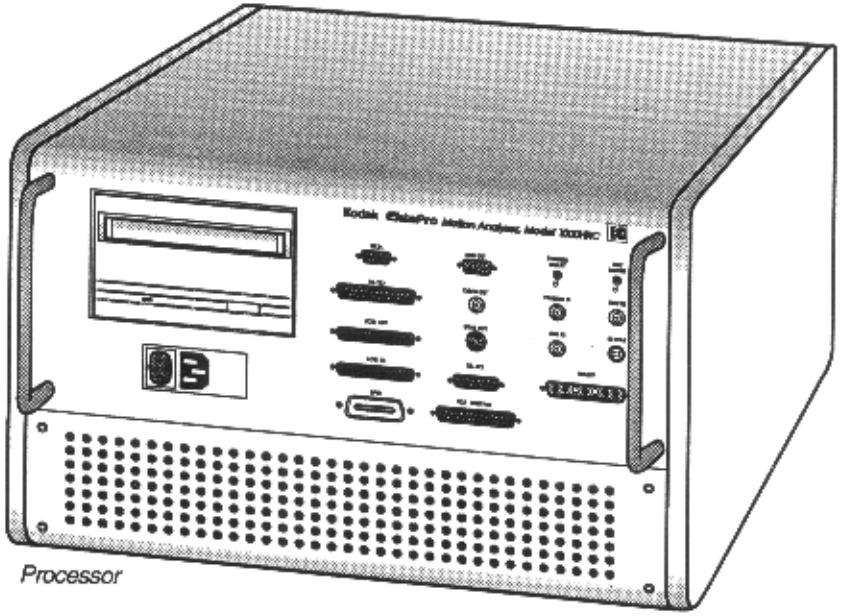
Visual Introduction



Keypad



Imager

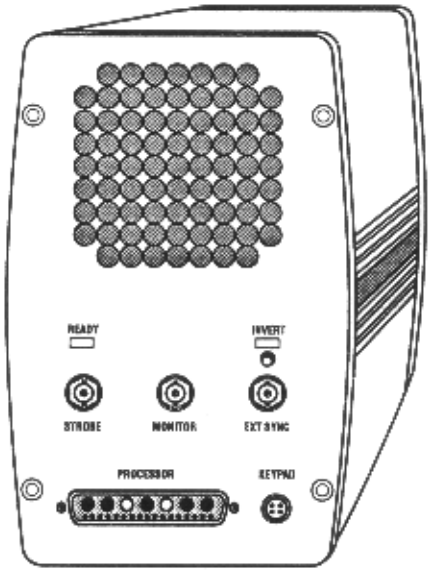


Processor

Imager

Processor

This connector accepts the cable that connects the Processor to the Imager. All video, control and power lines between the Processor and the Imager pass through this connection.



Keypad

This connector is identical to the connector on the Processor and serves the same purpose. The motion analyzer can be controlled by a keypad plugged into the Imager or the Processor.

Strobe

This is a BNC type connector with an output signal that coincides with the sensor exposure interval. This signal may be used to trigger a strobe pulse or to synchronize other equipment used in the event under study. The output is TTL compatible going positive from ground to at least 3.8 volts at the beginning of each frame. This output will drive a coaxial cable terminated through 75 Ohms to ground at the receiving equipment.

Monitor

This is a BNC type connector that is another video output for the motion analyzer. The signal present at this connector is identical to the VIDEO OUT connector on the Processor. The signal is standard Composite Video with 75 Ohms output impedance. This output should be connected to a video monitor or VCR terminated through 75 Ohms to ground at the receiving equipment.

Imager

Ext Sync (External Synchronizing Input)

A BNC type connector that receives an exposure synchronizing input from the user. This input accepts signals from open collector, switch closure or TTL sources. The EXT SYNC input is connected to logic circuits within the Imager that interpret any voltage between -30.0 and +0.6 volts as a "low". Input voltages between +2.6 and +30.0 volts are interpreted as a "high." A fixed duration exposure may be selected from the keypad or the exposure is controlled by the width of the EXT SYNC signal.

CAUTION

Do not connect this input directly to the AC mains and do not exceed 30 volts DC or 30 volts RMS AC.

Invert

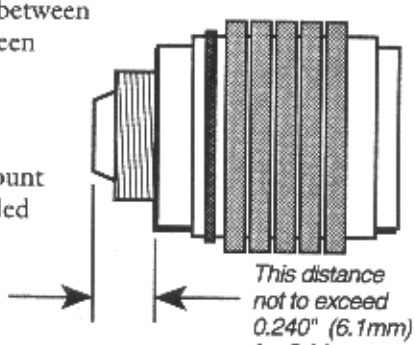
A momentary push button switch that changes the operating polarity of the EXT SYNC input. When the yellow LED above the switch is not illuminated a low to high transition of the EXT SYNC input begins an exposure. If the INVERT indicator is illuminated a high to low transition of the EXT SYNC input starts an exposure.

Ready

An LED that illuminates to indicate that the Imager and the Processor are properly connected, that the power is on, and that the communication diagnostics between the Processor and the Imager have been successfully completed.

Lens Mount

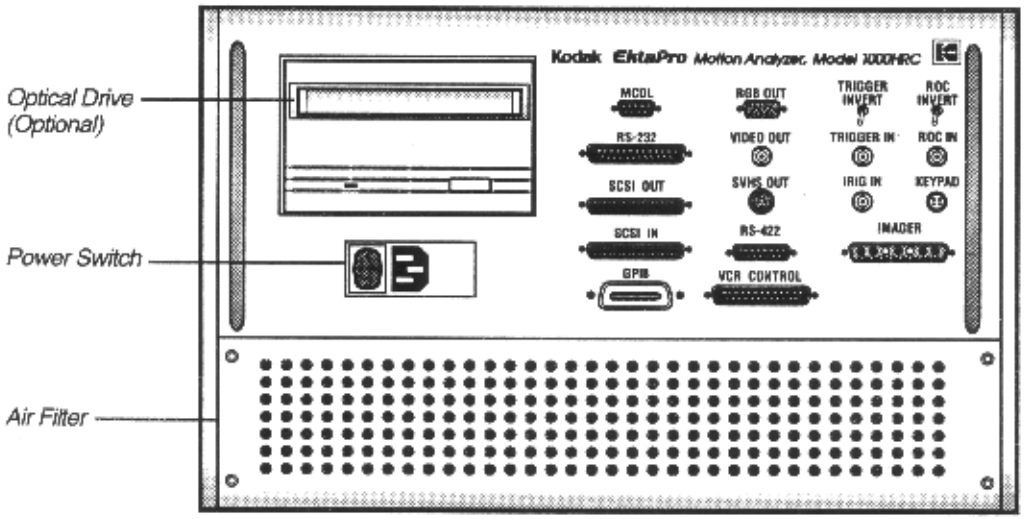
The Imager is equipped with a C-Mount threaded lens adapter. A lens is installed by screwing the lens clockwise into the lens mount until you are no longer able to turn the lens with light pressure.



CAUTION

A lens that intrudes past the mounting flange more than 0.240" will damage the glass filter located inside the camera. Measure from the flat surface at the base of the mounting threads to the end of the lens. This dimension must be less than 0.240."

Processor



NOTE

Do not operate the Processor in any position other than illustrated if an optical drive is installed.

Power Switch and AC Input Connector

The power switch turns the motion analyzer on and off. The AC power input is a standard IEC/CEE plug connector. The KODAK EKTAPRO Motion Analyzer, Model 1000HRC, is designed to work with input voltages of 110 and 220 volts AC. The power input frequency can be either 50 or 60 Hertz. Power consumption is 150 VA maximum. Both of the input power lines are fused at 6.3 amps time delay.

CAUTION

The KODAK EKTAPRO Motion Analyzer, Model 1000HRC must be turned off before connecting or disconnecting the AC power cord.

MCDL (Optional)

A nine pin D subminiature connector that accepts the cable connected to the KODAK EKTAPRO Multi Channel Data Link (MCDL). The user can supply analog and digital data to be recorded along with the images from the Imager.

RS232

This is a twenty five pin D subminiature connector for a serial data communication port. This port is for connection to a remote computer and conforms to the RS232 specification.

Processor

SCSI OUT

This is the Small Computer System Interface (SCSI) output connector. This output provides a data path to an archiving device.

SCSI IN

This is the Small Computer System Interface (SCSI) input connector. This connector accepts SCSI protocol commands from a computer.

GPIB (Optional)

Standard GPIB (General Purpose Interface Bus) connector digital video data and machine control are available through this interface.

RGB

Standard fifteen pin VGA connector used by most computer display monitors.

Video Out

The color video signal generated by the motion analyzer is output through this BNC type connector. The video output is designed to drive a 75 Ohm coaxial cable. The coaxial cable should be terminated through 75 Ohms to ground at the equipment receiving the video signal. Most VCR equipment is already terminated correctly.

SVHS Out

SVHS type connector that carries the color video output signal from the motion analyzer. This output connects directly to a SVHS VCR or monitor for better quality video.

RS422

A fifteen pin D subminiature connector for a serial data communication port. This port is for connection to a remote computer and conforms to the RS422 specification.

VCR Control

A twenty five pin D subminiature connector carrying RS232 serial data for controlling a remote VCR. The Processor uses this control link to a VCR for automated archiving of images from the Processor's video frame store.

NOTE

The Computer Interface Manual for this product contains the information explaining the use of the GPIB, RS232 and RS422 interfaces. The Processor can be controlled by any one of these interfaces.

Processor

Trigger In

A BNC type connector that receives a TRIGGER input from the user. This signal is connected to logic circuitry where a "low" is a voltage anywhere between -30.0 and +0.6 volts. The logic circuitry will read a voltage between +2.6 and +30.0 volts as a "high."

CAUTION

Do not connect this input directly to the AC mains and do not exceed 30 volts DC or 30 volts RMS AC.

Trigger Invert

This switch can be used to invert the user supplied input signal, if needed, for proper operation of the TRIGGER function. A complete explanation of the TRIGGER function can be found in chapter 5.

IRIG In

This BNC type connector accepts a standard IRIG time code signal. The time and date carried by this signal are displayed on the monitor with the video images in LIVE mode. The IRIG time code also gets recorded with the video images and the recorded timing information is displayed with the playback video.

Imager

Connector for the imager interconnect cable. All video, control and power lines between the Processor and the Imager pass through this connection.

ROC In

A BNC type connector that receives a TTL compatible ROC (Record On Command) input from the user. This signal is connected to logic circuitry where a "low" is a voltage anywhere between -30.0 and +0.6 volts. The ROC circuitry will read a voltage between +2.6 and +30.0 volts as a "high."

Processor

ROC Invert

This switch can be used to invert the user supplied input signal if needed for proper operation of the ROC function. A complete explanation of the ROC function can be found in chapter 5.

CAUTION

Do not connect this input directly to the AC mains and do not exceed 30 volts DC or 30 volts RMS AC.

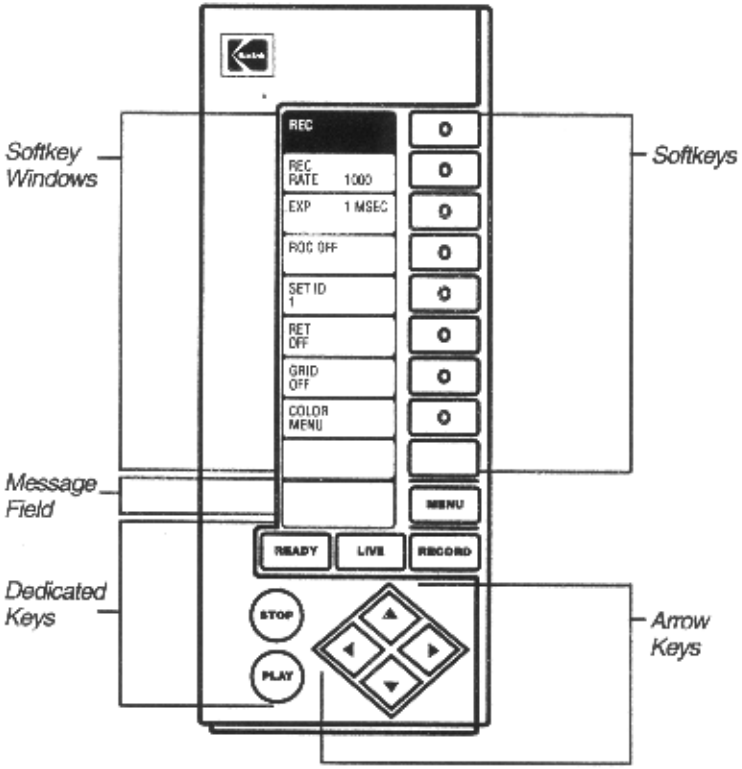
Keypad

This is where the keypad is connected to the Processor. The keypad may also be connected to the Imager.

Keypad

The keypad has a Liquid Crystal Display (LCD) and control keys that allow the user to manage all the KODAK EKTAPRO Motion Analyzer, Model 1000HRC functions. The keypad has nine softkeys, six dedicated keys and four arrow keys. A softkey's function changes according to the menu page being used but the dedicated keys and the arrow keys always do the same thing. The LCD gives the user information about the function of each softkey and system status.

The keypad will beep whenever you try to select a function that is disallowed. For example, if you press the PLAY key before you make your first recording, the keypad will "beep" because there are no pictures in memory to play.



Softkeys and Softkey Windows

Pressing a softkey highlights the softkey window to it's left. A dark background with light letters in a softkey window indicates that the function is active. Press the softkey repeatedly to cycle through its available options.

Keypad

Arrow Keys

Use the arrow keys to change any parameters shown in the active softkey window. Pressing either the UP or the RIGHT arrow key will increase the value of numbered functions. Pressing either the DOWN or the LEFT arrow key will decrease the value of numbered functions. Holding down an arrow key will cause the keypad to scroll through the variable's values.

