FASTEC IMAGING™

SportsCam

High-Speed Camera

Operator's Manual

FASTEC IMAGING™

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Using this Guide

The purpose of this document is to:

- Provide an introduction to the SportsCam high-speed digital camera.
- Provide guidance through camera setup and configuration.
- Describe camera operational procedures.

Additional Resources

Refer to the following documents for additional information about the Fastec Imaging systems and software.

Document Number	Title
3000-0005.A.00	Troubleshooter LE/SportsCam Camera Quick Start Guide.
Version 1.4	MiDAS 4.0 Express User Guide.


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1. SportsCam Camera Overview

1.1. Introduction to the Fastec Imaging Family of High-Speed Cameras

SportsCam high-speed digital camera are offered in monochrome or color with various high-speed digital image recording capability using a range of recording rates, sensor resolutions, and on-board memory options.

Monochrome and Color SportsCams both have a 10-bit CMOS single chip sensor. Images are gamma mapped, user adjustable, and stored as 8124-bit images. The cameras are equipped with a standard C-mount lens mount, and 1/4-20 tripod mount.

This manual provides setup and operational procedures for the following camera:

- SportsCam.

SportsCam Cameras support the following three modes of operation:

- Standalone camera operation using on-board SODIMM memory to record and playback captured images.
- Standalone camera operation using a Compact Flash (CF) card to store images captured by the on-board SODIMM memory.
- Remote operation of the camera using the MiDAS 4.0 Express software, a host PC, and USB 2.0 interface.

MiDAS 4.0 Express software is provided with the SportsCam Cameras. This software offers control for remote recording, playback and downloading images to a Windows compatible computer. Images downloaded and saved in AVI file format can be view in MiDAS 4.0 Express for image playback and analysis.

Thanks to the built-in LCD screen, Compact Flashcard SP slot, and battery pack operation, SportsCam Cameras can be used to view and shoot an event with no setup or host computer necessary.

1.2. SportsCam Cameras

The SportsCam Camera housing is made of injection molded PC ABS, and machine finished aluminum. The camera body and interface connectors are enclosed to resist dirt and moisture. The camera protective removable boot is made of neoprene rubber. This model is equipped with a combination plug and cable (for external trigger, sync in, and sync out), RCA video output, USB 2.0 port, and a power plug. The camera is optimized for handheld standalone (no host computer) operation. It can also be used in a remote controlled (host computer) operational mode. Power is supplied by an AC power adapter or the built in battery pack.

Figure 1-1: SportsCam Camera

Table 1-1: SportsCam Operational Specifications

Component	Specification
Record Frames per Second	50, 60, 125, 250, 500 (320x240, 440x330, or 640x240 modes only)
CMOS Sensor Resolution	320x240, 440x330, 640x240, 640x480
On Board SODIMM Memory	512 MB, or 1024 MB
Manual and Remote Triggers	Start, 25%, 50%, 75%, End
Frame Storage	1,318 to 10,619 frames depending on record rate and memory size (see Table Table 3-2)
Record Time	5.3 to 212.4 seconds depending on record rate and memory size (see Table Table 3-2)

1.2.1. SportsCam Camera Displays, Controls, Indicators and Connectors

Figure 1-2, Figure 1-3, and Figure 1-4 show the SportsCam displays, controls, indicators and connectors. Table 1-2, Table 1-3, and Table 1-4 provide a brief description of each item.

Figure 1-2: SportsCam Back Panel

Table 1-2: SportsCam Back Panel

Back Panel	Description
1. Power LED / CF LED	Illuminates green when power is applied to the camera. Illuminates red while downloading data to the compact flash card.
2. Stop Button	Press the **Stop** button to stop recording, trigger camera, or exit the setup menus.
3. Play Fwd / Rev Buttons	Play back a captured event in a forward or reverse direction.
4. Select Button	Camera configuration commands and camera status are accessed through a series of Configuration Screen menus. When the menu option is highlighted green, press the **Select** button to open camera configuration menus Configuration menus include: ❑ Setup Menu ❑ Info Menu ❑ Set Date/Time ❑ Memory Menu

Back Panel	Description
5. Left/Right Select Buttons	Floating menus are used to access the most commonly used camera settings in real time. Increase or decrease the currently highlighted floating menu parameter. ❑ Changes values up or down in the various menus.
6. Up/Down Select Buttons	Select a superimposed floating menu item on the camera LCD display. The active menu item is illuminated green. ❑ Navigates up/down in the various menus.
7. Record	**Note:** When the camera is turned on, it automatically enters Record mode. **Record Button** Press the **Record** button once to begin capturing images into camera on board memory. If the camera has a recoding in memory, pressing the **Record** button while in the Playback mode will cause the following warning screen to be displayed: *Are you sure you want to return to the Record mode???* *All unsaved data will be lost.* *Press Stop to Cancel.* *Press Record again to Continue.* Used to initiate a download of images to the compact flash (CF) card. Used to accesses File Review Menu when in RECORD mode.
8. Power Button	Use the power button to turn the camera "On" and "Off". The camera uses volatile memory to record high speed events. Event data is not permanently stored until a download to a Compact Flash Card or a PC is performed. If the **Power** button is pressed, the following message is displayed: "*Are you sure you want to turn off power???* *All unsaved data will be lost.* *Press Stop to Cancel.* *Press Power again to Continue.*
9. Battery Eject	Press down on button to release battery from compartment. **CAUTION:** **TO AVOID DROPPING AND DAMAGING THE BATTERY HOUSING, HOLD THE CAMERA LEVEL WHEN THE BATTERY EJECT BUTTON IS DEPRESSED. TILT THE CAMERA TO SLIDE THE BATTERY FROM THE BATTERY STORAGE COMPARTMENT.**

