USER'S MANUAL
MODEL 1012
MODEL 1000-E

KODAK EKTAPRO Hi-Spec Motion Analyzer

MOTION ANALYSIS SYSTEMS

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WARRANTY

NEW EQUIPMENT WARRANTY
KODAK EKTAPRO HI-SPEC MOTION ANALYZER

EASTMAN KODAK COMPANY, MOTION ANALYSIS SYSTEMS DIVISION, WARRANTS THIS **KODAK EKTAPRO** HI-SPEC PROCESSOR, **KODAK EKTAPRO** HI-SPEC IMAGER 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 Hi-Spec Motion Analyzer in accordance with Kodak's written instructions, including environmental specifications listed in the User's Manual.

If there is evidence of the KODAK EKTAPRO Hi-Spec Motion Analyzer being subjected to accidental damage, misuse or abuse.

If the KODAK EKTAPRO Hi-Spec Motion Analyzer 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.

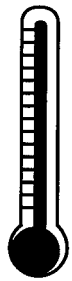
KODAK MAKES NO OTHER WARRANTIES, EXPRESS, IMPLIED, OR OF MERCHANTABILITY FOR THIS EQUIPMENT. IF THIS **KODAK EKTAPRO** HI-SPEC MOTION ANALYZER DOES NOT FUNCTION PROPERLY DURING THE WARRANTY PERIOD, KODAK WILL REPAIR IT WITHOUT CHARGE ACCORDING TO THE TERMS STATED ABOVE. REPAIR WITHOUT CHARGE IS KODAK'S 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 91000030-001 Rev C.

PRECAUTIONS

OPERATION

Ventilation



Vented holes in the Processors cover are provided for proper ventilation. To protect from over-heating, do not block or cover the holes and do not operate with the Processor in a space that does not have proper ventilation.

Temperature

The KODAK EKTAPRO Hi-Spec Motion Analyzer is designed to operate satisfactorily in an environment where the ambient temperature is between -21 and 50 degrees Centigrade (-6 and 122 degrees Fahrenheit), and there is no water condensation present.

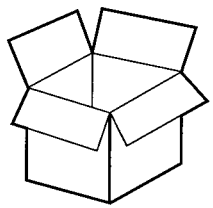
STORAGE

Temperature

Do not store the equipment in an area where the temperature will drop below -57 degrees or exceed 71 degrees Centigrade (-71 to 160 degrees Fahrenheit). Ensure that at no time does moisture condense on the system.

SHIPPING

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



Do not ship the equipment in an area where the temperature will drop below -33 degrees or exceed 70 degrees Centigrade (-27 to 158 degrees Fahrenheit). Ensure that at no time does moisture condense on the system.

PRECAUTIONS

PRECAUTIONS

WARNING

The 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 insure that it is in good condition.

CAUTION

To avoid the risk of fire, use only the fuses specified for the equipment.

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

Insure power is turned off before connecting or disconnecting the Camera and Signal Processing Unit or any other devises.

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.

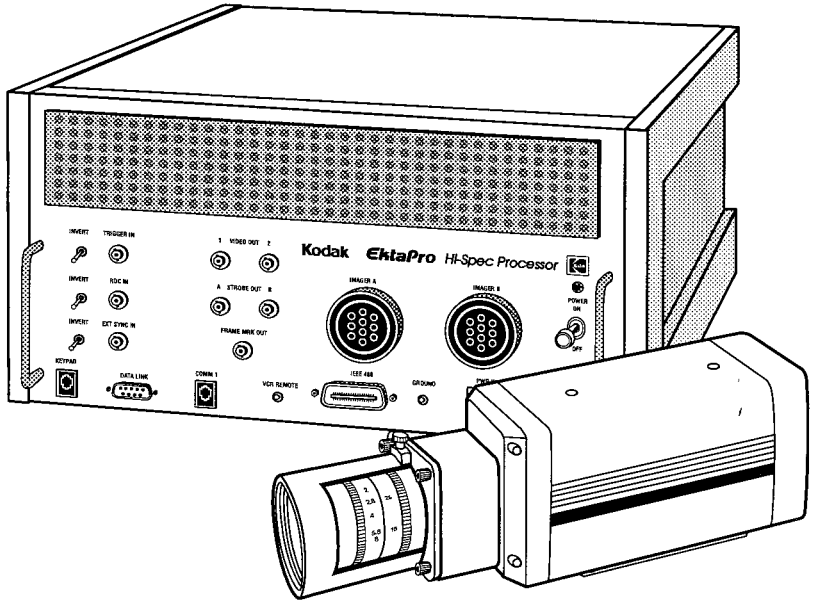
INTRODUCTION

The KODAK EKTAPRO Hi-Spec Motion Analyzer is a system designed to record high-speed events and provide immediate, slow-motion playback. With its rugged design and ability to capture up to 12,000 pictures per second, the system is ideal for use in ballistic testing on ranges, vehicle impact testing, airborne systems testing and many other demanding, high-speed events.

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 monitor is what will be captured in memory when the RECORD key is pressed.

The images recorded are immediately available for analysis.

The information in this manual will teach you how to operate the KODAK EKTAPRO Hi-Spec Motion Analyzer, and take advantage of the many features of the system designed to speed up and simplify the task of motion analysis.



HOW TO USE THIS MANUAL

CHAPTER 1. INTRODUCTION TO THE KODAK EKTAPRO Hi-SPEC Motion Analyzer, Users Manual.
This chapter contains the Warranty, precautions, introduction and how to use this manual.

CHAPTER 2. CONTROLS AND CONNECTORS.
Introduction to the all of the elements of your Motion Analyzer. Explains the use of each connector, control and the meaning of each element presented in the DATA-FRAME Border on the video monitor.

CHAPTER 3. KEYPAD BASICS.
Explains use of the various dedicated keys, how to move between the menu pages and how to manipulate the parameters associated with a softkey.

CHAPTER 4. GETTING STARTED.
Explains how to connect and operate the KODAK EKTAPRO Hi-Spec Motion Analyzer. The step by step instructions in Chapter 4 will assist you in setting up and connecting the system components, and recording and playing back an experiment.

CHAPTER 5. USING THE KEYPAD.
A detailed explanation of each function available using the softkeys.

CHAPTER 6. RECORDING STRATEGIES.
Explains how to use the different record modes, typical triggers, selecting the correct record mode, Record On Command and External Synchronization.

CHAPTER 7. ROUTINE CARE.
Explains how to take care of the system for the best results and to avoid problem.

CHAPTER 8. SPECIFICATIONS.
This section lists the specifications for the KODAK EKTAPRO Hi-Spec Processor.

HOW TO USE THIS MANUAL

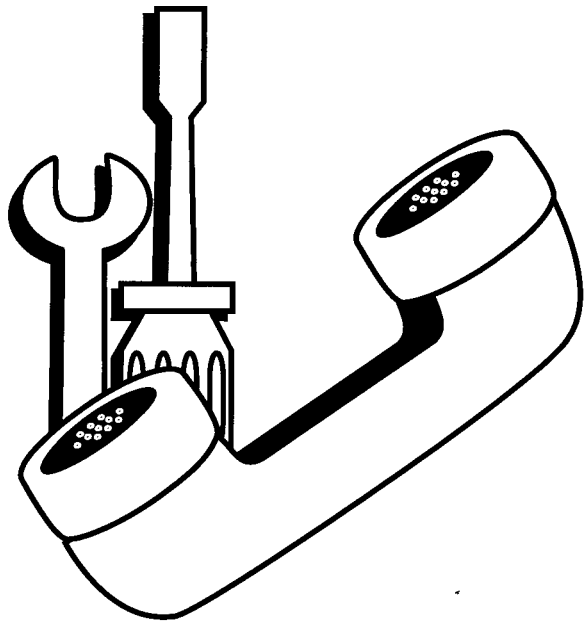
Please familiarize yourself with the table of contents. The manual can then be studied as needed for information about specific topics such as keypad menu options and routine care of the system.

If you require additional technical information regarding the care, technical service and operation of the KODAK EKTAPRO Hi-Spec Motion Analyzer or its components, please contact a field service representative in San Diego by calling:

Outside California
800-854-7006

In California
800-542-6417

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



NOTES

CHAPTER 2. CONTROLS AND CONNECTORS

VISUAL INTRODUCTION

KODAK EKTAPRO Hi-Spec IMAGER

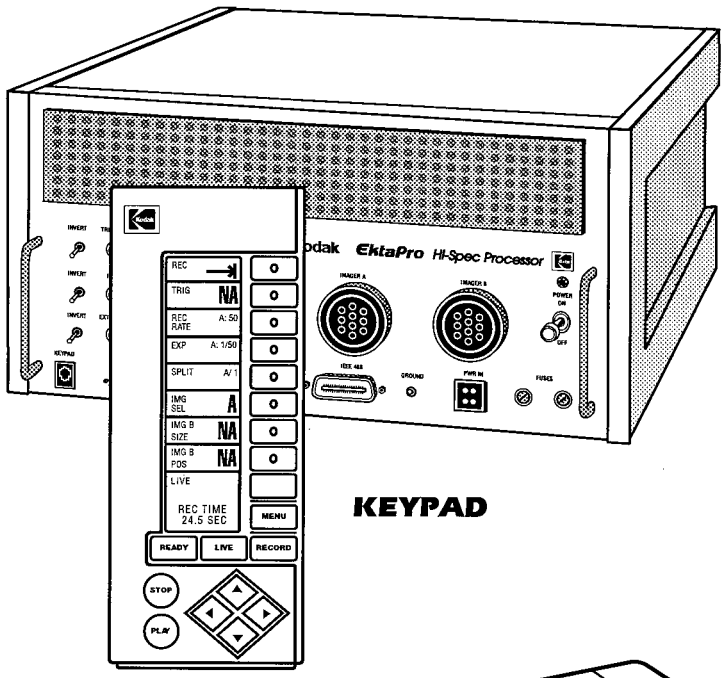
KODAK EKTAPRO Hi-Spec PROCESSOR

VIDEO DISPLAY

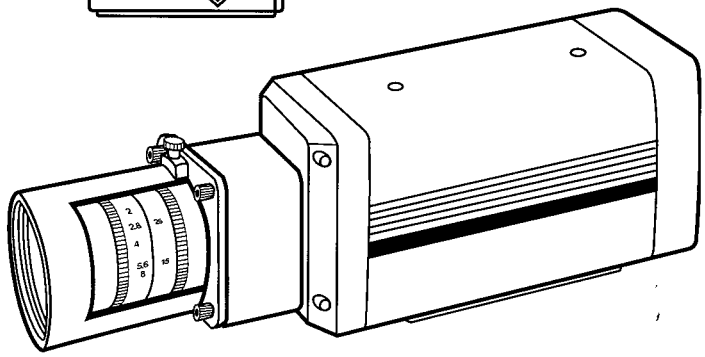
NOTES

VISUAL INTRODUCTION

KODAK EKTAPRO
Hi-Spec Processor



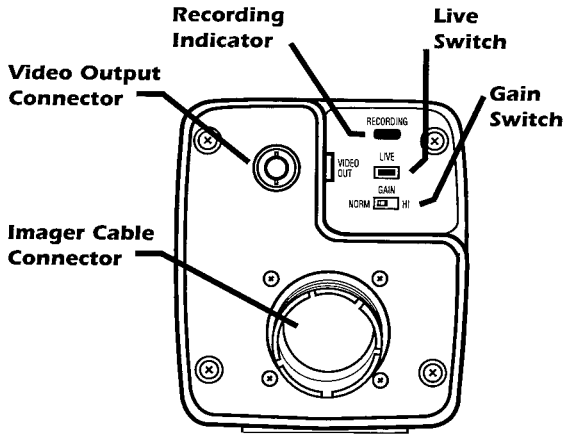
KEYPAD



KODAK EKTAPRO
Hi-Spec Imager

CONTROLS AND CONNECTORS

KODAK EKTAPRO Hi-Spec Imager



GAIN SWITCH

The Gain Switch allows you to select NORMAL or HIGH GAIN. The NORMAL position sets the imager video amplifiers to a standard gain setting. The HIGH GAIN position sets the imager video amplifiers to produce approximately one f-stop more sensitivity as compared to the NORMAL position.

When HIGH GAIN is selected, the picture will change intensity and flicker while the Processor power supply stabilizes. After the power supply stabilizes, the picture will be approximately 1 f/stop more sensitive. You may notice a slight decrease in picture quality when the Imager is operated in High Gain. This is considered standard operation.

When NORMAL is selected, the picture will change intensity and flicker while the Processor power supply stabilizes. After the power supply stabilizes, the Imager and Processor will be operating in the normal mode.

CONTROLS AND CONNECTORS

KODAK EKTAPRO Hi-Spec Imager

IMAGER CABLE CONNECTOR

Receives the imager cable that is connected to the Processor. All video, control and power lines between the Processor and the Imager pass through this connection.

VIDEO OUTPUT CONNECTOR

BNC type connector that provides the same video signal that appears on the front panel of the Processor. This video output provides a way to connect a remote monitor to an Imager that is a long distance from the Processor.

RECORDING INDICATOR

This red LED illuminates any time the motion analyzer is recording images.

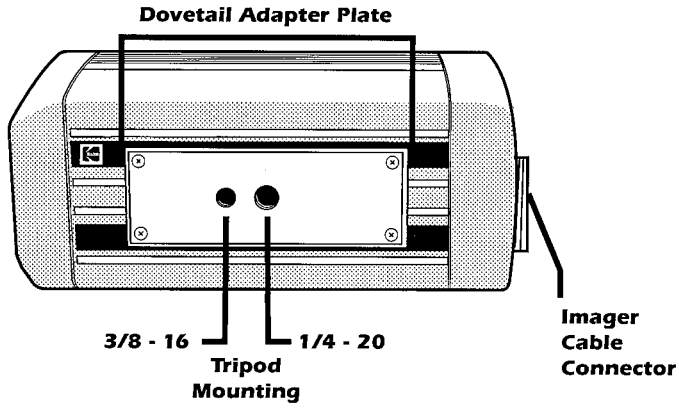
LIVE SWITCH

This push-button on the back of the Imager acts just like the LIVE key on the keypad.

CONTROLS AND CONNECTORS
KODAK EKTAPRO Hi-Spec Imager

IMAGER MOUNTING PLATE

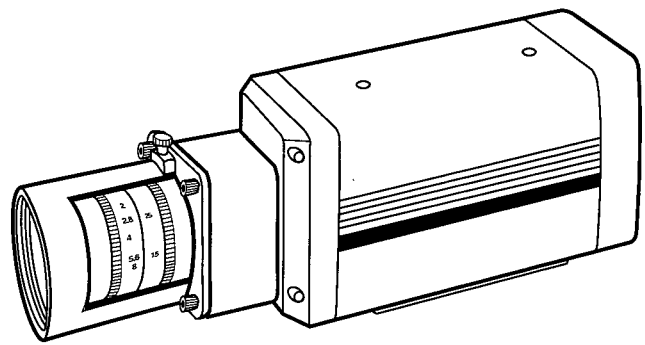
The KODAK EKTAPRO Hi-Spec Imager comes equipped with an industry standard 2-5/8" x 4-3/4" dovetail adapter plate similar to the ones used on high speed film cameras. There are also two threaded holes in the dovetail adapter for mounting on conventional tripods. Use the dovetail mount when performing high G tests.

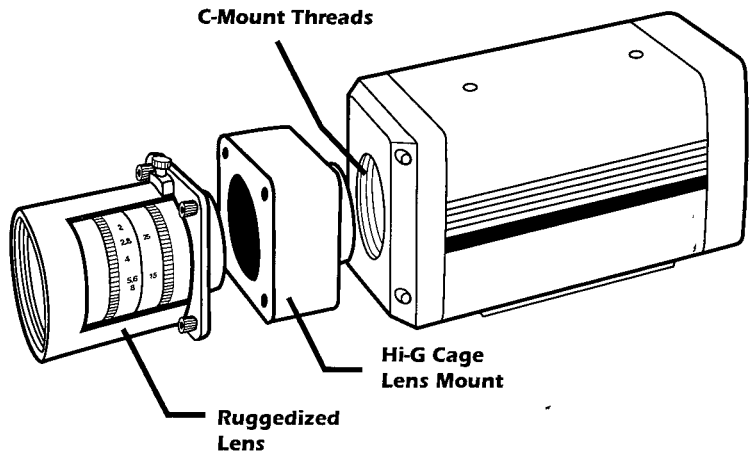


CONTROLS AND CONNECTORS
KODAK EKTAPRO Hi-Spec Imager

LENS
The lens focuses the light from the scene being studied on to the sensor.

LENS MOUNT DETAILS
The Imager has threads for a C-Mount lens in the front plate but is also equipped with a flanged lens mount designed to accept Hi-G Cage Lens mount. The adapter plate supplied with the imager has four mounting holes in a 2.0 x 1.0 inch rectangular pattern. The adapter is tapped to accept #6-32 machine screws.