Dedicated Keys

LIVE Places the system in the LIVE mode with frames being taken at the rate and exposure that is selected. The LIVE mode does not record pictures in the Processor memory. Pressing the LIVE key also switches the keypad to the LIVE menu.

READY The READY key must be pressed first in order for the RECORD key to work. Requiring the READY key to be pressed before the RECORD key protects against accidental recordings caused by bumping the RECORD key. The keypad MESSAGE field will display READY TO RECORD and the monitor STATUS field will display LIVE/READY. Pressing the STOP key is the only way to cancel the ready to record state.

RECORD Starts a recording if READY was the last key pressed.

NOTE

Pressing the RECORD key will record over images previously recorded in memory.

STOP Stops any LIVE, RECORD or PLAY function with the video monitor displaying a stopped frame.

PLAY Plays recorded images and the associated DATA FRAME information. Pressing the PLAY key switches the keypad to the PLAY menu.

MENU Press the MENU key to select the SETUP menu.

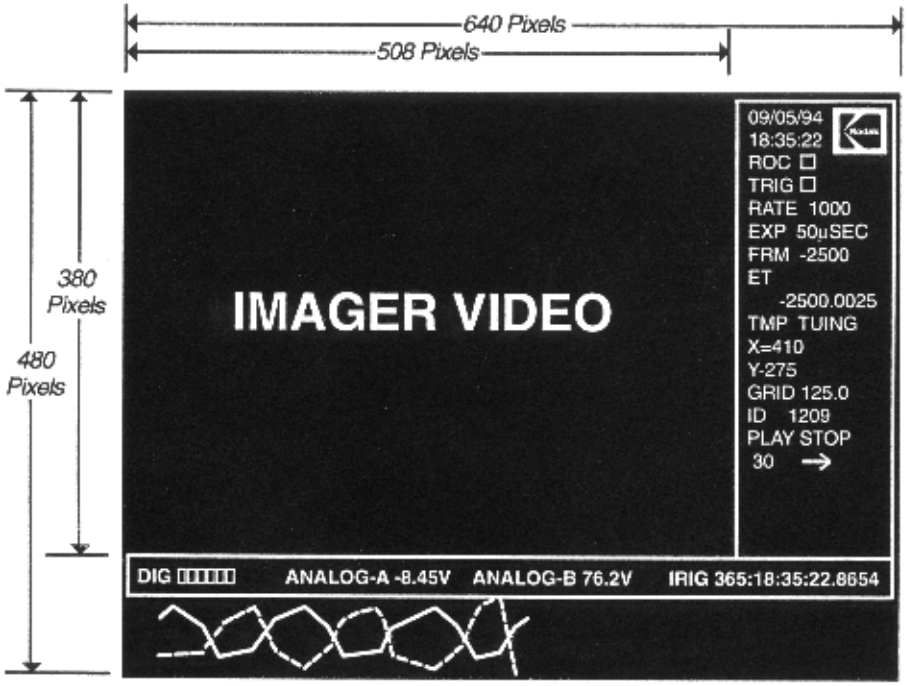
Message Field

The Message field provides you with Processor status and error messages.

Video Display

The video display for the KODAK EKTAPRO Motion Analyzer, Model 1000HRC is best seen on a good quality monitor designed for use with personal computers. The display has a resolution of 640 pixels horizontally and 480 pixels vertically. The video from the Imager has a resolution of 508 by 380 pixels and is displayed in the upper left portion of the video monitor.

The alphanumeric data displayed along the right side of the imager video is the status of the motion analyzer at the moment, or the motion analyzer settings that were in effect when the recording was made.



CHAPTER

3 Getting Started

Connecting the System

The following is a short step by step procedure that will teach you how to connect the Motion Analyzer components and then use them to make a recording. Please follow this sequence exactly and do not turn power on until instructed to do so.

Connecting AC Power

The power supply in the Processor will automatically select 110 volts AC or 220 volts AC. The power supply will operate properly when the AC power source is between 47 and 440 hertz.

CAUTION

Before plugging the Processor into the AC power source, insure that the AC ON/OFF SWITCH on the front panel is OFF. Verify that the AC power source is between 90 and 132 volts or between 180 and 264 volts.

Check the rating of the fuses installed in the Processor, both fuses must be rated at 6.3 amps, time delay.

Connecting the Keypad

Connect the keypad cable between the keypad and the Processor using the cable supplied with your Motion Analyzer.

Connecting and Adjusting the Video Monitor

Connect the video monitor to the Processor using a seventy five Ohm coaxial cable if you are using the VIDEO OUT BNC connector. If you are using a computer graphics type monitor connect it to the fifteen pin RGB output. At this point the monitor and the keypad should be connected to the Processor.

Connecting the KODAK EKTAPRO Imager

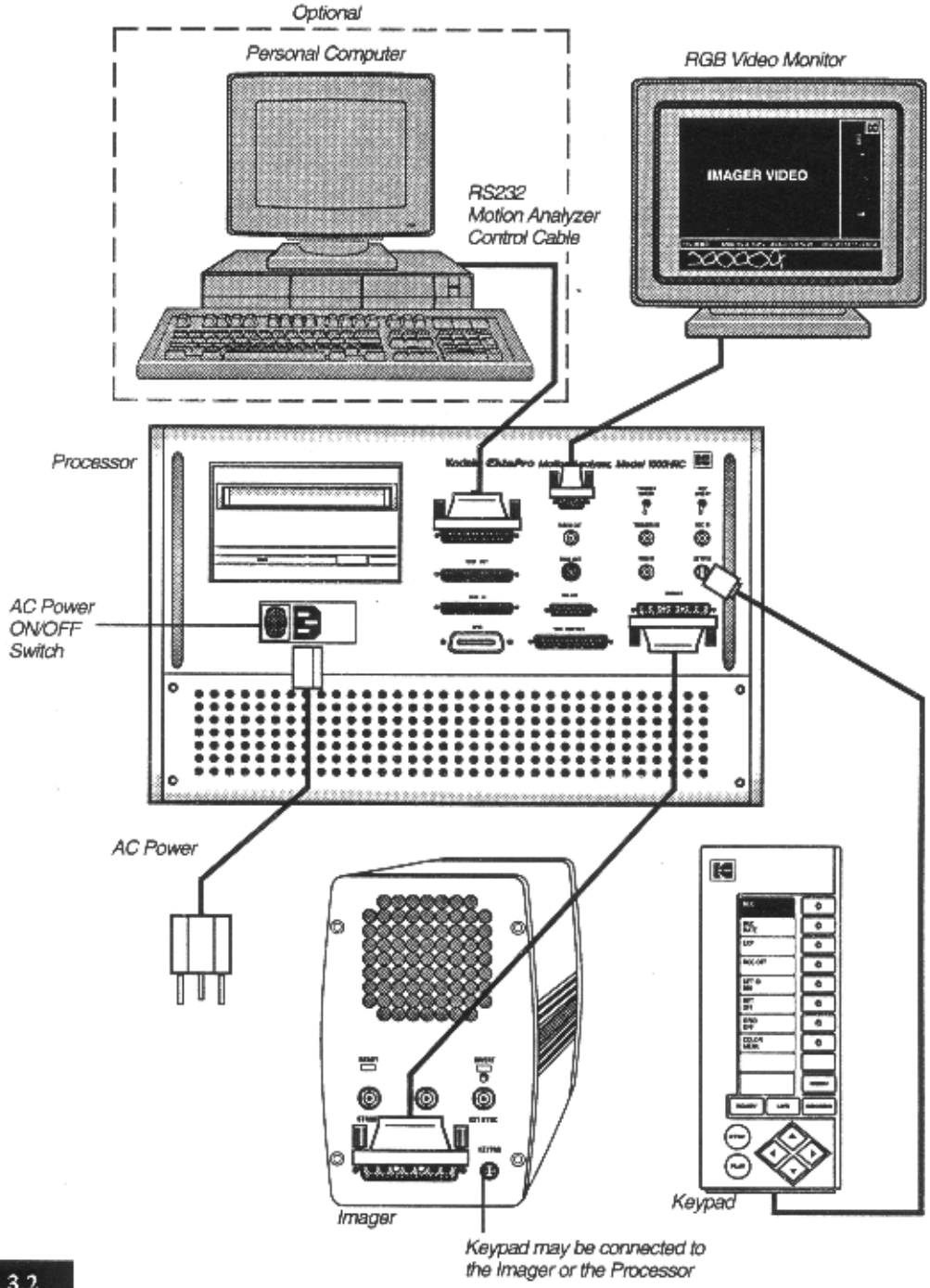
CAUTION

The processor power must be off before connecting or disconnecting the Imager.

Mate one end of the imager cable to the connector on the rear panel of the Imager. Mate the other end of the imager cable to the connector on the front panel of the Processor.

Power On

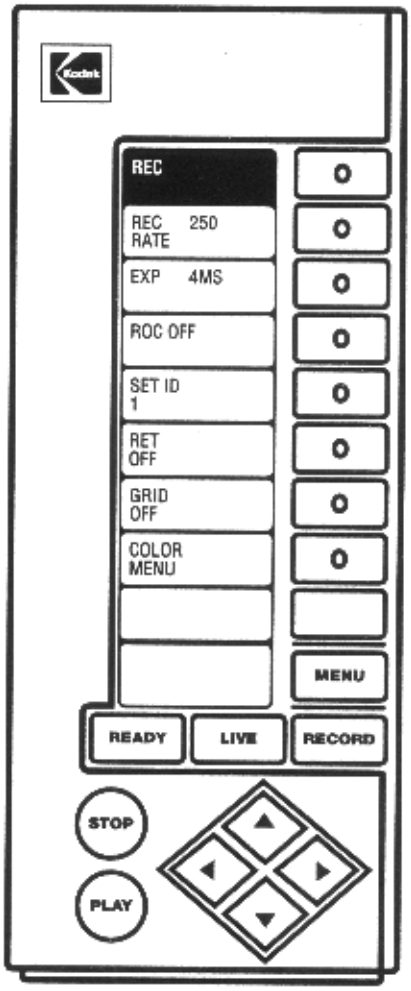
Turn the AC ON\OFF switch ON.



Your First Recording

Keypad

While the Processor performs its power on self test the keypad message field will display "System Initialization in Progress." After initialization is complete the keypad display should have each value set as in the example below.



If Your Keypad Selections are Different

1. Press the LIVE key and see that the keypad message field and the video monitor status both display LIVE.

2. Then press the softkey to the right of any window that is different than the example.

3. Press the softkey again and again until the keypad looks like the example.

Setting Up the Picture

If you are working in an area with normal office lighting, and you have removed the imager lens cap there should be a picture on the video monitor.

Point the Imager at something interesting and adjust the lens aperture and focus rings to obtain an acceptable picture on the video monitor. If you are using a zoom lens you may have to adjust the focal length.

Your First Recording

Making a Recording

When you have the picture set, press the READY key on the keypad. The keypad message field will display READY and the video monitor status will display READY.

To start recording press the RECORD key on the keypad. The keypad message field and the video monitor status will display RECORDING.

The recording will automatically stop at the End Of Memory (EOM). If you want to stop the recording before EOM, you can press the STOP key on the keypad. In either case, the message field on the keypad will display RECORDING STOPPED and the status on the video monitor will display REC/STOP.

Looking at Your First Recording

To view the recording you have just made, press the PLAY key on the keypad. Playback, at a rate of thirty frames per second, automatically begins at the first frame of the recording. Thirty frames per second, forward, is the default setting the first time that the PLAY key is pressed after a recording.

Playback direction and rate can be changed by pressing the different arrow keys while in the PLAY or PLAY/STOP mode. The left and right arrow keys control direction. The up and down arrow keys control playback rate.

You have just recorded at 250 frames per second (fps) and played back at thirty frames per second. Any motion that occurred during the recording was slowed because the record speed was 250 fps and the playback speed is 30 fps. To slow events down even more you will need to make recordings at the higher frame rates.

Summary

Procedure for a Typical Recording Session

1. Connect the system components together and turn the power on.

2. Press the LIVE key and select the record parameters using the softkeys.
   a.) Record mode
   b.) Record rate
   c.) Exposure

3. Adjust the lens aperture, focus and the lighting to best capture your event.

4. Make a recording by pressing READY and then RECORD.

5. Playback the recording by pressing the PLAY key.

6. Perform any analysis required using the various keypad functions and the DATA-FRAME Border information.

7. Download any pictures you wish to keep for later review to the optional optical disk drive or a VCR.

For a detailed explanation of the keypad menu structure and the purpose of the menu selections turn to Chapter Four of this manual.