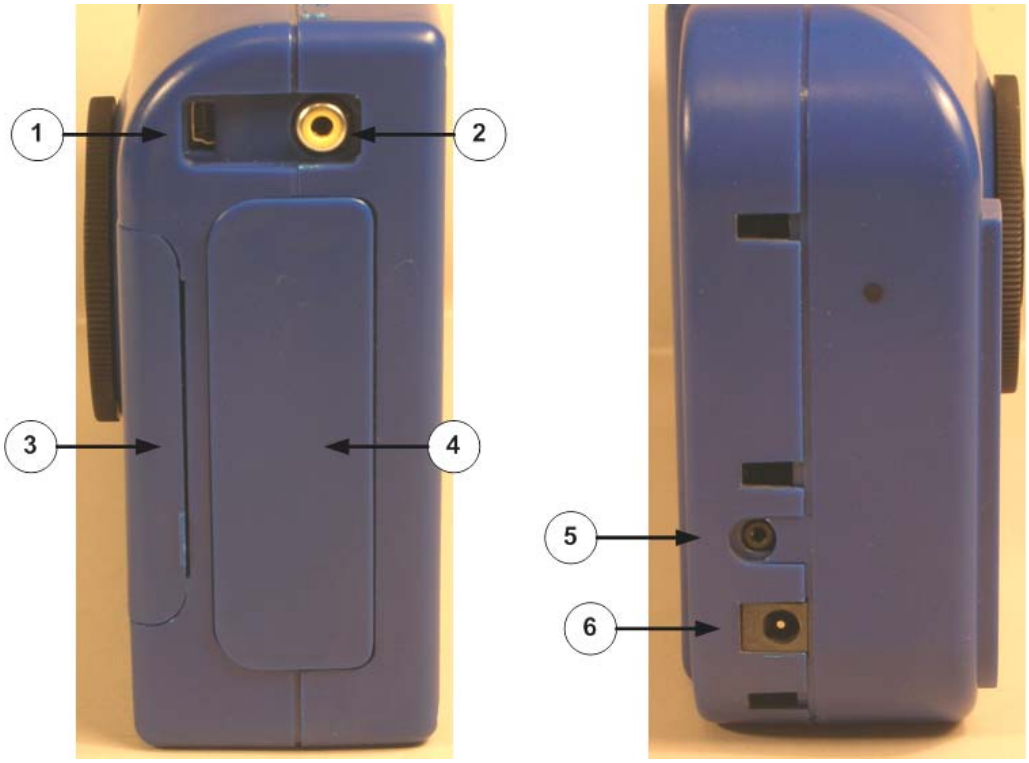

Figure 1-3: SportsCam Side Panels

Table 1-3: SportsCam Connector Panel

Connector Panel	Description
1. USB 2.0 Connector	Connect the camera to a PC running the MiDAS 4.0 Express. ❑ Standard "Mini B USB" connector on camera.
2. Video Out	NTSC/PAL menu selectable composite video output.
3. Compact Flash Card Access Door	Image files can be permanently saved using a CF card. **Note:** **The firmware on the camera is tuned to work specifically with SanDisk™ Extreme III or IV CF cards. Use of other brands of CF cards May result in non-operation or other problems.**
4. Removable Battery	Rechargeable Battery Pack.
5. External Trigger and Sync (via Multiple I/O Camera Interface Cable)	Receive and output sync pulse signals. Receive an external trigger signal.
6. DC Power Input Connector	Apply 18 volt DC power to the camera.

Figure 1-4: Multiple I/O Camera Interface Cable

Table 1-4: SportsCam Multiple I/O Camera Interface Cable

Connector	Description
1. Sync In BNC Connector	Receive sync pulse signals from an external source. Can be a SportsCam camera in Master configuration or other instrument outputting a TTL level signal.
2. Sync Out BNC Connector	Output sync pulse to drive a second SportsCam camera for Phase Lock operation. Also used for strobe control.
3. Ext. Trigger BNC Connector	External trigger signal input used to initiate image capture.

1.3. MiDAS 4.0 Express Software

Your camera is provided with a MiDAS 4.0 Express CD ROM. The CD is accompanied with a serial number and activation code. The activation code is a 16-digit number that activate MiDAS 4.0 Express software for use on one computer. Additional seat licenses can be purchased separately.

This software program is used for remotely controlling and adding functionality to your SportsCam high speed camera. The software supports complex and advanced event capture and image analysis.

The fundamental features will allow you to record, play, view, save, and load image sequences as well as measure both velocity and distance directly on-screen when performing image processing.

For updates to your MiDAS software, visit the web site download page at:

http://www.xcitex.com/downloads.html.

While installing the MiDAS 4.0 Express software, the MiDAS 4.0 Express User's Guide is automatically loaded onto to your computer in an Adobe PDF format. The User's Guide can be accessed any time. Updates to the guide are available from Xcitex directly by email at sales@xcitex.com.

To install the application, refer to the *MiDAS 4.0 Express CD* enclosed with your camera.


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2. Camera Setup

2.1. Unpack the Camera

When you unpack your shipping box you should find the following items:

- High-Speed Digital Camera.
- Rechargeable Battery Pack.
- CD ROM with Camera Operator's Manual and Quick Start Guide.
- CD ROM with MiDAS 4.0 Express software, user's guide, serial number, and activation code.
- AC/DC 18 volt Power Supply.
- Additional items may be enclosed by local distributors (i.e. lens, etc.).

Fastec Imaging retails its cameras through independent distributors. The distributors will provide the accessory items required for camera operation according to each customers particular application needs.

2.2. Getting Started

Prior to operating the camera the following items must be installed:

- Lens.
- Power source (On board battery pack or external AC/DC power).

2.2.1. Install the Lens

To install the lens:

Step 1 Remove the lens receptacle cover from the camera's C-mount.

- The cover is installed at the factory to protect the image sensor.

Step 2 Thread the C-mount lens into the lens mount located in the front of the camera.

- Do not over tighten the lens. The lens should be "finger tight".
- As a starting point for recording, open the lens aperture about half way and set the lens focus to infinity.

Note:
Avoid holding the camera with the lens opening facing up after the dust cover is removed. Dust could settle on the face of the sensor and degrade the image quality.

2.2.2. Install the Camera Battery Pack or External Power Supply

The camera can be powered by a rechargeable battery pack (included), or an external 18 V power supply (included). The battery pack is installed into the battery compartment; access is located on the left side of the camera.

To install battery:

Step 1 Peel back the rubber boot from the left side of the camera. This will expose the battery so it can be installed /uninstalled.

- ❑ Use your right hand to hold the boot back. The material is very flexible and bending it back will not affect it.

Step 2 Line battery pack up with battery compartment on the camera.

Step 3 Slide the battery pack inside the battery compartment until you hear it lock in place.

Step 3 Release and reposition the camera boot.

Step 4 Press the Power button. The Power LED illuminates green.

Step 5 If the Power LED doesn't illuminate:

- ❑ Check the battery charge level.

When the camera is going to be operated for an extended periods of time, battery life can be preserved by using the external AC/DC 18 volt power supply provided with the camera. The camera external AC/DC 18 volt power supply connector is located on the right side of the camera.

To connect the external power supply:

Step 1 Make sure the camera is turned off.

Step 2 Connect the external power cable to the external power jack on the camera's connector panel.

Step 3 Press the Power button.

Step 4 If the Power LED doesn't illuminate:

- ❑ Recheck cable connections.
- ❑ Be sure that the AC/DC 18 volt power supply is receiving AC power.

2.2.3. Charge the Camera Battery Pack

The camera battery pack will operate the camera for approximately 8 hours in all operating modes and take approximately 3.5 - 4 hours to recharge.

Rechargeable Lithium Ion battery physical life is generally specified in terms of capacity over multiple charge cycles. For this type of battery, 500 charge/discharge cycles will typically reduce capacity to approximately 75-80% of original capacity assuming no abuse has occurred.

The camera battery pack is warranted for use in SC/LE cameras only. The battery is warranted to maintain greater than 75% of its rated capacity throughout the period of the warranty. Warranty period is 1 year from date of shipment, subject to abuse exclusions. Abuse includes evidence of charging with an unapproved charger, overheating, shorting, water exposure, physical damage, shock, etc.

To charge the Battery Pack:

Step 1 Make sure the camera is turned off.

Step 2 Remove the battery pack from the camera.

Step 3 Plug the external power jack into the **Charger Input** on the battery pack.

The **Charge Status indicator**:

- Illuminates amber when charging.
- Illuminates green when fully charged.

Step 4 Remove the external power jack from the battery pack after the battery Charge Status indicator illuminates green.

2.2.4. Install or Remove the Compact Flash Card

The camera can capture and play back high-speed image clips without a compact flash card being installed. If you turn the camera off, any image clips stored in camera **memory are lost**. Image files can be permanently saved using a CF card.

> **Note:**
>
> For best results in download speeds, Fastec Imaging recommends use of a SanDisk Extreme III or IV CF card. Other brands of CF cards will download more slowly or **may not work at all**.

To insert the Compact Flash (CF) card:

Step 1 Open up the CF card door on the front of the camera.

Step 2 Insert a new CF card with the label facing the same direction the lens is pointing.

- ❑ Press the card along the guide slots until it seats against the connector pins.

To release the Compact Flash card:

Step 1 Press the ejector mechanism above the CF card.

Step 2 After the CF card is released, remove the CF card from the slot.

2.2.5. Camera Lens Back-Focus Adjustment

The C-mount on the camera has a "no tools required" adjustment to allow you to perform a lens back-focus adjustment. When you perform a back-focus adjustment you change the distance between the flange mount surface of the lens and the CMOS sensor array.

