

## EO CAMERA OPERATING INSTRUCTIONS

### Table of contents

- A. List of system components.
- B. General description of system.
- C. Controls and displays.
- D. Normal operating procedures.
- E. Extended functions.

## A. LIST OF SYSTEM COMPONENTS

The following items comprise the complete EO camera system as delivered:

### Camera:

- a. Canon F-1 body
- b. Canon AE finder
- c. Electronic imaging back
- d. Flat cable
- e. Canon 50mm f1.2 L lens
- f. Canon motor drive
- g. Canon NiCd battery pack
- h. Canon NiCd charger
- i. Modified SE focusing screen
- j. Canon AE focusing screen
- k. Canon data back
- l. Infrared blocking filter
- m. Skylight filter
- n. Strap

### Recorder:

- a. Recorder unit
- b. Recorder case

### Archive:

- a. Archive unit
- b. AC line cords (4)
- c. DC car lighter cord
- d. 8mm video cassettes
- e. Archive and accessory case

## B. General description of system

The EO camera system includes three major components:

1. The camera consists of a Canon F-1 body, Canon lens, a modified focusing screen, an electronic imaging back, and optionally a Canon motor drive. Most Canon mount lenses, accessories, flashes, etc. may be used with the system just as they would be used with film. The imaging back places a charge coupled device (CCD) image sensor in the focal plane of the camera. The camera body may be used with film by replacing the electronic back with the supplied Canon data back.
2. The Recorder unit is attached to the camera back by a small cable and is normally carried in a shoulder bag. The recorder converts the images exposed on the CCD to digital information and stores that information on an internal disk drive.
3. The Archive unit may be attached to the Recorder unit to transfer image information from the disk drive to tape cassettes for later use. The archive also contains the battery charger for the system. The battery charger will operate from any international AC line and from an automobile lighter.

### C. Controls and displays

Camera - the Canon F-1 body provides a number of controls and indicators which are necessary for EO camera operation. The Canon instruction books should be reviewed to familiarize the operator with normal operation of the camera before attempting to use the EO system.

Imaging back - Three LEDs on the imaging back provide all the status information normally required when taking pictures. They indicate the following:

Green LED blinking - system is ready to take pictures.

Yellow LED blinking - the system is still ready but the disk is nearly full (10 images left) or the battery is nearly exhausted.

Red LED blinking - the battery is exhausted or the disk is full and the camera will not take pictures.

When the yellow or red LED blinks, check the control panel display to determine the reason.

Recorder - The recorder control panel consists of a liquid crystal display screen and three momentary toggle switches. The functions of the switches and the information displayed vary and are controlled by the internal computer.

The three toggles provide six momentary actions (left toggle up, left toggle down, bottom toggle left, bottom toggle right, right toggle up, right toggle down). Not all of the toggle actions are effective all the time. The display indicates which toggles are active by triangular arrows. For example, if an arrow pointing up is located near the left side of the display, the left toggle up action will do something. What it does is either indicated by words on the display or otherwise implied.

The various functions of the control panel appear as a series of screens in several major groups. The bottom and right toggles are used to move from screen to screen in a circular sequence. From the main status screen, the right toggle allows movement up or down to the clock and timer screens; the bottom toggle allows left or right movement to the 6 groups of special functions. These are "System Functions," "Disk Functions," "Tape Functions," "Special Functions," "Cooling Functions," and "Imaging Functions." When one of these screens is visible, the right toggle may be used to move up or down through the various functions within each group. Since everything is circular you always return to the group screen after moving through all the screens in a group. (this is easier done than described; try using the bottom and right toggles to move through all the screens).

NOTE: Only the left toggle ever actually activates a function which affects the system. The right and bottom toggles may be used carelessly to look at various screen with no danger of messing anything up or losing images.

Main status screen - this screen provides a variety of information about the system. A typical screen is shown and described below:

Mode indicator  
Battery indicator  
Image number  
Seconds indicator  
Time

13:45 [00234] S  
x0/23 Ready

Camera indicator  
Buffer image count  
Disk indicator  
Disk image count  
Message display

Time - The first 5 characters indicate the current time of day (13:45) in 24 hour format. This time may be set via the Clock screen.

