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APPLICATION NOTE

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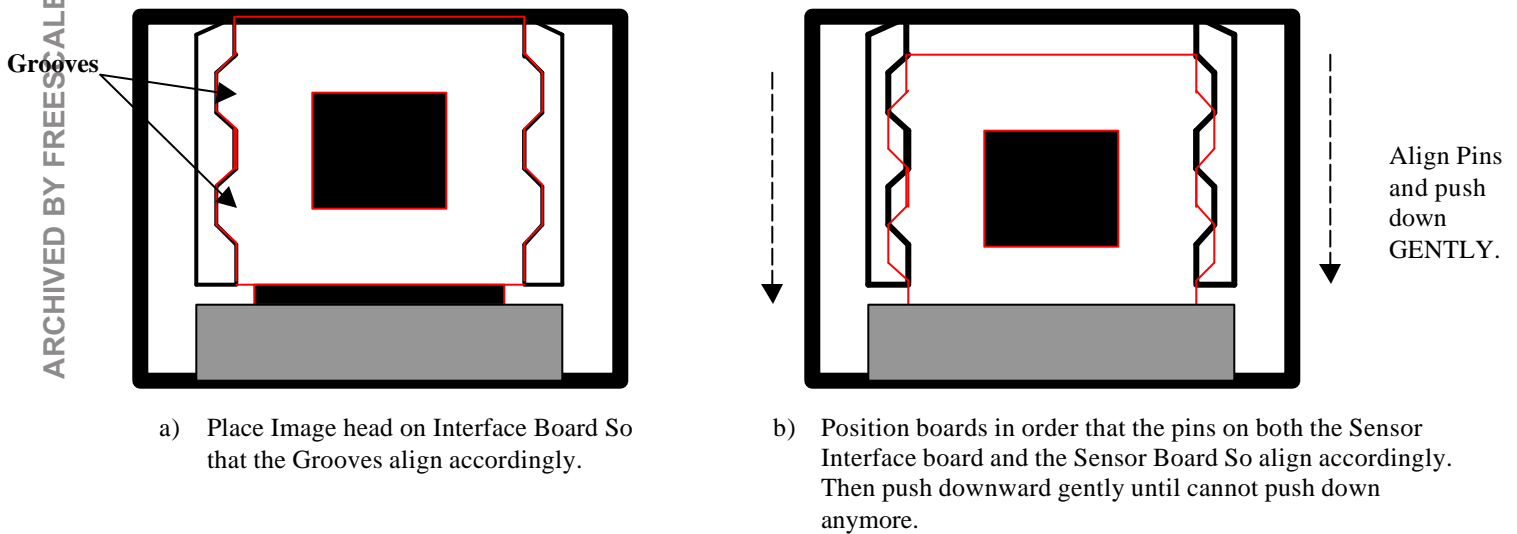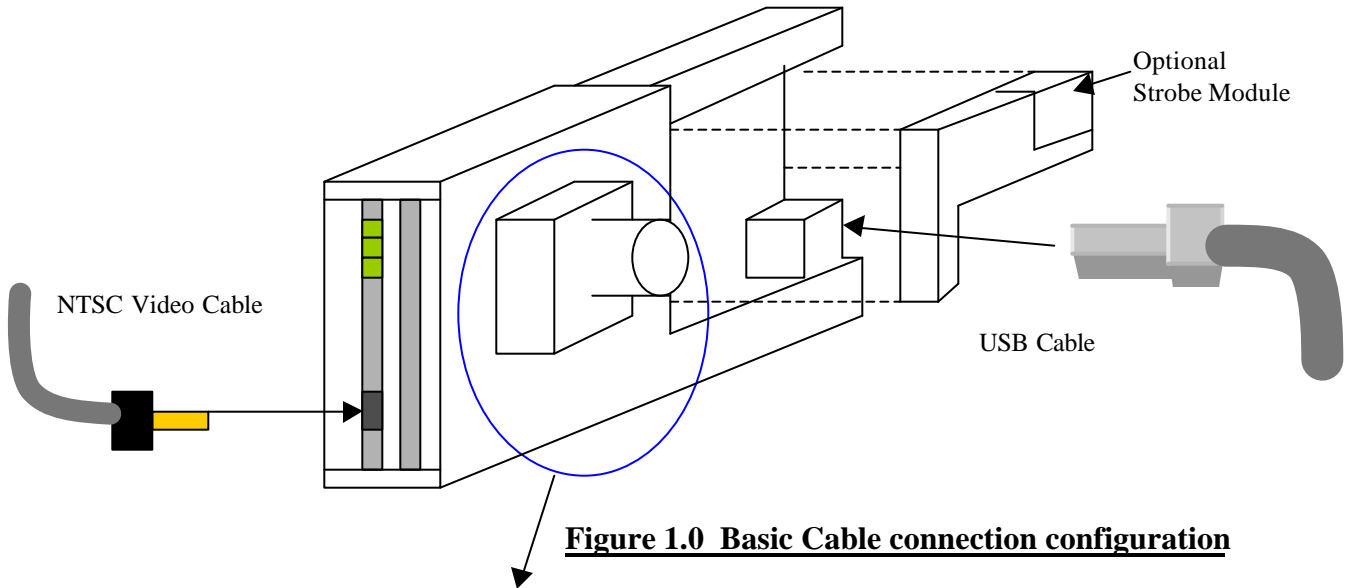*ImageMOS™*

Roadrunner
Digital Camera System

USER MANUAL

Rev 1.2

Motorola
Image Capture Operation
Chandler, AZ

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Revision 1.2 – 05/06/01
This document contains information on a new product. Specifications and information herein are subject to change without notice

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1.0 HardWare Setup

Optional
Strobe Module

NTSC Video Cable

USB Cable

Figure 1.0 Basic Cable connection configuration

Grooves

Align Pins
and push
down
GENTLY.

a) Place Image head on Interface Board So
    that the Grooves align accordingly.

b) Position boards in order that the pins on both the Sensor
    Interface board and the Sensor Board So align accordingly.
    Then push downward gently until cannot push down
    anymore.

Figure 1.1 Image Head Mounting

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1.1.1 Power

Power is supplied to the system via 3 x 1.5 Volt AA Batteries. The system uses a linear voltage regulator to supply the system with 3.1V to 3.8V @ ~250-400mA. Please don't reverse the batteries – No protection!!.