Figure 2-1: Back-Focus Components

Table 2-1: Camera Connector Panel

Connector Panel	Description
1. C-mount Ring	Connects the lens to the C-mount fixture.
2. C-mount Lock Nut	Lock the C-mount ring in place.
3. Lens Mounting Plate	Used to hold the lens and C-mount

In most cases, changing the lens on your camera will not require a lens back-focus adjustment. The most common symptom of an incorrect back-focus is an inability to focus the camera on distant objects.

To perform a Lens Back-Focus adjustment:

Step 1 Remove C-mount ring and C-mount lock nut from the camera. Screw the lens onto the C-mount ring.

Step 2 Thread the C-mount lock nut onto the C-Mount ring until it's almost flush against the back of the lens. The indented side of the C-mount lock nut faces the camera body.

Step 3 Screw the C-mount ring into the front of the camera until the lens C-mount locking nut is flush with the lens mounting plate.

Step 4 Aim the lens at target which is a measured distance from the C mount surface. (5 ft in this example).

Step 5 Power up the camera.

Step 6 For maximum light sensitivity, set camera record speed to 50 frames per second.

Step 7 Adjust the lens opening for ambient light.

Step 8 Adjust lens focus until target is appears focused on the LCD display.

Step 9 Observe the lens foot reading.

If the feet number reading on lens is low (less than 5 feet), adjust the C-mount ring out/away from camera (counter-clockwise if facing front of camera).

- Counter-clockwise rotation increases lens focal length.
- Clockwise rotation decreases lens focal length.

Figure 2-2: Focal Length to Low

Step 10 If the feet number reading is high (greater than 5 feet), adjust the C-mount ring into the camera (clockwise if facing front of camera).

Figure 2-3: Focal Length to High

Step 11 Tighten the C-mount lock nut against the camera body when the correct back-focus is set.

CAUTION:

ENSURE THAT NOTHING MAKES CONTACT WITH THE SURFACE OF THE IMAGE SENSOR.

2.3. Connecting the Camera to a Computer

The camera can be connected to a computer via USB 2.0 cable. The camera USB connector (Mini-B) is on the left side of the camera's connector panel, (viewed from the rear). Once the camera is connected to the computer, the MiDAS 4.0 Express software can be used to remotely configure and control camera operation. Events recorded in the camera memory can be saved as AVI files on the computer.

> **Note:**
>
> MiDAS 4.0 Express should be already installed onto your computer prior to performing the procedure below. If not, perform the installation using the enclosed MiDAS 4.0 Express CD enclosed with your camera

2.3.1. To Remotely Configure and Control a Camera from a PC

Step 1 Supply power to the camera.

Step 2 Press the camera **POWER** button - ON.

Step 3 Using a USB cable, connect the camera to your computer USB port. The device window shown below opens on the computer desktop indicating a connection with the camera. The USB cable needs to have a standard USB "Mini B" connector at the camera connection point.

- ❑ To your computer, the camera appears as a mass storage device and typically opens a window like this when connected.

Step 4 Double-click on the MiDAS 4.0 Express desktop icon to open the application.

For further information regarding interacting with MiDAS 4.0, refer to the *MiDAS 4.0 Express User's Guide*.


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3. Camera Configuration

3.1. Technical Keypoints

3.1.1. Shutter Multiplier Setting

The shutter multiplier setting determines the camera shutter speed. Shutter speed is defined as the inverse values of the frame rate times the shutter multiplier.

For example:

- **Frame Rate** = 250 fps (inverse value is 1/250 or .004 seconds).
- **Shutter Multiplier** = A setting of 4X (inverse value is 1/4th or .25).
- **Shutter speed** = .004 x .25 or .001 seconds.

The following table displays shutter speeds based on selected Frame Rates and Shutter Multipliers.

Table 3-1: Shutter Speed Settings

	Record Rate in Frames per Second (Reciprocal)				
Shutter Multiplier (Reciprocal)	**50 (.020)**	**60 (.0167)**	**125 (.008)**	**250 (.004)**	**500 (.002)**
1X	.020000	.016700	.008000	.004000	.002000
2X (.500)	.010000	.008333	.00400	.002000	.001000
3X (.333)	.006666	.005560	.002670	.001330	.000667
4X (.250)	.005000	.004170	.002000	.001000	.000500
5X (.200)	.004000	.003330	.001600	.000800	.000400
10X (.100)	.002000	.001667	.000800	.000400	.000200
20X (.050)	.001000	.000833	.000400	.000200	.000100

Changing shutter does not change record rate or frame resolution. Faster shutter speeds reduce object blur, but require more light on the subject of interest.

3.1.2. Record Time Matrix

The event record time and maximum number of frames stored is determined by the following factors:

- Recorded frames per second.
- Sensor resolution selection.
- Onboard camera memory.

Table 3-2: Camera Record Time Matrix

Frames per Second	Sensor Resolution	Standard Memory 512 MB		Enhanced Memory 1 GB	
		Total Frames	Record Time (Sec)	Total Frames	Record Time (Sec)
50	640 x 480	1,318	26.3	2,637	52.7
60	640 x 480	1,318	21.9	2,637	43.8
125	640 x 480	1,318	10.5	2,637	21.0
250	640 x 480	1,318	5.3	2,637	10.6
50	640 x 240	2,654	53.1	5,309	106.2
60	640 x 240	2,654	44.2	5,309	88.4
125	640 x 240	2,654	21.2	5,309	42.4
250	640 x 240	2,654	10.6	5,309	21.2
50	440 x330	2,773	55.5	5,546	111.0
60	440 x330	2,773	46.2	5,546	92.4
125	440 x330	2,773	22.2	5,546	44.4
250	440 x330	2,773	11.1	5,546	22.2
500	440 x330	2,773	5.5	5,546	11.0
50	320 x 240	5,309	106.2	10,619	212.4
60	320 x 240	5,309	88.5	10,619	177.0
125	320 x 240	5,309	42.5	10,619	85.0
250	320 x 240	5,309	21.2	10,619	42.4
500	320 x 240	5,309	10.6	10,619	21.2

3.1.3. Camera Internal Trigger

Image capture is referenced to the frame that's captured the moment you click on the camera **Stop** button (or a remote trigger input is detected by the camera). This frame is called the trigger point and is always tagged as frame 00000.

The trigger point is expressed as a percentage of the total frames captured, or as the Start (beginning) or End of the video frame capture. Refer to *Table 3-3*. Images captured before a trigger frame are labeled with negative numbers. Images captured after a trigger frame are labeled with positive numbers.

In other words, a trigger point is an auto stop for an image capturing sequence. Figure 3-1 below shows the image recording function of the camera when an internal trigger point of 25% was selected. The first 25% of the image capturing sequence would be retained in memory, while the remaining 75% of the image capturing sequence will continue recording new images.