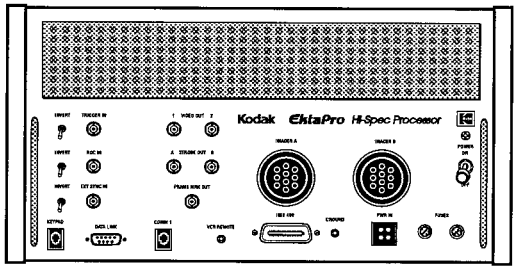


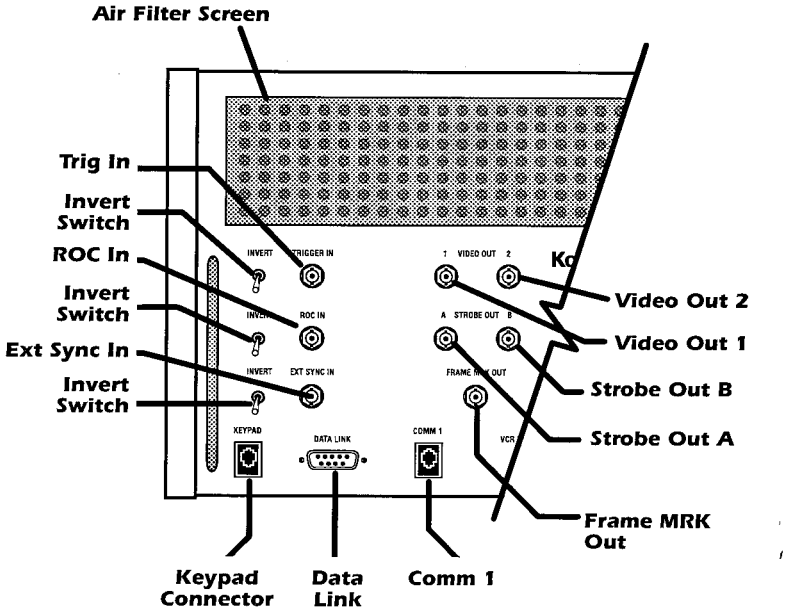


CONTROLS AND CONNECTORS

PROCESSOR FRONT PANEL

KODAK EKTAPRO Hi-Spec Processor FRONT PANEL

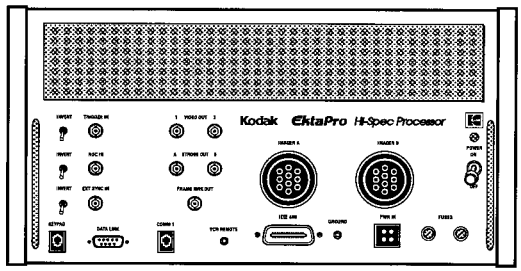


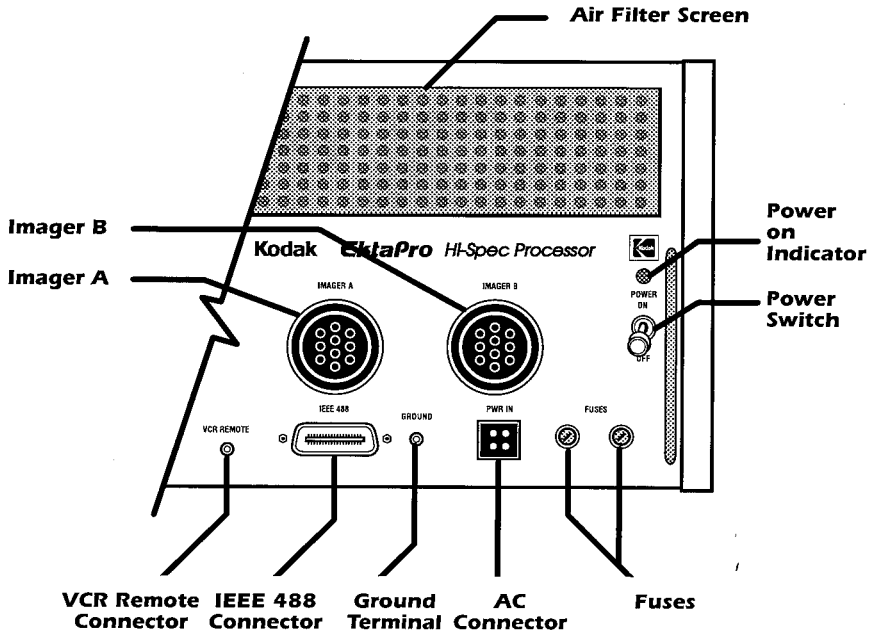


CONTROLS AND CONNECTORS

PROCESSOR FRONT PANEL

KODAK EKTAPRO Hi-Spec Processor FRONT PANEL (Cont.)





CONTROLS AND CONNECTORS

PROCESSOR FRONT PANEL

VIDEO OUT 1

BNC type connector that carries the video output signal from the Motion Analyzer. This output is designed to drive a seventy five ohm coaxial cable that can be connected to a monitor, VCR or hard copy printer.

VIDEO OUT 2

VIDEO OUT 2 is identical to VIDEO OUT 1.

STROBE OUT A

Provides a positive going ten volt pulse synchronized with the picture rate of Imager A. This signal provides a trigger for a KODAK EKTAPRO Intensified Imager or a strobe light.

STROBE OUT B

Provides a positive going ten volt pulse synchronized with the picture rate of Imager B. This signal provides a trigger for a KODAK EKTAPRO Intensified Imager or a strobe light.

IMAGER A

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

IMAGER B

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

CONTROLS AND CONNECTORS

PROCESSOR FRONT PANEL

GROUND

Thumb screw ground connection provided as a convenience to the user. The connection could be used to insure that external devices, a trigger source for example, connected to the Processor are at the same ground potential.

VCR REMOTE

Connection for the infrared remote control used by the Processor to control a VCR during video download operations.

FRAME MRK OUT

BNC type connector that provides a ten volt pulse output. A pulse is output at the beginning of each frame stored in memory.

COMM 1

Reserved for future use. RS232 format data communications channel.

DATA LINK

Nine pin connector providing clock, sync and serial data connection to various accessories for the EKTAPRO Hi-Spec Motion Analyzer.

KEYPAD

Connection for the keypad cable providing power and signal path between Processor and keypad.

IEEE 488

Standard GPIB (General Purpose Interface Bus) connector used by the Computer Access Interface accessory. Digital video data and limited machine control will be available through this interface.

CONTROLS AND CONNECTORS

PROCESSOR FRONT PANEL

TRIGGER IN

BNC type connector that receives a TRIGGER input from the user. This signal is connected to TTL logic circuitry where a "low" is a voltage anywhere between -30 and +0.6 volts. The TTL circuitry will read a voltage between +2.6 and +30 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.

There is a switch located to the immediate left of the connector labeled "INVERT." This switch can be used to invert the user supplied input signal if needed for proper operation of the TRIGGER function.

ROC IN

BNC type connector that receives a TTL compatible ROC (Record On Command) input from the user. This signal is connected to TTL logic circuitry where a "low" is a voltage anywhere between -30 and +0.6 volts. The TTL circuitry will read a voltage between +2.6 and +30 volts as a "high."

There is a switch located to the immediate left of the connector labeled "INVERT." This switch can be used to invert the user supplied input signal if needed for proper operation of the ROC function.

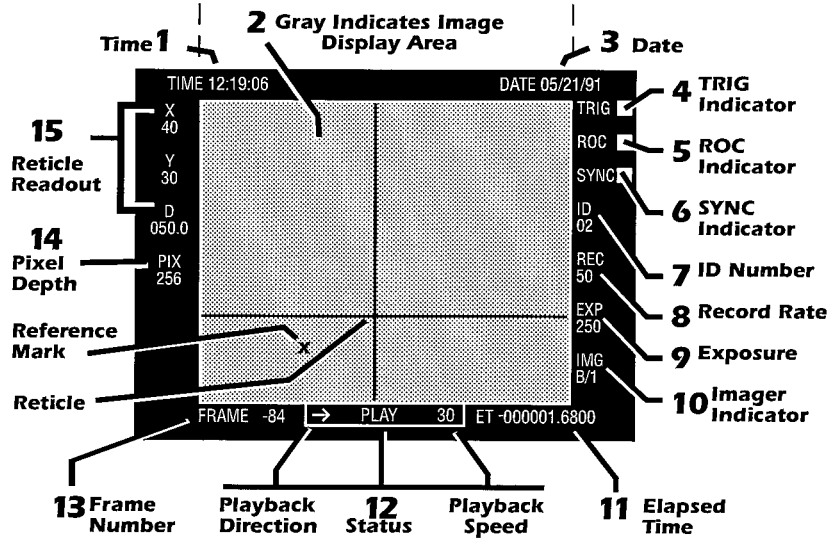
EXT SYNC IN

BNC type connector that receives a TTL compatible EXT SYNC (External Synchronization) input from the user. This signal is connected to TTL logic circuitry where a "low" is a voltage anywhere between -30 and +0.6 volts. The TTL circuitry will read a voltage between +2.6 and +30 volts as a "high."

There is a switch located to the immediate left of the connector labeled "INVERT." This switch can be used to invert the user supplied input signal if needed for proper operation of the EXT SYNC function.

CONTROLS AND CONNECTORS

VIDEO DISPLAY



1. REAL TIME

This field displays the current time of day in twenty four hour format to the nearest second during LIVE operation. In any of the STOP modes the time displayed just before the STOP key was pressed will be frozen in the display. During PLAY the time of day that was recorded with the pictures will be displayed.

2. IMAGE DISPLAY AREA

This area displays the pictures from the imagers.

3. DATE

This field will display the current date in mm/dd/yy format in LIVE mode. In any of the STOP modes the date displayed just before the STOP key was pressed will be frozen on the display. During PLAY the date that was recorded with the pictures will be displayed.

CONTROLS AND CONNECTORS

VIDEO DISPLAY

4. TRIGGER INDICATOR

The word TRIG appears when the RECORD TRIGGER mode is selected. A white box to the right of the word TRIG shows that the Processor is receiving a trigger input signal.

5. RECORD ON COMMAND INDICATOR

The word ROC or BROC appears when a RECORD ON COMMAND feature is selected. A white box to the right of the word (B)ROC shows that the Processor is receiving a ROC input signal. A hollow white box means that at least one ROC input signal occurred during the recording.

6. EXTERNAL SYNCHRONIZATION INDICATOR

The word SYNC appears when the EXT SYNC feature is on. A white box to the right of the word SYNC appears briefly each time an external synchronizing signal is received.

7. IDENTIFICATION NUMBER

The ID field shows the current ID in LIVE mode and the recorded ID in PLAY mode. The ID can be changed using the keypad. The ID automatically increments one after each recording. The ID power on default is 01.

Some users have found that it is useful to keep a log of each recording. Logging the DATE, ID and description of a shot saves some time when you are trying to find a specific image later.

8. REC

The REC field shows the current record rate in LIVE mode and the record rate of the recording in PLAY mode. A RECORD RATE of 1000 means that the Imager is taking pictures at 1000 pictures per second.

There will be two REC numbers displayed when both imagers are active. The top number will be the record rate for Imager A and the bottom number will be for Imager B.

CONTROLS AND CONNECTORS
VIDEO DISPLAY

9. EXP
EXP (exposure) is the amount of time that the sensor integrates light for each picture. Read an EXP value of 1000 to mean 1/1000 of a second.

There will be two numbers displayed when both imagers are active. The top number will be the EXP for Imager A and the bottom number will be the EXP for Imager B.

10. IMAGER / SPLIT (MODEL 1012 ONLY)
This field provides two elements of information. The letter to the left of the "/" indicates the Imager being displayed in the image display area. The number to the right of the "/" shows the number of splits. A display of "A/2" means Imager A is being displayed and the frame has been divided into two pictures.

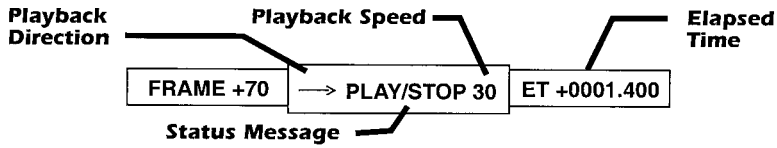
Imager A and Imager B can be split independent of each other, that is why there are separate RECORD RATE, EXPOSURE, and IMAGER SPLIT fields on the monitor for each Imager.

11. ELAPSED TIME
The Processor calculates ELAPSED TIME and displays the result in seconds during playback. The ELAPSED TIME is referenced to frame number zero. A value of -1.250 means that the frame being displayed was recorded 1.250 seconds before frame zero. A value of +0.016 means that the frame being displayed was recorded 0.016 seconds after frame number zero.

12. STATUS
The status field indicates what the Processor is doing. The following lists the messages that can appear in the status box and their meaning.

CONTROLS AND CONNECTORS

VIDEO DISPLAY



STATUS WINDOW MESSAGES

LIVE The Processor is displaying imager pictures but it is not recording the imager pictures into the Processor memory.

LIVE/STOP A STOP key was pressed while the Processor was in LIVE. The monitor will display the last picture viewed in LIVE.

LIVE/READY The monitor is displaying live imager pictures. Pressing a RECORD key will start a recording. Pressing a STOP key will place the Processor in LIVE/STOP.

RECORDING The Processor is displaying and recording imager pictures.

REC/STOP A STOP key was pressed while the Processor was RECORDING. The monitor will display the last picture recorded.

PLAY The Processor is displaying images at a playback rate that permits each picture in memory to be shown in sequence.

SCAN The Processor is displaying images at a playback rate that is fast enough that some pictures in memory are skipped over.

PLAY/STOP A STOP key was pressed while the Processor was in PLAY. The monitor will display the last picture viewed in PLAY.

SCAN/STOP A STOP key was pressed when the Processor was in SCAN. The monitor will display the last picture viewed in SCAN.

PLAYBACK DIRECTION Playback direction is indicated by an arrow. The arrow points to the right for play forward and to the left for play reverse.

PLAYBACK SPEED The playback speed is expressed in frames per second (fps).

13. FRAME NUMBER

During playback, FRAME NUMBER displays the number of the picture on the monitor. Each frame in a recording has a unique number that can be positive, negative or zero.

14. PIXEL DEPTH READOUT

The number displayed in this field represents the number of levels of gray that are being used to represent the light falling on each pixel.

15. RETICLE INFORMATION

The RETICLE INFORMATION is present only when the reticle has been turned on from the keypad. The RETICLE INFORMATION consists of X, Y and D numbers.

X COORDINATE

The X COORDINATE is the distance in pixels along the X axis between the reticle and the reference mark.

Y COORDINATE

The Y COORDINATE is the distance in pixels along the Y axis between the reticle and the reference mark.

D VALUE

Represents the distance between current reticle intersection and the reference mark in pixels. This value is calculated using the following formula:

$$D = \sqrt{x^2 + y^2}$$

NOTES

CHAPTER 3.
KEYPAD BASICS

KEYPAD CONTROLS

SOFTKEYS

DEDICATED KEYS

NOTES

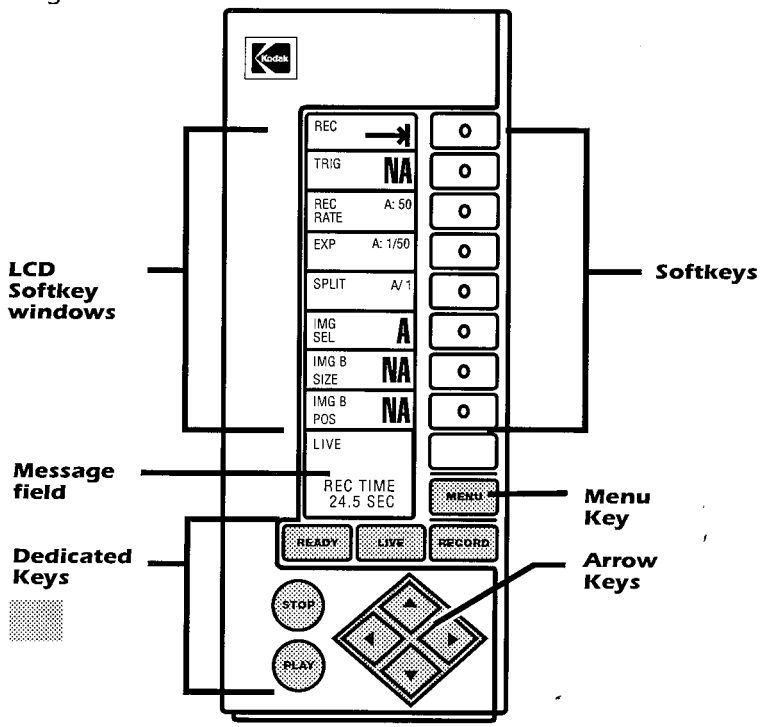
KEYPAD BASICS

KEYPAD CONTROLS

The keypad has a large Liquid Crystal Display (LCD) and several control keys that allow the user to manage all of the KODAK EKTAPRO Hi-Spec Motion Analyzer functions. The display gives the user information about system status and the function of each key. The keypad has eight "softkeys" whose function changes according to the menu page being used and ten dedicated keys that always perform the same function.

The keypad will BEEP whenever a function that cannot be performed is selected. 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.