1.1.2 Video

This system is capable of viewing a still image on a NTSC monitor through a sub mini micro stereo connector on the side of the system. The video is compatible with NTSC (American Television) and has capabilty for PAL as well. A 75 ohm cable is supplied with the system for connection to a TV/Monitor.

1.1.3 Optics

The system has the ability to use 10mm, 12mm and "C" mount optics. This is done by using one of 3 different optic housing that bolts to the main PCB. The system comes equipped with 12mm fixed focus plastic optic. "C" mount optic or additional fixed focused optic can be requested from the factory.

(For more Info – refer to Optical application Note @ www.motorola.com/adc/imaging)

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1.2 Button Layout/Description

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TOP VIEW
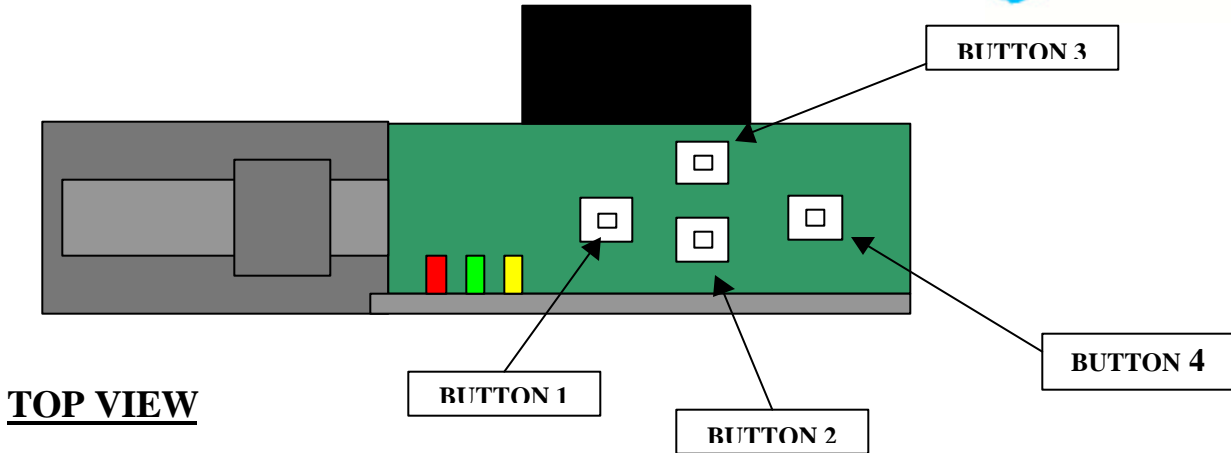
Figure 1.1 Roadrunner Button Layout

1.2.1 Camera Modes

There exists currently 3 modes in which the Roadrunner system can currently run :
a) **Still Camera mode** – this mode allows for taking of pictures.
  - **to be in this mode, both the USB and the Video cable have to be DISCONNECTED from the camera.**

b) **NTSC Video mode** –this mode allows for viewing of pictures taken as well as programming of certain different logic parameters while the camera is connected to NTSC Video monitor.
  -**to be in this mode, ONLY the Video cable should be CONNECTED to the camera.**

c) **USB Mode** -this mode allows for viewing of pictures taken as well as programming of certain logic parameters via the TWAIN Driver menu while the camera is connected to a computer via USB.
  -**to be in this mode, ONLY the USB cable should be CONNECTED to the camera.**

1.2.2 SWITCH/BUTTON DESCRIPTION

A) IN Picture Mode: (No USB or Video cable connected in Camera)

i) BUTTON 1 - Power Button.

ii) BUTTON 2 - CURRENTLY UNUSED in Camera mode.

iii) BUTTON 3 - Strobe/Flash On/Off Switch in Camera mode.

iv) BUTTON 4 - Shutter Button (ie. Click to take picture).

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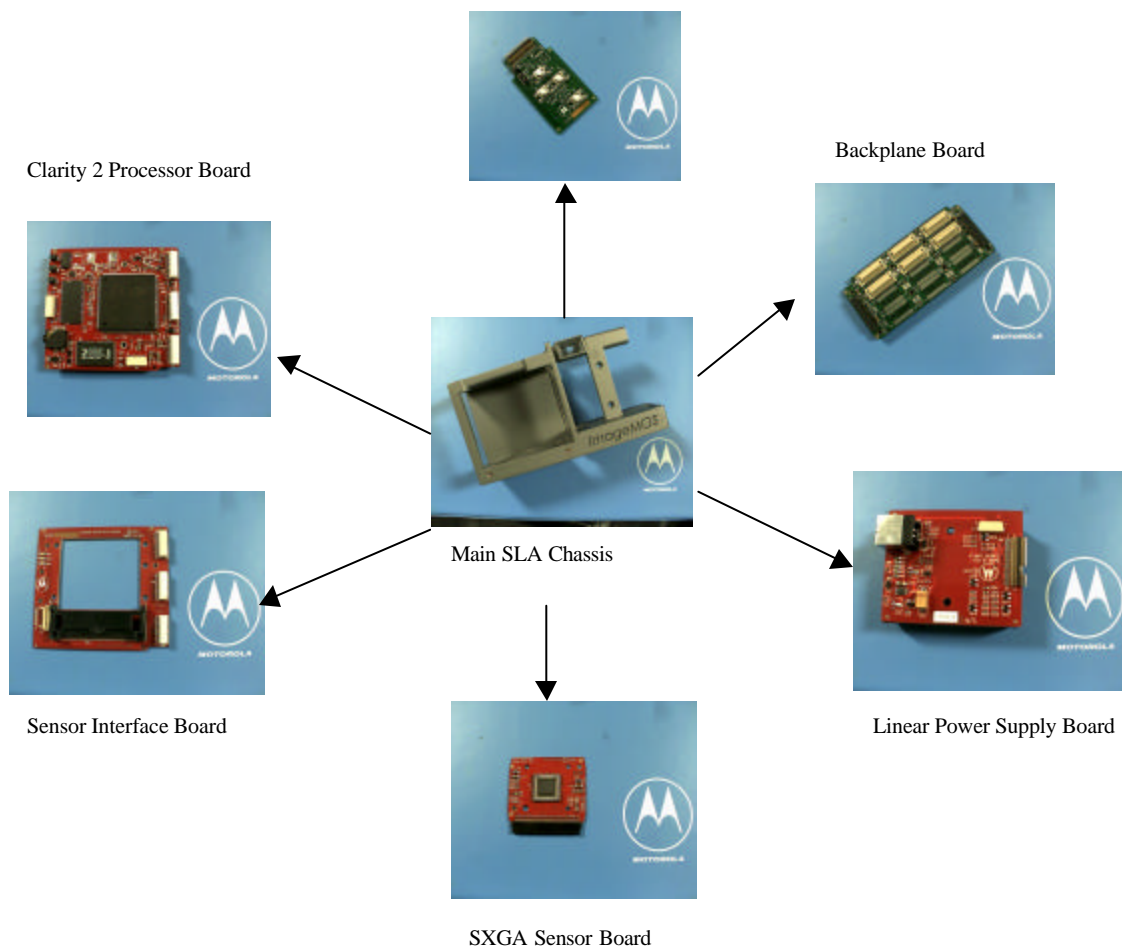**B) IN NTSC Video Mode: (Only Video Cable connected to Camera)**