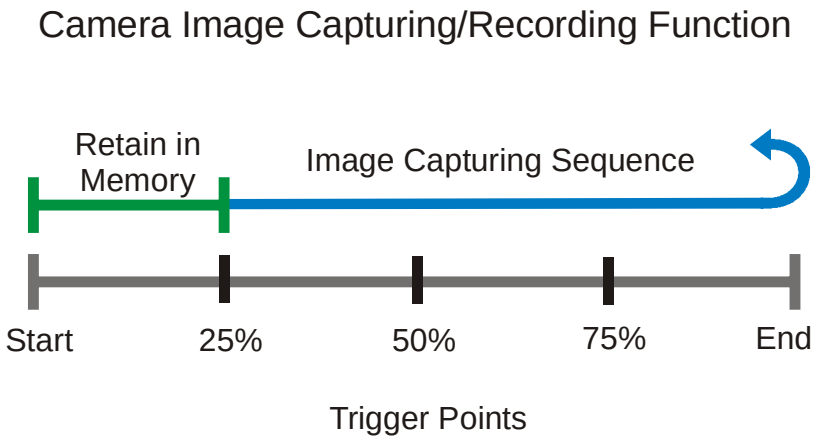

Figure 3-1: Camera Function Using Internal Trigger Points

Table 3-3: Trigger Points and Functions

Trigger	Function
Start	Begin capturing image frames in camera memory when the trigger point is detected. ❑ Make the trigger point the first frame captured.
25%	Retain 25% of the frames captured before the trigger point was detected. ❑ Record new frames in the remaining 75% of camera memory.
50%	Retain 50% of the frames captured before the trigger point was detected. ❑ Record new frames in the remaining 50% of camera memory.
75%	Retain 75% of the frames captured before the trigger point was detected. ❑ Record new frames in the remaining 25% of camera memory.

Trigger	Function
End	Stop capturing frames in camera memory once the trigger point is detected. ❑ Retain all frames recorded in camera memory up to the moment of the trigger.

Note:

For 25%, 50%, and 75% trigger points, an early trigger (received before camera has filled the memory with video data) will result in a partial recording and trigger position that will be less than 25%, 50%, and 75%. This is normal behavior.

3.1.4. Remote Trigger Input

A remote trigger signal can be used to initiate image capture. When connecting multiple cameras together, make sure the external trigger is connected to the first camera (Master) in the chain.

The remote trigger input signal enters the camera through the BNC connector on the Multiple I/O cable labeled TRIGGER. Refer to *Figure 1-4*.

The remote TRIGGER input signal is a low true (less than .7 volts DC) input to a type SN74LVC14A inverter. It can be grounded through a simple momentary switch or be driven actively. The input can tolerate +/- 30V. An input voltage below 0.7V is "true" and above 2.0V is "false". There is a pull-up resistor at the inverter input that clamps voltage to 3.3V.

- When the camera is set to trigger: **Falling** (default), the camera detects a trigger when voltage on the trigger input "falls" below approximately 0.7 Volts DC.

- When the camera is set to trigger: **Rising**, the camera detects a trigger when voltage "rises" above approximately 0.7 Volts DC. This input is compatible with TTL out put devices.

3.1.5. Sync Out Signal

Every image frame capture generates a SYNC OUT signal that can be used in multiple locations to synchronize external equipment or cameras with the event. The SYNC OUT signal is output through the Multiple I/O cable BNC connector labeled SYNC OUT.

The SYNC OUT signal is a positive-going, 3.3 volt, 21 microsecond nominally square pulse whose rising edge corresponds to the beginning of the integration time for the current frame.

3.1.6. Sync In Signal

Used in providing an input signal to synchronize Slave cameras with the MASTER camera. Refer to *Section 3.1.5*.

3.1.7. Phase Lock Multiple Cameras

Fastec Imaging cameras have the ability to perform synchronized recording in a parallel configuration. If only cameras are implemented, the first camera in the chain is designated as the "Master" and all additional cameras in the chain are synchronized to the Master in a "Slave" mode.

If external trigger hardware is present, all cameras in the parallel chain are operated in the "Slave" mode to the external event trigger.

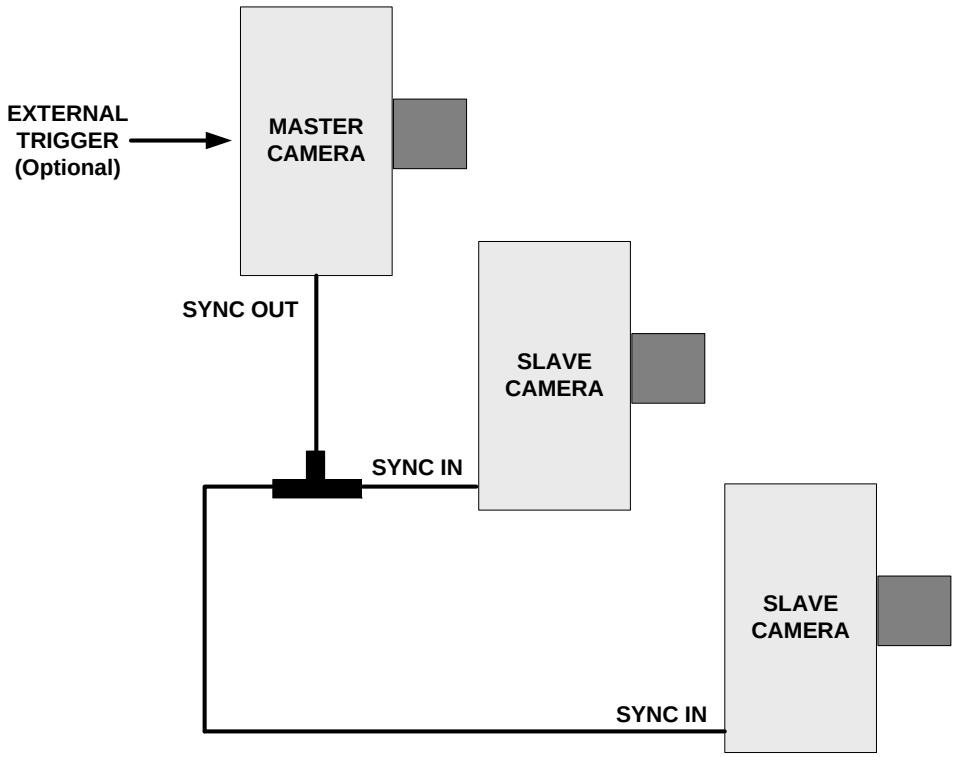

Figure 3-2: Multiple Cameras, Phase Locked Configuration

To operate parallel chained cameras in a synchronized mode:

Step 1 On the first camera in the chain, Set the **SETUP** menu **SYNC MODE** command to "MASTER". Refer to *Section 3.3.1*.

Step 2 On subsequent cameras in the chain, Set the **SETUP** menu **SYNC MODE** command to "Slave". (Ensure Slave cameras are in record mode).

Step 3 Ensure all cameras are set at the same **RECORD RATE, RESOLUTION and TRIGGER POSITION**. Refer to *Section 3.2.1*.

Step 4 Press the Master camera **RECORD** button to begin synchronized recording of images on all cameras in the chain.

Step 5 Press the Master camera **STOP** button to stop recording, or input an **External Trigger** signal.

- ❑ All Slave cameras will freeze in the RECORD mode when the Master camera completes its recording and stops.

Step 6 Press the Slave camera's stop button to "unfreeze" them and enter play mode.

Step 7 Review and save data at each camera as required.

Step 8 Repeat steps 4 through 7 as required.

3.2. Floating Menu Configuration Commands and Displays

There are two menu schemes implemented to configure the camera.

- Frequently accessed Record and Playback commands and displays are superimposed over the image display using Floating menus.
- More complete options are accessed through a series of Configuration Screen menus (including the frequently accessed items in the floating menus).

3.2.1. Record Mode Floating Menu

Figure 3-3 shows the Record Mode floating menu configuration commands and displays. Table 3-4 provides a brief description of command and displays for color and monochrome cameras.