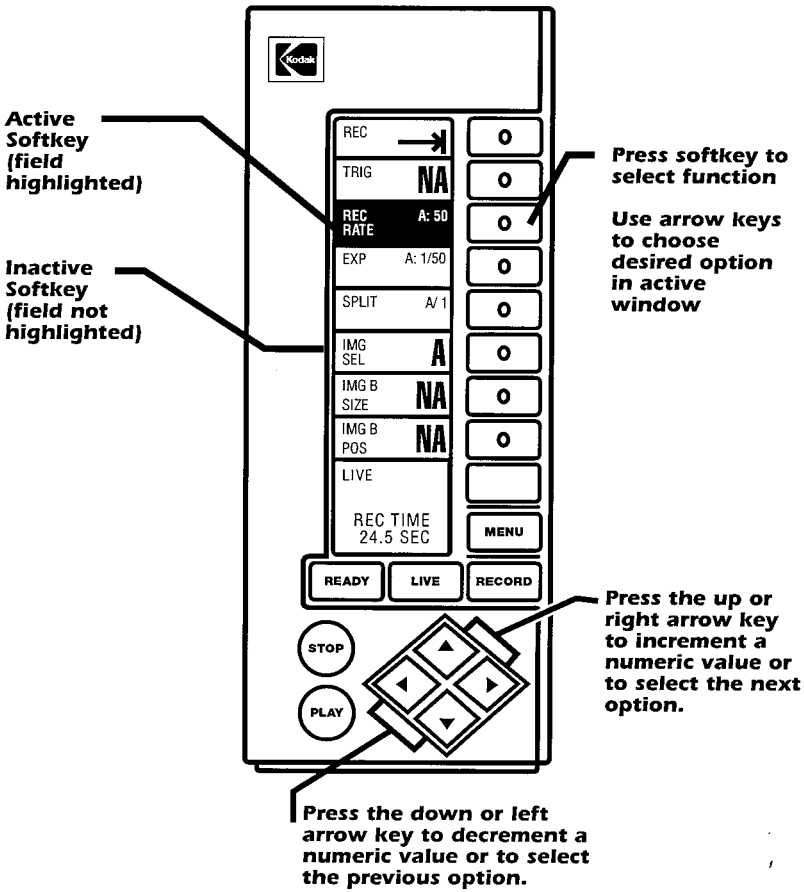
The MESSAGE field provides you with Processor status and error messages.



KEYPAD BASICS
SOFTKEYS

HOW TO WORK WITH THE SOFTKEYS

Pressing a softkey highlights the softkey window to its left. A dark background with light letters in a softkey window indicates that the function is active. Use the arrow keys to change the parameters shown in the active softkey window.

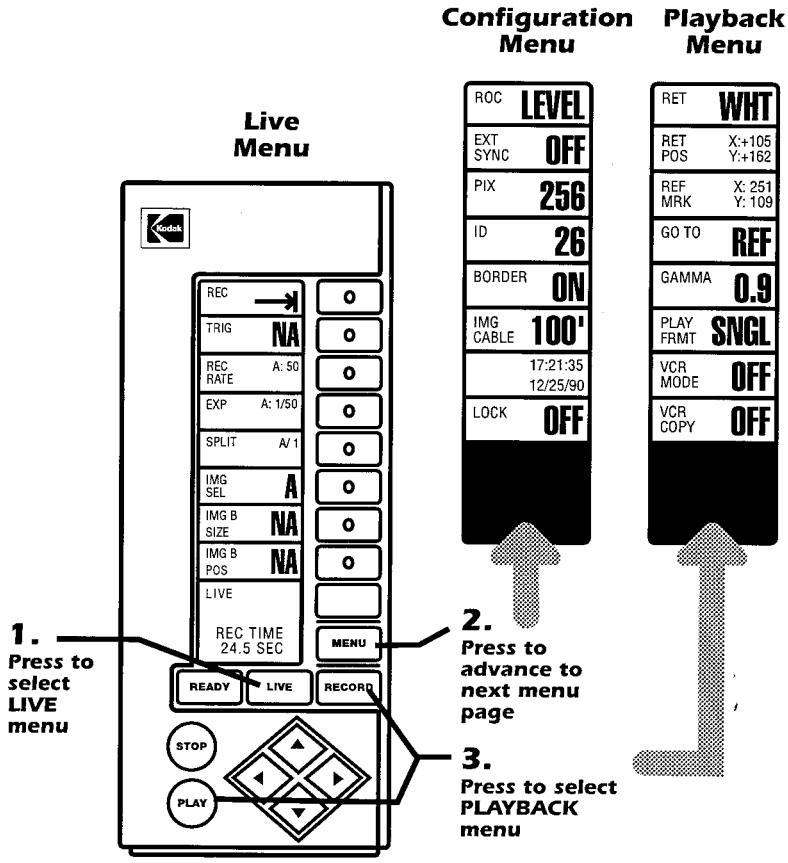


The keypad will BEEP whenever you press a key for a disallowed function. The keypad will BEEP when you press the IMG softkey when only one imager is connected to the Processor.

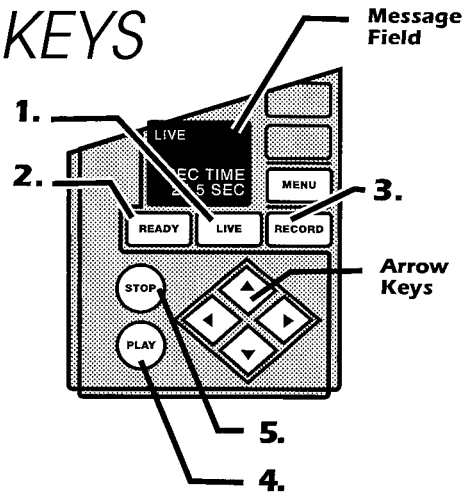
KEYPAD BASICS
SOFTKEYS

WORKING WITH THE MENU PAGES

There are twenty four functions that are controlled by the softkeys. Since there are only eight softkeys, the functions have been divided into three menu pages. The first or LIVE menu page contains functions always used to prepare the Motion Analyzer for a recording session. The second or CONFIGURATION menu page contains functions that are used less often in preparing for a recording. The third or PLAYBACK menu page contains functions that are used to play back, analyze and download a recorded event.



KEYPAD BASICS
DEDICATED KEYS



1. 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 page.

2. 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.

Press the STOP key to cancel. The STOP key is the only key that will cancel READY TO RECORD.

3. RECORD
Starts a recording if READY was the last key pressed. Pressing the RECORD key also switches the keypad to the PLAYBACK menu page.

NOTE

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

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

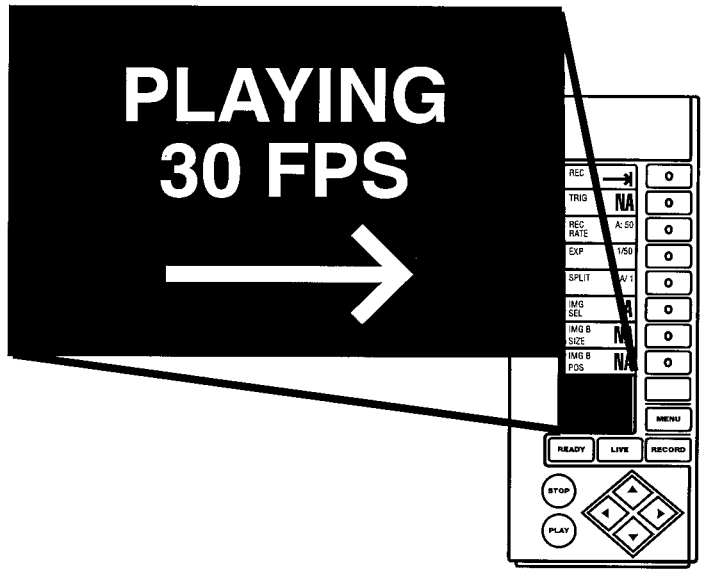
5. PLAY
Plays recorded images and the associated DATA-FRAME Border information. Pressing the PLAY key also switches the keypad to the PLAYBACK menu page.

KEYPAD BASICS
DEDICATED KEYS

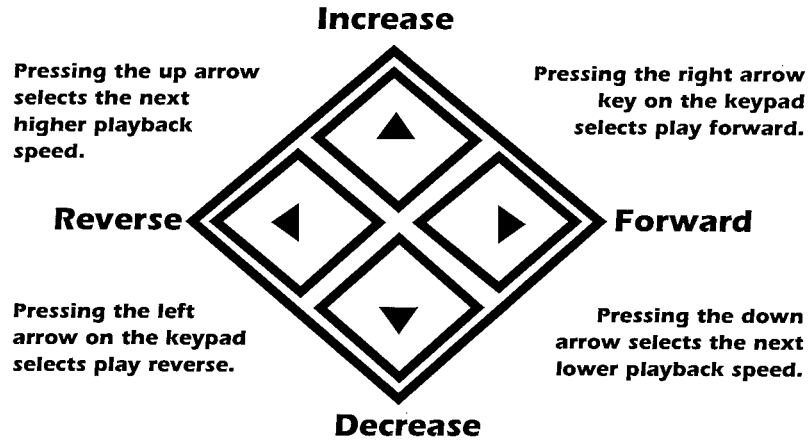
USING THE ARROW KEYS TO CONTROL PLAYBACK SPEED AND DIRECTION

The first time PLAY is selected after a recording the Processor automatically selects play forward at a frame rate of 30 or 50 fps depending on the video scan rate standards used in your country. The oldest frame stored is the first frame displayed.

The keypad message field and the video monitor display the selected playback speed and direction. The Processor playback speed or direction can be changed while the Processor is playing or is in the PLAY / STOP mode.



KEYPAD BASICS
DEDICATED KEYS



Pressing and holding the up or down arrow key will cause the Processor to scroll through the playback speeds. When the highest to lowest playback speed is reached, the Processor will wrap around and continue to scroll through the playback speeds in the same direction again.

The STOP key can be pressed to freeze a frame on the video monitor. The playback speed can be changed while in PLAY/ STOP. The new speed will take effect when the PLAY key is pressed or when a direction arrow key is pressed.

Playback speed 0 (zero) is single step. Press the left keypad arrow to single step reverse. Press the RIGHT keypad arrow to single step forward. Press PLAY to single step one frame in the selected playback direction. If you hold down the left arrow, the right arrow or the PLAY key the Processor will single step at about 7 frames per second in the selected direction.

KEYPAD BASICS
DEDICATED KEYS

DEFAULT PLAYBACK RATES

The video output of the Processor is configured at the factory for 525 lines / 60 hertz or 625 lines / 50 hertz video scan rates.

The 525 lines / 60 hertz configuration is used in Canada, Japan, the United States and other countries. The 625 lines / 50 hertz configuration is used in England, Germany, Italy and other countries.

The Processor video configuration also effects the playback speeds available. The Processor can playback in either forward or reverse in the following playback steps.

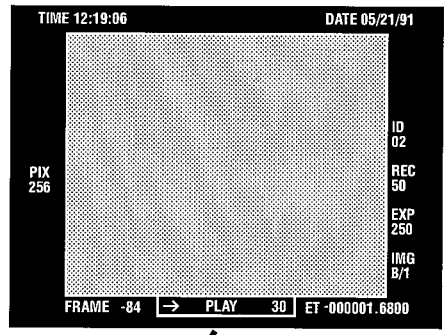
Playback rates for 525 lines / 60 hertz:

0, 1, 2, 3, 3.8, 5, 6, 7.5, 10, 15, 30, 60, 90, 120, 240, 480, 960 fps

Playback rates for 625 lines / 50 hertz:

0, 1, 2.5, 3, 4.2, 5, 6.2, 8.3, 12.5, 25, 50, 75, 100, 200,400, 1000 fps

The playback speed displayed in the DATA-FRAME Border and the keypad message field is an integer number rounded up or down.



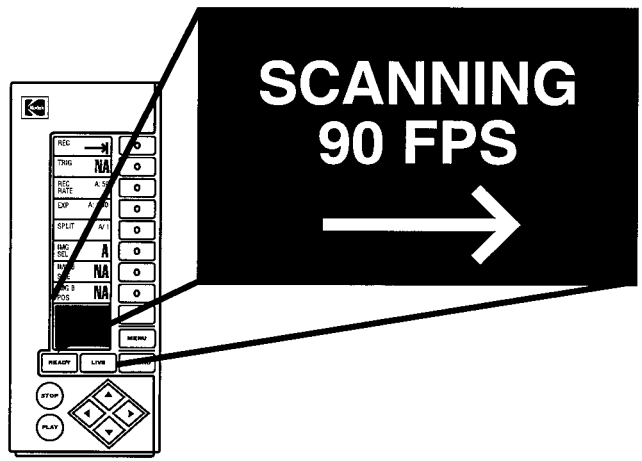
KEYPAD BASICS
DEDICATED KEYS

SCAN RATES

You will notice at some point that the message field on the keypad will toggle from PLAYING to SCANNING as the playback speed is increased. The status field on the monitor will also switch from PLAY to SCAN at the higher playback rates. This change in nomenclature is to let the operator know that a significant change in the video information being viewed or downloaded has taken place.

As long as the word PLAYING is displayed every frame of video in memory is presented at the video output in sequence. When the Processor is SCANNING some frames of video are skipped in order to achieve the playback rate requested.

This will not matter unless you have downloaded some video to a VCR while SCANNING. If you use the VCR single frame advance feature to review the video you will notice that there are frames missing in the playback sequence.



CHAPTER 4. GETTING STARTED

NOTES

CONNECTING THE SYSTEM

The following is a procedure for mounting and connecting the components of your KODAK EKTAPRO Hi-Spec Motion Analyzer. We also will instruct you how to make your first recording in this chapter. Please follow the instructions in sequence and don't turn the power on until instructed to do so.

MOUNTING INSTRUCTIONS

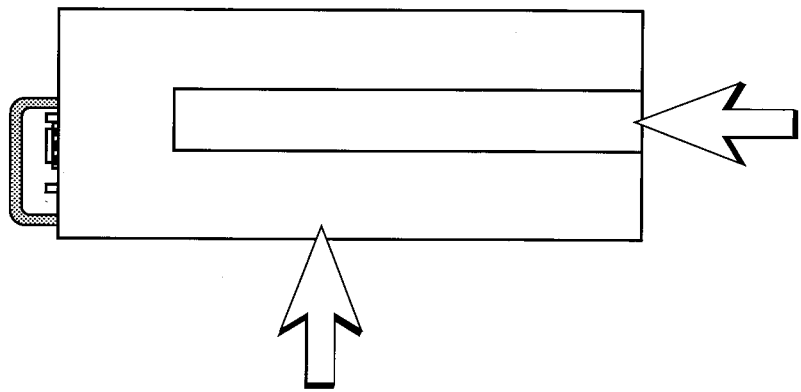


Fig 4.1 Processor Preferred Force Vector Diagram.

The KODAK EKTAPRO Hi-Spec Processor is most resistant to impacts when the acceleration forces are from the directions shown in fig 4.1. You should minimize the shear forces applied to any connectors when ever possible, especially the main imager cable. Cables must be routed and secured to minimize the amount of free swinging mass.

CONNECTING THE SYSTEM

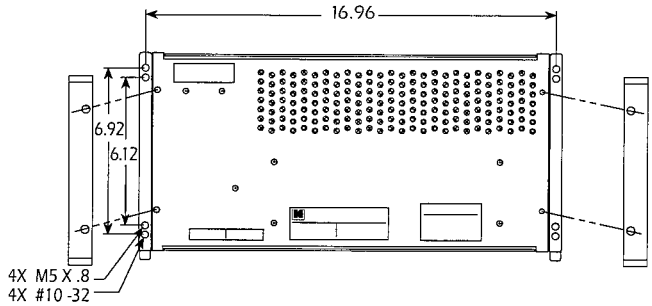


Fig 4.3 Mounting points on the rear panel of the Processor.

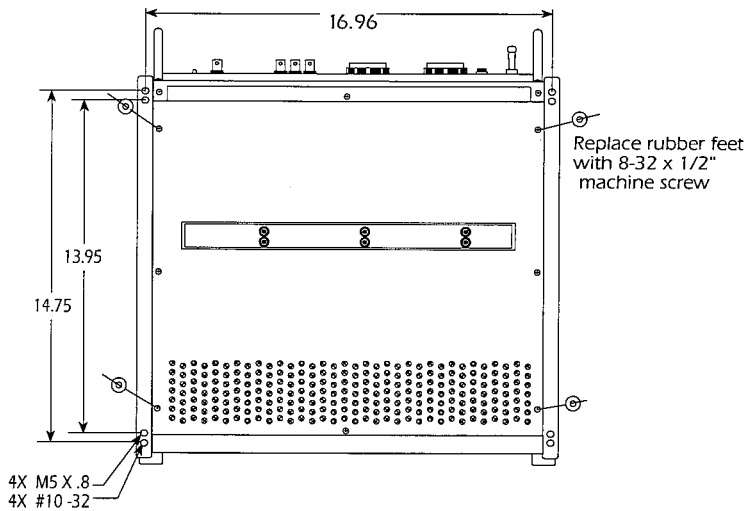


Fig 4.2 Mounting points on the bottom of the Processor.

The processor has mounting points at each corner on the bottom and the rear of the processor. You may use these mounting points to secure the processor to a mount during any high G testing. There are two threaded holes provided at each mounting point. The outer hole is threaded for a #6-32 machine screw with a hole depth of 0.50 inches. The inner hole is threaded to accept an M 5 x .8 metric machine screw. The hole depth is at least 1.25 centimeters.

CONNECTING THE SYSTEM

INPUT ELECTRIC POWER SAFETY CHECKS

WARNING

Do not connect the Processor to a power source without checking the voltage of the power source and the amperage rating of the fuses installed in the Processor.

AC POWERED PROCESSORS

The Processor can be purchased with AC or DC power supplies. A Processor with an AC supply must have an input voltage between 90 and 132 or between 180 and 264 volts AC. The Processor will operate satisfactorily with the AC input power frequency between 47 and 63 Hertz. The supply automatically senses its input voltage and will work properly with an AC voltage within the specified ranges.

The operator is responsible for installing the correct ampere rated fuses for the voltage supplied to the Processor. If you are operating the Processor with an AC input voltage of around 110 volts both fuses must be 5 amps time delay. If you are operating the Processor with an AC input voltage of around 220 volts both fuses must be 3 amps time delay.