Seconds indicator - the small box following the time moves up and down each second, and provides a simple "system alive" indication.

Image number - the 5 digit number enclosed in square brackets ([00234]) is the sequential or serial number of the NEXT image to be acquired. This number will increment as soon as an exposure is made and is never reset. The image number is used as part of the image file name when image data been downloaded to a computer.

Battery indicator - the next symbol indicates the condition of the internal battery. When the battery is nearly exhausted, the camera will not operate and the red LED will flash.

Mode indicator - the next letter indicates the internal mode of the recorder as follows:

S - standby, ready for camera operation.  
F - flush CCD, ready for exposure.  
E - expose CCD, the shutter is open.  
A - start archive operation.  
O - open archive door.  
L - load archive tape.  
I - start recording image.  
H - record image header.  
D - read image data from disk.  
T - write image data to tape.  
Z - write end of tape mark.  
U - unload tape.  
Q - archive operation complete.

These indications do not require operator response, but are provided primarily for troubleshooting and may be safely ignored.

Camera indicator - this symbol tells what the recorder thinks the camera is doing. An "x" indicates that the camera meter is off. A box indicates that the meter is on (shutter button has been partially depressed). A box with one side open indicates that the shutter is open. This indicator is also intended for troubleshooting or as a quick verification that the camera body interface is working.

Buffer image count - this single digit indicates the number of images in the image buffer waiting to be recorded on the disk. The buffer holds 6 images.

Disk indicator - this symbol tells what the disk is doing. A "/" indicates that the disk is not ready (stopped or not up to speed). A "-" indicates that the disk is ready. An arrow indicates that data is being transferred from the buffer to the disk.

Disk image count - two digit counter indicates the number of images on the disk. This number increases as images are transferred from the buffer and decreases as they are archived. The disk holds 60 images.

Message display - this area displays various messages indicating status of the system or actions the operator should perform. The following messages are displayed:

- Ready - the system is ready to capture images.
- Exp - the shutter is open (exposure).
- LOW BATT - the battery is exhausted and the camera disabled.
- DISK FULL - the disk is full and no more images may be captured.
- CHECK CABLE - the camera/recorder cable is not connected properly.
- Timer - the automatic timer is set.
- Timer ON - the timed imaging sequence has started.

The following messages only appear when the archive is attached:

- Test - the archive recorder is performing a power on self test.
- LOAD TAPE - the system is waiting for the operator to load a tape.
- Busy - the archive process is underway.
- Done - all images have been recorded on the tape.
- ERROR - a problem has occurred when archiving and the process stopped.
- ABORT - the archive process has been stopped by the operator.

Archive - the archive has no controls or displays required for normal system operation. Archive functions are controlled through the recorder control panel.

## D. Normal operating procedures

### Taking pictures

The EO camera operation when actually taking pictures is much the same as using a film camera. The camera body serves to expose the electronic image sensor (CCD) to the light from the scene. The rest of the system then records the image information automatically. The operator must be primarily concerned with exposure, focus and framing just as when using film.

To prepare to take pictures:

1. Ensure that the imaging back, modified focusing screen, and lens are properly attached to the camera body. Attach the motor drive if needed.
2. Connect the flat cable to the camera back and to the recorder. The cable is reversible. Insert the plugs on the cable squarely and CAREFULLY into the camera and recorder sockets.

To turn the camera on:

1. Press the left toggle UP momentarily and the "Enter Code" screen will appear.  
Enter the security code (3,4,6,1) by pressing the appropriate toggles one at a time. When the code has been correctly entered the main status screen will appear.
2. If the main screen displays the "Ready" message, you are ready to take pictures. If the "LOW BATT" message is displayed, charge the battery as described below. If the "DISK FULL" message is displayed, the disk is full of images and should be archived on a tape as described below. If the "CHECK CABLE" message is displayed the camera to recorder cable is not connected properly.