i) BUTTON 1   - Power Button.

ii) BUTTON 2   - CURRENTLY UNUSED in NTSC Video Mode.

iii) BUTTON 3 - Menu Scroll button (ie. UP and DOWN scroll keys).

iv) BUTTON 4 - Menu Select / Enter button.

C) IN USB Mode: (Only USB Cable connected to Camera)

While in USB mode, all buttons on the Roadrunner system are INACTIVE. All camera functions are controlled via the USB TWAIN Graphical User Interface.

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1.2.3 Roadrunner Individual Boards:

Backplane Board

Clarity 2 Processor Board

Main SLA Chassis

Sensor Interface Board

Linear Power Supply Board

SXGA Sensor Board

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1.3- LED DISPLAY

1.3.1 Location of the LED Clusters on the Roadrunner:

Each LED cluster on the Roadrunner system contains 3 LEDs. They can be found on 3 different locations on the camera:
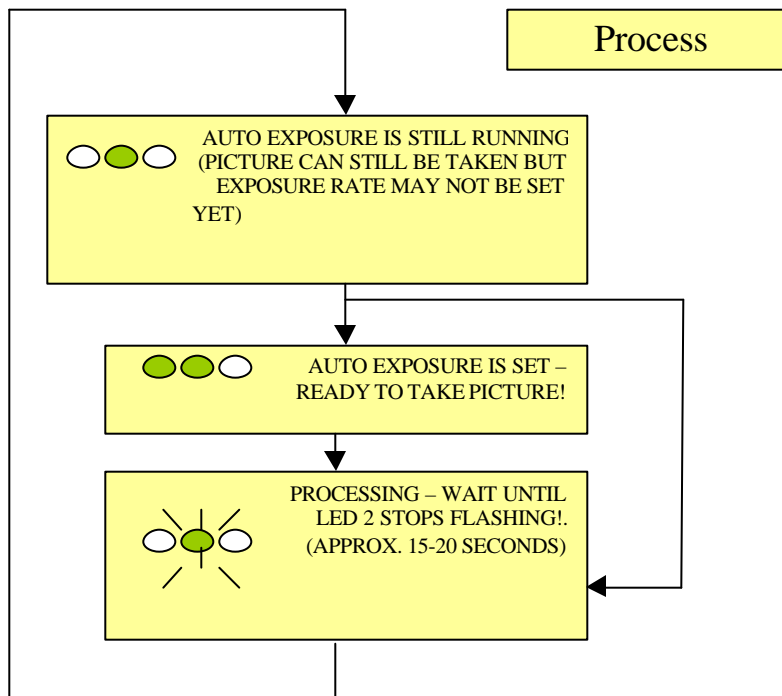i)   The Button Board
ii)   The Processor Board *
iii)   The Sensor Backplane Interface Board.

* Note – On some Roadrunner Camera systems the LED cluster on the Processor board will be depopulated to conserve power.
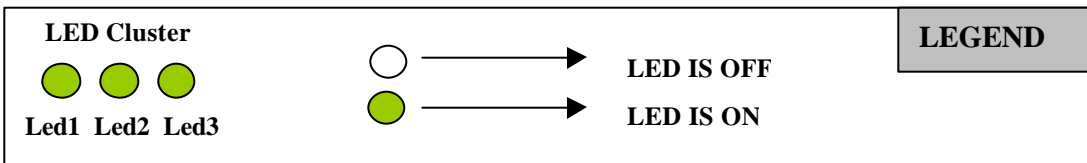
LED Cluster

Led1 Led2 Led3

LED IS OFF

LED IS ON

LEGEND

The following is a LED Lighting/Flashing Pattern flowchart explaination: (Explains how to determine what process is going on in the CAMERA based on what LEDS are ON or FLASHING)

NOTE!! This pattern is applicable ONLY when Strobe/Flash is ON. For more info on the Strobe/Flash – see section 1.4.
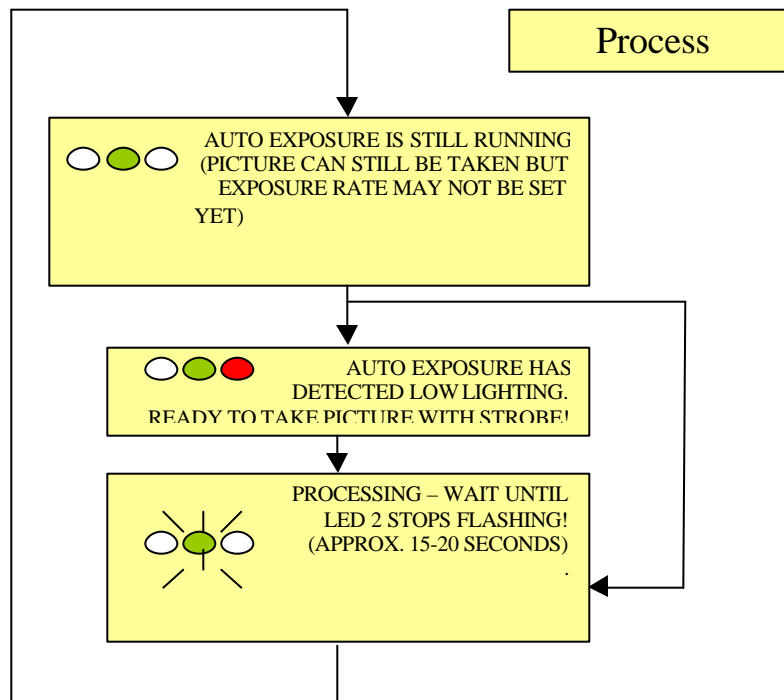
Process

AUTO EXPOSURE IS STILL RUNNING (PICTURE CAN STILL BE TAKEN BUT EXPOSURE RATE MAY NOT BE SET YET)

AUTO EXPOSURE IS SET – READY TO TAKE PICTURE!