CHAPTER

4 Keypad Operation

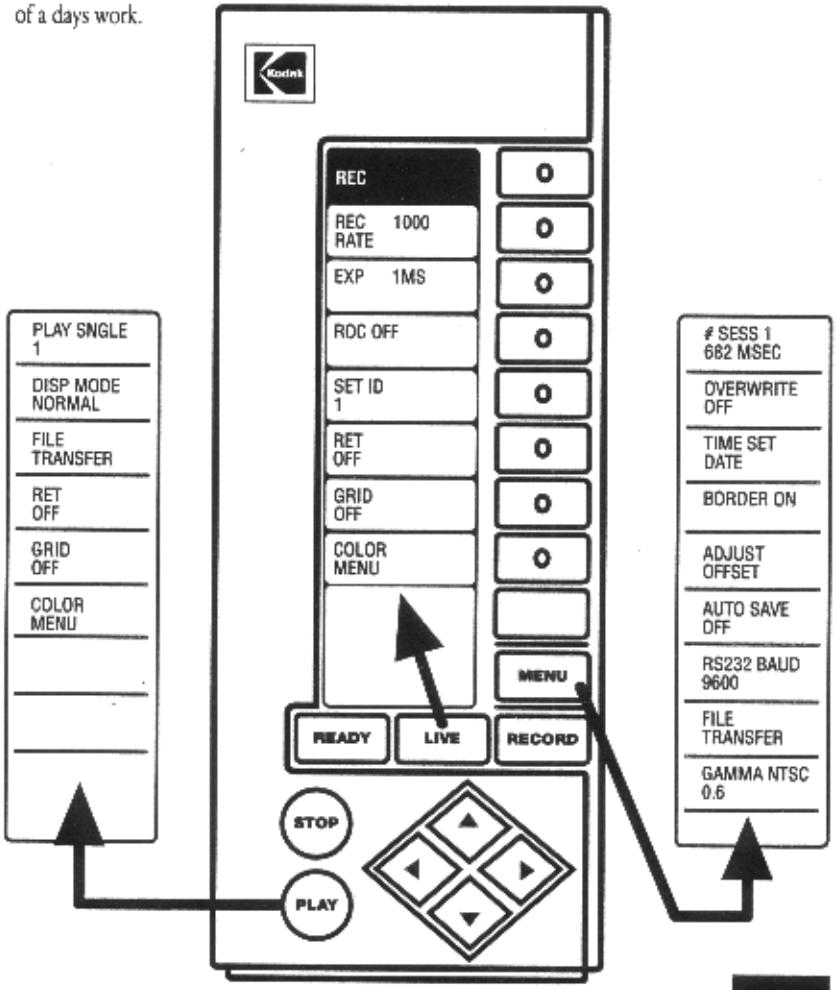
Introduction

This chapter explains in detail the effect that each softkey option has on the KODAK EKTAPRO Motion Analyzer, Model 1000HRC. This chapter has a section for each of the menu pages of the keypad. There are three primary menus, LIVE, PLAY, and SETUP. There are also two submenus, COLOR and FILE TRANSFER. While you are reading this chapter it is a good idea to experiment with the Motion Analyzer to reinforce what you learn by doing.

PLAY MENU
The PLAY menu contains all of the functions used to play back and archive your recordings during the course of a days work.

LIVE MENU
The LIVE menu contains all the functions used to prepare for a recording.

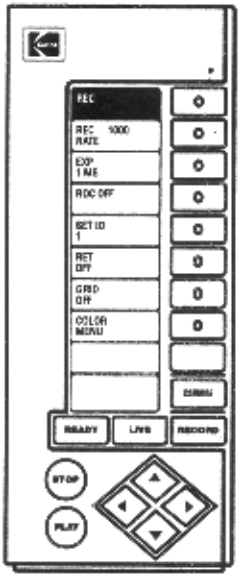
SETUP MENU
The SETUP menu contains the functions used to prepare the Motion Analyzer for use.



Live Menu

Press the **LIVE** *key to access*

The LIVE menu is the menu that appears when the Processor is first turned on. The LIVE menu carries all parameters relevent to making a recording.



Record Mode

Press the REC softkey to highlight the REC mode window on the LCD. Each additional press of the REC mode softkey steps through the available record modes.

NOTE

The length of any recording is affected by the number of sessions (# SESS) selected. RETRIG recording is further affected by OVERWRITE. See page 4.17 for an explanation of OVERWRITE and # SESS.

In RECORD the Processor starts recording and stops when the available memory has been filled with images.

IN RECORD MANUAL STOP the Processor starts recording and continues to record until the STOP key is pressed.

In RECORD TRIGGER the Processor starts recording and continues to record until a signal is received at the TRIG IN connector. The Processor stops recording once the correct number of frames before and after the trigger are recorded. The softkey window displays the number of frames saved before the trigger occurs. Set the number of pretrigger frames with the arrow keys.

The RECORD RETRIGGER mode works the same as the trigger mode discussed above. However in retrigger, instead of stopping, the Processor automatically starts another recording in anticipation of another trigger. The Processor will continue to retrigger creating additional recordings until all of the sessions in memory have been filled. Memory may be divided into a maximum of one hundred sessions.

Record Mode (CONTINUED)

If OVERWRITE is OFF, the Processor will stop recording once every session has a recording in it. If OVERWRITE is ON, the Processor will continue to record sessions in memory, overwriting the oldest recording in memory each time.. The operator can stop the recording by pressing the STOP key.

When the Processor is powered on, the record mode will return to the selection that was in effect when power was turned off.

How to Start a Recording

Once a record mode has been selected press the READY key and then the RECORD key to start recording pictures.

How to Stop a Recording

The Processor will always stop recording pictures the instant the STOP key is pressed no matter what record mode is being used.

Additional Information on the Different Record Modes

The names chosen for the modes will help you understand the operator actions and input signals involved in making a recording. In the REC mode pressing the READY key and then the RECORD key is the only operator action required as the recording will stop automatically when memory is full.

In the REC MAN STOP mode the operator starts the recording by pressing the READY key and then the RECORD key, and ends the recording by pressing the STOP key.

In the REC TRIG or REC RETRIG mode the operator starts the recording by pressing the READY key and then the RECORD key. The application completes the recording by supplying a trigger signal through the TRIG IN connector on the front panel of the Processor.

Record

If the STOP key is pressed before the Processor has filled available memory with pictures the last frame recorded becomes frame zero. The frames recorded before frame zero will have negative frame numbers. The playback will skip over any frames that do not have pictures in them from the latest recording.

Live Menu

Press the **LIVE** key to access

Record Stop

The last frame recorded becomes frame zero. The frames recorded before frame zero will have negative frame numbers.

If you press STOP before the Processor memory is full, the number of playback frames will be less than the maximum recording capabilities of the Processor.

Record Trigger

The frames recorded before the TRIG IN (trigger input) signal have negative numbers. The frames recorded after the TRIG IN signal have positive numbers. The frame recorded when the TRIG IN signal is received is frame number zero.

Record Retrigger

Retrigger records one or more sessions sequentially stopping when memory is full if OVERWRITE is OFF or when the STOP key is pressed if OVERWRITE is ON. The number of sessions in memory is selected by the #SESS softkey in the SETUP menu. Each session is a partition in memory that will accept one recording with its own ID number. All retrigger recordings have the same frame numbering scheme as described for trigger.

Trigger and Retrigger Recording Cautions

If the STOP key is pressed before the TRIG IN signal is received, the last frame recorded becomes frame zero. The frames recorded before frame zero will have negative frame numbers.

If the STOP key is pressed after the TRIG IN signal is received, the trigger frame is still frame zero. The STOP key will stop the post trigger part of the recording.

When the TRIG IN signal is received before the desired number of pretrigger frames are recorded, the trigger frame is still frame zero. The number of pretrigger frames available during playback will be less than the pretrigger selection.

For example: Assume that you set 200 as the number of pretrigger frames. The recording is started and with only 100 frames recorded the TRIG IN signal is received. The TRIG IN frame is frame zero and the number of pretrigger frames available during playback is from -99 to 0.

Live Menu

Press the **LIVE** key to access

REC Rate (Record Rate)

Press the REC RATE softkey to highlight the REC RATE window on the LCD. Each additional press of the REC RATE softkey steps through the three available record frame rates and EXT (External).

This softkey is used to select a record frame rate for LIVE mode and the next recording. The record rate for the Imager is shown in the REC RATE softkey window. The unit of measure is frames per second (fps). The Processor records at 250, 500, 1000 frames per second or at a rate controlled by the EXT SYNC input on the rear of the Imager.

When the Processor is powered on the record rate will return to the same value that was in effect when power was turned off.

EXP (Exposure)

Press the EXP softkey to highlight the EXP window on the keypad LCD. Each additional press of the EXP softkey steps through the available exposure times.

This softkey is used to select an exposure time for LIVE mode and the next recording. The arrow keys may also be used to step through the available exposure times.

The selected exposure time, the amount of time that the sensor collects light for each frame, is shown in the EXP softkey window in MS (milliseconds) or US (microseconds). The longest exposure permitted for each frame is equal to one divided by the Record Rate. The exposure times available at the different record rates are detailed in the table below.

Frames Per Second	Permitted Exposure Times				
1000	50 US	100US	1 MS		
500	50 US	100US	1 MS	2 MS	
250	50 US	100US	1 MS	2 MS	4 MS
External	50 US	100US	Set by EXT SYNC pulse width		

When the Processor is powered on the exposure time will return to the same value that was in effect when power was turned off.

NOTE

The exposure time automatically changes to one divided by the Record Rate when you change to a faster frame rate. For example, if you change from 250 fps to 1000 fps, the exposure time will change from 4 ms to 1 ms.

Live Menu

Press the **LIVE** key to access

ROC (Record On Command)

Press the ROC softkey to highlight the ROC window on the LCD. Pressing the ROC softkey repeatedly will toggle between ROC ON and ROC OFF.

ROC stands for Record On Command. The user controls the record process with the record on command signal input at the ROC IN connection on the front panel of the Processor. The Processor will read a +2.6 to +30 volt signal as a true when the ROC INVERT switch handle is down. The Processor will read a +0.6 to -30 volt as true when the ROC INVERT switch handle is up.

The Processor will record images using the record mode selected only when the user supplied ROC input signal is true. The ROC icon will be visible in the video display when ROC is ON. The ROC icon will be a hollow square when the ROC input signal is false and a solid white square when ROC is true and images are being recorded.

Record On Command function is off, the ROC icon is not visible on the monitor and all record modes operate as previously defined The power on default for ROC is OFF.

Set ID

Press the SET ID softkey to highlight the SET ID window on the LCD. Each press of the SET ID softkey will increment the session ID number by one. The arrow keys can also change the session ID number.

The identification number (ID) is stored with the images each time a recording is made. The ID number, one to four digits, is displayed in the DATA-FRAME Border and in the SET ID window on the keypad. In LIVE mode the session ID number is used for the next recording. In PLAY mode the session ID number displayed belongs to the recording being viewed.

When the processor's video frame store memory is partitioned into more than one session, each session's recording has its own ID number. The Processor prevents the operator from using a session ID number that is currently in memory with the following exception. You may reuse the most recent session ID number stored in memory. This has the effect of erasing the last session in memory and reusing that partition.

Live Menu

Press the **LIVE** key to access

Set ID (CONTINUED)

The # SESS softkey in the Setup Menu sets the number of recordings or sessions that can coexist in memory.

The power on default for session ID is 1. The ID number will automatically increment after each recording.

RET (Reticle)

Press the RET softkey to highlight the RET window on the LCD. Each successive press of the RET softkey will cycle through the following options:

The reticle, and reticle parameters are not displayed on the monitor.

A black reticle is turned on. The X and Y fields are turned on and displayed in the DATA-FRAME Border.

A white reticle is turned on. The X and Y fields are turned on and displayed in the DATA-FRAME Border.

Live Menu

Press the **LIVE** key to access

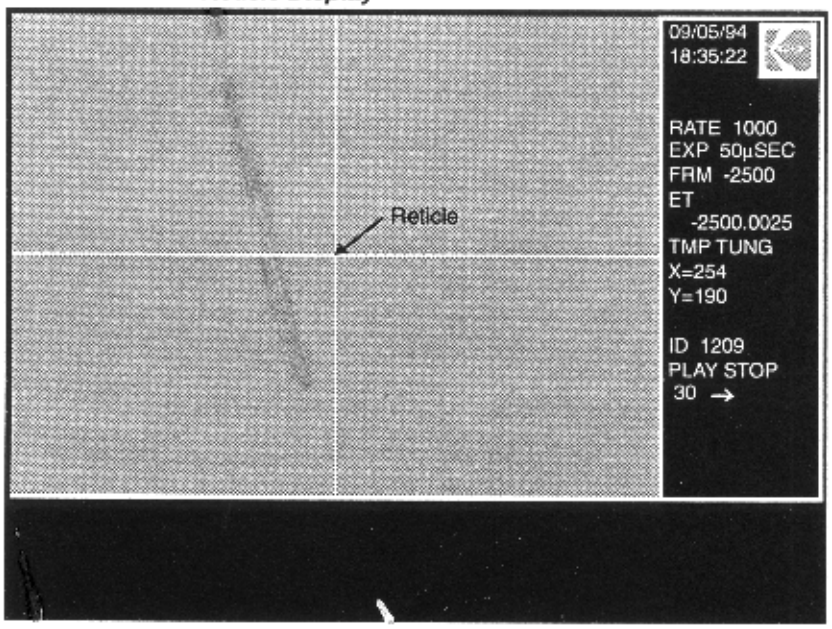
RET (CONTINUED)

The reticle is formed by intersecting horizontal and vertical lines, both lines are one pixel wide. The X and Y coordinates for the reticle intersection are displayed in the X and Y fields on the monitor and in the RET window. Use the arrow keys to change the reticle position. The right and left arrow move the vertical line right and left. The up and down arrow move the horizontal line up and down.

Each quick press of an arrow key causes the Reticle to move one pixel. When an arrow key is held down for a longer time, the Reticle will begin to move faster and faster. The maximum Reticle movement is 16 pixels at a time and is achieved by holding down an arrow for approximately 1 second.

The power on default for Reticle is off. When the reticle is first turned on it is positioned at X = 254, Y = 190 in the center of the image display area on the monitor. The origin of the coordinate set (X = 0, Y = 0) is the lower left corner of the Imager display area. The upper right corner of the Imager display area is X = 508 and Y = 380.

Reticle Display



Reticle X & Y coordinate

Live Menu

Press the **LIVE** key to access

Grid

Press the GRID softkey to highlight the GRID window on the LCD. Each successive press of the GRID softkey will cycle through the following options:

GRID OFF

The grid is not displayed on the monitor.