To turn the camera off:

1. When the display shows the main status screen, push the left toggle down and hold until the display blanks.

NOTE: The camera uses little power when not actually recording pictures but will discharge the battery in about 12 hours. To conserve battery power, turn the system off when you will not be using it for some time.

To take a picture:

1. Set the camera ASA according to the lighting as follows:

Daylight, fluorescent with IR filter - 200 ASA  
Incandescent or no IR filter - 800 ASA

NOTE: These ASA numbers are approximate and may result in blooming or under exposure in some lighting situations. A very useful exposure histogram display is provided (see the extended functions) which indicates whether an image is over or under exposed immediately after shooting. This display may be used to select a better ASA setting under unusual lighting.

2. Set the camera for manual or automatic exposure as desired following the Canon instruction book.
3. Wind the camera, or use the motor drive as described in the Canon book.
4. Focus CAREFULLY, particularly if using a large aperture (low f number).
5. Shoot. The image will be recorded automatically. If you use the motor drive and take many pictures rapidly, the camera will pause when the buffer is full and then take a new picture as each image is recorded on the disk.

IF THE CAMERA DOESN'T WORK:

First, check the LED's on the camera back.

If the green or yellow LED is blinking, the electronics are OK, but the camera body won't let you shoot. Check for the following:

- camera not wound?
- battery cord not connected securely to the front of the camera body?
- lens set to "A" but no motor drive?
- both lens and shutter dial set to "A"?

NOTE: The F-1 provides two modes of automatic exposure. Setting the shutter speed dial to "A" sets the camera for aperture-priority operation (you set the aperture, the camera sets the shutter speed). This mode is always available. Setting the lens aperture ring to "A" sets the camera for shutter-

priority (you set the shutter speed, it sets the aperture). This mode ONLY works with the motor drive attached. Setting both controls to "A" is illegal and the camera will not operate. Refer to the Canon manual for more information.

If the red LED is blinking, check the recorder display. "LOW BATT" or "DISK FULL" conditions must be corrected as described below.

## Archiving Images

The Archive allows the images stored on the disk drive in the Recorder unit to be copied to a removable tape cassette for transfer to a workstation for enhancement and display. The Recorder is attached to the top of the Archive unit and when turned on, will automatically transfer all the images on the disk to the tape and eject the tape. When the Recorder is on the Archive, the camera will not function.

To archive images:

1. Turn the recorder off (display screen blank).
2. Remove the dust covers from recorder and archive connectors.
3. Position the recorder on the archive so that the connectors are aligned and rest two recorder screws in the black sockets on the archive. Press down firmly on the connector end of the recorder to mate the connectors.
4. Turn the recorder on (security code must be entered). The archive will perform a self test for about 70 seconds and then open the tape door. The message "LOAD TAPE" will appear on the display.
5. Insert an 8mm video cassette into the tape drive with the label side up. The ERASE switch on the cassette must be ON (to allow writing on the tape). The tape need not be blank, but any images or other information on the tape will be written over when archiving!
6. Close the door of the tape drive. After a few seconds, the display will indicate "Busy" and image transfer will begin. The disk image count on the display will decrement as each image is transferred. When all images are on the tape, the display will indicate "Done" and the tape will eject.

If any problems occur in the automatic transfer, the display will indicate "ERROR" and the tape will be ejected. Turn the recorder off and back on. When the "LOAD TAPE" message is displayed, insert a new tape and close the door.

If you wish to stop archiving before all images have been transferred, use the "abort archive" function in the "system functions" menu (see control panel operation section).

7. Remove the tape cassette.
8. Turn the recorder off.
9. Lift the recorder carefully off the archive (or leave the units mated if charging the batteries).
10. Replace the connector dust covers.

## Battery Charging

The batteries in the Recorder and Archive units are charged by two chargers in the Archive. One charger operates from AC line power and will work from any international power (90 to 250 volts, 44 to 440 hertz). The other charger operates on DC power from 10 to 20 volts, normally supplied by a car battery through the cigarette lighter socket. The Archive battery may be charged by itself or both Recorder and Archive batteries may be charged simultaneously. The system need not be turned on to charge the batteries.