PROCESSING – WAIT UNTIL LED 2 STOPS FLASHING!. (APPROX. 15-20 SECONDS)

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1.4 Strobe Unit (Optional)

The Strobe unit on the Roadrunner allows for the capturing of images in low lighting enviroments. In order to use the strobe unit on the Roadrunner:

a)   Version 5.005 and up of Firmware has to be loaded/programmed onto the Roadrunner system. (For more info on firmware downloads – refer to sections 1.5.2 and/or 3.3.4,

b)   The Strobe mode must be switched on by either the TWAIN menu (see "FLASHMODE" – Section 3.3.3) or by pressing Button 3 until LED 3 illuminates.

The following is a LED Lighting/Flashing Pattern flowchart explaination: (Explains how to determine what process is going on in the CAMERA based on what LEDS are ON or FLASHING)

NOTE!! This pattern is applicable ONLY when Strobe/Flash is ON.

Process

○ ● ○ AUTO EXPOSURE IS STILL RUNNING (PICTURE CAN STILL BE TAKEN BUT EXPOSURE RATE MAY NOT BE SET YET)

○ ● ● AUTO EXPOSURE HAS DETECTED LOW LIGHTING. READY TO TAKE PICTURE WITH STROBE!

○ ● ○ PROCESSING – WAIT UNTIL LED 2 STOPS FLASHING! (APPROX. 15-20 SECONDS)

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1.5 Compact Flash

The Roadrunner has the capability of storing images onto a Compact Flash card instead of its internal Flash memory. The advantage of this is increased storage capacity.

The Roadrunner has been tested and proven to work with Compact Fash cards in the range of 8Mbyte-64Mbyte.

1.5.1 Saving Images Onto Compact Flash:

Inserting a Compact flash card into the Roadrunner system automatically causes the system to automatically save all images onto the Compact Flash card. If the user requires that the images be stored on the Roadrunner camera systems memory, ensure that the card is removed from the Roadrunner system.
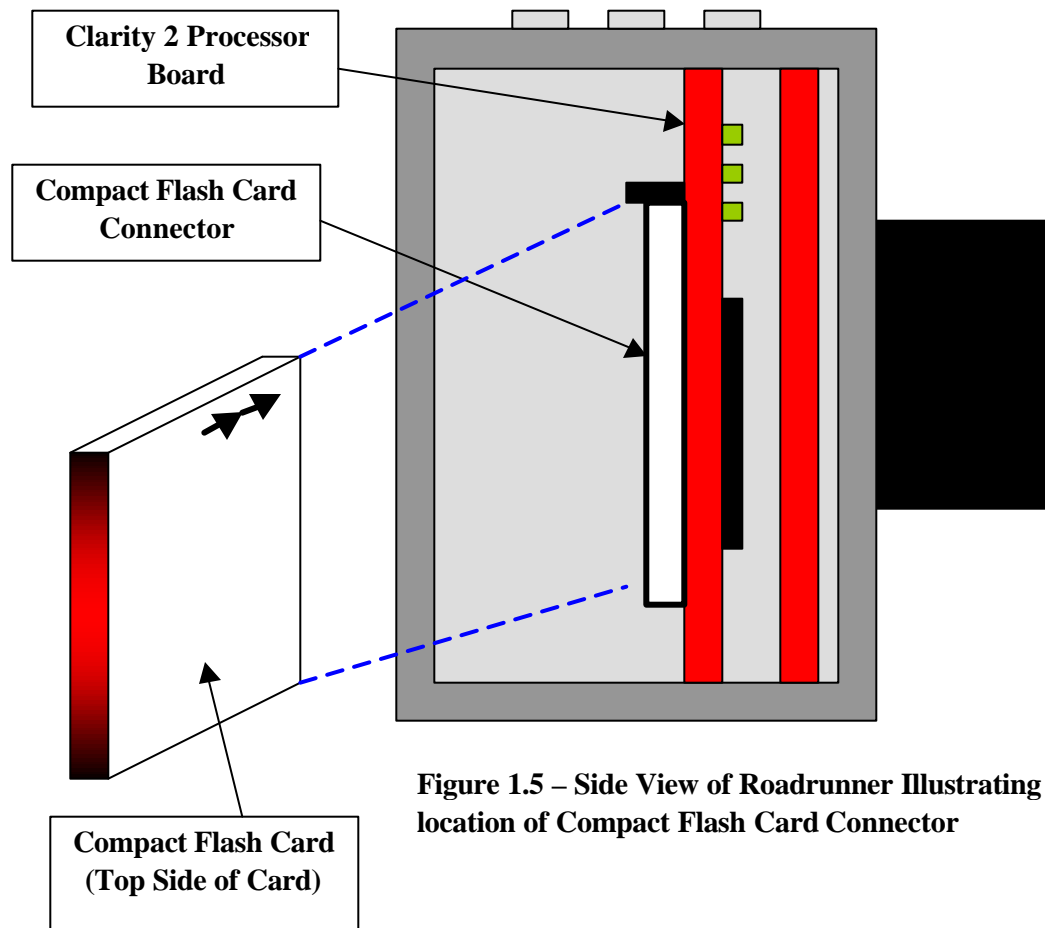
Clarity 2 Processor Board

Compact Flash Card Connector

Compact Flash Card (Top Side of Card)

Figure 1.5 – Side View of Roadrunner Illustrating location of Compact Flash Card Connector

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1.5.2 Loading Camera Firmware Via Compact Flash Card

NOTE!! In order for this function to work – please ensure that the firmware version running on the Roadrunner system is Version 5.004 and higher

[NOTE!! For instructions on Loading Camera Firmware VIA USB – see Section 3.3.4]

In order to load a Binary firmaware (.BIN) file onto the Roadrunner system via Compact Flash Card the following procedure must be followed:

Compact Flash Firmware Update Procedure
     (IMPORTANT - Please follow each step to its completion)

   NOTE!! Make sure that the battery in the camera is new. If battery dies during firmware update, the FLASH Memory will be permanently corrupted.