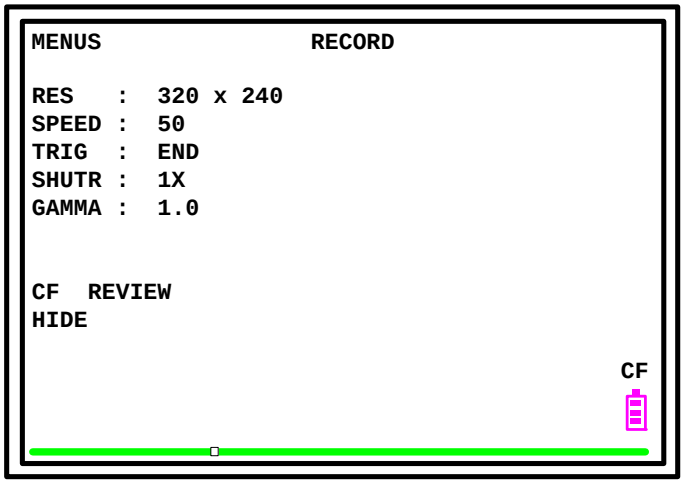

Figure 3-3: Record Mode Floating Menu

Table 3-4: Record Mode Floating Menu Commands and Displays

Command / Display	Description
MODE	**RECORD** Mode of Operation Displays: When in Record Mode or Playback Mode there is a memory buffer Status Bar across the bottom of the camera display. In Record Mode this Status Bar is green and it contains a small white "bug" that shows where the displayed frame is in relation to the entire SODIMM memory bank. Once a camera has been triggered a magenta T will be placed on the Status bar at the point of the Trigger Frame (Frame 0). For example if the Trigger is set to 50% then the magenta T icon will be exactly in the middle of the Status Bar, and end trigger will place the icon at the end of the Status Bar which is on the far right end.

Command / Display	Description
MENUS	Select a camera Configuration menu ❑ Setup Menu ❑ Info Menu ❑ Set Date/Time ❑ Memory Menu
RES	Resolution command: Display the current Record Resolution setting in pixels.
SPEED	Record Rate command: Displays the current Record Rate setting in frames per second.
TRIG	Capture Event Trigger command: Display the current Trigger setting.
SHUTR	Shutter command: Display the current Shutter Speed setting.
GAMMA	Enhance image details. ❑ Decrease gamma to enhance details in dark areas. ❑ Increase gamma to enhance details in light areas. ❑ Gamma of 1.0 is normal (image details not enhanced)
CF REVIEW	Review any AVI files on the Compact Flash card.
HIDE	Hide most floating menus. To redisplay menus, press the **SEL Down** arrow.
CF (Above Battery Icon)	Displayed when a Compact Flash card is present in the camera.
Battery Icon	Three bars indicate battery is fully charged. When icon displays one bar, work should be saved.
Memory Buffer Status Bar	The bar simulates the entire SODIMM internal memory buffer. There is a white "Bug" that indicates where the active frame being recorded is located. The Bug starts on the far left side of the bar and moves across the bar toward the right side. The Bug wraps around back to the left when it reaches the far right side of the green bar. A magenta colored T on the memory buffer status bar indicates the trigger frame. For example, for an end trigger the T will be at the far right side of the buffer status bar. The T in this case indicates the location of the end trigger frame 00000.

3.2.2. Playback and Stopped Mode Floating Menu

Figure 3-4 shows the Playback and Stopped Mode floating menu configuration commands and displays. Table 3-5 provides a brief description of command and displays.

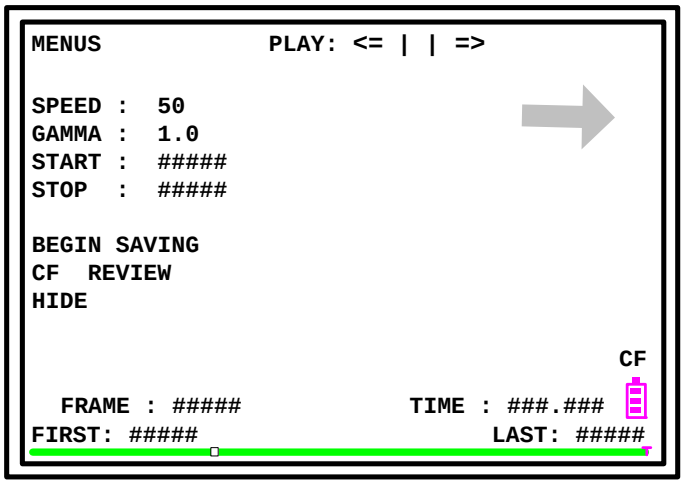

Figure 3-4: Playback and Stopped Mode Floating Menu

Table 3-5: Playback and Stopped Mode Floating Menu Commands and Displays

Command / Display	Description
MODE	**MODE PLAY: || (PAUSED)** Mode of Operation displays: Camera record stopped, one recorded image displayed.
MODE	**MODE PLAY: < = = > (PLAYBACK)** Mode of Operation displays: Playback a captured event in a forward or reverse direction by using the **PLAY Fwd / Rev** arrows. Stop playback using the **STOP** button.
MENU	Select a camera Configuration menu: ❑ Setup Menu ❑ Info Menu ❑ Set Date/Time ❑ Memory Menu
SPEED	Playback Rate command: Displays the current playback Rate setting in frames per second.
GAMMA	Adjust camera gamma setting.
⇨ ⇩ ⇦ **(Trigger arrows)**	Arrow in upper right portion of screen: ❑ Points toward the right starting 100 frames before the trigger. ❑ Points down on the trigger frame. ❑ Points toward the left for 100 frames after the trigger frame.

Command / Display	Description
START	Many times, the event of interest is only a few frames in length. The **START** and **STOP** commands are used to define the frame interval to be saved to the CF card. Points to the first frame to be saved to compact flash card when the **BEGIN SAVING** option is selected. Defaults to first frame after each new recording.
STOP	Points to the last frame to be saved to compact flash card when the BEGIN SAVING option is selected. Defaults to last frame after each new recording.
BEGIN SAVING	Save the interval of frames defined by the **START** and **STOP** options to CF card. Refer to *Section 4.1.4*.
CF REVIEW	Review contents of Compact Flash card.
HIDE	Hide most floating menus. To redisplay menus, press the **SEL DOWN** or **UP** button.
CF (Above Battery Icon)	Displayed when a Compact Flash card is present in the camera.
Battery Icon	Three bars indicate battery is fully charged. When icon displays one bar, work should be saved.
FRAME: +/-#####	Frame number currently being displayed: ❑ (-) Indicates a "Pre" trigger frame. ❑ (+)Indicates a "Post" trigger frame. Standard onboard memory stores 2184 frames. Enhanced onboard memory stores 4,368 frames. Play buttons used to reverse playback direction.
TIME: +/-###.###	Time of the current frame relative to the trigger in seconds and milliseconds. ❑ (-) Number of seconds before the trigger pulse. ❑ (+) Number of seconds after the trigger pulse
FIRST/LAST	Display first and last frame numbers of the entire memory buffer after a trigger event has occurred.
Memory Buffer Status Bar	The bar simulates the entire SODIMM internal memory buffer. There is a white "Bug" that indicates where the active frame being played back is located. The Bug starts on the far left side of the bar and moves across the bar toward the right side. The Bug wraps around back to the left when it reaches the far right side of the green bar. A magenta colored T on the memory buffer status bar indicates the trigger frame. For example, for an end trigger the T will be at the far right side of the buffer status bar. The T in this case indicates the location of the end trigger frame 00000.

3.3. Configuration Screen Menus

All user configurable camera settings are managed by a series of screen menus. Menus are accessed by using the **Up/Down** and **Left/Right SELECT** buttons.

- **SETUP MENU**– Change record mode settings.
- **INFO MENU** – Display camera information.
- **SET DATE/TIME** – Set saved AVI file header date and time values.
- **MEMORY MENU** – Set partitions in camera memory and display record times in seconds pre and post trigger for different speed and resolution settings.

The above menu screens are accessed and navigated by pressing the camera buttons described in Table 3-6.