To charge battery from AC line:

1. Select the line cord with the correct plug for the available power and connect it to the AC input socket on the Archive and to the AC outlet.
2. Attach the Recorder unit if charging both batteries.

To charge battery from DC power:

1. Connect the DC power cord to the connector on the Archive and to the car lighter socket (must be 12 volt negative ground system!).
2. Attach the Recorder unit if charging both batteries.

NOTE: Both batteries may be fully charged in about 3 hours. The main status screen battery indicator will show a full condition when charging the battery and is not useful as long as the charger is operating.

## E. Extended functions

The following paragraphs describe the various extended control functions available through the recorder control panel. Most of these functions will never be needed for normal system use, but it is worthwhile to familiarize yourself with what is available.

Timer - This screen is used to set the automatic timer for unattended photography. This timer allows a specified number of images (up to 60) to be taken at specified interval (5 to 600 seconds) starting at a specified time (in the next 24 hours). The motor drive must be used, unless you only want to take one picture.

To use the timer:

1. Set the start time. Use the bottom toggle to position the underline cursor at the hour and then the minute. Use the left toggle to increase or decrease the number.
2. Set the interval. Use the bottom toggle to position the cursor at the "s" number and use the left toggle to increase or decrease the interval.
3. Set the number of images. Position the cursor at the "OFF" and use the left toggle to set the number of images to be taken.
4. Return to the main status screen (using the right toggle) and verify that the message "Timer" is displayed.
5. Attach the motor drive and set it to "L".
6. Depress the camera shutter release and hold it while moving the camera control lever from "A" to "L". This will lock the button down allowing the camera to take a picture when the system powers it up.

NOTE: Be sure to release the shutter button (by setting the lever to "A") before turning the timer off. Otherwise the camera will start taking pictures.

To remotely control the camera:

1. Set the number of images to "0".
2. Return to the main status screen (using the right toggle) and verify that the message "Timer" is displayed.
3. Attach the motor drive and set it to "L".
4. Depress the camera shutter release and hold it while moving the camera control lever from "A" to "L". This will lock the button down allowing the camera to take a picture when the system powers it up.
5. Press the left toggle up to take a picture.

Clock - This screen displays the current time and date maintained by the internal clock. It also provides for setting the time and date. To set, use the bottom toggle to move the underline cursor left or right to the number you wish to change. Then use the left toggle to increase or decrease that number. Note that the date is in year/month/day format.

#### System Functions:

Auto Off / Power On - This switch controls the auto power off function in camera mode. In AUTO OFF position, power to the imaging system and disk drive will be turned off automatically after a short period with no camera activity. In the POWER ON position, power to the system remains on continuously (This will drain the battery in about 1 hour). The POWER ON function is useful when taking many pictures quickly to prevent the delay caused by disk startup.

Rec Temp / Battery - This screen displays the internal temperature of the portable recorder in degrees centigrade and the battery voltage. If the archive is attached, the battery voltage is that of the combined recorder and archive batteries.

Clear Buffer - This function clears the RAM buffer of images which have not yet been recorded on the disk.

Reset micro - This function resets the recorder microcomputer and reinitializes the system firmware. These functions are useful for recovery from problems and should not normally be needed.

Abort Archive - This function terminates the archiving process before all the images on the disk have been transferred to tape. If data transfer has started, the image being transferred will be completed before aborting, so the tape will be usable. Images remaining on the disk may be archived at a later time.

Restore Disk - This function returns the disk to its condition prior to the beginning of the last archive operation. Images which were copied to tape are still present on the disk and this function causes the system to recognize them. It is not possible to restore images after a new image is acquired with the camera. This function may also be used to recover images after the clear disk function has been used.

#### Disk Functions:

Clear Disk - This function deletes all images on the disk. The image data is still present on the disk, but the system will not archive them and will write over them if new images are acquired. This function may be reversed using the Restore Disk function if no new images have been acquired.