   Step 1) Copy the firmware update file (*.bin) to the Compact Flash Card.
   Step 2) Turn on the power on the camera (USB cable should not be attached)
   Step 3) Plug in Compact Flash Card
   Step 4) LED 2 on the Roadrunner system should flash as a rapid pace (see Section 1.3). This indicates that the Roadrunner has identified a Firmware binary file on the Compact Flash card and has started the update process.
   Step 5) Wait for at least 3 mins or until LED 1 on the Roadrunner has illuminated again.
   Step 6) Cycle the Power on the Roadrunner.
   Step 7) To ensure that the update has taken place – connect the camera to the PC via USB. Then via the TWAIN menu (see section 3.2) - Click on "Check status" to verify connectivity between the camera and PC via the USB. (If status indicates no connection – check cable connection and try again)
      NOTE!! If no connection cannot be obtained between the camera and PC, DON'T GO ANY FURTHER.

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2.0- NTSC Video Mode

This mode is used to view the pictures stored in the camera`s memory. The camera can also be programmed in this mode.

When the camera is turned on and is hooked into a NTSC monitor via a NTSC cable (i.e. is in Graphical User Interface mode – See section 1.2), the following menu is displayed on the monitor (see Figure 2.0 below):

NOTE!! IF THE COMPACT FLASH CARD IS INSERTED INTO THE ROADRUNNER – ONLY FILES/IMAGES CONTAINED ON THE COMPACT FLASH CARD WILL BE DISPLAYED.
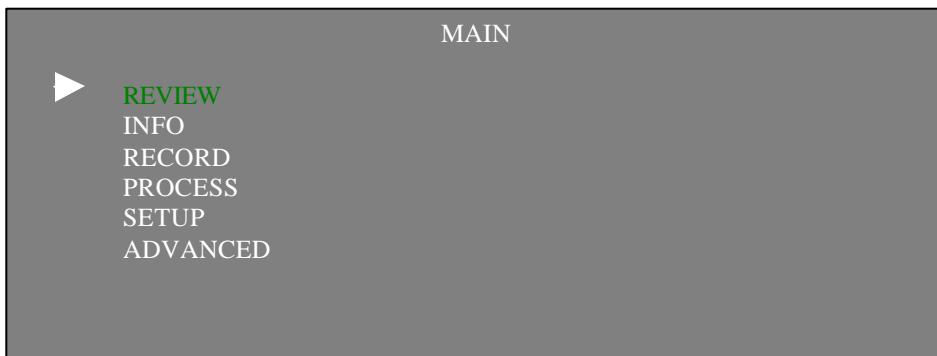
Figure 2.0 Main programming Screen

There are 6 choices that are available from this menu:
1) REVIEW
2) INFO
3) RECORD
4) PROCESS
5) SETUP
6) ADVANCED

To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) and then press the SELECT/ENTER KEY (Button 4- see section 1.2).
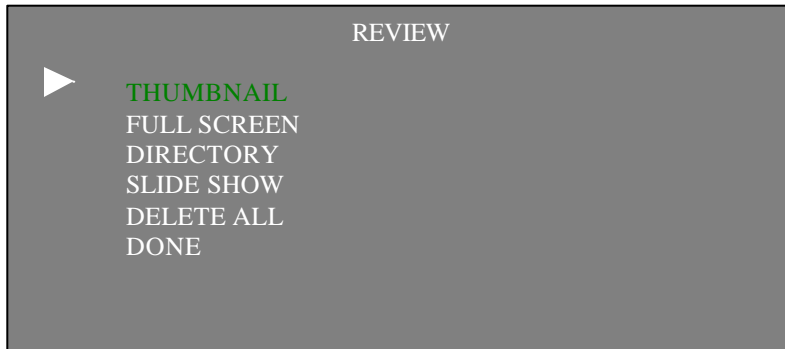
NOTE!! If there are no pictures in memory (i.e. No pictures have been taken) the first 3 selections : REVIEW, INFO and RECORD - will be UNAVAILABLE.

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2.1 REVIEW

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Selecting "REVIEW" from the Main menu brings up a menu/screen like the one below (see figure 2.1). From this Menu, there are a further 5 choices

To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2).
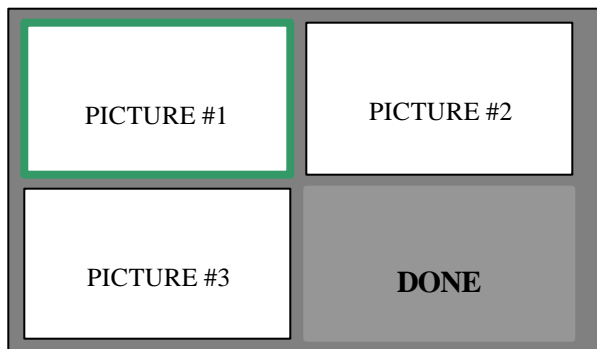
```
                         REVIEW

        ►    THUMBNAIL
             FULL SCREEN
             DIRECTORY
             SLIDE SHOW
             DELETE ALL
             DONE
```

Figure 2.1 Review screen

2.1.1 THUMBNAIL

STEP 1) Selecting "THUMBNAIL" from the "REVIEW" menu allows the user to view all the pictures contained in the camera memory in a SMALLER THUMBNAIL format. A maximum of 4 thumbnail pictures can be viewed on a single page/screen. (see Figure 2.1.1 below).
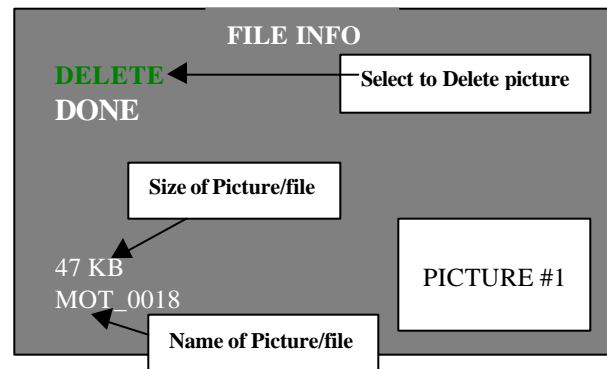
STEP 2) To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2). This action will take you to the File info of that image. (See figure 2.1.1b)