Table 3-6: Configuration Screen Menu Operational Controls

Camera Button	Function
SELECT	Blanks out the camera LCD screen and displays the first Configuration Screen menu (Setup). Press this button to next menu.
UP/DOWN SELECT BUTTONS	Press these buttons to scroll to a configuration command of interest. The active command is highlighted.
LEFT/RIGHT SELECT BUTTONS	Press these buttons to change active value.
STOP	Press this button to exit the Configuration Screen menus.

3.3.1. Setup Menu Commands

Figure 3-5 shows the SETUP menu and current configuration settings. Table 3-7 provides a brief description of commands and displays.

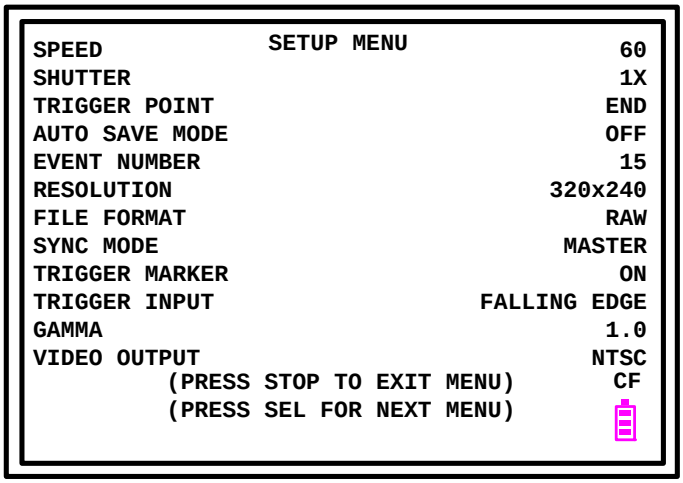

Figure 3-5: Camera, Setup Menu

Table 3-7: Camera Setup Menu Configuration Settings and Descriptions

Setting	Description
SPEED	Set record speed in frames per second.
SHUTTER	Set shutter speed.
TRIGGER POINT	Select camera trigger points (START, 25%, 50%, 75%, END).
AUTO SAVE MODE	If set to "On", download camera memory to the CF card automatically after recording is stopped.
EVENT NUMBER	Set a record/capture event number: ❑ Each recording is given an automatically incrementing event number. Using the **FUNCTION** and **SELECT** buttons in the **SETUP** menu can change the event number. ❑ The event number is primarily used when creating downloaded file names.
RESOLUTION	Set camera resolution.
FILE FORMAT	Set file format for saving recorded event(s). (AVI, RAW)
SYNC MODE	Set camera sync mode to Master or Slave: ❑ Allow two or more cameras to be synchronized for multi angle or 3-dimensional image capture.
TRIGGER MARKER	Displays or hides trigger arrows in the upper right portion of the display. Refer to *Table 3-5*.
TRIGGER INPUT	Set external trigger input to either falling or rising edge.
GAMMA	Enhance image details. ❑ Decrease gamma to enhance details in dark areas. ❑ Increase gamma to enhance details in light areas. Gamma of 1.0 is normal (image details not enhanced)
VIDEO OUTPUT	Set video output at the video connector to NTSC or PAL standard

3.3.2. Info Menu Commands

Figure 3-6 shows the INFO menu and current configuration settings. Table 3-8 provides a brief description of commands and displays.

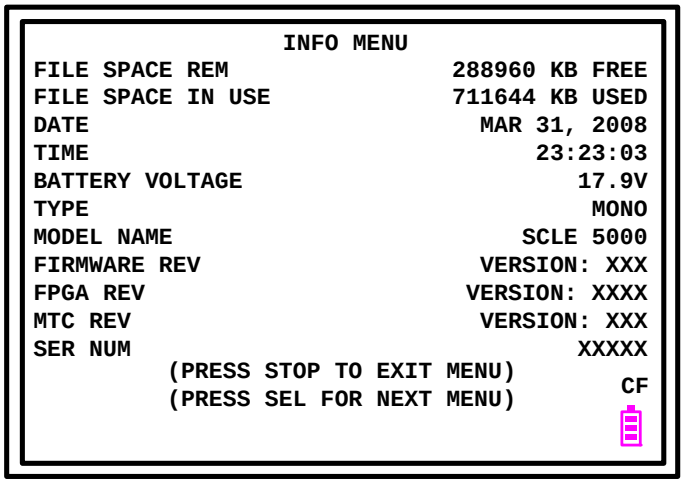

Figure 3-6: Configuration Screen, Info Menu

Table 3-8: Info Menu Configuration Settings, Displays, and Descriptions

Setting / Display	Description
FILE SPACE REM	Displays the file space remaining on the compact flash card (if installed). Otherwise, displays internal program flash memory.
FILE SPACE IN USE	Displays the file space used on the compact flash card (if installed). Otherwise, displays internal program flash memory.
DATE	Displays the current date. Change the date setting on the next configuration screen.
TIME	Displays the current Time. Change the time setting on the next configuration screen.
BATTERY VOLTAGE	Battery voltage indicator.
TYPE	Displays the model/sensor type.
MODEL NAME	Displays the camera model name.
FIRMWARE REV	Displays the camera firmware revision number.
FPGA REV	Displays the FPGA firmware revision number. FPGA = another processor that moves data from the sensors to the RAM.
MTC REV	Displays the revision number of the Master Timing Controller (MTC).
SER NUM	Camera serial number

3.3.3. Set Date/Time Menu Commands

Figure 3-7 shows the SET DATE/TIME menu and current configuration settings. Table 3-9 provides a brief description of commands and displays.

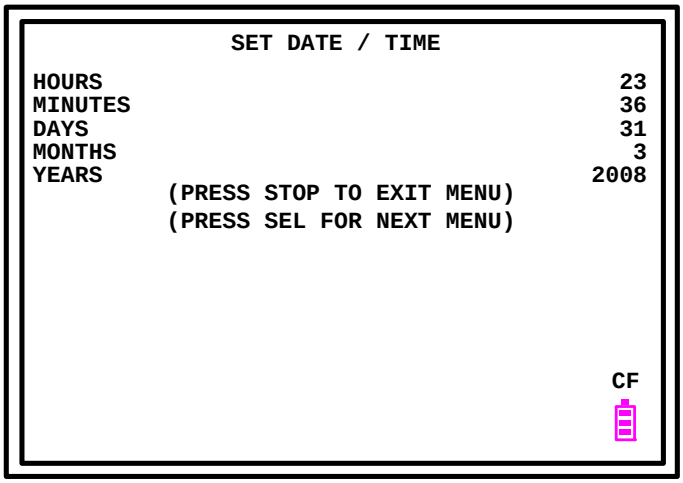

Figure 3-7: Configuration Screen, Set Date/Time Menu

Table 3-9: Set Date/Time Menu Configuration Settings and Description

Setting	Description
HOURS	Set hours value (24 hour clock).
MINUTES	Set minutes value.
DAYS	Set day of month value.
MONTHS	Set month value.
YEARS	Set year value.

3.3.4. Memory Menu Commands

Figure 3-8 shows the Memory menu and current configuration settings. Table 3-10 provides a brief description of commands and displays.