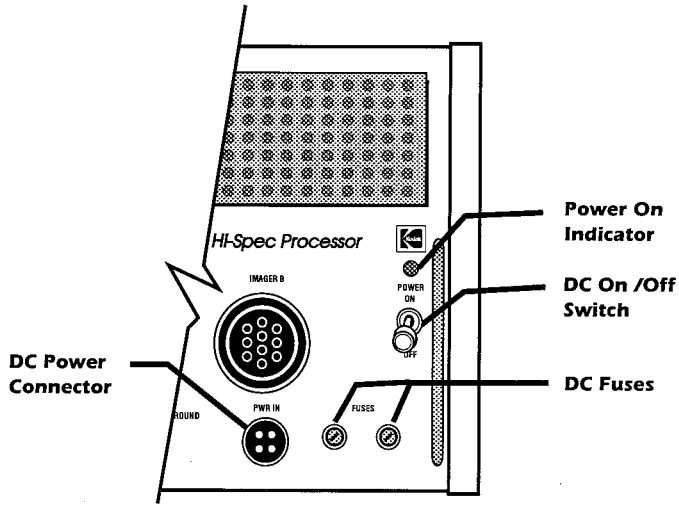
DC POWERED PROCESSORS

A Processor with a DC supply requires a power input voltage between 21 and 32 volts. The DC power source should be rated for continuous operation at 28 volts with a power draw of at least 15 amps.

The operator is responsible for checking for the correct ampere rated fuses. If you are operating the Processor with an DC input voltage of 28 volts both fuses must be 15 amps time delay.

CONNECTING THE SYSTEM

INPUT ELECTRIC POWER SAFETY CHECKS



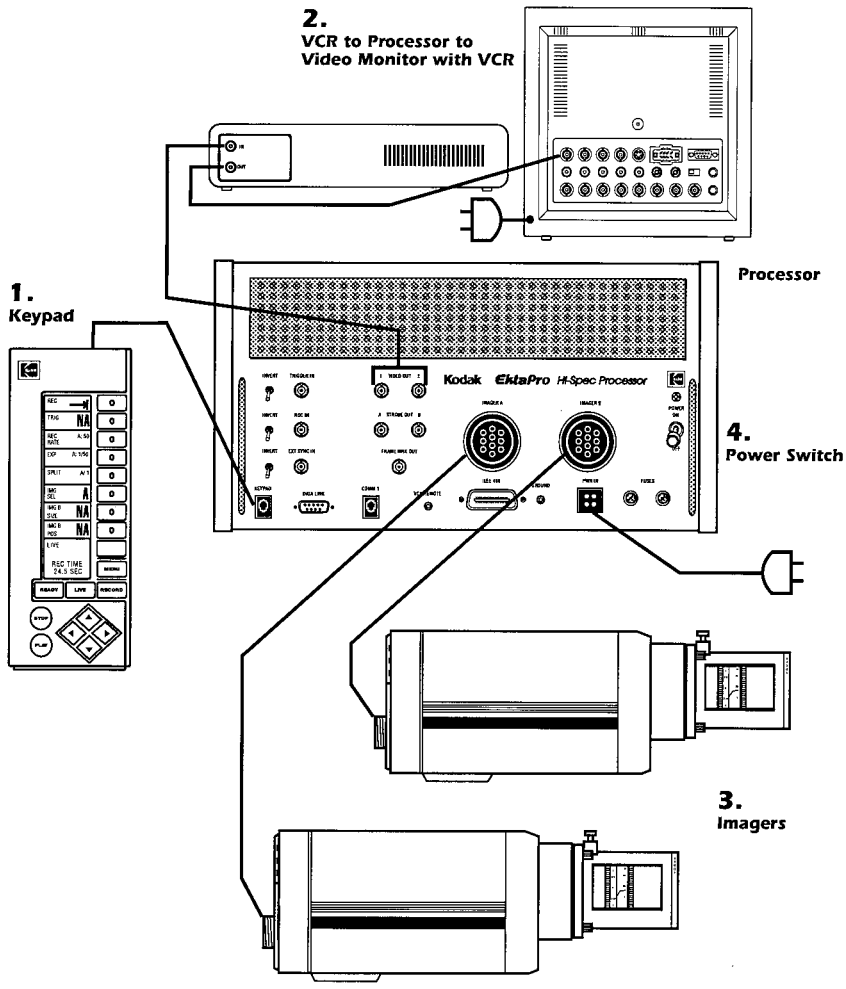
CHANGING THE FUSES

To change a fuse, make sure that the Processor is not connected to the power source, then unscrew the fuse holder cap using a counter clock wise rotation. Next remove the fuse from the holder and replace it with a fuse of the correct amperage rating. Put the replacement fuse in the fuse holder cap and screw the cap into the holder with a clockwise rotation

WARNING

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 reasons, could result in electrical shock. Use the proper power cord and insure that it is in good condition.

CONNECTING THE SYSTEM



1. CONNECTING THE KEYPAD

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

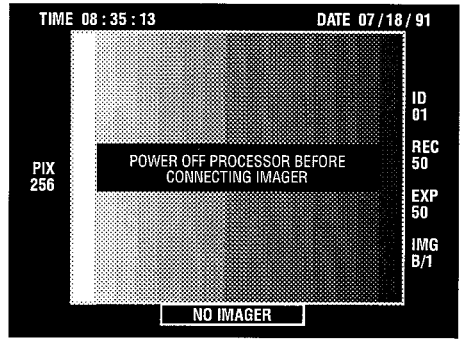
2. CONNECTING AND ADJUSTING THE VIDEO MONITOR

Connect the video monitor to the EKTAPRO Hi-Spec Processor using a seventy five ohm coaxial cable.

To include a VCR in your system connect the VIDEO OUT on the Processor to the VIDEO IN on the VCR. Next connect the VIDEO OUT on the VCR to the VIDEO IN on the monitor. Connect the VIDEO OUT on the Processor to the VIDEO IN on the monitor if you are not using a VCR.

At this point the monitor, the Processor and the keypad should be connected. We will connect the Imager after setting the monitor contrast and brightness controls.

Power on the monitor and the KODAK EKTAPRO Hi-Spec Processor.



When the Processor is powered on without an Imager the video displayed on the monitor should look like this.

The gray scale test pattern can be used as a reference while adjusting the video monitor contrast and brightness controls. Use the brightness control to set the black border area just below visibility. Use the contrast control to set the white bar of the gray scale for comfortable viewing.

Once you are satisfied with the monitor settings turn the power off at the AC power switch on the front panel of the Processor.

POWER ON

3. CONNECTING THE KODAK EKTAPRO Hi-Spec Imager

CAUTION

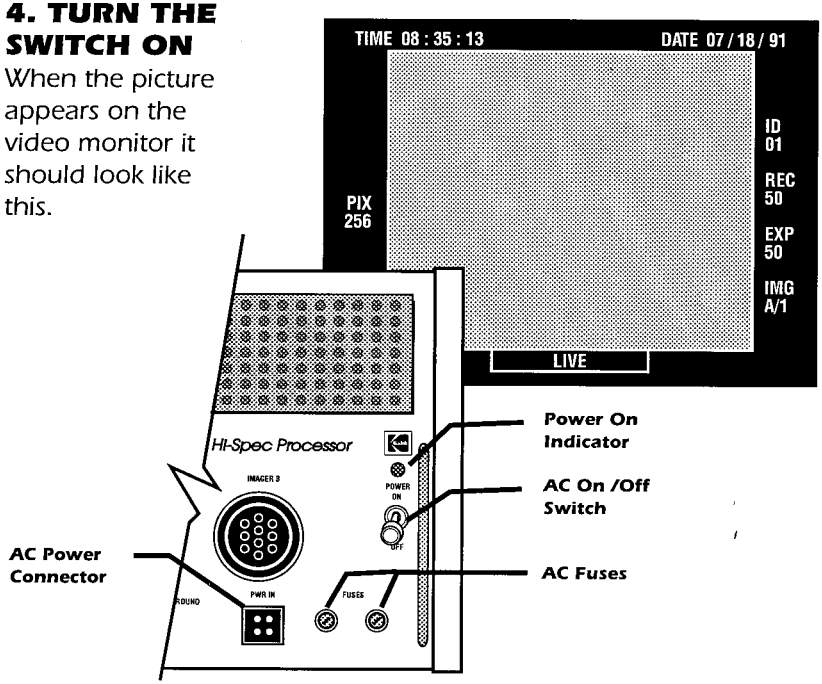
The processor power must be off before connecting or disconnecting the Imager.

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

Do not use force, as there are several locating keys on the cable that allow it to be inserted only when the cable is rotated to the correct position. After inserting the cable, turn the knurled ring on the cable connector until the red stripe is no longer visible.

4. TURN THE SWITCH ON

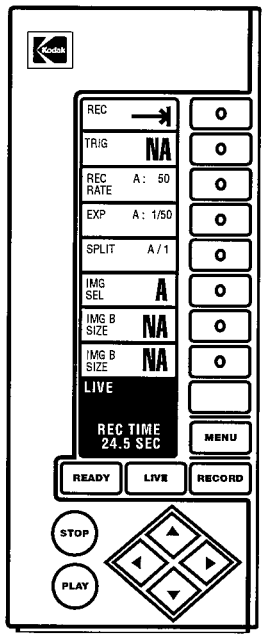
When the picture appears on the video monitor it should look like this.



POWER ON

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

Press the LIVE key on either the keypad or the back of the Imager. The keypad message field and the video monitor status will display LIVE.

Press the key to the right of the selection that is different.

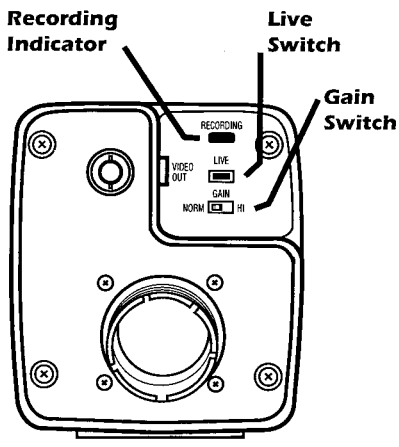
Press the up or down arrow key until your keypad selection is the same as the example.

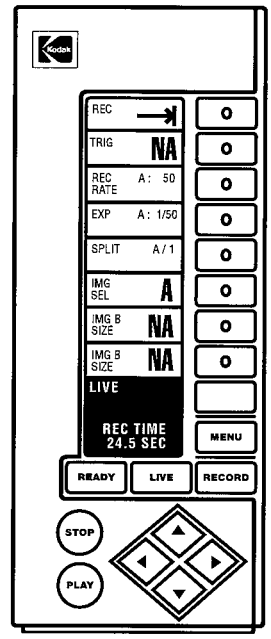
MAKE YOUR FIRST RECORDING

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.





PRESSING THE RECORD KEY

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

MAKE YOUR FIRST RECORDING

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 fifty frames per second and played back at thirty frames per second. Any motion that occurred during the recording was slowed very little because the record and playback speeds were almost the same. 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 power on.

2. In LIVE select the record parameters.

   a.) Record mode
   b.) Record rate
   c.) Exposure
   d.) Imager(s)

3. Adjust the lens setting and the lighting to best capture your event.

4. Make a recording.

5. Playback the recording.

6. Perform any analysis required using the DATA-FRAME Border information.

7. Download any pictures you wish to keep for later review.

The next chapter will give you detailed information on how to use the keypad to control each feature of your Motion Analyzer.

NOTES

CHAPTER 5.
USING THE KEYPAD

LIVE MENU

CONFIGURATION MENU

PLAYBACK MENU

NOTES

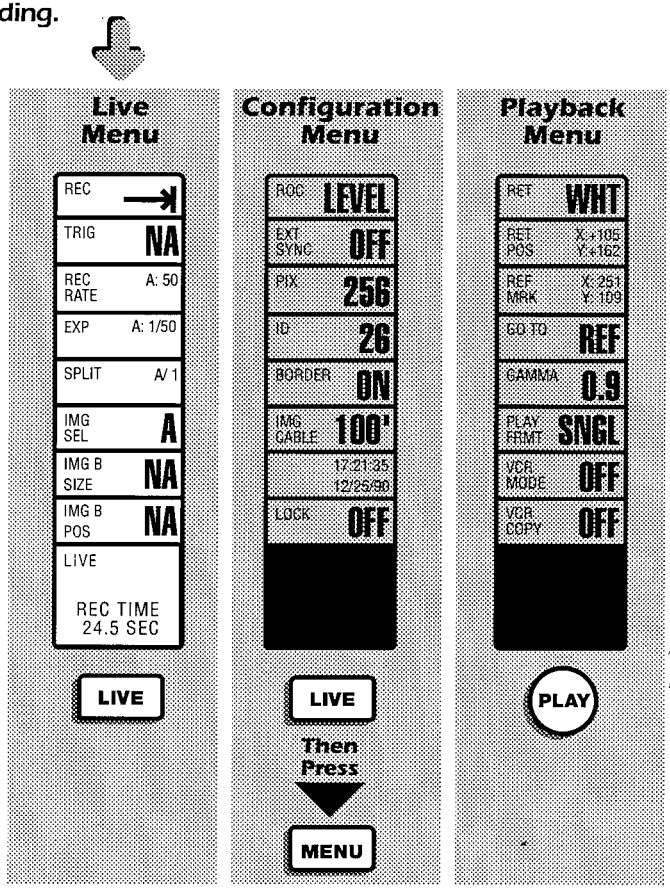
LIVE MENU
RECORD MODE

LIVE

INTRODUCTION

This chapter explains in detail the effect that each softkey option has on the KODAK EKTAPRO Hi-Spec Motion Analyzer. This chapter has a section for each of the three menu pages of the keypad. In some cases we have gone beyond a simple explanation of key press and its result to explain the benefit of using a particular feature. While you are reading this chapter it is a good idea to experiment with the Motion Analyzer to reinforce what you learn by doing.

Press the LIVE key to access this menu. All of the functions on this menu page are used to setup for a recording.

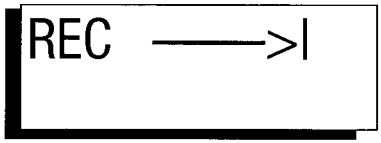


LIVE MENU

LIVE

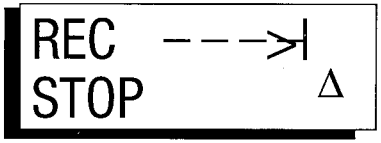
SELECTING A RECORD MODE

Press the REC softkey and then use the arrow keys to select one of the following three options:



The Processor starts recording and stops when the available memory has been filled with pictures.

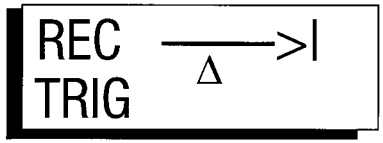
The first frame recorded becomes frame zero. If the STOP key is pressed before the Processor has filled available memory with pictures the last picture or frame recorded becomes frame zero. The frames recorded before frame zero will have negative frame numbers. The playback will skip over any frames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



The Processor starts recording and continues to record until the STOP key is pressed.

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

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



The Processor starts recording and continues to record until a trigger signal is received.

The Processor stops recording once the correct number of pictures before and after the trigger have been recorded. The TRIG softkey is used to set the number of frames saved prior to the trigger signal.

LIVE MENU

LIVE

SELECTING A RECORD MODE

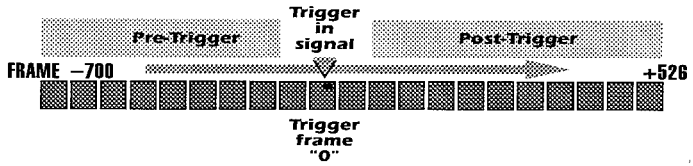
The frames recorded before the TRIGGER input signal have negative numbers. The frames recorded after the TRIGGER input signal have positive numbers. The frame recorded when the TRIGGER IN signal is received is frame number zero.

If the STOP key is pressed before the trigger input 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 trigger input signal is received, the trigger frame is still frame zero. The STOP key will stop the post-trigger part of the recording.

When the TRIGGER input signal is received before the desired number of pre-trigger frames are recorded, the trigger frame is still frame zero. The number of pre-trigger frames available during playback will be less than the pre-trigger selection.

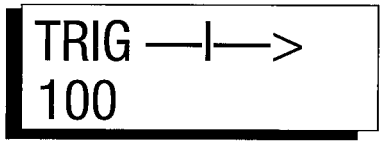
For example: Assume that TRIG is set for 200. The recording is started and with only 100 frames recorded the TRIGGER input signal is received. The TRIGGER frame is frame zero and the number of pre-trigger frames available during playback are from -99 to 0.



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

LIVE MENU
TRIGGER POINT SETUP

LIVE



Press the TRIG softkey and then use the arrow keys to set the number of frames to be saved before the trigger signal is received.

If the REC TRIG mode is not selected the TRIG softkey window will read NA and the keypad will beep if the TRIG softkey is pressed.

The number of TRIG frames selected will be retained when the power is off.

The TRIG softkey controls the number of frames recorded before the TRIGGER IN signal is received. The number of frames recorded after the TRIGGER IN signal can be calculated as follows:

post-trigger frames = mf - (pre + 1)

mf (maximum frames) is the highest number of frames available in the TRIG Softkey field.

pre (pre-trigger) is the number of frames selected in the TRIG Softkey field.

The one accounts for frame zero which is assigned to the frame being recorded when the trigger input signal is received.