GRID RECT WHITE

GRID RECT BLACK

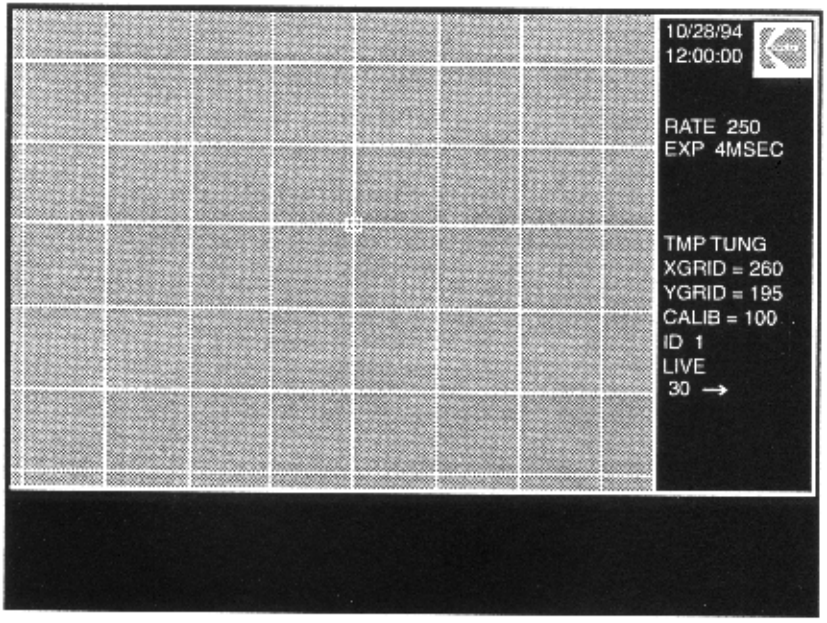
A rectangular grid overlays the video from the Imager. The origin of the grid is displayed as an X,Y coordinate pair in the DATA-FRAME Border. The origin may be moved to any place in the picture using the arrow keys. The grid spacing is the difference between PT1, and PT2 set with the CALIBRATE function as explained below. The grid color can be either white or black.

GRID CIR WHITE

GRID CIR BLACK

A circular grid overlays the video from the Imager. The origin of the grid is displayed as an X,Y coordinate pair in the DATA-FRAME Border. The origin may be moved to any place in the picture using the arrow keys. The grid spacing is the difference between PT1, and PT2 set with the CALIBRATE function as explained below. The grid color can be either white or black. See example on page 4.15.

Rectangular Grid Display



GRID ORIGIN X,Y coordinate
GRID spacing in pixels

Live Menu

Press the **LIVE** *key to access*

Grid (CONTINUED)

Press the GRID softkey to highlight the GRID window on the LCD. Each successive press of the GRID softkey will cycle through the following options:

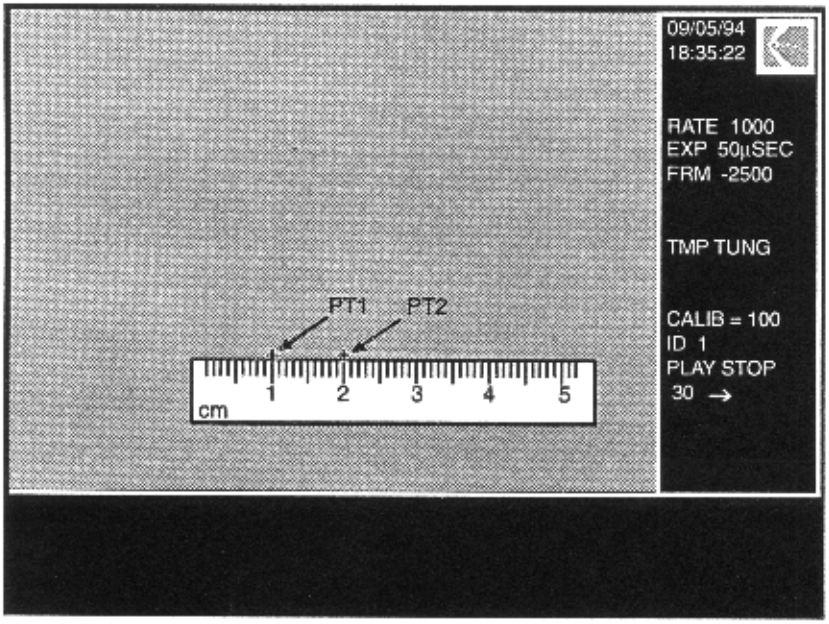
CALIBRATE WITH PT 1

Used to establish the spacing for the grid system. Place a scale marked in either Metric or English units in the scene that you wish to analyze. With the arrow keys place the blue marker (PT1) at the start of the measurement reference in the image on the monitor. Once you are satisfied with the marker placement, press the GRID softkey to advance to PT2.

CALIBRATE WITH PT 2

The blue highlight switches to PT2 when the GRID window shows PT2. Use the arrow keys to place the blue marker at the end of the measurement reference in the image on the monitor. Once you are satisfied with the marker placement, press READY and then RECORD to save the calibration you just performed.

Grid Calibration Display



PT1 - PT2 spacing in pixels.

1 cm = 100 pixels.

Live Menu

Press the **LIVE** *key to access*

Color Menu

Press the COLOR MENU softkey and the Processor will switch to the color menu. The color menu has white balance, hue and saturation controls, as well as exposure checking.

NOTE

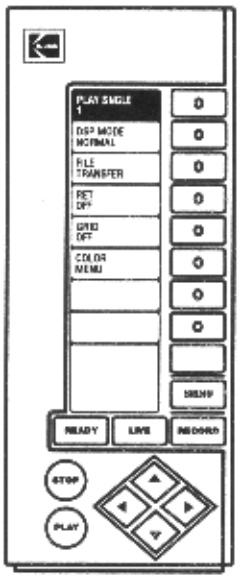
The COLOR MENU softkey does not appear on the LIVE menu if a monochrome Imager is connected to the Processor. COLOR MENU is replaced by EXP CHECK when the Processor detects a monochrome Imager.

EXP Check (Exposure Check)

This function helps the operator check the light levels in a live image. The areas of the image that are overexposed will be red hued, areas that are properly exposed will be gray and areas of the image that do not have enough light will be blue in color. Adjust the lens aperture to eliminate red areas in the display and add light to the areas of the image that appear blue.

Play Menu

Press the PLAY key to access



The Processor starts playing the current session right after the PLAY key is pressed. Use the up or down arrow key to change the playback speed. Use the right arrow key to play forward or use the left arrow key to play in the reverse direction.

Play Sngle (Play Single)

Press the PLAY SNGLE softkey to highlight the PLAY SNGLE window on the LCD. Each press of the softkey toggles between PLAY SNGLE and PLAY MULTI if memory contains more than one recording.

PLAY SNGLE 1

The Processor will play the session number displayed in the softkey window. Use the arrow keys to select a session number to play. Press the PLAY key to begin playback of the session number showing in the PLAY SNGLE window.

PLAY MULTI 4

The Processor will play every session stored in memory sequentially. The current session number is displayed in this softkey window and on the monitor. Press the PLAY key to begin playback of the session number shown in the PLAY MULTI window.

Disp Mode (Display Mode)

Press the DSP MODE softkey to highlight the DSP MODE window on the LCD. Each additional press of the DSP MODE softkey steps through the available display modes.

DISP MODE NORMAL

The Processor displays each frame full screen on the monitor.

DISP MODE 2 x 2

The Processor displays four frames in a 2 X 2 array on the monitor. The information displayed in the DATA-FRAME Border is for the frame appearing in the upper left hand corner of the image area.

DISP MODE 4 x 4

The Processor displays sixteen frames in a 4 X 4 array on the monitor. The information displayed in the DATA-FRAME Border is for the frame appearing in the upper left hand corner of the image area.

Play Menu

Press the PLAY key to access

File Transfer

FILE TRANSFER

Press the FILE TRANSFER softkey to highlight the FILE TRANSFER window on the LCD. The keypad will then switch to FILE TRANSFER menu where you can upload image files to the Processor or download files to an image archive device.

RET (Reticle)

Press the RET softkey to highlight the RET window on the LCD. Each successive press of the RET softkey will cycle through the following options:

REC OFF

The reticle, and reticle parameters are not displayed on the monitor.

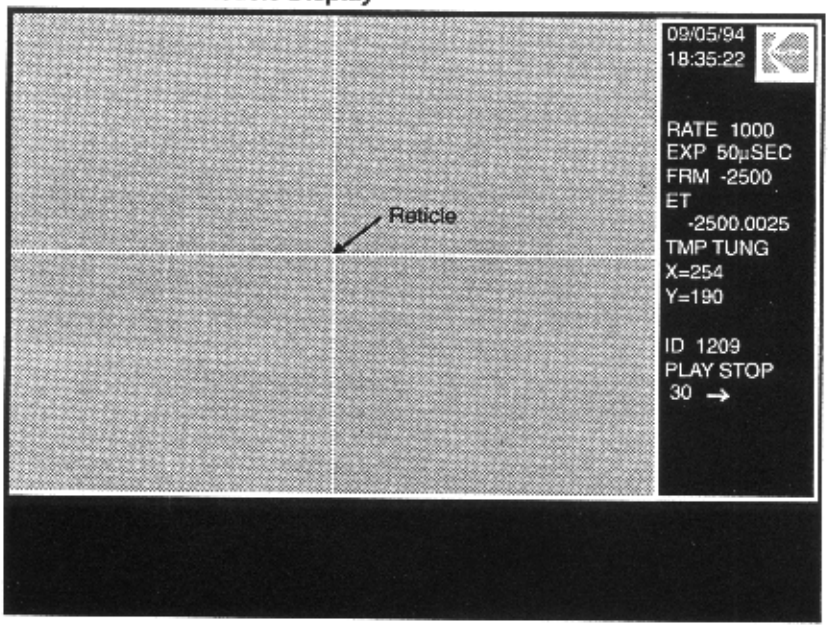
RET X:254 BLK Y:190

A black reticle is turned on. The X and Y fields are turned on and displayed in the DATA-FRAME Border.

RET X:254 WHT Y:190

A white reticle is turned on. The X and Y fields are turned on and displayed in the DATA-FRAME Border.

Reticle Display



Reticle X & Y coordinate

RET (CONTINUED)

The RETICLE is formed by intersecting horizontal and vertical lines, both lines are one pixel wide. The X and Y coordinates for the reticle intersection are displayed in the X and Y fields on the monitor and in the RET window. Use the arrow keys to change the reticle position. The right and left arrow move the vertical line right and left. The up and down arrow move the horizontal line up and down.

Each quick press of an arrow KEY causes the Reticle to move one pixel. When an arrow key is held down for a longer time, the Reticle will begin to move faster and faster. The maximum Reticle movement is 16 pixels at a time and is achieved by holding down an arrow for approximately 1 second.

The power on default for Reticle is OFF. When the reticle is first turned on it is positioned at X = 254, Y = 190 in the center of the image display area on the monitor. The origin of the coordinate set (X = 0, Y = 0) is the lower left corner of the Imager display area. The upper right corner of the Imager display area is X = 508 and Y = 380.

Grid

Press the GRID softkey to highlight the GRID window on the LCD. Each successive press of the GRID softkey will cycle through the following options:

The grid is not displayed on the monitor.

A rectangular grid overlays the video from the Imager. The origin of the grid is displayed as an X,Y coordinate pair in the DATA-FRAME Border. The origin may be moved to any place in the picture using the arrow keys. The grid spacing is the difference between PT1, and PT2 set with the CALIBRATE function as explained below. The grid color can be either white or black.

Play Menu

Press the PLAY key to access

Grid (CONTINUED)

GRID CIR WHITE

GRID CIR BLACK

A circular grid overlays the video from the Imager. The origin of the grid is displayed as an X,Y coordinate pair in the DATA-FRAME Border. The origin may be moved to any place in the picture using the arrow keys. The grid spacing is the difference between PT1, and PT2 set with the CALIBRATE function as explained below. The grid color can be either white or black.

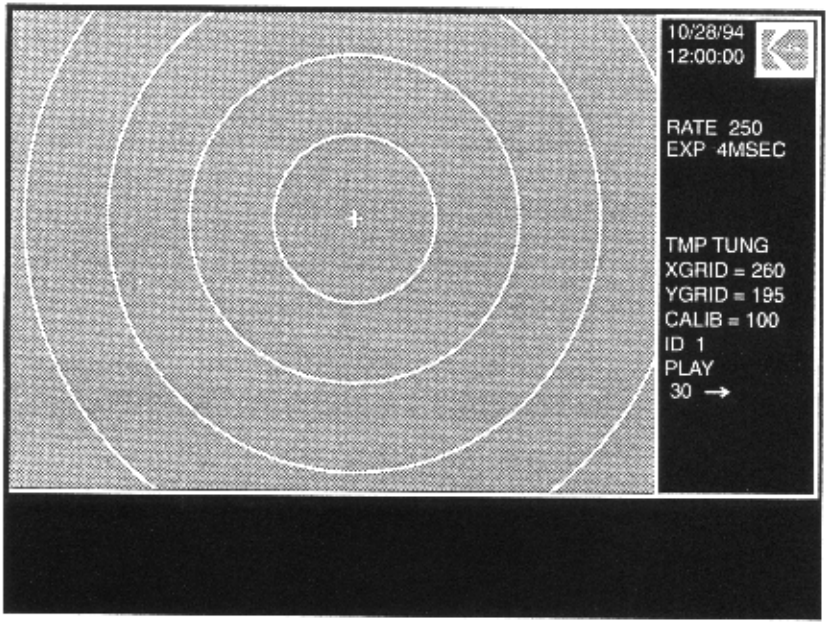
CALIBRATE WITH PT 1

Used to establish the spacing for the grid system. Place a scale marked in either Metric or English units in the scene that you wish to analyze. With the arrow keys place the blue marker (PT1) at the start of the measurement reference in the image on the monitor. Once you are satisfied with the marker placement, press the GRID softkey to advance to PT2.