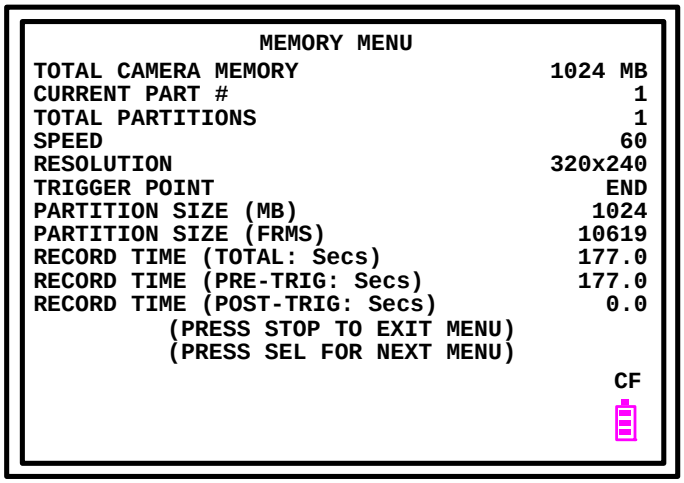

Figure 3-8: Configuration Screen, Memory Menu

Table 3-10: Memory Menu Configuration Settings and Description

Setting	Description
TOTAL CAMERA MEMORY	Displays the camera memory size.
CURRENT PART #	Partition number currently in use.
TOTAL PARTITIONS	Set the number of memory partitions.
SPEED	Set record speed in frames per second.
RESOLUTION	Set camera resolution.
TRIGGER POINT	Set camera trigger points (START, 25%, 50%, 75%, END).
PARTITION SIZE (MB)	Display the total amount of memory available in the camera.
PARTITION SIZE (FRMS)	Display the total number of memory frames available in the camera.
RECORD TIME (TOTAL: Secs)	Display the record time available to each partition.
RECORD TIME (PRE-TRIG: Secs)	Display the amount of pre-trigger record time available.
RECORD TIME (POST-TRIG: Secs)	Display the amount of post-trigger record time available.

4. Camera Operational Procedures

This chapter contains camera operational procedures for both handheld and remote controlled camera applications. Figure 4-1 displays the camera operational controls.

Figure 4-1: Camera Operational Controls

Before you begin any of the following procedures, ensure that your camera has been setup and configured properly. If you need to review camera configuration procedures, refer to *Chapter 2, Camera Setup and Chapter 3, Camera Configuration*.

4.1. Handheld Camera Operational Procedures

The following procedures contain instructions for handheld operation of the camera.

4.1.1. How to Setup the Camera for Handheld Operation

Step 1 Remove the lens receptacle cover and install a C Mount lens.

- ❑ Shorter focal length lens = greater field of view, lower magnification, and larger depth of field.

Step 2 Set the lens iris to the fully open position.

- ❑ Smallest number on the lens aperture ring.

Step 3 Connect power to the camera.

- ❑ AC/DC power supply.
- ❑ Battery pack.

Step 4 Press the **POWER** button – ON (Figure 4-1).

- ❑ After a few seconds, the camera wakes up in record mode.
- ❑ Images are stored in a circular memory buffer.
- ❑ The camera stays in record mode until the **STOP** button (Figure 4-1) is pressed or an **External Trigger** (Table 1-3) is received.

Step 5 Aim camera and focus on subject.

Step 6 Adjust lens iris, record speed, shutter and trigger position as needed to capture desired event.

Step 7 Press **STOP** or **External Trigger** camera to record video.

Use this area to record notes regarding your application.

4.1.2. How to Record an Event

Step 1 After performing camera setup, position the camera to capture an event.

Step 2 Press the **Record** button (Figure 4-1) if the camera is not in the record mode.

Step 3 Focus the lens and adjust the lens aperture setting.

- ❑ Smaller aperture setting = greater depth of field.
- ❑ Greater lens-to-object distance = greater depth of field.

Step 4 After an event occurs, press the **STOP** button (Figure 4-1) or **External Trigger** capture the event and exit the record mode.

- ❑ Depending on your subject, you may want to press **STOP** at the start or middle of your event rather than waiting for the end.

Step 5 If you need to recapture the event, press the **RECORD** button (Figure 4-1) and repeat previous step.

Note:

If a faster moving subject appears blurred, open the lens iris and increase the camera shutter speed (2X, 4X, ...). More light maybe required.

Use this area to record notes regarding your application.

4.1.3. How to Playback an Event Stored in Camera Memory

Step 1 After capturing an event, press the **PLAY** button (Figure 4-1) to observe the stored event.

- Use the **Right PLAY** button to increment frames (played forward); start with Frame 0.
- Use the **Left PLAY** button to decrement frames (played backward); start with Frame 0.

Step 2 Use the **Left / Right SELECT** buttons (Figure 4-1) to increase or decrease the Frames/Second displayed.

Step 3 Images in memory are displayed in a continuous loop until the **STOP** button (Figure 4-1) is pressed.

Use this area to record notes regarding your application.

4.1.4. How to Record Events in Partitioned Memory

Step 1 Toggle the **SETUP** button (Figure 4-1) to select the Memory Menu.

Step 2 Use the **Up/Down SELECT** buttons (Figure 4-1) to select the **TOTAL PARTITIONS** option.

Step 3 Use the **Left/Right SELECT** buttons (Figure 4-1) to choose the number of Memory Partitions (maximum of 16).

- ❑ By default, record starts in memory partition one.
- ❑ Change the **CURRENT PART #** option to start recording in another memory partition (Figure 3-8).

Step 4 Press the **STOP** button (Figure 4-1) to exit the Setup menus.

Step 5 Press the **RECORD** button (Figure 4-1) to begin recording in the designated memory partition.

- ❑ To select another memory partition for recording, change the partition number.

Step 6 Use the **Up/Down SELECT** buttons (Figure 4-1) to select the **CURRENT PART #** floating menu (Figure 3-8). Use the **Left/Right SELECT** buttons (Figure 4-1) to choose the desired memory partition.

Step 7 Press the **RECORD** button (Figure 4-1) to begin recording in the selected memory partition.

4.1.5. How to Save an Event Stored in Camera Memory as an File on the Compact Flash Card

Both Mono and Color Cameras can save images on the CF card in RAW or AVI (uncompressed) formats. In many cases, only a small subset of images will contain the event of interest. To conserve memory space and reduce download time, attempt to save only the event of interest.

Step 1 Open the CF (compact flash) access door and insert a Compact Flash card.

- ❑ When the CF card is inserted correctly, the letters CF appear above the battery icon.

Step 2 Record an event of interest.

Step 3 Stop recording by pressing the **STOP** button or using an external input via the trigger cable. When the camera is stopped it will default to the Play Mode. If desired, use the **SELECT** button to change playback **SPEED** parameter on the LCD screen.

Step 4 Press the forward or reverse **PLAY** buttons to view the image buffer until the beginning frame of the event of interest is displayed. Press the **STOP** button (Ignore pressing STOP if SPEED is set to STEP).

Step 5 Use the **UP** or **DOWN** SEL buttons to highlight the **START** option. Press the **SEL** button to set the first frame of the event of interest to be recorded. The cursor automatically highlights the **STOP** option. The Menu screen shot below shows the layout at this point. The menu option **STOP** will be highlighted.

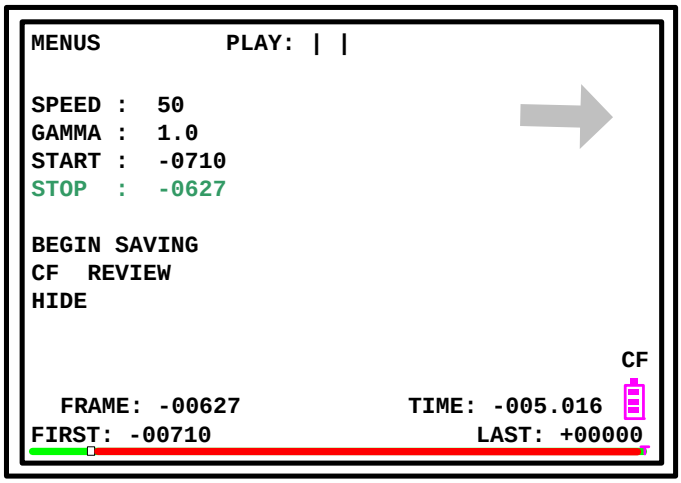

Figure 4-2: Setting Save Limits

Step 6 Press the **FORWARD** or **REVERSE** PLAY buttons to view the image buffer until the ending frame of the event of interest is displayed. Press the **STOP** button (Ignore pressing STOP if SPEED is set to STEP).