STEP 3) TO EXIT: Highlight "DONE" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

```
  ┌──────────────┐  ┌──────────────┐
  │              │  │              │
  │  PICTURE #1  │  │  PICTURE #2  │
  │              │  │              │
  └──────────────┘  └──────────────┘
  ┌──────────────┐  ┌──────────────┐
  │              │  │              │
  │  PICTURE #3  │  │    DONE      │
  │              │  │              │
  └──────────────┘  └──────────────┘
```

```
                    FILE INFO
    DELETE ◄─────────────    ┌──────────────────────┐
    DONE                     │ Select to Delete picture │
                             └──────────────────────┘

                     ┌──────────────────┐
                     │ Size of Picture/file │
                     └──────────────────┘
                                                  ┌──────────┐
    47 KB                                         │          │
    MOT_0018                                      │PICTURE #1│
           ┌──────────────────┐                   │          │
           │ Name of Picture/file │               └──────────┘
           └──────────────────┘
```

Figure 2.1.1a   SELECTING A PICTURE-BRINGS UP "FILE INFO" ON THAT PICTURE   **Figure 2.1.1b**

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2.1.2 FULLSCREEN

STEP 1) Selecting "FULLSCREEN" from the "REVIEW" menu allows the user to view all the pictures contained in the cameras memory in a FULL PAGE/SCREEN format. i.e. 1 picture per page/screen (see Figure 2.1.2a below).

STEP 2) To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2). This action will take you to the File info of that image. (See figure 2.1.2b)

STEP 3) TO EXIT: Scroll through pictures until the "DONE" screen appears - press the SELECT/ENTER KEY (Button 4- see section 1.2).
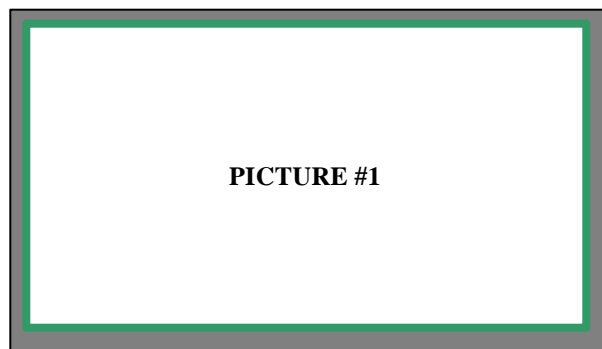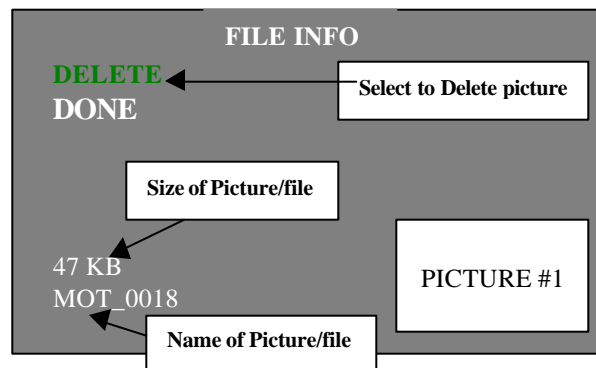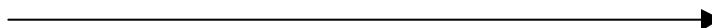
PICTURE #1

FILE INFO

DELETE

DONE

Select to Delete picture

Size of Picture/file

47 KB

MOT_0018

Name of Picture/file

PICTURE #1

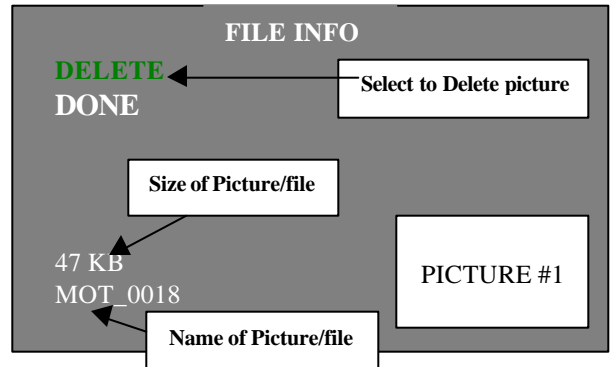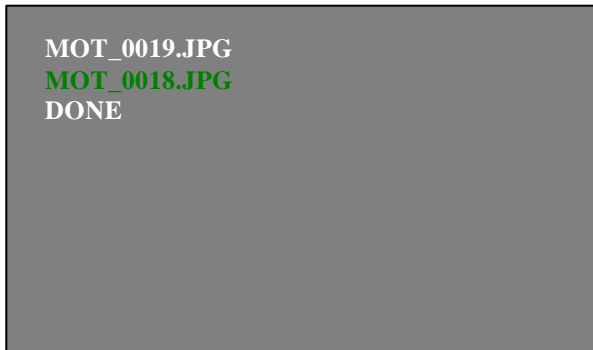**Figure 2.1.2a**   **SELECTING A PICTURE-BRINGS UP "FILE INFO" ON THAT PICTURE**   **Figure 2.1.2b**

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2.1.3 DIRECTORY

STEP 1) Selecting "DIRECTORY" from the "REVIEW" menu allows the user to view all the FILE NAMES of the pictures contained in the cameras memory (see Figure 2.1.3a below).

STEP 2) To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2). This action will take you to the File info of that image. (See figure 2.1.3b)

STEP 3) TO EXIT: Highlight "DONE" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

MOT_0019.JPG
MOT_0018.JPG
DONE

FILE INFO
DELETE ← Select to Delete picture
DONE

Size of Picture/file

47 KB
MOT_0018

PICTURE #1

Name of Picture/file

2.1.4   SLIDE SHOW

Figure 2.1.3a   SELECTING A PICTURE-BRINGS UP "FILE INFO" ON THAT PICTURE   **Figure 2.1.3b**

STEP 1) Selecting "SLIDE SHOW" from the "REVIEW" menu allows the user to view all the pictures contained in the ca1meras memory automatically in predefined intervals of 5-1 seconds. (see Figure 2.1.4a below).