CALIBRATE WITH PT 2

The blue highlight switches to PT2 when the GRID window shows PT2. Use the arrow keys to place the blue marker at the end of the measurement reference in the image on the monitor. Once you are satisfied with the marker placement, press READY and then RECORD to save the calibration you just performed.

Circular Grid Display



GRID ORIGIN X,Y coordinate
GRID spacing in pixels

Play Menu

Press the PLAY key to access

Color Menu

Press the COLOR MENU softkey and the Processor will switch to the color menu. The color menu has white balance, hue and saturation controls, as well as exposure checking. The COLOR MENU is described in detail on page 4.26.

NOTE

The COLOR MENU softkey does not appear on the PLAY menu if a monochrome Imager is connected to the Processor. COLOR MENU is replaced by EXP CHECK when the Processor detects a monochrome Imager.

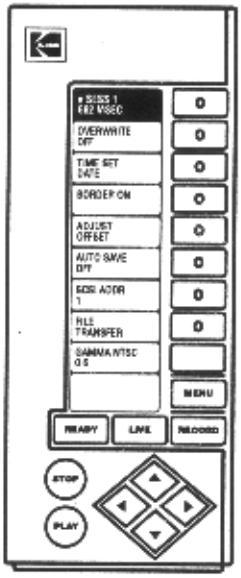
EXP Check (Exposure Check)

This function helps the operator check the light levels in a live image. The areas of the image that are overexposed will be red hued, areas that are properly exposed will be gray and areas of the image that do not have enough light will be blue in color. Adjust the lens aperture to eliminate red areas in the display and add light to the areas of the image that appear blue.

Setup Menu

Press the **MENU** *key to access*

Press the menu key again to toggle between the SETUP menu and the previous menu. If you entered the SETUP menu from the LIVE menu, pressing the MENU key again will return you to the LIVE menu.



SESS (number of sessions)

Press the # SESS softkey to highlight the # SESS window on the LCD. Each press of the # SESS softkey will increment the number of sessions by one. The arrow keys also change the number of sessions.

You can divide memory into sessions with each session holding one recording identified by a unique ID number. You may choose from one to one hundred sessions with the arrow keys. The number of sessions selected is shown in the softkey window along with the total record time per session expressed in milliseconds, The time per session is a function of frame rate and the amount of memory installed in the Processor.

The # SESS defaults to one when the Processor is turned on.

Overwrite

Press the OVERWRITE softkey to highlight the OVERWRITE window on the LCD. Each press of the softkey toggles OVERWRITE ON or OFF. The OVERWRITE command is used only in conjunction with the retrigger record mode.

With OVERWRITE OFF the Processor will place recordings in each empty session in memory and then stop recording. If you attempt to write over an old recording, the keypad will beep and warn you that you are about to erase images stored in memory. You are permitted to overwrite old images after the warning has been given.

When OVERWRITE is ON, the Processor will continue to record a session in the next memory partition with each trigger input until the STOP key is pressed. OVERWRITE automatically turns off at the end of each recording. The power on default for OVERWRITE is OFF.

Setup Menu

Press the **MENU** key to access

Time Date

Press the TIME DATE softkey to highlight the TIME DATE window. The window changes to a two row display with the time in the first row and the date in the second row. Use the left or right arrow key to move the cursor to the field that you want to change. Change the numbers in a field by using the up and down arrow keys.
The time stops incrementing when you select the time and date display. The clock will start running again when the TIME DATE softkey is pressed again.

The time will be in HH:MM:SS format with the cursor over the hour field. Use the up or down arrow keys to change the hour to the correct value. Move the cursor to the minute's field with the right arrow key. Set the minute to the correct value. Move to the second's field and set a value.

Use the right arrow key to move the cursor to the month field and then set the month using the up and down arrow keys. Continue using the same procedure to set day and year. Press the TIME DATE softkey to start the clock with the corrected values.

Border

Press the BORDER softkey to highlight the BORDER window on the LCD. Each press of the softkey toggles BORDER ON or OFF.

Setup Menu

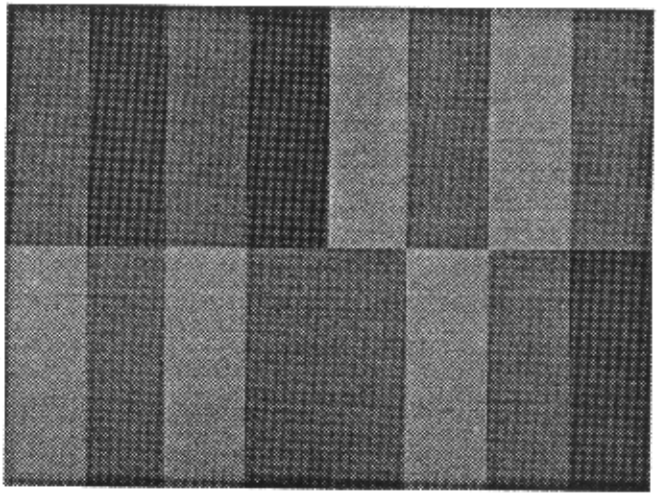
Press the **MENU** key to access

Adjust

Press the ADJUST softkey to highlight the ADJUST window on the LCD.

ADJUST OFFSET

The ADJUST OFFSET calibration balances the sixteen video channels to the same offset or black level. The lens must be covered so that there is no light falling on the sensor while the calibration is taking place. This offset procedure should be done whenever you notice that there is an offset difference between the video channels. The channels divide the image into eight segments across the top half of the image and another eight segments across the bottom half of the image.



Channel offset problems will look like this

Procedure:

The Imager requires a uniform black level to make a good picture. Follow this procedure to perform an offset calibration that will restore black level uniformity:

1. Cover the Imager lens so that no light falls on the sensor during the adjustment.
2. Press the ADJUST OFFSET softkey, press READY, and the RECORD to start the process.
3. While the Imager is calibrating the keypad controls will be disabled and a message will appear in the status field on the keypad stating that a ADJUST OFFSET cycle is in progress.
4. During the calibration process the Processor will make several recordings in order to arrive at the best adjustment. Be patient, this calibration can take several minutes.
5. After the Processor returns the keypad to normal operation, press the LIVE key and remove the lens cover.

Setup Menu

Press the **MENU** key to access

Auto Save

Press the AUTO SAVE softkey to highlight the AUTO SAVE window on the LCD. Each successive press of the AUTO SAVE softkey will cycle through the following options:

AUTO SAVE OFF

Auto save is disabled and the motion analyzer records and plays normally.

AUTO SAVE VCR

Use AUTO SAVE to download images form the Processor to a VCR when you are using the REC RETRIG mode. This permits you to make a series of triggered recordings with video tape archiving for extended periods of time, typically overnight.

The video input of a VCR must be connected to the VIDEO OUT BNC or the SVHS connector on the front panel of the Processor. The RS232 remote control input of the VCR must also be connected to the VCR control output on the front panel of the Processor. When a trigger is received the Processor makes a recording, stops and then commands the VCR to start recording. The Processor then plays back the images it just recorded. At the end of the playback the Processor then rearms itself and waits for the next trigger.

Setup Menu

Press the **MENU** key to access

RS232 Baud

Press the RS232 Baud softkey to highlight the RS232 Baud window on the LCD. Each successive press of the RS232 Baud softkey will cycle through the following options:

This option sets the BAUD rate of the RS232 serial port on the front panel of the Processor. The baud rates available are 2400, 9600 and 19200. Use the arrow keys to select the value that will work with your interface.

This option sets the BAUD rate of the RS422 serial port on the front panel of the Processor. The baud rates available are 2400, 9600 and 19,200. Use the arrow keys to select the value that will work with your interface.

This option sets the GPIB address for the Processor. The GPIB address may be a number zero through seven inclusive. Use the arrow keys to select an address that is not in use by any other device currently on the GPIB bus.

File Transfer

Press the FILE TRANSFER softkey to highlight the FILE TRANSFER window on the LCD. The keypad will then switch to FILE TRANSFER menu where you can upload image files to the Processor or download files to an image archive device.

Gamma

Press the GAMMA softkey to highlight the GAMMA window on the LCD. Each press of the GAMMA softkey toggles between GAMMA NTSC and GAMMA RGB.

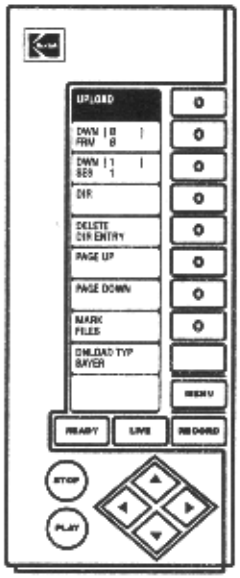
Sets gamma correction for the VIDEO OUT and SVHS OUT signals. Gamma correction can be adjusted from 0.4 to 1.0 with the arrow keys. The image on the monitor usually looks best with a setting of around 0.6. Use the setting that gives you the most pleasing picture.

Sets gamma correction for the RGB OUT signal. Gamma correction can be adjusted from 0.4 to 1.0 with the arrow keys. Use the setting that gives the most pleasing picture.

File Transfer

Press the **MENU** key and then the **FILE TRANSFER** softkey to access

The FILE TRANSFER menu is used to download recorded information from the Motion Analyzer to the internal optical disc, or a SCSI device of your choosing. FILE TRANSFER appears on the PLAY and the SETUP menus.



Upload

UPLOAD

Press READY and then RECORD to upload files from the optical disk to the Processor memory. The session directory or files to upload are selected by using a combination of the DIR and MARK FILES softkeys. The session directory that is highlighted or the file(s) that are marked will be uploaded when the READY and then the RECORD keys are pressed.

DWN FRM (Download Frame)

Press the DWN FRM softkey to highlight the DWN FRM window on the LCD.

DWN [Ø]
FRM Ø

The up or down arrow key will move the brackets up and down within the softkey window. Use the left and right arrow keys to change the frame number enclosed by the brackets. The number in the brackets is the first frame to be down loaded from the current session.

DWN Ø
FRM [100]

The up or down arrow key will move the brackets up and down within the softkey window. Use the left and right arrow keys to change the frame number enclosed by the brackets. The number in the brackets is the last frame to be down loaded from the current session. The Processor will not allow you to select a nonexistent frame number for down load. Press READY and then RECORD to perform the download.

The Motion Analyzer will create a directory on the optical disc and place all of the frames that you selected for download in that directory. Each frame is placed in its own file. The directory name will start with an "S" and then four digits for the session number, followed by a "B" for Bayer or "T" for TIFF. The last character of the directory name will be a "C" if you have a color imager or an "M" if you have a monochrome imager. If you downloaded in Bayer file format from session 1945 and you used a color imager, the directory would appear as follows:

```
S1945BC        <DIR>   MM-DD-YY    HH:MM:SS
```

The files in the directory would have a name of "F" followed by the frame number with a file extension that identifies the file type. A file extension of "BAY" identifies Bayer files and a file extension of "TIF" identifies TIFF files.

File Transfer

Press the **MENU** key and then the **FILE TRANSFER** softkey to access

DWN SES (Download Session)

Press the DWN SES softkey to highlight the DWN SES window on the LCD.

The up or down arrow key will move the brackets up and down within the softkey window. Use the left and right arrow keys to change the session number enclosed by the brackets. The session number in the brackets is the first session number to be down loaded from memory.

The up or down arrow key will move the brackets up and down within the softkey window. Use the left and right arrow keys to change the session number enclosed by the brackets. The session number in the brackets is the last session number to be down loaded from memory.

The Processor will not allow you to select a nonexistent session number for download. Press READY and then RECORD to perform the download.

The Motion Analyzer will create a directory on the optical disc for each of the sessions that you selected for download. The directory name will be the session number and every frame from that session will be placed in that directory. The date and time of the download are used to further identify the directory. Each frame download becomes a separate file with the frame number used as the file name. All files have a file extension of ".bay".

DIR (Directory)

Press the DIR softkey to highlight the DIR window on the LCD. The directory appears on the monitor where the Imager video is normally displayed. The arrow keys are used to navigate through the directory structure. The up and down arrow keys will scroll through the files displayed in a directory. To open a directory, highlight the directory using the up or down arrow key and then use the left or right arrow key to view the files within that directory.

To close a directory highlight the second line of the directory listing that appears as follows:

```
..      <DIR>  MM-DD-YY      HH:MM:SS
```

With the second directory line highlighted, press the left or right arrow key to exit the directory.

File Transfer

Press the **MENU** key and then the **FILE TRANSFER** softkey to access

Delete

Press the DELETE softkey to highlight the DELETE window on the LCD.

When the file that you wish to delete is highlighted or marked press READY and then RECORD to delete the file or files. Mark the files that you wish to delete by using the MARK FILE menu option explained below.

Page Up

Press the DIR softkey to display a file directory on the monitor. Pressing PAGE UP will move the file list up one full screen each time the softkey is pressed. If you are at the beginning of the file list nothing will happen when you press the PAGE UP softkey.

Page Down

Press the DIR softkey to display a file directory on the monitor. Pressing PAGE DOWN will move the file list down one full screen each time the softkey is pressed. If you are at the end of the file list nothing will happen when you press the PAGE UP softkey.

File Transfer

Press the MENU key and then the FILE TRANSFER softkey to access

Mark Files

Press the MARK FILES softkey to highlight the MARK FILES window on the LCD. This softkey will mark a file or files for upload, download or deletion.