Step 7 Press the **SEL** button to set the last frame of the sequence to be recorded. The cursor automatically highlights the **BEGIN SAVING** option. The image buffer bar across the bottom of the display will indicate the sequence of frames to be saved to the CF card in green and those not being saved in red.

Step 8 Press the **SEL** button to save event of interest to the CF card.

Step 9 Multiple sequences can be saved from a single recording.

Step 10 To view stored events on the CF card, select the **CF REVIEW** option. A list of saved files is displayed on the screen.

Step 11 Use the **UP** or **DOWN** SEL buttons to highlight a file to be viewed.

Step 12 Use the **Left/Right** Playback buttons to view the stored video file.

Step 13 Press the **SEL** button to exit CF REVIEW.

Note:

Files downloaded in RAW format represent pure data received directly from the sensor. Unlike AVI files, RAW files will always have Fixed Pattern noise present **(looks like vertical lines in the image)**.

When downloaded to a PC, RAW files require MiDAS player to process them properly and remove the Fixed Pattern noise. The benefit of RAW files is they download faster than AVI files.

- Typically two times faster on a mono camera.
- Typically three times faster on color camera.

Table 4-1: Typical Download Times to CF-Cards

Resolution	# of Frames	Color / Mono	Size	Download Time (Seconds)
320x240	100	Mono	7.5 MB	5
320x240	500	Mono	37.5 MB	25
320x240	1000	Mono	75 MB	50
320x240	100	Color	30 MB*	15*
320x240	500	Color	150 MB*	75*
320x240	1000	Color	300 MB*	150*
640x480	100	Mono	30 MB	34
640x480	500	Mono	150 MB	170
640x480	1000	Mono	300 MB	340
640x480	100	Color	90 MB*	45*
640x480	500	Color	450 MB*	225*
640x480	1000	Color	900 MB*	450*
640x240	100	Mono	125 MB	64
640x240	500	Mono	625 MB	320
640x240	1000	Mono	1.25 GB	640
440x330	100	Color	375 MB*	192*
440x330	500	Color	1.8 GB*	960*
440x330	1000	Color	3.75 GB*	1,920*

*Times and sizes reflect the AVI format. RAW format times/sizes are the same as mono.

4.2. Remote Camera Operational Procedures

MiDAS 4.0 Express is a single window application used to remotely operate a single camera or multiple cameras. MiDAS 4.0 Express is located on the CD ROM that came with your camera.

MiDAS 4.0 Express provides the following:

- A direct interface to Fastec Imaging cameras via the USB interface.
- Features a full size viewfinder window.

Figure 4-3 shows the MiDAS 4.0 Express window. Refer to the *MiDAS 4.0 Express User's Guide* for more detailed information regarding MiDAS 4.0 Express software application.

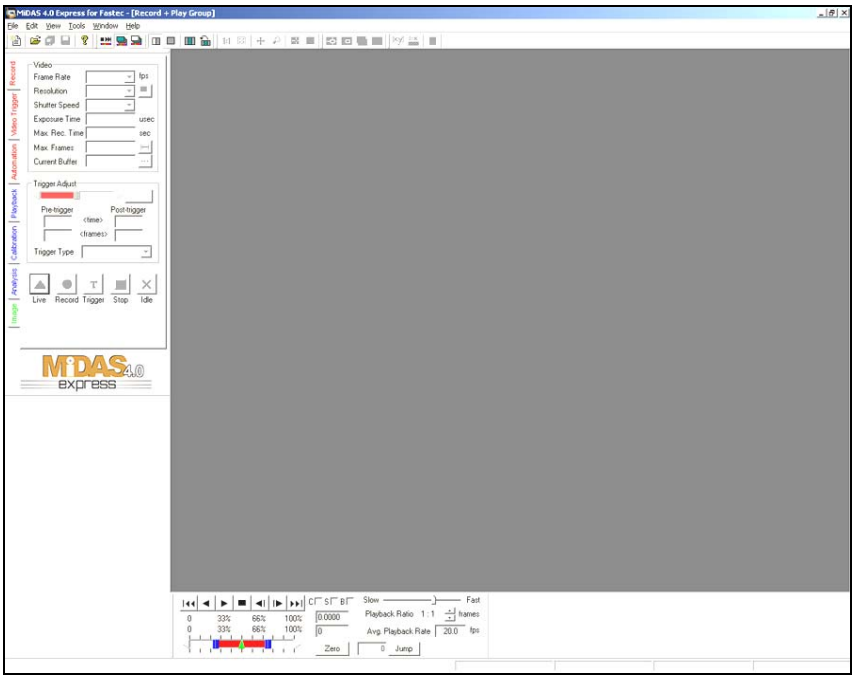

Figure 4-3: MiDAS 4.0 Express Window Buttons and Displays

For information regarding the Interacting with MiDAS 4.0 Express, refer to the following Chapters of the *MiDAS 4.0 Express User's Guide*.

- Recording a Video; Chapter 4.
- Playing Recorded Videos; Chapter 5.
- Image Processing; Chapter 6.
- Saving and Loading; Chapter 7.
- Calculating Velocity and Distance; Chapter 8.

4.2.1. USB Download Times

Table 4.2 provides an area to record USB download times for your camera and computer.

Table 4-2: Typical USB Download Times Non-Compressed and Compressed File

Resolution	# of Frames	Color/ Mono	Size	Download Time (Seconds)	Size	Download Time (Seconds)
			Not Compressed		Compressed	
320x240	100	Mono	29.3 MB	7.7	364 KB	10.8
320x240	500	Mono				
320x240	1000	Mono				
320x240	100	Color	29.3 MB	16.8	210 KB	20
320x240	500	Color				
320x240	1000	Color				
640x480	100	Mono	MB	16.1	736 KB	31.3
640x480	500	Mono				
640x480	1000	Mono				
640x480	100	Color	117 MB	55	578 KB	68
640x480	500	Color				
640x480	1000	Color				
640x240	100	Mono	500 MB	81	1.52 MB	119
640x240	500	Mono				
640x240	1000	Mono				
440x330	100	Color	500 MB	244	1.29 MB	278
440x330	500	Color				
440x330	1000	Color				

Use the area above to record notes regarding your application.

4.2.2. Setting up to Remotely Operate the Camera

Step 1 Install MiDAS 4.0 Express software on your computer.

Step 2 Connect power to the camera.

Step 3 Using a USB cable, connect the camera to your computer USB port.

Step 5 Press the camera **POWER** button - ON.

If the MiDAS 4.0 Express software was installed correctly, The camera appears as a mass storage device and typically opens a window like the example shown below when connected.

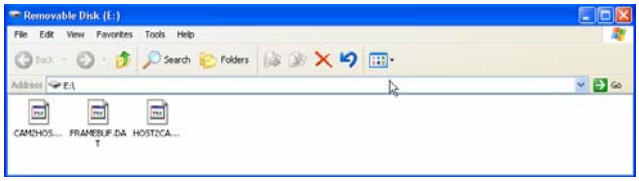

Figure 4-4: Camera Displayed as a Removable Drive

Step 6 Position and focus the camera to capture an event.

Use this area to record notes regarding your application.


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5. Index


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