STEP 2) To make a selection while the Slide Show is going on, - then press the SELECT/ENTER KEY twice (Button 4- see section 1.2) – Once to STOP the show – Two to select the highlighted picture. This action will take you to the File info of that image. (See figure 2.1.4b)

STEP 3) TO EXIT:
1) **If Slide Show is complete** - "DONE" - press the SELECT/ENTER KEY (Button 4- see section 1.2).
2) **The FILE INFO page** - Highlight "DONE" and press the SELECT/ENTER KEY (Button 4- see section 1.2). Note!! This will take you back to the Slide show – keep pressing the SELECT/ENTER KEY until you reach the screen that displays- "DONE" - press the SELECT/ENTER KEY (Button 4- see section 1.2).

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**PICTURE #1,2,3,…….
(switches every 1-5 sec's)**

FILE INFO

DELETE ← Select to Delete picture
DONE

Size of Picture/file

47 KB
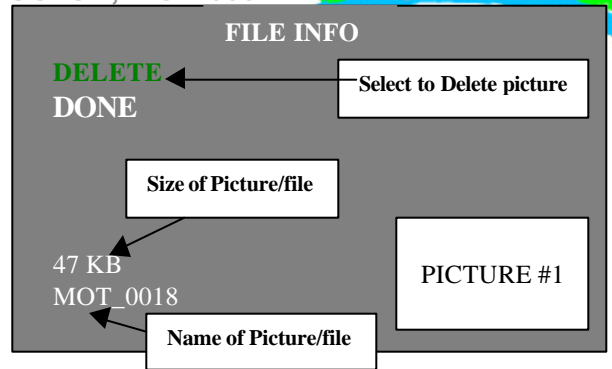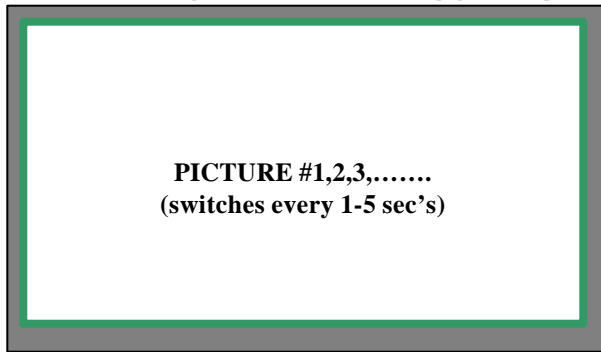MOT_0018

Name of Picture/file

PICTURE #1

Figure 2.1.4a   SELECTING A PICTURE-BRINGS UP "FILE INFO" ON THAT PICTURE   **Figure 2.1.4b**

2.1.5   DELETE ALL

STEP 1) Selecting "DELETE ALL" from the "REVIEW" menu allows the user to delete all the PICTURES/FILES contained in the cameras memory (see Figure 2.1.5a below).

STEP 2) To DELETE -HIGHLIGHT the "OK" selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2). A Screen like Figure 2.1.5b will appear informing you that the CAMERA MEMORY is being FORMATTED.

!! IMPORTANT NOTE - DO NOT SHUT DOWN CAMERA WHILE MEMORY FORMATTING IS IN PROCESS – DOING SO CAN CAUSE DAMAGE TO THE OPERATING SYSTEM. IF THIS OCCURS PLEASE CONTACT MANUFACTURER – SEE CONTACT INFO FOR DETAILS)

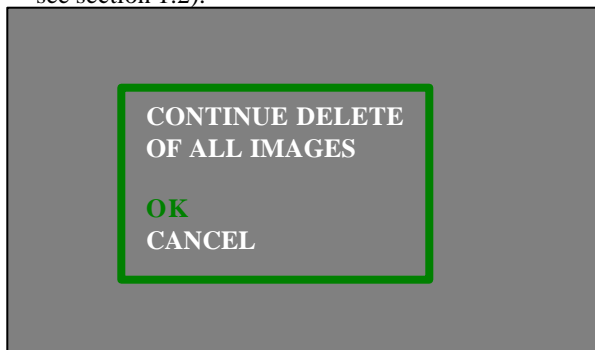**STEP 3) TO CANCEL & EXIT**: Highlight "CANCEL" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

CONTINUE DELETE OF ALL IMAGES

OK
CANCEL

FORMATTING MEMORY

Figure 2.1.5a   SELECTING "OK" – FORMATS THE CAMERA MEMORY   **Figure 2.1.5b**

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2.2 INFO

Selecting "INFO" from the Main menu brings up a menu/screen like the one below (see figure 2.2). The screen provides the following information to the user:

1) **BATTERY STATUS** - please ignore this item until further notice.
2) **VERSION** - lists the Software Version the camera is running.
3) **MEMORY** - Gives approximate amount of Memory that : - has been used.
                                             - is currently free/not been used.
                                             - total memory.

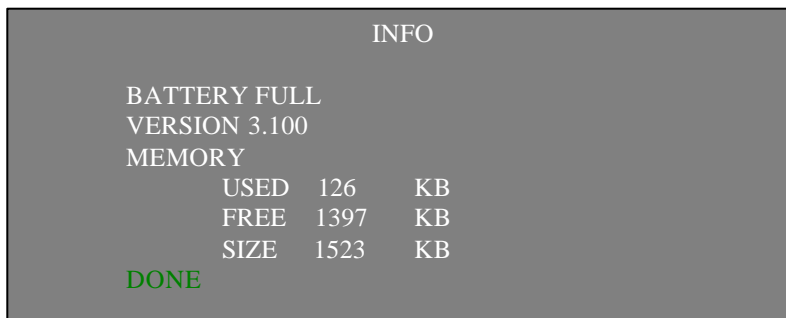**TO EXIT**: Highlight "DONE" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

```
                        INFO

        BATTERY FULL
        VERSION 3.100
        MEMORY
                USED    126     KB
                FREE    1397    KB
                SIZE    1523    KB
        DONE
```

Figure 2.2 Info Screen

2.3 RECORD

Selecting "RECORD" from the Main menu brings up a menu/screen like the one below (see figure 2.3). From this Menu, there are a further 2 choices:

```
                        RECORD

        EXP                 AUTO
        FORMAT              FINE
        SAVE
```