MARK FILES

Once the MARK FILES softkey window is highlighted use the arrow keys to mark additional files. A marked file is identified by the symbol, <<<<<, to the right of the file name. To exit the file marking process at any time press any other softkey in the FILE TRANSFER menu.

UNMARK FILES

Notice that if files have been marked the MARK FILES softkey is now labeled UNMARK FILES. Pressing the UNMARK FILES softkey will immediately unmark all files without having to search out each marked file.

Dnload Typ (Download type)

Press the DNLOAD TYP softkey to highlight the DNLOAD TYP window on the LCD. The Processor can save images from memory to the optical drive in two different file formats. Each press of the DNLOAD TYP softkey will toggle between these two options.

DNLOAD TYP BAYER

The Bayer file format is the normal format that the Processor uses to store information in memory. Bayer format files may be uploaded from the optical drive back into memory for further review using the Processor. If desired uploaded Bayer files may be downloaded as TIFF files.

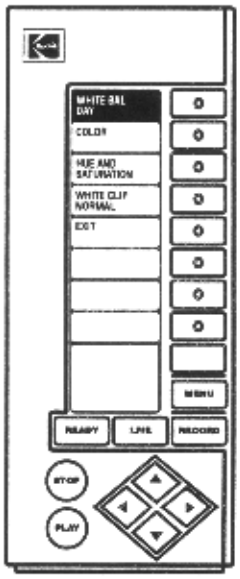
DNLOAD TYP TIFF

The TIFF file format is the familiar format usable by many different image processing and graphics software packages. A TIFF file cannot be loaded back into the Processor's memory.

Color Menu

Press the **LIVE** key and then the **COLOR MENU** softkey to access

The COLOR menu is used to select a white balance setting, adjust the hue and saturation of the color in the images on the monitor or switch the display to a black and white image. The COLOR MENU softkey appears on both the LIVE and the PLAY menus.



White BAL (White Balance)

Press the WHITE BAL softkey to highlight the WHITE BAL window on the LCD.

Each successive press of the WHITE BAL softkey will cycle through the following options:

WHITE BAL DAY Selects a color balance appropriate for natural light from the sun, or a color temperature of about 5500+ Kelvin.

WHITE BAL TUNGSTEN Selects a color balance that works with most artificial studio lights, or with color temperatures of around 3200+ Kelvin.

WHITE BAL METAL Selects a color balance for best color rendition with a light color temperature of about 4500+ Kelvin. Metal vapor lamps and fluorescent lights fall in this range.

Color Menu

Press the LIVE key and then the COLOR MENU softkey to access

White BAL (CONTINUED)

WHITE PT X:254 Y:190

White patch provides the operator with a calibration tool to balance the color reproduction of the Imager for the existing light.

When you select this menu option a small white square appears on the monitor overlaying the video from the Imager. Use the arrow keys to place this box over a portion of the scene that is white. To perform the white patch calibration press READY and then RECORD. The Processor will adjust the Red, Green and Blue gains to make the target video white,

NOTE

The Imager can be fooled into producing inaccurate color renditions with white patch balance. Make sure that the lighting is color neutral and that the object used as a white reference is white. The R, G & B amplitude numbers in the DATA-FRAME Border should not exceed 230 for best results.

Color

Press the COLOR softkey to highlight the COLOR softkey window on the LCD. Each successive press of the COLOR softkey will cycle through the following options:

COLOR

Indicates that the Imager and the Processor are color capable and that the color is turned on.

EXP CHECK

This function helps the operator check the light levels in an image. The areas of the image that are overexposed will be red hued, areas that are properly exposed will be monochrome gray and areas of the image that do not have enough light will be blue in color. Adjust the lens aperture to eliminate red areas in the display and add light to the areas of the image that appear blue.

BLACK AND WHITE

The Processor will display all images in black and white even though a color Imager is connected to the Processor.

Color Menu

Press the LIVE key and then the COLOR MENU softkey to access

Hue and Saturation

HUE AND SATURATION

Press the HUE AND SATURATION softkey to highlight the HUE AND SATURATION window on the LCD.

The left and right arrow keys change the hue of colors displayed on the monitor while the up and down arrow keys change the color saturation of the display. When you are satisfied with the color rendition press READY and then RECORD to store the new hue and saturation settings. Pressing any other softkey or exiting the COLOR MENU will leave the hue and saturation values as they were.

The values for hue and saturation appear in the DATA-FRAME Border while you are using the HUE AND SATURATION softkey. The nominal value for hue is H = 0, and the range for hue is from -180 to 180. The nominal value for saturation is S = 0 and the range for saturation is -100 to 100.

White Clip

Press the WHITE CLIP softkey to highlight the WHITE CLIP window on the LCD. Each press of the WHITE CLIP softkey toggles between NORMAL and EXTENDED white clip modes.

WHITE CLIP NORMAL

The overexposed parts of the scene turn white. The Processor detects any channel, Red Green or Blue, that reaches 100 % amplitude and makes that portion of the picture white by setting the remaining channel(s) to 100 % as well.

WHITE CLIP EXTENDED

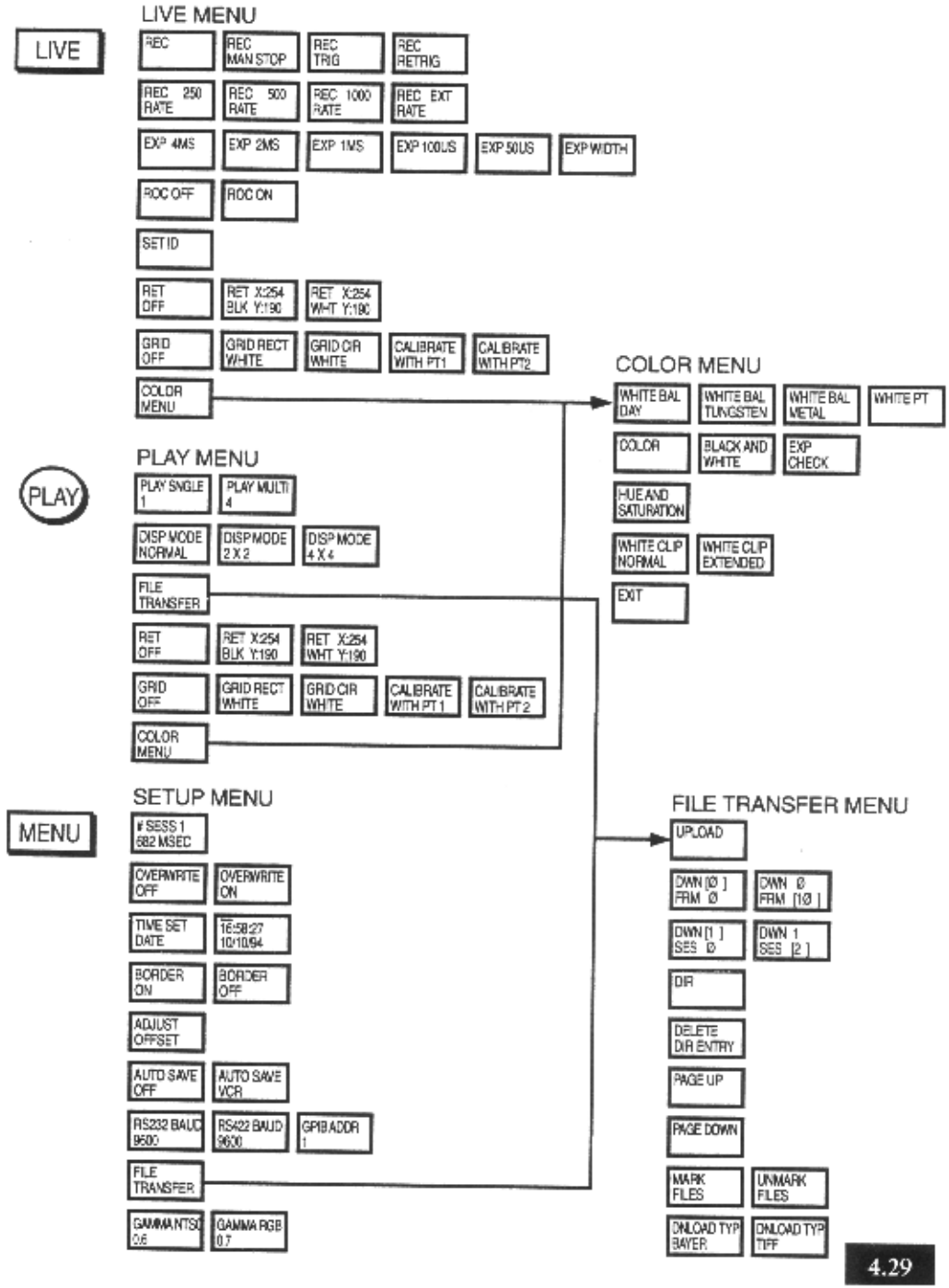
Extended white clip is a unique feature of the KODAK EKTAPRO Motion Analyzer, Model 1000HRC. The areas that would normally be pure white because of the action of the white clip algorithm are reduced in amplitude to a shade of gray. Then the signal from the unsaturated color channel(s) are inserted in the clipped region to show you detail that would otherwise be lost.

Exit

EXIT

Press this softkey to exit the COLOR menu. You may also exit the COLOR menu by pressing the PLAY, LIVE or MENU keys at any time.

KODAK EKTAPRO Motion Analyzer, Model 1000HRC
Menu Tree



CHAPTER

5 Recording Strategies

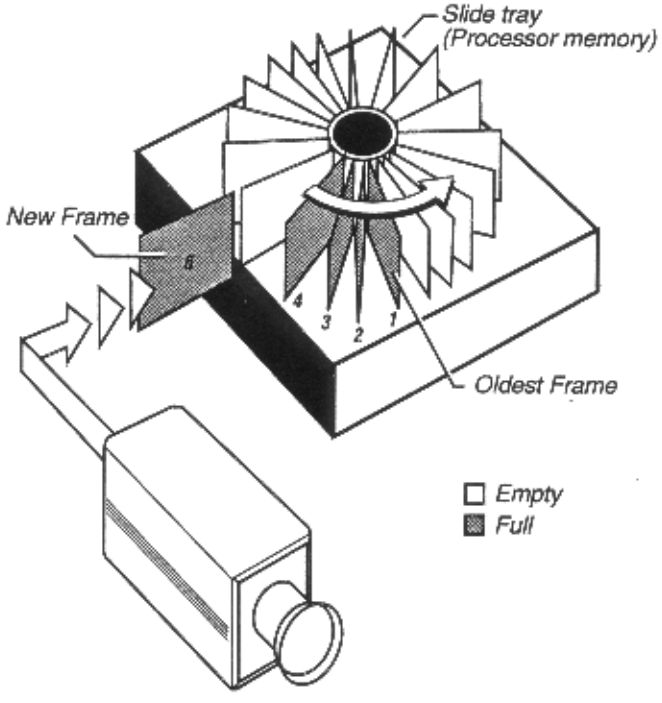
Introduction

The first section of this chapter is devoted to a brief description of how the KODAK EKTAPRO Motion Analyzer, Model 1000HRC moves images in and out of memory. We feel this will assist you to decide which record mode is best suited to a particular application.

The Processor stores its images in random access memory (RAM) rather than on film or magnetic tape. The major advantage of storing pictures in RAM is speed. There are no moving mechanical parts involved in the recording process. A mechanical part takes time to stabilize at its operating speed. The stabilization time is the major source of delay between pressing the record key and the true start of the recording in film or tape based motion analyzers. How then, does the Processor manage the picture storage process?

How the Processor Stores Images

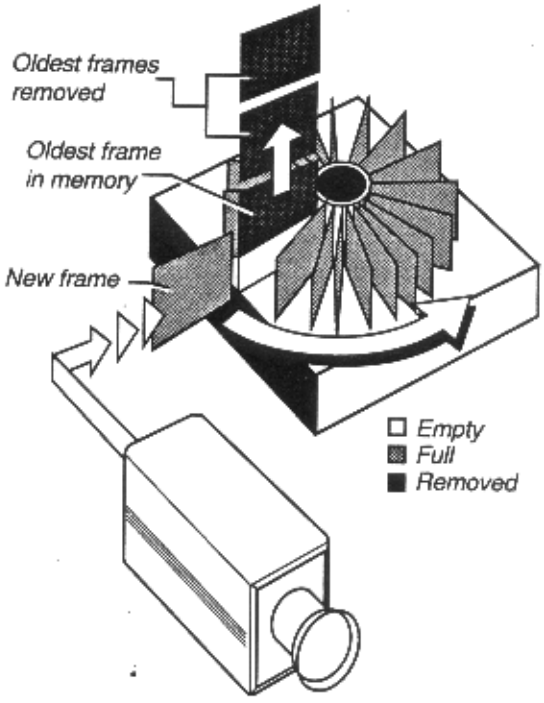
An analogy for the recording and playback process would be a Kodak Carousel slide projector and a Kodak Carousel slide tray. Think of the Processor as a Carousel slide projector and the Random Access Memory (RAM) as the Carousel slide tray. For our discussion the RAM is divided into small sections or frames that are just large enough to hold a single video image. These frames can be thought of as the pockets in a slide tray that hold the slides or images. In this analogy the slide tray holds 1364 slides or the processor memory has 1364 frames.



How the Processor Stores Images

A slide tray is usually loaded with slides starting at location number one and continuing on around the tray in sequence until the last location is loaded. When the slide tray is full, a slide must be removed before another slide can be put in. The Processor memory is loaded with images in a similar way. The first image is placed in the first frame of Processor memory. The second image is placed in the next frame and so on until image number 1364 is placed in the last location. When the Processor memory is full, the Processor will erase the image in the first frame and insert a new picture in its place. This process continues frame by frame around the circle. The result is that the Processor memory always holds the most recent 1364 images.