The vertical line is a trigger position indicator. The left end of the arrow represents the first available frame in memory. The right end of the arrow represents the last available frame in memory and tells you the total number of frames installed in the Processor. The trigger position indicator moves along the arrow to provide a visual display of trigger positioning within available memory.

LIVE MENU
RECORD RATE

LIVE

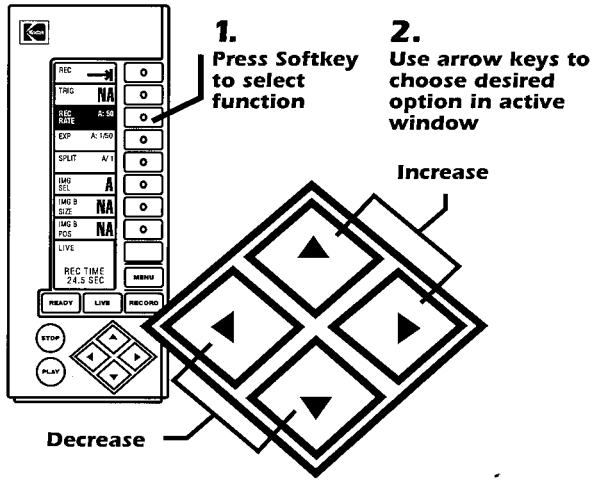
REC A:	50
RATE B:	50

Press the REC RATE softkey and then use the arrow keys to select a record rate.

The record rate for each Imager is shown in the REC RATE softkey window. The unit of measure is pictures per second (pps).

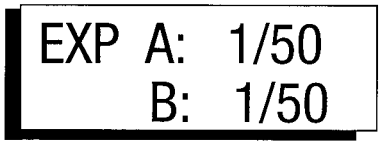
The Processor records at 50, 125, 250, 500, 1000, 2000, 3000, 4000, 6000, and 12000 pictures per second. A picture can occupy the entire image area or a picture can be a horizontal band of video information ranging from 1/2 to 1/12 of the vertical height of the image area. Picture height depends on the number of SPLITS selected. The maximum record rate for a picture that occupies the full image area is 1000 (pps).

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



LIVE MENU
EXPOSURE RATE

LIVE



Press the EXP softkey and then use the arrow keys to adjust the exposure rate of the Imagers.

The exposure number shown in the softkey window is the amount of time that the sensor collects light for each frame, measured in fractions of a second.

The longest exposure for each frame is equal to one divided by the Record Rate. The shortest exposure for each frame depends on the picture SPLIT selected. See Table 2. in the section explaining SPLIT operation.

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

When the RECORD RATE is changed, the EXPOSURE will also change to a value of 1 divided by the Record Rate.

When a strobe light is used, the amount of time that the sensor collects light will be controlled by the strobe light duration.

LIVE MENU

LIVE

SPLIT FRAMES

SPLIT A/1

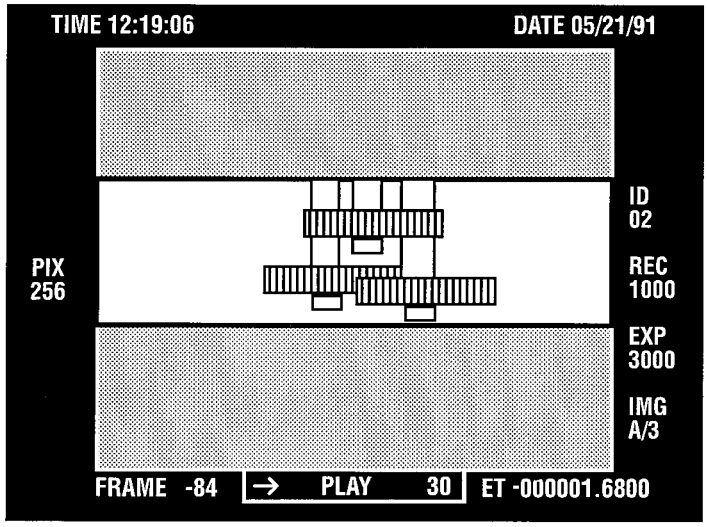
Press the SPLIT softkey and then use the arrow keys to change the number of splits.

NOTE

The KODAK EKTAPRO Hi-Spec Motion Analyzer, Model 1000-E does not have the split frame feature installed therefore the SPLIT softkey will beep if you press it.

The up and down arrow keys are used to select Imager A or B, a small arrow points to the selected Imager in the softkey window. The left and right arrow keys change the number of splits for the selected Imager. The SPLIT selected for Imager A can be different than the SPLIT selected for Imager B.

The picture height is reduced by the SPLIT selected. For a SPLIT of 2 the picture height is 1/2 of the image area, or for a SPLIT of 6 the picture height would be 1/6 of the image area. The picture height can be SPLIT or reduced by a factor of 2, 3, 4, 6, or 12. The image display area is filled in with a grey border above and below the active picture as the different SPLIT values are selected.



LIVE MENU

LIVE

SPLIT FRAMES

WHY USE SPLITS?

Splitting the image area into 2 or more pictures gains additional record time and the option of shorter exposure times. There are two tables below to illustrate the interaction between SPLIT, REC RATE, EXP and available record time.

Table 1 shows that for a given record rate the record time gets longer as the number of SPLITS is increased. Smaller pictures permit you to store more pictures in the same amount of memory. More pictures equals longer record time.

The record time appears at the bottom of the keypad message field whenever the Processor is in LIVE mode.

SPLIT/PPS	50	125	250	500	1000	2000	3000	4000	6000	12000
1	24.5	9.8	4.9	2.4	1.2					
2		19.6	9.8	4.9	2.4	1.2				
3		29.4	14.7	7.3	3.6		1.2			
4		36.8	18.4	9.2	4.6	2.3		1.1		
6			29.4	14.7	7.3	3.6	2.4		1.2	
12				24.5	12.2	6.1	4.0	3.0	2.0	1.2

TABLE 1. RECORD TIME IN SECONDS

Table 1 assumes that the Processor has enough memory installed to store about 1,200 pictures at full picture height.

LIVE MENU
SPLIT FRAMES

LIVE

Some combinations of REC RATE and SPLIT are not implemented because of the odd divisions required. Cells in Table 1 and Table 2 are left blank when a specific combination of SPLIT and REC RATE are not implemented.

SPLIT/PPS		50	125	250	500	1000	2000	3000	4000	6000	12000
1	MAX	1/50	1/125	1/125	1/125	1/125					
	MIN	1/1000	1/1000	1/1000	1/1000	1/1000					
2	MAX		1/125	1/125	1/125	1/125	1/1000				
	MIN		1/2000	1/2000	1/2000	1/2000	1/2000				
3	MAX		1/125	1/125	1/125	1/125		1/1000			
	MIN		1/3000	1/3000	1/3000	1/3000		1/3000			
4	MAX		1/125	1/125	1/125	1/125	1/1000		1/1000		
	MIN		1/4000	1/4000	1/4000	1/4000	1/4000		1/4000		
6	MAX			1/250	1/250	1/250	1/1000	1/1000		1/1000	
	MIN			1/6000	1/6000	1/6000	1/6000	1/6000		1/6000	
12	MAX				1/500	1/500	1/1000	1/1000	1/1000	1/1000	1/1000
	MIN				1/12k	1/12k	1/12k	1/12k	1/12k	1/12k	1/12k

TABLE 2. EXPOSURE TIME RANGE IN SECONDS

Table 2 details the range of exposure times available for each combination of REC RATE and SPLIT. A way to get to the combination of record time, record rate and exposure required for your application would be to set SPLIT, REC RATE and then EXP.

When different splits are selected for the two Imagers there are several combinations of SPLIT, REC RATE and EXP that are not implemented because of problems associated with playback of those particular combinations. The Processor will only allow you to select legal combinations.

LIVE MENU
IMAGER SELECTION

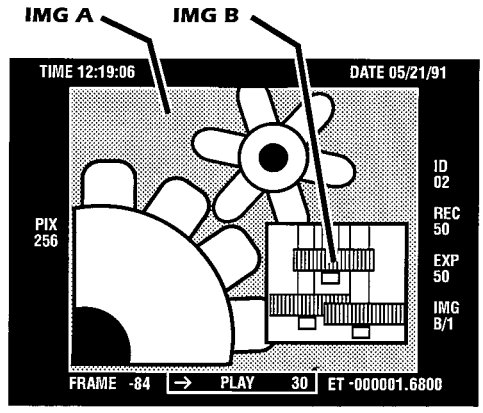
LIVE

Press the IMG softkey and then use the arrow keys to select one of the following three options:

IMG **A**	Selects pictures from Imager A for display and recording.
IMG **B**	Selects pictures from Imager B for display and recording.
IMG **AB**	The picture from Imager B is superimposed over the left half of the picture from Imager A for display and recording.

The size and location of the Imager B overlay can be changed to suit the operators needs by using the IMG B SIZE and IMG B POS softkeys.

NOTE
If there is only one Imager connected to the Processor the keypad will beep when you attempt to select the IMG softkey.



LIVE MENU
IMAGER B SIZE

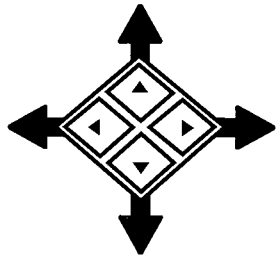
LIVE

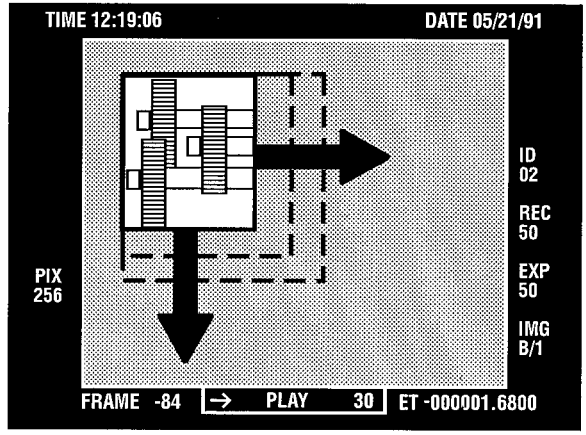
IMG B SIZE

Press the IMG B SIZE softkey and then use the arrow keys to change the size of the B Imager picture.

The left and right arrow keys move the right side of the B image in the direction that the arrow key points. The up and down arrow keys move the bottom of the B image in the direction that the arrow points.

This softkey is available only when IMG A B is displayed in the softkey window above. If IMG A B has not been selected the IMG B SIZE softkey window will read NA and the keypad will beep when the softkey is pressed.





LIVE MENU

LIVE

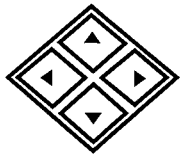
IMAGER B POSITION

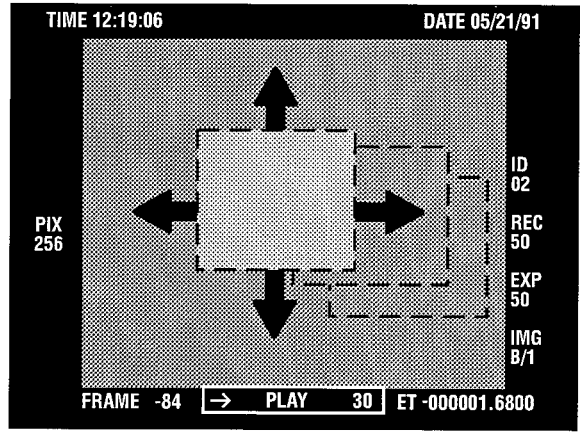
IMG B POS

Press the IMG B POS softkey and then use the arrow keys to change the position of the B Imager picture.

The left and right arrow keys move the B image left or right. The up and down arrow keys move the B image up or down.

This softkey is available only when IMG A B is displayed in the IMG softkey window. If IMG A B has not been selected the IMG B POS softkey window will read NA and the keypad will beep when the softkey is pressed.



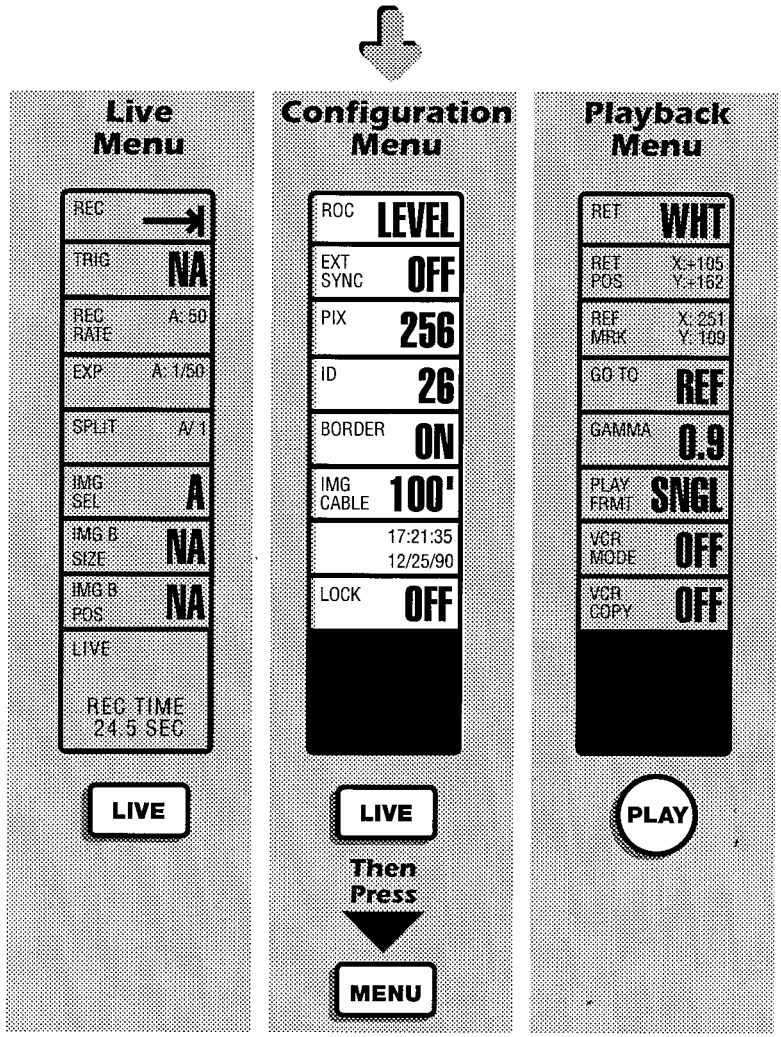


CONFIGURATION MENU

INTRODUCTION

Press the MENU key to access this menu from the LIVE menu.

Some of the functions on this menu page are used to setup for a recording and the rest are used as required to configure the Motion Analyzer.



CONFIGURATION MENU

RECORD ON COMMAND

Press the ROC softkey. Then use the left or right arrow keys to select one of the following three options:

Record On Command function is off and all record modes operate as previously defined.

Record On Command function is operating. Pictures will be stored in memory only when and as long as the user supplied ROC IN signal connected to the Processor front panel is "true".

Burst ROC is operating. The number of pictures shown in the softkey window will be stored in memory each time the ROC IN signal transitions to "true."

Any number of frames between 1 and 1000 can be selected. Use the up or down arrow keys to set the number of frames to be taken.

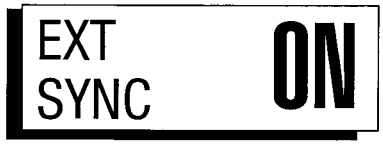
ROC stands for Record On Command. The user literally takes command of the record process with the record command signal input at the ROC IN connection on the front panel of the Processor. The power on default for ROC is OFF.

NOTE

When you are using ROC the image will remain frozen when there is no ROC input signal present at the front panel. Use the INVERT switch to temporarily unfreeze the image.

CONFIGURATION MENU

EXTERNAL SYNCHRONIZATION



Press the EXT SYNC softkey and then use the arrow keys to select ON or OFF.

The EXT SYNC or external synchronization function permits the EKTAPRO Hi-Spec Motion Analyzer, to operate asynchronously. This means that the start time of each picture recorded is controlled by a "true" transition at the EXT SYNC IN connection on the front panel of the Processor.

One picture will be recorded for each EXT SYNC signal transition. For full frame pictures the maximum repetition rate for the synchronizing signal is 1,000 pulses per second. If you are using split frames the maximum repetition rate for the synchronizing signal is 6,000 pulses per second. In the EXT SYNC mode, repetition rates greater than 6,000 pulses per second are too fast for the processor electronics to handle. Trying to run the processor at over 6,000 pulses per second will result in scrambled images when playing back that recording.

The sensor is always gathering light, so as the time between picture readouts get longer, image quality will tend to degrade. Image quality is still reasonably good with a synchronizing signal repetition rate of 10 pulses per second.

When EXT SYNC is on the REC RATE and EXP softkey windows will show NA, and the REC TIME readout in the keypad message field will be blank.

CONFIGURATION MENU

PIXEL DEPTH

Press the PIX softkey and then use the arrow keys to select the number of grey levels to be recorded.

There are seven different selections of grey scale resolution available:

256, 128, 64, 32, 16, 8 and 4

The power on default for PIX is 256.

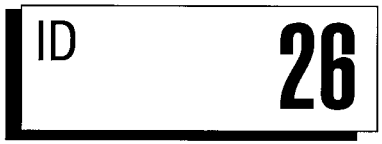
The reason that this feature has been included is to increase record time. As the number of grey levels recorded is decreased you will note in the message field of the keypad that the record time increases; for example:

At 256 grey levels the record time is 9.8 seconds. With only 4 grey levels recorded the record time increases to 36.8 seconds.