Clr Last Img - This function deletes the last image recorded on the disk.

Test Disk - This function performs a self test on the disk drive if the disk is running. If the test is successful, the display will indicate "OK" after a few seconds.

Format Disk - This function initializes all disk sectors. In doing so, it writes fixed data over the entire disk and checks for bad sectors. This function is useful for cleaning image data from the disk for security purposes. System power must be on.

Start Disk - This function starts the disk drive motor if it was stopped by the stop disk function. System power must be on.

Stop Disk - This function stops the disk drive motor if it was running.

Write Disk - This function copies the data in a reserved area of the RAM buffer to a reserved area of the disk. Disk must be running.

Read Disk - This function copies the data in the reserved disk area to the reserved RAM buffer area. Disk must be running.

#### Tape Functions:

Erase Tape - This function erases an entire tape cassette starting at the present tape position.

Unload Tape - This function rewinds and ejects the tape cassette.

Filemark - This function records a filemark on the tape.

Rewind Tape - This function rewinds the tape to the logical start point.

Space +1 - This function spaces forward to a filemark.

Space -1 - This function spaces backward to a filemark.

Write Tape - This function copies the data in the reserved RAM buffer area to the tape.

Read Tape - This function copies data from the tape to the reserved RAM buffer area.

#### Special Functions:

Hex - This screen provides access to the memory space of the microcomputer.

Disk Image - This screen displays the image number of each image on the disk. Images which have been cleared from the disk or archived but are still present will be appear.

Bfr Image - This screen displays the image number of each image in the RAM buffer. When system power is off, all images in RAM are lost and the image number displayed is 00000.

Start Clock - This function starts or restarts the real time clock and calendar. The date and time will be set to a default value.

Stop Clock - This function stops the real time clock and calendar. This is useful to preserve the clock battery (separate from the system battery) if the recorder will not be used for several months.

Clock adj - This function allows the speed of the real time clock to be adjusted. Each step will add or subtract about 5 seconds per month.

Write Bfr - This function copies data from the microcomputer memory to the image buffer.

Read Bfr - This function copies data from the image buffer to the computer memory.

#### Cooling Functions:

Cooling On / Cooling Off - This switch enables or disables the CCD cooler. Cooling should normally be left on, but may be turned off to extend battery life in the Ready mode.

Cam Temp - This display indicates the temperature inside the camera back in degrees centigrade.

Cam Hum - This display indicates the relative humidity inside the camera back in percent.

CCD Temp - This display indicates the temperature of the CCD image sensor in degrees centigrade.

Dew Temp - This display indicates the calculated dew point temperature inside the camera back. The CCD temp will be kept several degrees above this temperature to prevent condensation on the CCD window.

Cooler - This display indicates the voltage being supplied to the CCD cooler.

## Imaging Functions:

**Histogram** - This display shows a simple histogram of the pixel values of the last image acquired. The pixel values are divided into 12 ranges and the percent of the total falling within each range is shown by a bar graph. A line indicates that no pixels fell in that range. A sample of the image pixels, evenly distributed over the image area, is used to produce this histogram.

A properly exposed image will produce a histogram with several bars over the range, rather than a few large bars at one end or the other. Any bars in the last 2 or 3 positions are probably saturated image portions which will cause blooming. In this case, a higher ASA should be selected.

**Pixel** - This display indicates the numeric value of individual pixels in the last image acquired.

The left and bottom toggles may be used to select the vertical and horizontal coordinates of the desired pixel. The pixel value is displayed as a number from 0 to 255 (8 bit resolution). This display works only when system power is on.

**Pre** - This display indicates the offset voltage applied prior to the Log amp.

**Post** - This display indicates the offset voltage applied after the Log amp.

**Video** - This display indicates the dark video signal voltage at the start of image transfer.

**Capture Image** - This function will transfer one CCD frame to the buffer.

**CCD Clk Mode** - This switch allows the horizontal and vertical CCD clocks and the dark sample signal to be controlled manually for testing.