The RECORD MODE specifies the procedure used to store frames into memory during a recording. The four record modes are: REC (Record), REC STOP (Record Stop), REC TRIG (Record Trigger) and REC RETRIG (Record Retrigger).

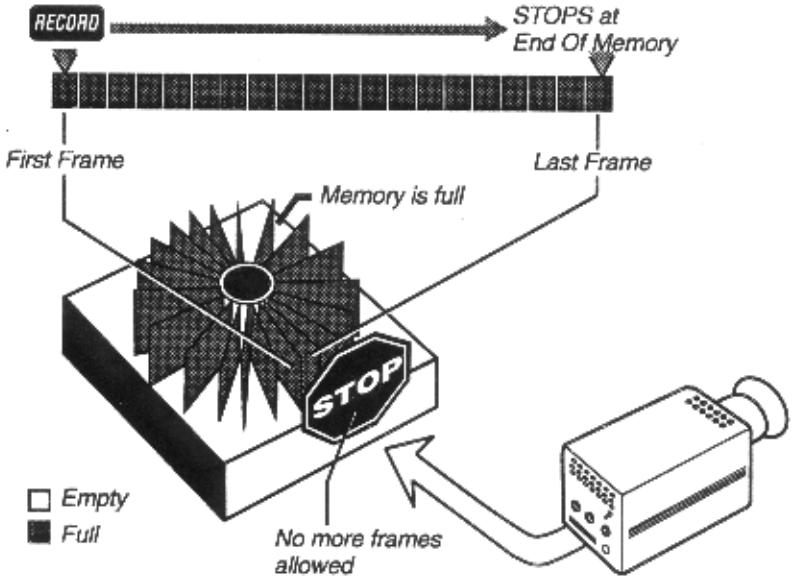


How the Processor Stores Images

Record

The RECORD mode treats the memory as if it were a fixed length and did not have the capability of recording over old images. The recording stops after the last memory frame is loaded with a video image.

You use the RECORD mode when you wish to start a recording session manually. This mode is used when the experiment has an observable start and you are interested in the action immediately after the recording is started.

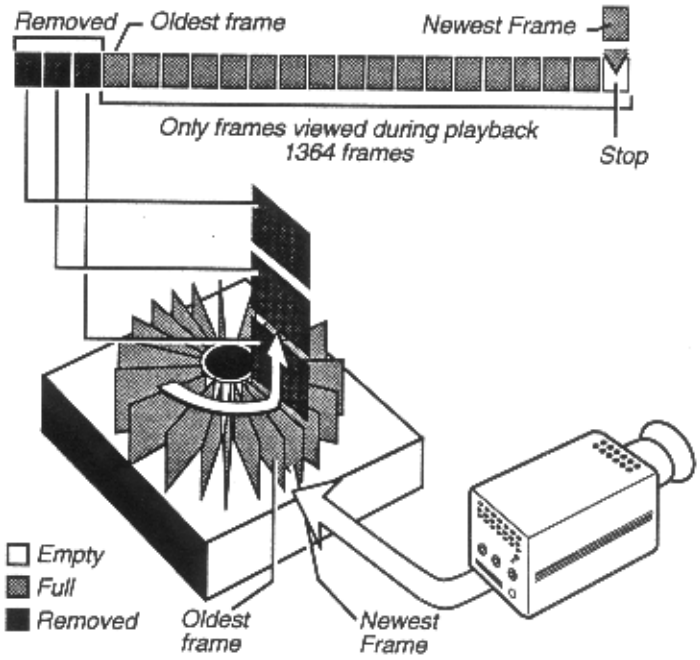


How the Processor Stores Images

Record Stop

The Processor treats memory as a circular buffer when using the RECORD STOP mode. Pictures are stored in sequence with the current picture replacing the oldest picture in memory until you press the STOP key. This approach to recording gives you an infinite amount of record time while you wait for something to happen. After the recording is stopped you will have the last 1364 frames of action stored in memory.

You use the RECORD STOP mode when you wish to end a recording session manually. This mode is used when the experiment has an observable end and you are interested in the action immediately before the recording was stopped.

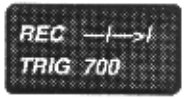


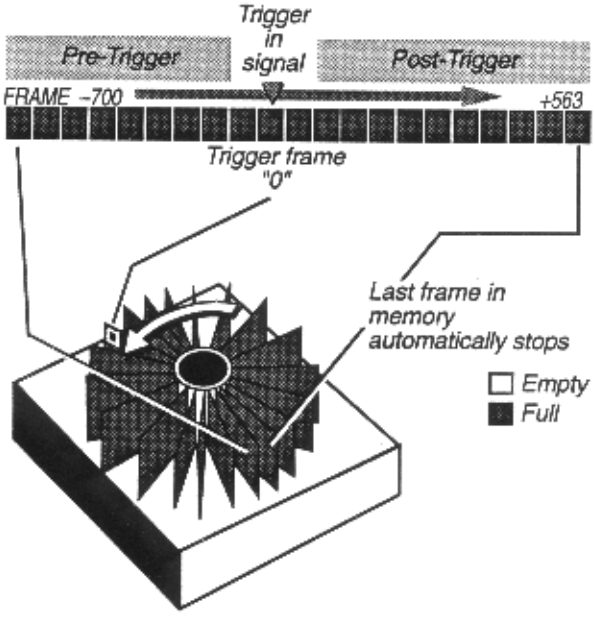
How the Processor Stores Images

Record Trigger

The Processor also treats memory as a circular buffer when using the RECORD TRIGGER mode. Pictures are stored in sequence with the current picture replacing the oldest picture in memory so that you always have the 1364 most recent frames. The trigger input signal causes the Processor to mark the next frame as frame zero. The Processor then reads the number of pretrigger frames set with the TRIG softkey and subtracts that number from the total number of frames of memory available. The result of this arithmetic is the number of post trigger frames to be recorded. The Processor records the calculated number of frames after the trigger and then stops recording.

If the event you are trying to study is controlled by an electrical signal or if the condition you are trying to study generates an electrical signal RECORD TRIGGER is the way to operate the Motion Analyzer. The trigger signal can cause the Processor to start a recording, stop a recording, or save x number of frames before the trigger and y number of frames after the trigger signal.



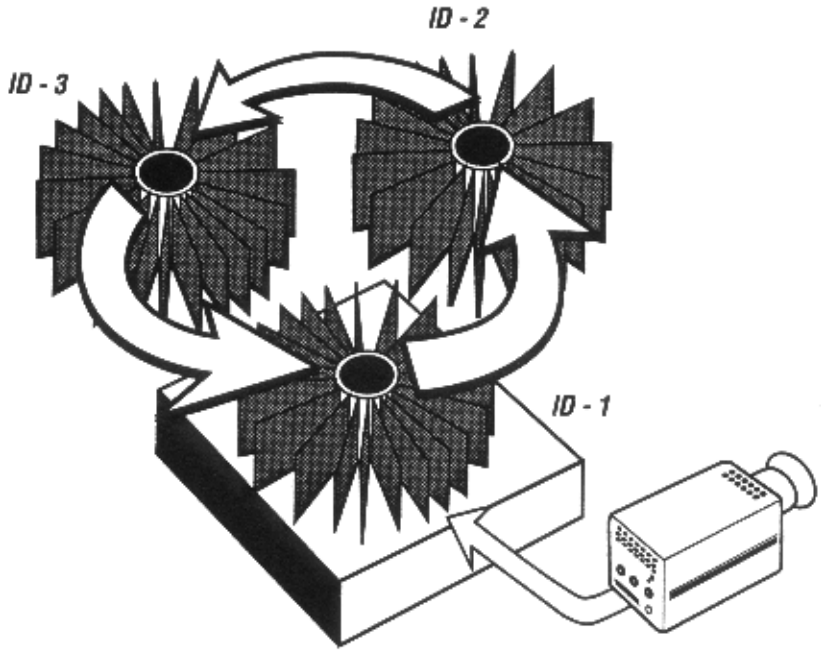


How the Processor Stores Images

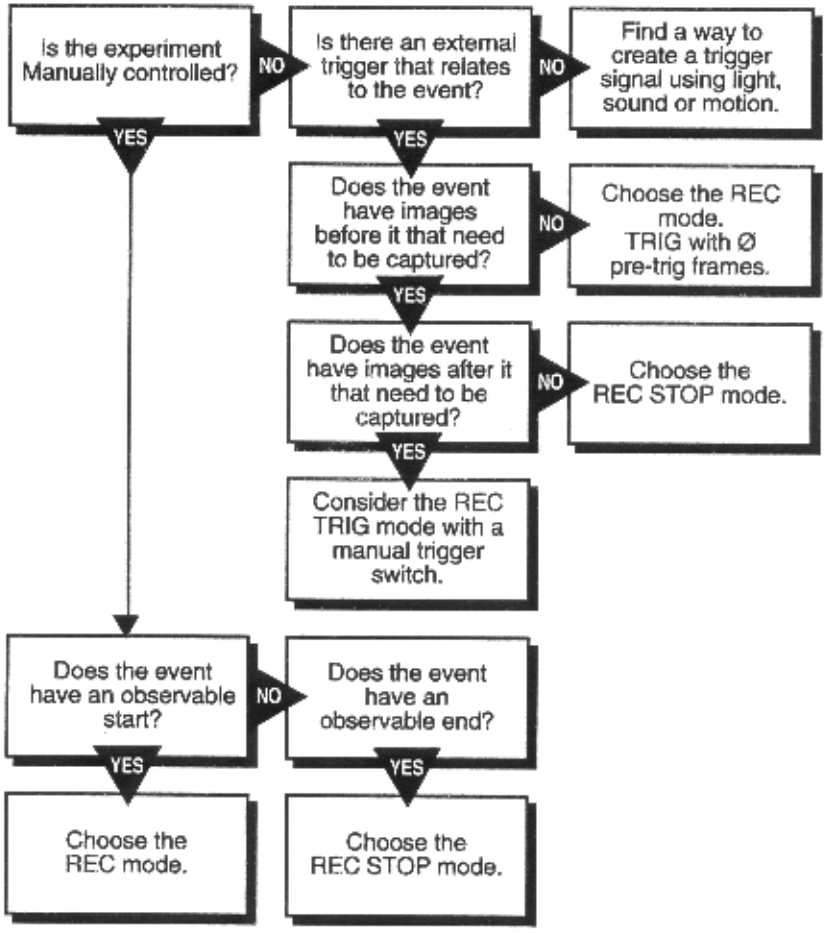
Record Trigger

The record process is exactly the same as it is during RECORD TRIGGER operation, except that memory may be divided into two or more circular buffers instead of just one. Returning to our slide try analogy we can now load multiple slide trays and have each tray accessible in memory at the same time. If OVERWRITE is ON, the Processor will keep putting images in each slide tray refilling the oldest tray in memory with new images until the operator presses the STOP key. If OVERWRITE is OFF, the Processor will fill each slide tray once and then stop RECORDING.

Each slide tray (SESSION) has a unique ID number for reference during playback or downloading.



Choosing a Record Mode



Triggered Recording

A solid state video recorder has unique capabilities that require a different mind set from people that are users of traditional forms of motion analysis. The motion analyzer does not use a recording medium such as magnetic tape or photographic film that runs out after a few seconds of operation. A motion analyzer with a solid state memory for image capture can record forever because of its ability to record over old images. So the challenge is to know when the images you wish to capture are present in the Processor's memory.

The phenomena that are typically the subjects for motion analysis tend to have a dramatic moment that is either initiated electrically or can be sensed electronically. Once an electrical signal that is time related to the event under study is available, using the Motion Analyzer to capture pictures of the event is easy. The event time related electrical signal, which we will call the trigger signal from now on, is connected to the Processor through the TRIGGER IN connector on the rear panel.

The trigger signal may be TTL compatible however, the trigger input circuitry will read any voltage between -30.0 and +0.6 volts as a "low". A voltage between +2.6 and +30.0 volts will be intrepreted as a "high" by the trigger logic circuits. Most signals used in instrument controlled experiments are TTL compatible. If the event you wish to study does not happen in response to an electrical signal there are other options.

If the event you wish to study makes a flash of light, makes a loud noise or closes a switch, there is hardware readily available to convert these physical events into electrical signals. There are also sensors available that will generate a suitable trigger signal each time an object moves past the sensor. There are sensors that react to changes in air pressure or a change in motion. The possibilities are endless.

Acoustical

Suppose you want to record a bullet as it leaves a gun. Usually there is a loud sound when the gun is fired. You could use this sound to trigger the Processor.

Place a microphone near the gun. Take the output of the microphone and condition it to be used as a trigger signal for the TRIGGER IN connector.

You will have to select the RECORD TRIGGER mode and set the TRIG number so that the bullet is in front of the Imager during the recording session.

Triggered Recording

Optical

Suppose you want to record part of an assembly line when a machine jams. The machine has a fault light that comes on whenever the machine jams.

Use a photo-transistor detection circuit to 'see' when the fault light comes on. Take the output of the photo-transistor detection circuit and condition it to be used as a trigger signal for the TRIGGER IN connector.

You will have to select the RECORD TRIGGER mode and set the TRIG number so that the Processor records the images you need when the jam occurs.

Switch Closure

Suppose a machine uses relays to activate certain functions. If the relay that controls the function you wish to record has an unused contact, you could connect that contact to the TRIGGER IN connector and use the relay contact as the triggering signal.

Voltage

Suppose you want to record a package as it passes in front of the Imager.

You could design an interface to detect the presence of the package and connect it to the TRIGGER IN connector. The interface would have to be a sensor that would detect the presence of the package and translate the sensor voltage into a proper trigger signal.

Each time the sensor detects a package the interface circuit would translate the sensor voltage into a trigger signal that would transition from a low to a high. The Processor would see the package and record its passage with the number of frames before and after the trigger time that you set up.