Experiment with the different options and notice the effect on picture quality. At 4 levels of grey the picture will look very much like some of the special effects seen on broadcast television. If your subject is very contrasty and you are only interested in time / distance information, reducing the number of grey levels recorded is a good way to get more record time.

CONFIGURATION MENU

ID AND BORDER



Press the ID softkey and then use the arrow keys to change the ID number.

The identification number, ID, is a two digit number stored along with the pictures each time a recording is made. The ID number is displayed in the DATA-FRAME Border.

In LIVE mode the ID number is the number that will be recorded with the next recording. In PLAY mode the ID number displayed belongs to the recording being viewed.

The power on default for ID is 01. The ID number will automatically increment after each recording.

Press the BORDER softkey and then press any arrow key once to turn the DATA-FRAME Border ON or OFF.

Some image processing equipment works better without a DATA-FRAME Border present in the video.

The power on default for BORDER is ON.

CONFIGURATION MENU

IMAGER CABLE LENGTH

Press the IMG CABLE softkey and then use the arrow keys to select the imager cable length.

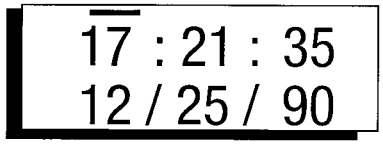
Choose the value shown in the IMG CABLE softkey window that is closest to the imager cable length you have connected between the Processor and the Imager. The IMG CABLE values available are 15', 50' and 100'.

If there is a mismatch between the imager cable length connected to the Processor and the value shown in the IMG CABLE softkey window the video image may be degraded. Imager cable length problems usually show up as a few thin horizontal lines in the picture or a notched appearance to vertical edges in the image.

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

CONFIGURATION MENU

TIME AND DATE



To set the time of day press the TIME DATE softkey.

This will change the TIME DATE softkey window from SET to a two row display with the time in the first row and the date in the second row.

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 left and right arrow keys move the cursor over the field that you want to change. Change the numbers in a field by using the up and down arrow keys.

Set the time a minute or two ahead so that you can press the TIME DATE softkey when your setting and the correct time match. The time will be in HH:MM:SS format with the cursor over the hour field. Use the up and down arrow keys to change the hour to the correct value. Move the cursor to the minutes field with the RIGHT ARROW key. Set the minute to the correct value. Move to the seconds 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 your corrected values.

CONFIGURATION MENU

LOCKING THE KEYPAD

LIVE
Then Press
MENU

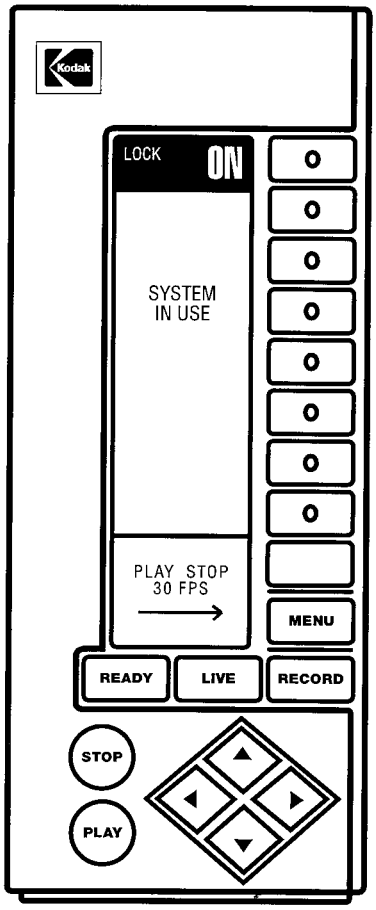
LOCK **OFF**

Press the LOCK softkey and then use the arrow keys to select ON or OFF.

When LOCK is on, all keys are disabled except for the arrow keys. When LOCK is off, all keys on the keypad are returned to their normal function.

The LOCK function is used to protect a session setup from disruption by an accidental key press. This is particularly useful when the system is waiting to record without the operator present.

The power on default for LOCK is off.

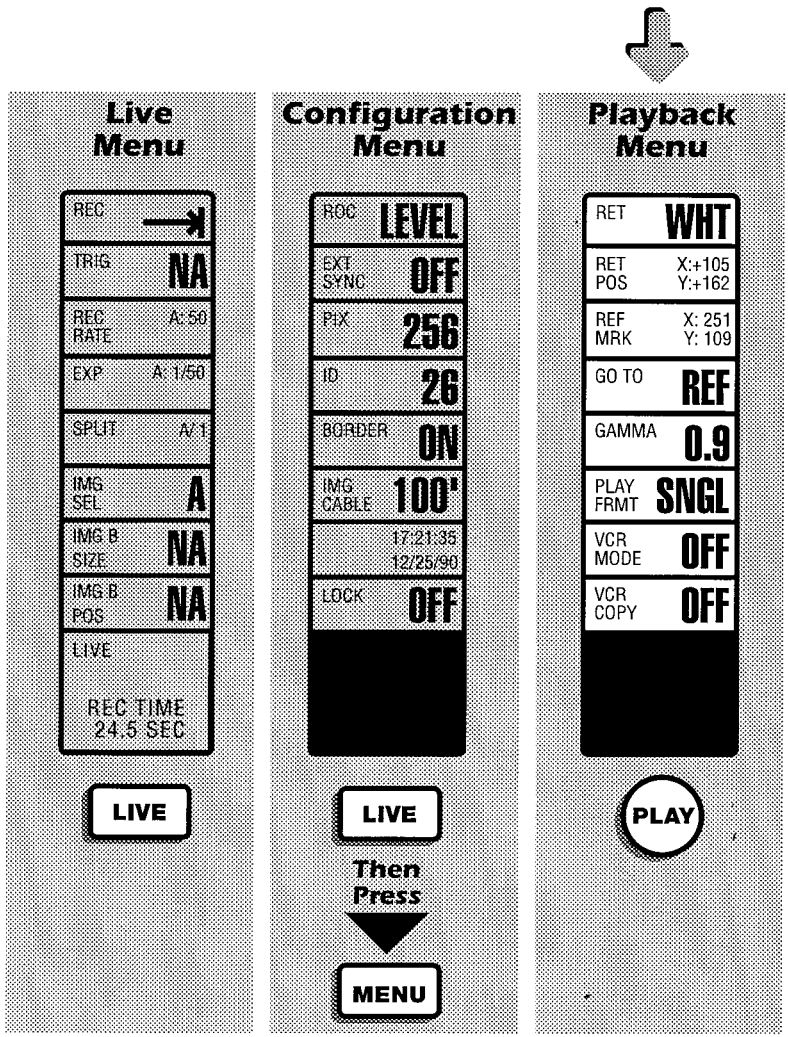


PLAYBACK MENU

INTRODUCTION

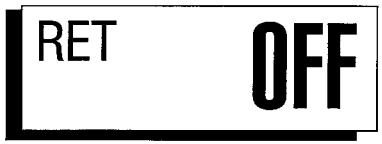
Press the PLAY key to access this menu.

All of the functions on this menu page are used to playback and analyze a recording. This menu will automatically be presented when the Motion Analyzer stops recording.



PLAYBACK MENU
RETICLE CONTROL

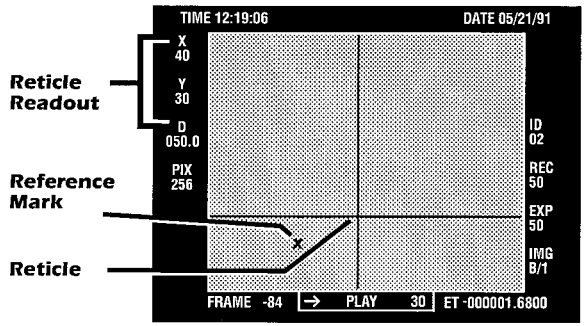
Press the RET softkey and then use the arrow keys to select one of the following three options:



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

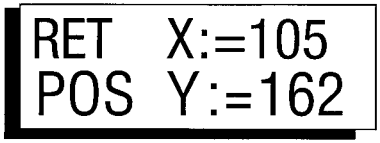
A white reticle is turned on. The X, Y and D fields are turned on and displayed in the left DATA-FRAME Border just below the TIME field.

A black reticle is turned on. The X, Y and D fields are turned on and displayed in the left DATA-FRAME Border just below the TIME field.



PLAYBACK MENU

MOVING THE RETICLE POSITION



Press the RET POS softkey and then use the arrow keys to move the Reticle Position.

The RET POS softkey window and the DATA-FRAME Border display the current X and Y coordinates relative to the reference mark.

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 key for approximately 1 second.

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, relative to the reference mark, are displayed in the X and Y fields in the DATA-FRAME Border and in the RET POS (reticle position) softkey window. The D field in the DATA-FRAME Border is the calculated distance from the reticle intersection to the reference mark.

The power on default for Reticle is off. When the reticle is first turned on the reference mark will be at (X=0, Y=0) in the lower left corner of the image area with the Reticle positioned at X = 119, Y = 095 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 = 238 and Y = 191.

PLAYBACK MENU

REFERENCE MARK

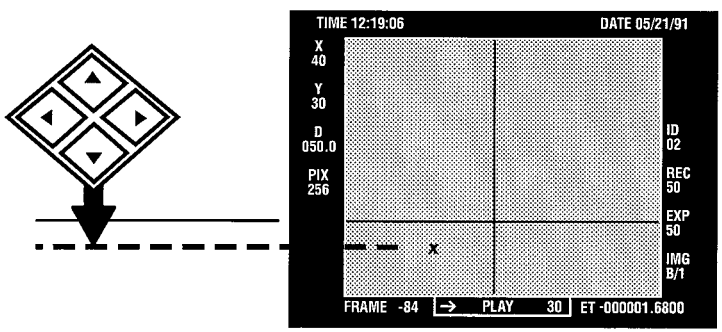
REF MARK	X: 251 Y:109

Press the REF MARK softkey and then press any arrow key once to jump the Reference Mark to the current position of the reticle.

The Reference Mark is a powerful tool for analyzing the captured image data. Using the Reference Mark in conjunction with the Reticle, the Motion Analyzer will calculate time and distance between a point in one frame and a point in any other frame in the recording.

When a Reference Mark is placed several things happen:

The Reference Mark location is marked with a X on the monitor.
The Elapsed Time is updated so that the frame containing the Reference Mark becomes ET = 0.000.
The RET POS softkey window displays X=0, Y=0.
The REF MARK softkey window displays the X and Y coordinates of the Reference Mark.



PLAYBACK MENU
REFERENCE MARK

PLAY

HOW TO DO TIME AND DISTANCE CALCULATIONS

Establish the number of pixels per unit of distance in the plane of the motion to be analyzed using the following procedure:

Place a scale in the picture next to the subject to be analyzed.

Place a Reference Mark at one end of the scale and position the reticle at the other end. Divide the number shown in the D field in the DATA-FRAME Border by the number of units on the scale. The result will be pixels per unit distance.

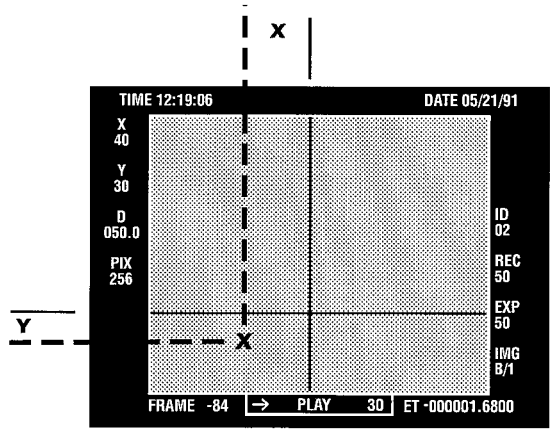
1.) Make a recording of an event.

2.) Place a Reference Mark in the frame at the start point of the action.

3.) Move to the frame containing the end point of the action.

4.) Position the Reticle at the end point.

The D field in the DATA-FRAME Border will contain the linear distance in pixels that the subject moved. The Elapsed Time field will contain the time from start to finish in seconds. If you have calculated the scale factor, apply it to the distance in pixels.



PLAYBACK MENU
GO TO REFERENCE MARK

PLAY

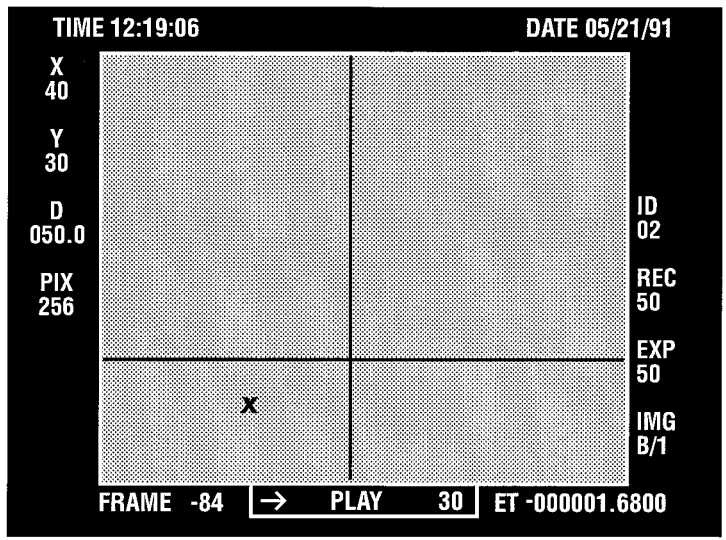
GO TO	REF

Press the GO TO softkey and then press any arrow key once to toggle between REF and LAST.

The GO TO softkey only works if you are in PLAY or PLAY/STOP.

GO TO REF will jump the video display to the frame containing the Reference Mark. After jumping to the reference frame, playback will continue in the direction and at the speed previously selected.

GO TO LAST will return the video display to the frame from which the GO TO REF command was executed and again playback will continue in the direction and at the speed previously selected.



PLAYBACK MENU
GAMMA CORRECTION

Press the GAMMA softkey and then use the arrow keys to change the gamma correction factor.

The GAMMA correction is normally set to a value of 0.9 but has a range from 0.1 to 1.0.

GAMMA correction is used to electrically correct a video monitor's gray scale rendition. GAMMA correction has the effect of increasing the contrast in the darker areas of the picture. This is useful when the lighting has been less than optimum and you wish to get a better look at subject matter that is lost in the darker areas of the picture.

To bring up the detail in the darker areas of the picture change the GAMMA correction factor from 0.9, to 0.8, to 0.7, and so on, until you can see what you need to see.

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

PLAYBACK MENU

MULTIPLE PLAY FORMAT

Press the PLAY FRMT softkey and then use the arrow keys to toggle between SNGL and MULT.

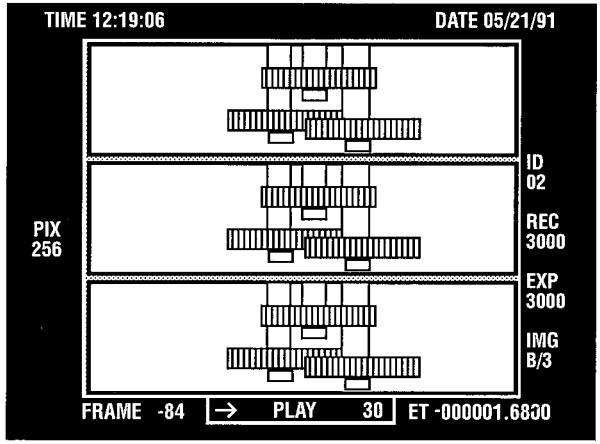
NOTE

The KODAK EKTAPRO Hi-Spec Motion Analyzer, Model 1000-E does not have the split frame feature installed therefore the PLAY FRMT softkey will beep if you press it.

The PLAY FRMT or Play Format softkey is only active when playing back pictures that were recorded with a SPLIT other than 1. If you try to use PLAY FRMT on a full height picture the keypad will beep and ignore the key press.

PLAY FRMT SNGL (Play Format Single) plays back the SPLIT pictures sequentially in a horizontal band in the center or the image display area.

PLAY FRMT MULT (Play Format Multiple) plays back SPLIT pictures stacked one below the other using the entire image area. If you are playing back a 3 way split there will be three pictures displayed with the earliest picture at the top and the latest picture at the bottom of the image display area. The DATA-FRAME Border information will be for the top picture in the display.



PLAYBACK MENU

DOWN LOADING TO A VCR

Press the VCR MODE softkey and then use the arrow keys to select one of the three modes listed below:

The output video is not interlaced and the remote VCR controller is off.

The output video is interlaced and the remote VCR controller is off. The operator must manually operate the Processor and the VCR in order to make an archive recording on the VCR.

The output video is interlaced. The Processor automatically makes a recording, downloads the pictures to a VCR and then keeps repeating the sequence until the operator presses a STOP key.

The power on default for VCR MODE is OFF.

INTERLACE

The video signal has to be interlaced in order to produce a good recording on a VCR. An interlaced video signal will cause a small amount of vertical jitter on the video monitor. Interlace is turned off to aid viewing pictures on the monitor and turned on to produce the best possible recording on a VCR.

A video signal is interlaced when the odd and even fields are offset by half of one horizontal line. All of the television pictures you view at home are interlaced and most computer displays are not.