Record on Command

Why ROC?

The Record-On-Command feature is a means of extending record time on those applications where you wish to capture a number of iterations of a repeating motion.

Lets imagine a piston traveling back and forth, you are specifically interested in what is happening when the piston reaches the end of its stroke. If you use the REC STOP mode with 1.2 seconds of record time available you would capture 6 cycles of the piston, assuming a speed of 300 rpm. The action that interests you all happens in the 10 frames as the piston reaches the end of its travel. If you could record just those 10 frames for each cycle, you would have enough record capacity to capture 120 cycles.

ROC is the answer to this need.

How to Use ROC

The Record-On-Command, (ROC), feature permits the user to control when frames are recorded. The record command signal from the user is input through the ROC IN connector on the front of the Processor. The signal supplied should not exceed ± 30 Volts, TTL compatible signals work fine. This signal is connected to logic circuitry where a "low" is a voltage anywhere between -30.0 and +0.6 volts. The ROC circuitry will read a voltage between +2.6 and +30.0 volts as a "high." Don't worry about the polarity of the signal as the Processor has a means of changing the polarity if needed.

For ROC operation the record command signal must be "true" for the entire time you wish to record. When the ROC feature is being used, ROC appears in the DATA-BORDER just below the time display. When the Processor senses a record command signal a solid white box appears to the right of the ROC field in the DATA-BORDER. This white box or ROC Indicator is driven by the user 's command signal. If the ROC indicator behaves just the opposite of what you expected, change the polarity of the command signal with the invert switch above the ROC IN connector.

Record on Command

Details of ROC Use

After the record command from the user goes "true" the Processor waits until the start of the next frame to start storing pictures in memory. This means that it is possible to have a time delay of as long as 1 / REC RATE from the time the user toggles the record command until the storage of the first picture.

NOTE

A peculiarity of ROC operation is that the picture on the monitor will be frozen when the record command signal is not "true". If you are in LIVE or RECORD and the ROC Indicator is not present there will be a still picture on the monitor. The picture will start moving when the command signal goes "true" and the Processor is putting pictures into memory.

In a session where the command signal may be toggled "true" a number of times before the recording is complete. The ROC Indicator will change to a hollow white box if at least one command signal has been received.

If you are viewing a recording done in the (ROC mode the ROC Indicator (white box) images captured will be visible on the video display during the entire playback.

The Processor does keep track of Elapsed Time and Time of Day while a ROC recording is being made. This means that the Elapsed Time display on the monitor to will show the actual time passed between one record command signal and the next.

EXT SYNC

Why EXT SYNC? (External Synchronization)

When the Motion Analyzer is operating in ROC mode the Imager is driven at the record rate and exposure selected with the Keypad. The recording does not start until the Imager begins the next frame. Some applications may require that each frame start at a precise point in the motion being analyzed, consequently a delay until the start of the next frame is unacceptable.

Suppose we need to check the amount of flex in a turbine blade as it rotates past the 90 degree mark. The turbine is rotating at something close to 10,000 rpm which means the blade will pass the study point every 6 milliseconds. No combination of record rate and exposure available on the Keypad will capture the blade one picture per revolution.

To take a picture of the blade at the same spot every time, we need the blade itself to control when the Processor takes a picture. A sensor that produces a pulse each time the blade goes by is needed. Once the sensor is in place and operating its output is connected to the EXT SYNC input on the back of the Imager. An EXT SYNC mode recording is made and we have our blade captured once every revolution.

EXT SYNC

How to use EXT SYNC

The External Synchronization, (EXT SYNC), feature permits the user to control the start time of every frame recorded. The external synchronizing signal from the user is input through the EXT SYNC connector on the rear of the Imager. The signal supplied should not exceed ± 30 Volts, TTL compatible signals work fine. This signal is connected to logic circuitry where a "low" is a voltage anywhere between -30.0 and +0.6 volts. The EXT SYNC circuitry will read a voltage between +2.6 and +30.0 volts as a "high." Don't worry about the polarity of the signal as the Imager has a means of changing the polarity if needed.

For EXT SYNC operation the synchronizing signal need only change state to read a picture into memory. If the EXT SYNC function behaves just the opposite of what you expected, change the polarity of the synchronizing signal with the INVERT switch above the EXT SYNC connector. Push the INVERT button once to change the polarity of the external synchronizing signal.

CHAPTER

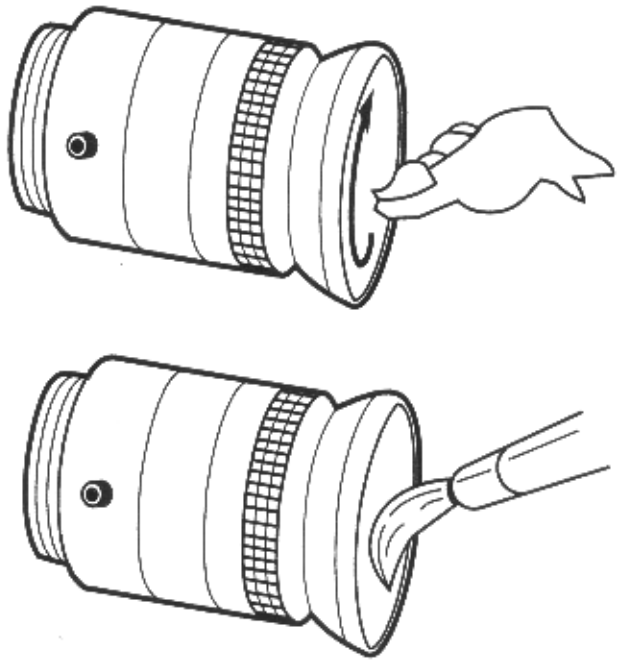
6 Routine Care

Lens Cleaning
Air Filter Care
Your Customer Support Program

Lens Cleaning

Modern lenses are coated with substances to reduce chromatic aberration, unwanted reflection and other conditions that tend to alter or distort images. The surfaces of lenses must be treated with care to protect this fragile coating.

Keep the ends of the lenses capped when not in use. Brush them gently with a camel's hair brush or lightly with a folded piece of lens paper to remove loose dust particles. Try to keep the glass lens surfaces clean so that it does not become necessary to clean them. If it becomes necessary to clean them, always use a commercial lens cleaning solution and photographic lens wipes that may be purchased from any camera or photographic supply. Never rub the lens with any direct pressure. Do not drop the cleaning solution directly on the lens surface.



Air Filter Care

Removing the Air Filter

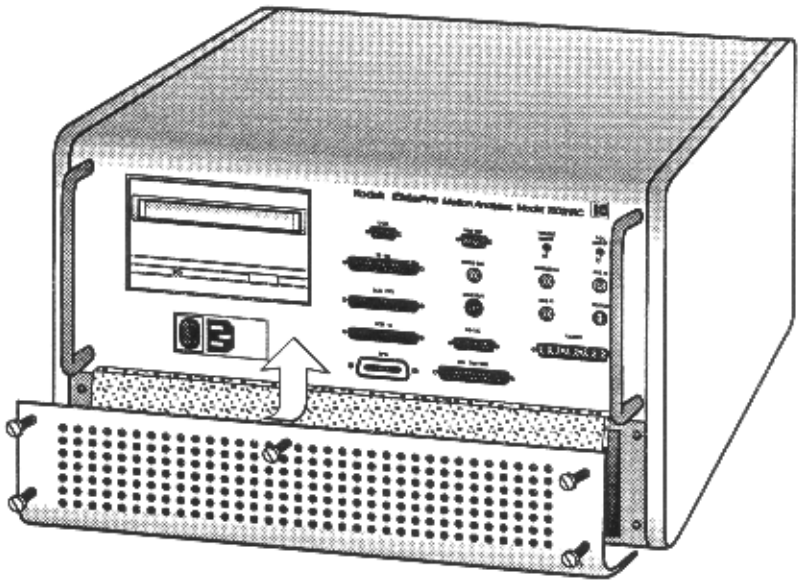
The air filter screen is held in place with five captive screws. Use a common blade screwdriver to loosen the four captive screws and then pull the filter screen forward. The filter is removed from the screen by simply lifting the filter up from the screen.

Cleaning the Air Filter

Clean the filter in soap and water. The filter must be completely dry before you reinstall it in the Processor. If the Processor is used in a clean environment, clean the filter after every 200 hours of operation or if it is soiled. If the Processor is in a dusty or industrial location, you may need to clean the filter frequently.

Reinstalling the Air Filter

After the filter has dried place the filter in the filter screen. Put the filter screen back in place on the Processor and tighten the five captive screws.



Your Customer Support Program

Custom Installation and Training

Installation, on-site checkout and operator training are valuable options for your new Motion Analyzer. Our Custom Installation Package provides you with an operator training seminar and a hands-on laboratory session. This lets your key operators learn the system in a familiar environment. With this on-site training they'll immediately see the value of motion analysis in their real world applications.

Warranty Service

During the initial one year warranty period all repairs, adjustments, parts and labor are free of charge as per the Warranty Statement in the first chapter of this Users Manual.

Equipment Maintenance Agreement (EMA)

EMAs provide emergency repair service when you need it most. The repair work will be performed by our field service engineers located throughout the United States. Call San Diego for EMA options.

Unscheduled Service

Whether you choose one of our other service programs, unscheduled, emergency repair service is available on a time and material basis. This service option schedules repairs either at your site or in one of our Service Centers.

Application Training

Your Motion Analysis System is an extremely versatile tool. Its full potential can best be realized when its users thoroughly understand its operation and flexibility.

Our training program offers three days of operation, applications and operator maintenance instruction. Classes can be scheduled in San Diego or in your plant. When on site classes are selected, your applications become a part of the course. To facilitate individual attention, classes are limited to five people.

For more information on any of our support options, please give us a call in San Diego at:

800-854-7006

The San Diego office is open from 7:00 a.m. to 5:00 p.m., Pacific time, Monday through Friday (excluding holidays).

CHAPTER

7 Specifications

Processor Specifications
Imager Specifications

Processor Specifications

Keypad	Back-lit LCD display provides user access to all system functions.
Recording Technique	Color digital images stored in Dynamic Random Access Memory (DRAM)
Recording Modes	RECORD: Records images until memory is full and then stops. RECORD STOP: Continually records images until STOP key is pressed. RECORD TRIGGER: Continually records images until a trigger signal is received, saves operator programed number of images before trigger point and then continues to record until memory is full. RECORD RETRIGGER: Operates the same as RECORD TRIGGER but rearms automatically making it possible for multiple recordings in memory. RECORD ON COMMAND: Records images at the selected record rate each time signal supplied by the user is "true." May be used in conjunction with all other record modes. EXTERNAL SYNCHRONIZATION: Frame start and interval between frames is controlled by synchronizing signal supplied by the user.
Record Rates	250, 500 and 1000 full frames/second,
Exposure	Inverse of frame rate, 50 µsec, 100 µsec, 1 ms, 2 ms, or 4ms
Frame Storage	682, 1,364, 2,728 or 5,456 frames. Archival storage to optional internal optical disc
Playback Rates	Variable
Reticle	Built in X, Y electronic crosshairs for data reduction
Video Outputs	SVGA 24 bit color, S-VHS, and Analog Color Video. System can be configured for either NTSC or PAL compatible video output.
VCR remote control	The Processor can control selected VCR type directly for automated download of image data.
DATA-FRAME Border	Date, Time, ID number, record rate,exposure, elapsed time, playback rate, frame number, ROC, TRIG reticle coordinates, IRIG time and system status. messages.
Inputs	TRIGGER: BNC connector TTL level positive or negative true logic ROC: BNC connector TTL level positive or negative true logic
Size	11.3"H x 17.6"W x 14.3"D (43cm X 50cm X 32cm)
Weight	Approximately 37 pounds. (16.8 kg)
Power	110 / 220 Volts AC, 60 / 50 Hertz, 700 VA
Operating Environment	0° to 45° C, non-condensing RH

Imager Specifications

Sensor	512 X 384 pixels
Spectral Response	400 to 1000 nanometers
Lens Mount	C-Mount
Input Jacks	EXT SYNC: BNC connector TTL level positive or negative true logic KEYPAD
Indicators	READY green LED EXT SYNC INVERT green LED
Outputs	RS170 analog video.
Tripod Mount	1/4-20 and 3/8-16 with standard ANSI hole pattern.
Cables (Imager to Processor)	20 ft. standard (50 ft. cable optional).
Size	Approximately 9"x4"x5" (23 cm X 10 cm X 12 cm)
Weight	17 lbs. (7.73 kg)
Power	Derived from Processor.
Operating Environment	0° to 45° C, non-condensing RH

Manufactured in U.S.A. UL APPROVED

Declaration of Conformity

Application of Council Directive(s)	: 89/336/EEC, 92/31/EEC, 73/23/EEC
Standard(s) to which Conformity is Declared	: EN55022, EN50082-1, EN60950
Manufacturer's Name	: Eastman Kodak Company Motion Analysis Systems Division
Manufacturer's Address	: 11633 SorrentoValley Rd. San Diego, CA 92121
Importer's Address	: Kodak Nederlands B.V. Electronic Vision Systems Zeisterweg 1 3984 NH Odijk The Netherlands
Type of Equipment	: Information Technology Equipment High Speed Video Equipment
Model No.	: Ektapro Model 1000 HR / HRC
Year of Manufacture	: 1995

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s)

Date: 30 May 95 John R Bagby
Signature

JOHN BAGBY / GENERAL MANAGER
Motion Analysis Systems Division
Eastman Kodak Company

EASTMAN KODAK COMPANY
Motion Analysis Systems Division
1162 Sorrento Valley Road
San Diego, CA 92121-1097
619-535-2908

P/N91000042-001 REV. D