PLAYBACK MENU
DOWN LOADING TO A VCR

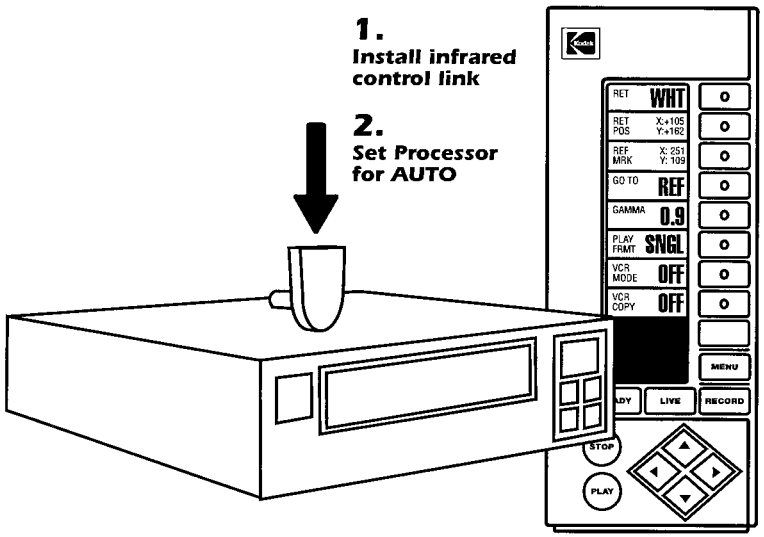
The VCR AUTO mode is used to monitor an application without needing the undivided attention of an operator. Set up for AUTO operation using the following guideline:

Connect the Processor video output to the VCR video input.

Connect the infrared control link to the processor front panel and attach the other end to the VCR remote control window.

Set up and make a test recording to make sure that you are getting the image data that you want at the appropriate record rate, exposure and so on. Check the infrared control link by using the VCR COPY mode.

Choose a playback rate that will be usable when recorded and played back from a VCR.



PLAYBACK MENU
DOWN LOADING TO A VCR

When you start the VCR AUTO mode the Motion Analyzer will go through the following steps:

1. **The Processor will make a recording.**
2. **Stop when the recording is complete.**
3. **Place the VCR in record.**
4. **Playback the pictures captured in memory as the VCR records them.**
5. **Stop the VCR when the playback is complete.**
6. **The Processor then starts a new recording.**

This cycle will repeat until the VCR runs out of tape or a STOP key is pressed. The Processor will not release the machine to the operator until it completes downloading the latest pictures to the VCR.

The tape in the VCR will hold a permanent record of every recording made by the Motion Analyzer while the AUTO mode was in effect.

Press the VCR COPY softkey and then press any arrow key to start the VCR copy process. Pressing any arrow key or a STOP key will turn VCR COPY OFF.

VCR COPY automatically downloads the pictures currently in memory to a VCR using the infrared control link to operate the VCR. When the playback is complete the Processor will stop the VCR, turn VCR COPY OFF and return control of the Motion Analyzer to the operator.

PLAYBACK MENU

DOWN LOADING TO A VCR

LIST OF VCRs THAT CAN BE CONTROLLED USING THE INFRARED CONTROL LINK

MANUFACTURER	MODEL	COUNTRY
Panasonic	FS100	Europe
Victor	HR-S8800	Japan
Panasonic	FS700	Japan
Toshiba	E52	Japan
Panasonic	PV-S4990	U.S.A

The VCRs listed above can be controlled by the Processor using the VCR AUTO or the VCR COPY modes of operation. The operator needs to make sure that the infrared control link is secured to the VCR directly over the remote control window. The Processor does not need to know which model VCR it is controlling.

CHAPTER 6. RECORDING STRATEGIES

NOTES

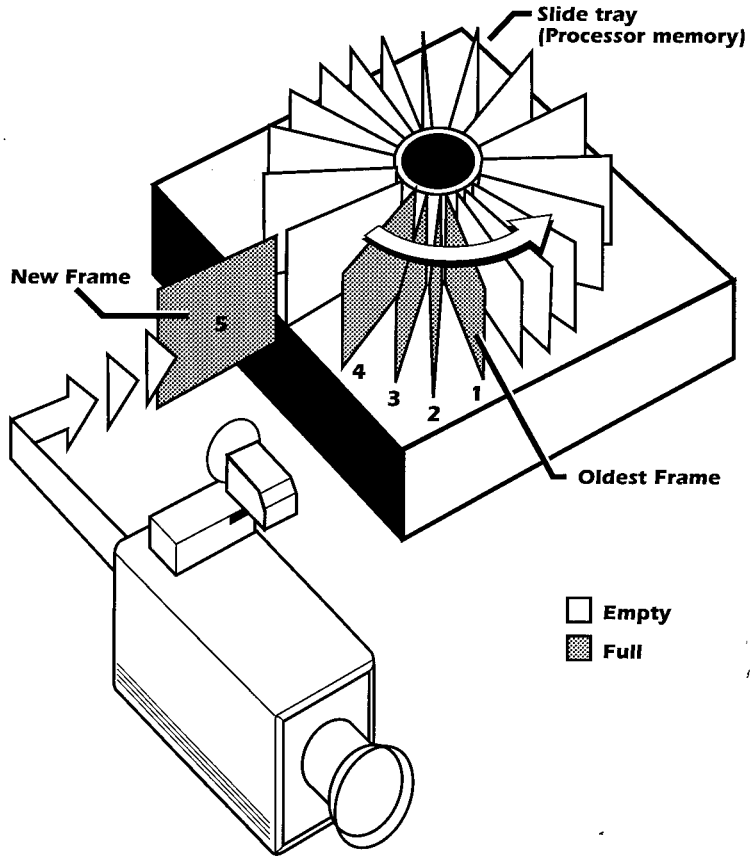
INTRODUCTION

The first section of this chapter is devoted to a brief description of how the KODAK EKTAPRO Hi-Spec Motion Analyzer, 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 EKTAPRO Hi-Spec 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 a particular speed. Eliminating the mechanical tape or film transport eliminates the major delay between pressing the record key and when recording actually begins. How then, does the Processor manage the picture storage process?

HOW THE PROCESSOR STORES IMAGES

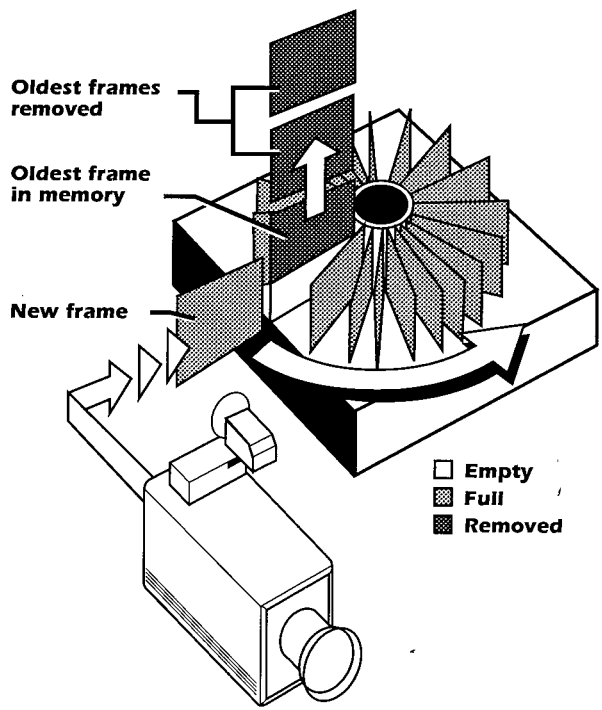
An analogy for the recording and playback process would be a Kodak Carousel slide projector and a Kodak Carousel slide tray. Think of the Processor as a Carousel slide projector and the Random Access Memory (RAM) as the Carousel slide tray. For our discussion the RAM is divided into small sections or frames that are just large enough to hold a single video image along with the information to be displayed in the DATA-FRAME Border. These frames can be thought of as the pockets in a slide tray that hold the slides or images. In this chapter the slide tray holds 1637 slides or the Processor memory has 1637 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 1637 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 1637 images.

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

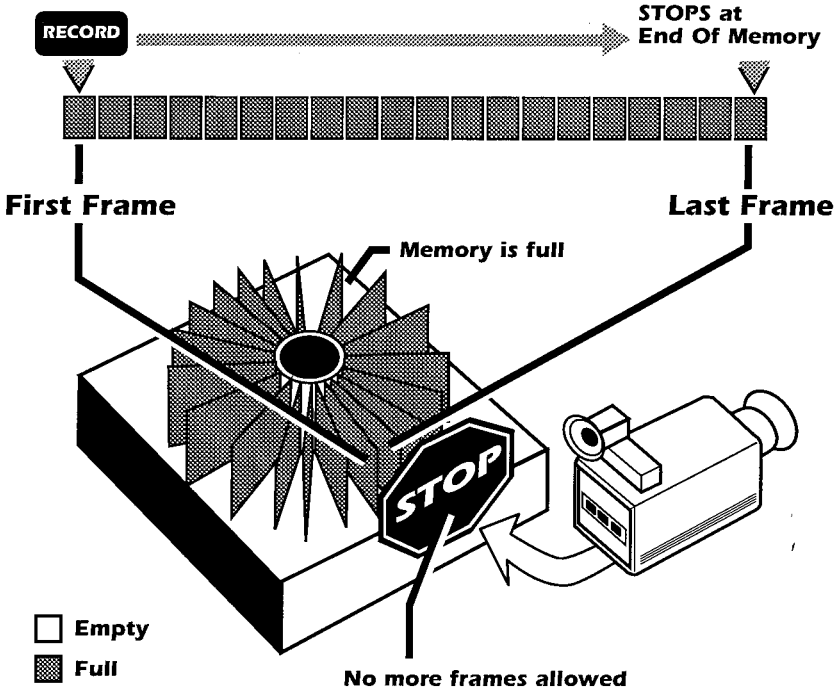


HOW THE PROCESSOR STORES IMAGES

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.

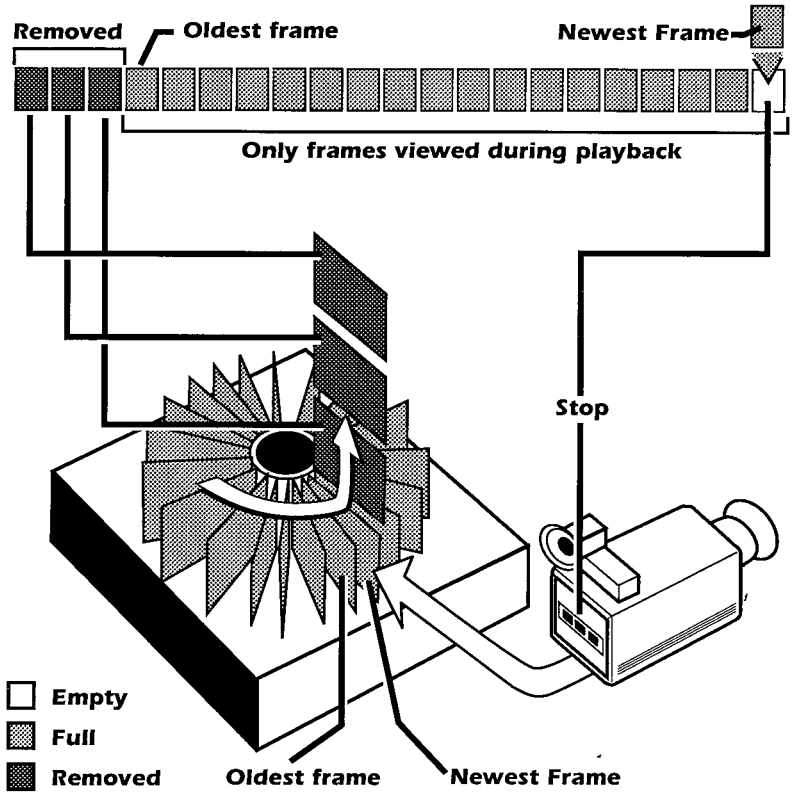
You use the RECORD mode when you wish to start a recording session manually. This mode is used when the experiment has an observable start and you are interested in the action immediately after the recording is started. Don't forget a mechanical device takes time to react, so allow for about a 100 millisecond delay from the time you see the event start until your finger presses the RECORD key.



HOW THE PROCESSOR STORES IMAGES

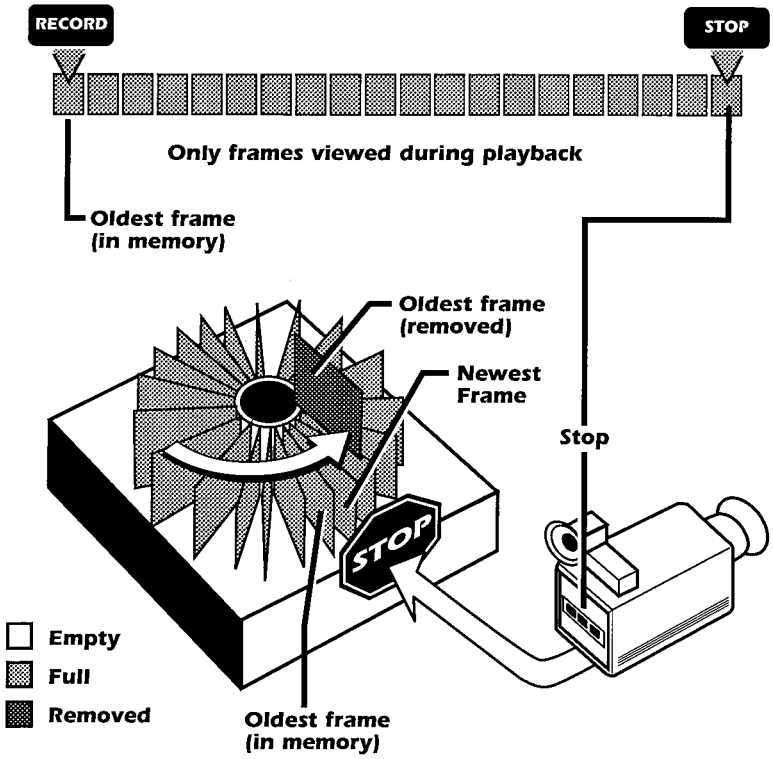
RECORD STOP

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 1637 frames of action stored in memory.



HOW THE PROCESSOR STORES IMAGES

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. Remember to allow for about a 100 millisecond delay from the time you see the event end until your finger presses the STOP key.

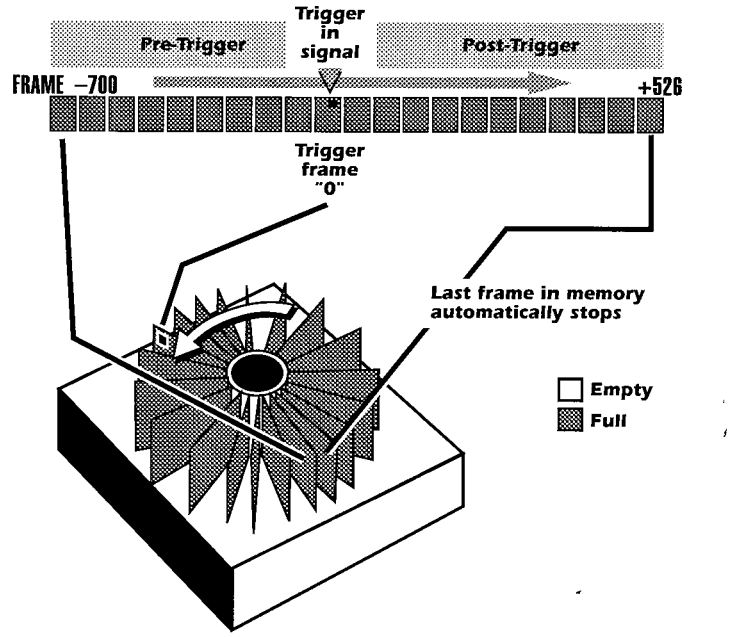


HOW THE PROCESSOR STORES IMAGES

RECORD TRIGGER

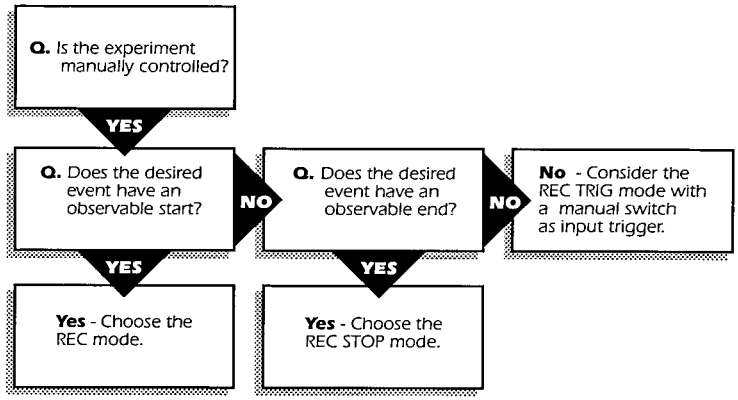
The Processor also treats memory as a circular buffer when using the RECORD TRIGGER mode. Pictures are stored in sequence with the current picture replacing the oldest picture in memory so that you always have the 1637 most recent frames. The trigger input signal causes the Processor to mark the next 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.

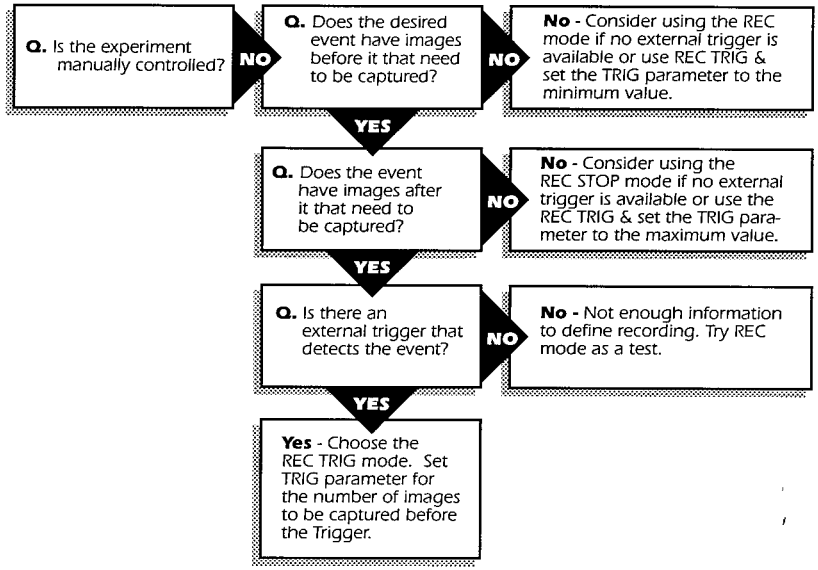


CHOOSING A RECORD MODE

EXPERIMENT MANUALLY CONTROLLED? "YES"



EXPERIMENT MANUALLY CONTROLLED? "NO"



TRIGGERED RECORDING

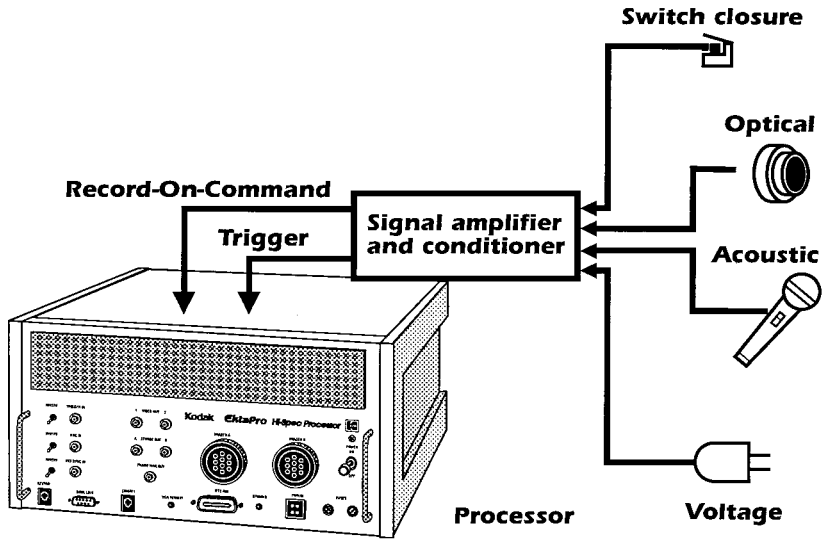
A solid state video recorder has unique capabilities that require a different mind-set from people that are users of traditional forms of motion analysis. The EKTAPRO Hi-Spec Motion Analyzer does not use a recording media such as magnetic tape or photographic film that runs out after a few seconds of 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 with the EKTAPRO Hi-Spec Motion Analyzer is to identify when the images you wish to study are in 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 electrically. Once an electrical signal that is time related to the event under study is available using the EKTAPRO Hi-Spec Motion Analyzer to capture pictures of the event becomes routine. 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 front panel.

The trigger signal must be TTL compatible meaning that the Processor will read a transition between zero and plus five volts as a trigger. 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 is still hope.

TRIGGERED APPLICATIONS

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. Amplify and condition the output of the microphone to be used as a trigger signal.

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 APPLICATIONS

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 part of the machine you wish to record 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, with the INVERT switch in the non-invert position.

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 TTL signal.

Each time the sensor detects a package the interface circuit would translate the sensor voltage into a TTL signal that would transition from a low to a high. With the INVERT switch in the invert position 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.

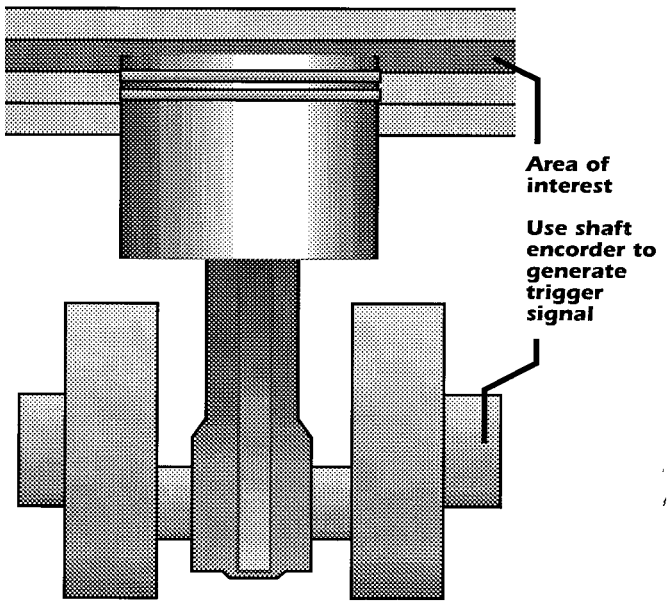
RECORD ON COMMAND

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.

Let's imagine a piston traveling up and down. You are specifically interested in what is happening when the piston reaches the top of its stroke. If you use the REC STOP mode with 1.6 seconds of record time available you would capture 8 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 160 cycles.

ROC is the answer to this need.



RECORD ON COMMAND

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 must be TTL compatible. Don't worry about the polarity of the signal as the Processor has a means of changing the polarity if needed.

There are two ROC operating modes, ROC LEVEL and BURST ROC. For ROC LEVEL operation the record command signal must be "true" for the entire time you wish to record. For BURST ROC operation the record command signal need only change state to begin recording the number of frames specified with the keypad.

When the ROC feature is being used, ROC, for ROC LEVEL operation, or BROC, for BURST ROC operation, appears on the right side of the DATA-FRAME Border. When the Processor senses a record command signal a solid white box appears to the right of the ROC field in the DATA-FRAME 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, the polarity of the command signal needs to be changed. There is a switch labeled INVERT next to the ROC IN connector. Change the position of this switch to change the polarity of the record command signal. The ROC Indicator should now behave and come on when you want it to.

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.

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 (B)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, it would be nice if the operator could tell whether or not any pictures have been captured yet. The (B)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 (B)ROC mode the ROC Indicator (white box) 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 will show the actual time passed between one record command signal and the next.

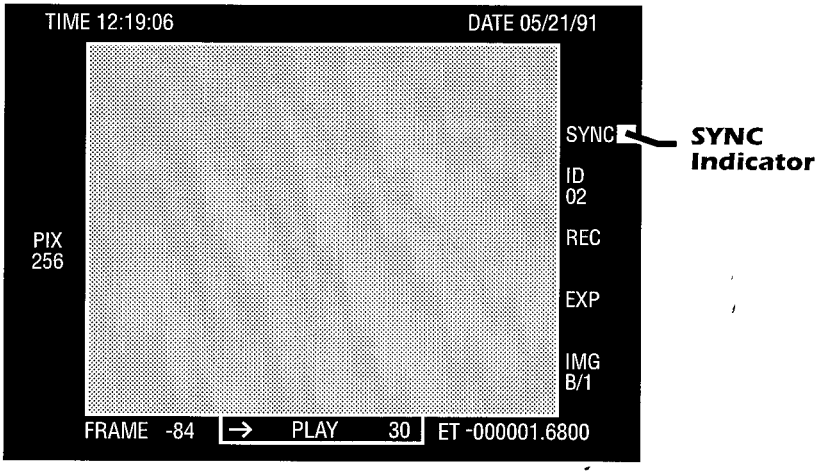
EXT SYNC

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 our 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 Processor. 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 IN connector on the front of the Processor. The signal supplied must be TTL compatible. Don't worry about the polarity of the signal as the Processor 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.

When the EXT SYNC feature is being used EXT SYNC appears on the right side of the DATA-FRAME Border. When the Processor senses an external synchronizing signal a solid white box appears for a moment to the right of the EXT SYNC field in the DATA-FRAME Border. This white box or EXT SYNC Indicator is driven by the user's synchronizing signal. If the EXT SYNC indicator behaves just the opposite of what you expected, the polarity of the command signal needs to be changed.

There is a switch labeled INVERT next to the EXT SYNC IN connector. Change the position of this switch to change the polarity of the external synchronizing signal. The EXT SYNC Indicator should now behave, and come on when you want it to.

CHAPTER 7. ROUTINE CARE

CARE OF IMAGER LENSES

CARE OF AIR FILTER

OPENING THE PROCESSOR

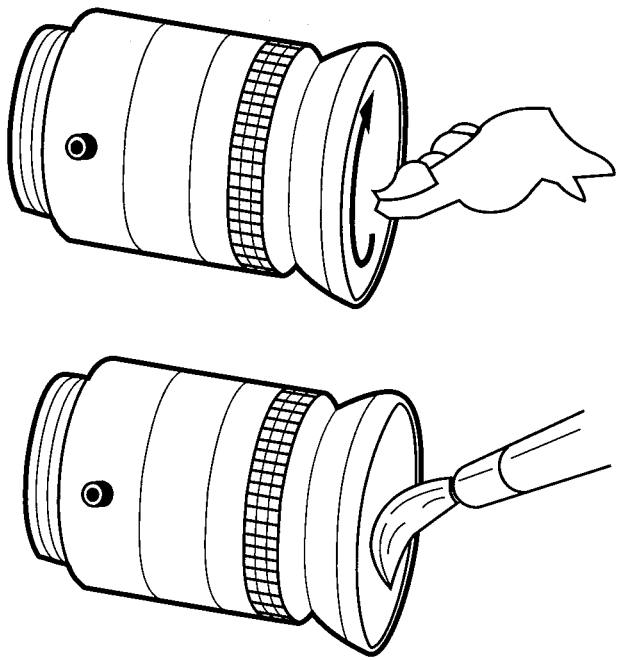
YOUR CUSTOMER SUPPORT PROGRAM

NOTES

CARE OF IMAGER LENSES

Modern lenses are coated with substances to reduce chromatic aberration, unwanted reflection and other conditions which 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 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 wash them. If it becomes necessary to clean them, always use a commercial lens cleaning solution and photographic lens wipes which 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.



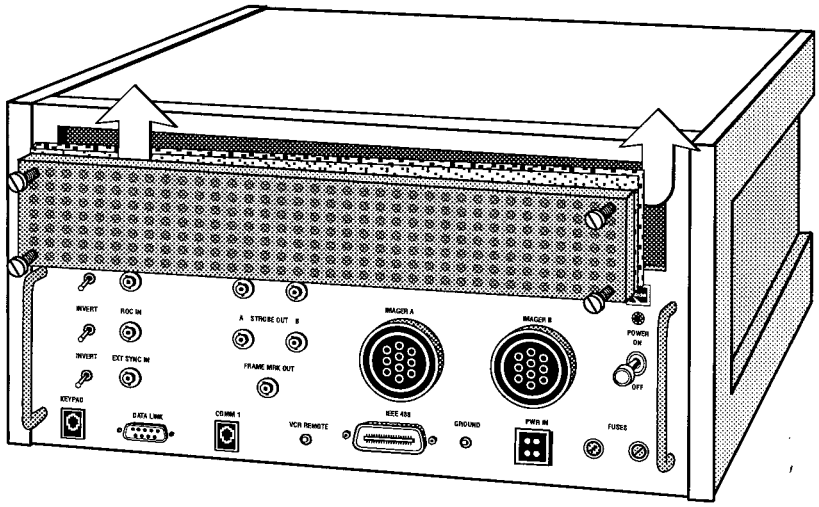
CARE OF AIR FILTER

CARE OF AIR FILTER

The air filter is located behind the perforated screen on the front of the Processor above the controls and connectors. The filter should be cleaned periodically to insure adequate cooling air for the electronics and power supply.

REMOVING THE AIR FILTER

The air filter screen is held in place with four 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.



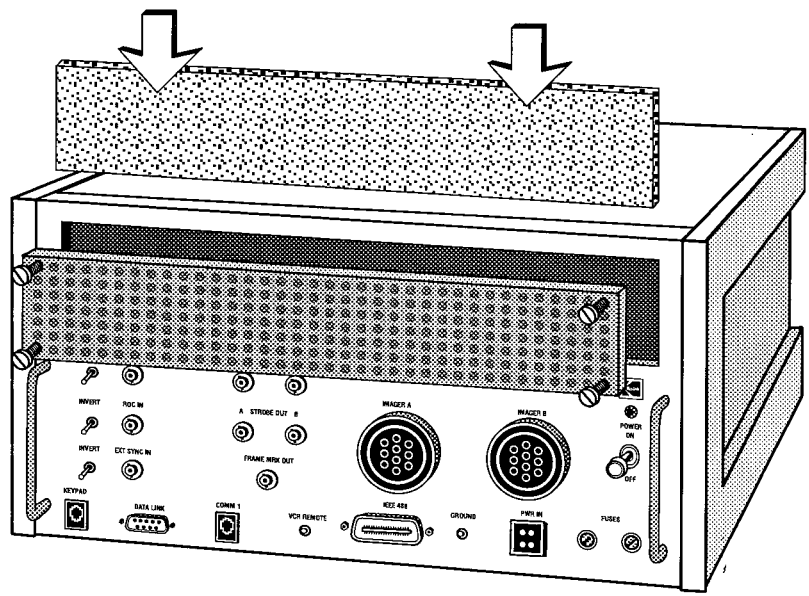
CARE OF AIR FILTER

CLEANING THE AIR FILTER

Clean the filter by washing in soap and water and let dry completely before reinstalling. 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 four captive screws.



YOUR CUSTOMER SUPPORT PROGRAM

CUSTOM INSTALLATION AND TRAINING

Installation, on site checkout and operator training are valuable options for your new motion analysis system. 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

This agreement provides emergency repair service when you need it most. The repair work will be performed by our field service engineers located throughout the United States. For a period of one year, labor, expenses, replacement parts and telephone support are included.

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 our Service Center.

YOUR CUSTOMER SUPPORT PROGRAM

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:

Outside California
800-854-7006

In California
800-542-6417

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

NOTES

CHAPTER 8. SPECIFICATIONS

SPECIFICATIONS

NOTES

SPECIFICATIONS

KODAK EKTAPRO Hi-Spec Processor

Keypad	Back-lit LCD display provides user access to all system functions.
Recording Technique	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 programmed number of images before trigger point and then continues to record until memory is full. 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	50, 125, 250, 500 and 1000 full frames/second, Up to 12,000 split frames per second.
Image Splits (Model 1012 only)	1,2,3,4,6 or 12 splits per frame. Permits record rates of up to 12,000 pictures per second. Can be played back with a single image per frame or multiple images per frame.
Exposure	1/50 to 1/12000 of a second depend ing upon image split and record rate. Will also support KODAK EKTAPRO , Intensified Imager with exposure rates as fast as 10 microseconds.

SPECIFICATIONS

KODAK EKTAPRO Hi-Spec Processor

Frame Storage	From 400 to 4,800 full frame images. Up to approximately 58,000 split frame images.
Playback Rates	NTSC: 0, 1, 2, 3, 3.8, 5, 6, 7.5, 10, 15, 30, 60, 90, 120, 240, 480, 960 fps plus single step, freeze frame forward or reverse. PAL 0, 1, 2.5, 3.1, 4.2, 5, 6.2, 8.3, 12.5, 25, 50, 75, 100, 200, 400, 1000 fps plus single step, freeze frame forward or reverse.
Reference Reticle	Built in X, Y electronic crosshairs with reference marker. The Processor automatically calculates the distance between the crosshairs and the reference mark.
Video Output	System can be configured for either NTSC or PAL compatible output.
VCR remote control	The Processor can control users VCR directly for automated download of image data.
DATA-FRAME Border	Date, ID number, record rate, exposure, image split, elapsed time, playback rate, frame number, pixel depth, reticle coordinates, real time and system status messages.
Signal Inputs	TRIGGER: BNC connector TTL level positive or negative true logic. EXT SYNC: BNC connector TTL level positive or negative true logic. ROC: BNC connector TTL level positive or negative true logic.
Size	8.25" H x 17.5" W x 16.5" D (20.9cm X 44.5cm X 42.9cm).
Weight	Approximately 38 pounds. (17.3 kg)
Power, Fuses	110 / 220 Volts AC, 60 / 50 Hertz, 5 / 3 amps. 21-32 volts DC, 15 Amps

SPECIFICATIONS

KODAK EKTAPRO Hi-Spec Imager

Switches	Live & Gain.
Output Jacks	Video.
Sensor	192 x 239 pixel NMOS array.
Spectral Response	400 to 1000 nanometers.
Gray Scale	256 levels of grey.
Lens Mount	C-Mount.
Tripod Mount	1/4-20 and 3/8-16 with standard ANSI hole pattern.
Cables (Imager to Processor)	15 ft. standard (available in 15 feet, 50 feet and 100 feet increments). 100 feet is the maximum cable length from Imager to Processor.
Sensitivity	ISO 200 (Hi gain setting)
Size	Approximately 9" x 4" x 5" (23 cm x 10 cm x 12 cm).
Weight	Approximately 5 pounds (without lens and viewfinder).
Power	Derived from Processor.

Manufactured in U.S.A. UL APPROVED

NOTES

EASTMAN KODAK COMPANY
Motion Analysis Systems Division
11633 Sorrento Valley Rd.
San Diego, California 92121-1097
619-535-2908

PN91000030-001 REV. C