Figure 2.3 Record Screen

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To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2).
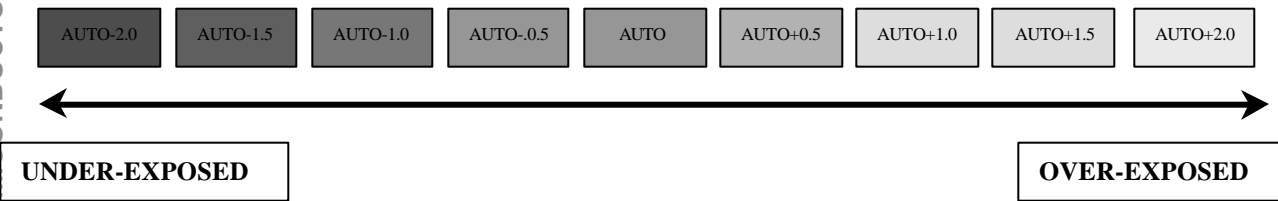
Choice 1) <u>EXP</u> – this allows the setting of the cameras Exposure rate. The more the exposure rate is, the more bright the picture will be, and vice versa (see Figure 2.3.1 below). There are 9 pre-set exposure rates that the user can choose from:
(To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

- a) AUTO : This causes the camera to automatically set the exposure level.
- b) AUTO-0.5 : REDUCES the automatic exposure level.
- c) AUTO-1.0 : Further REDUCES the automatic exposure level.
- d) AUTO-1.5 : Further REDUCES the automatic exposure level.
- e) AUTO-2.0 : Further REDUCES the automatic exposure level.
- f) AUTO+0.5 : INCREASES the automatic exposure level.
- g) AUTO+1.0 : Further INCREASES the automatic exposure level.
- h) AUTO+1.5 : Further INCREASES the automatic exposure level.
- i) AUTO+2.0 : Further INCREASES the automatic exposure level.

NOTE!! Please keep this setting at AUTO at all times.

AUTO-2.0	AUTO-1.5	AUTO-1.0	AUTO-.0.5	AUTO	AUTO+0.5	AUTO+1.0	AUTO+1.5	AUTO+2.0

UNDER-EXPOSED   **OVER-EXPOSED**

Figure 2.3.1

Choice 2) <u>FORMAT</u> – this allows the setting of the PICTURE SIZES. There are 3 different sizes that the user can choose/select from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

- a) **FINE -**   Approximately 640 X 480 pixels   (largest size available)
- b) **ECONOMY -**   Approximately 320 X 240 pixels   (smallest size available)
- c) **ZOOM X2 -**   Approximately 320 X 240 pixels   (smallest size available)

NOTE!! Selecting the ECONOMY and ZOOM X2 will produce the exact same sized image.

SAVE & EXIT - Highlight "SAVE" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

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2.4 PROCESS

Selecting "PROCESS" from the Main menu brings up a menu/screen like the one below (see figure 2.4). From this Menu, there are a further 3 choices:
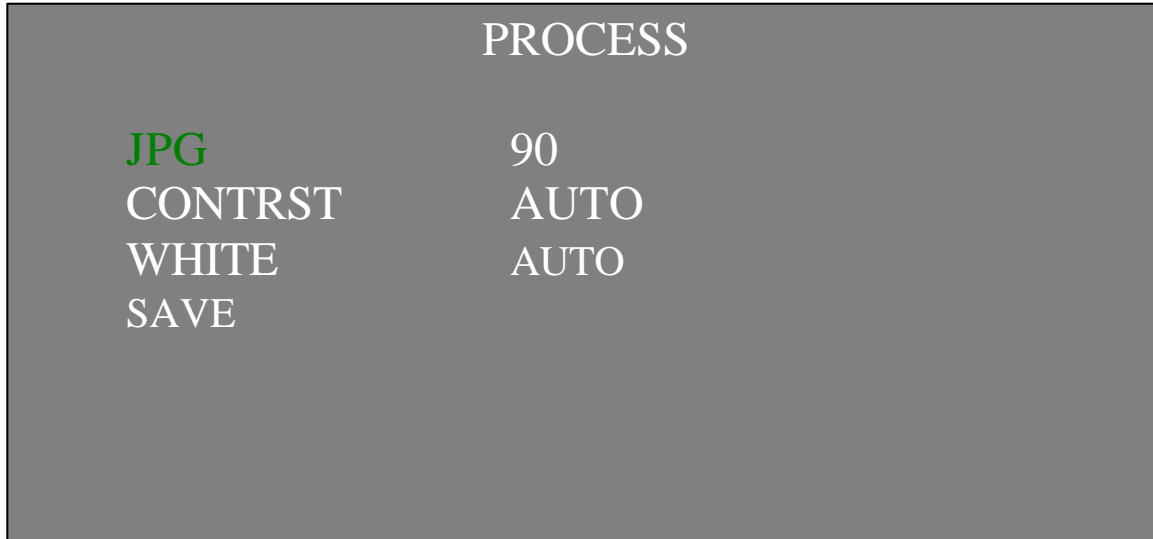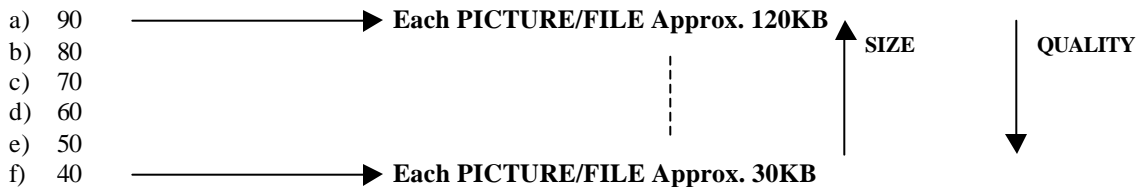

PROCESS

JPG   90
CONTRST   AUTO
WHITE   AUTO
SAVE

Figure 2.4 Process Screen

To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2).

Choice 1) JPG – This allows the setting of the JPG Compression level. The higher the number this is set at, the lower the compression level. There are 6 different choices that the user can choose/select from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

a) 90 ————▶ **Each PICTURE/FILE Approx. 120KB**   ▲ **SIZE**   ▼ **QUALITY**
b) 80
c) 70
d) 60
e) 50
f) 40 ————▶ **Each PICTURE/FILE Approx. 30KB**

Choice 2) CONTRST - This allows the setting of the CONTRAST level. The higher the level that this is set at, the more the contrast between the light and dark areas will be. (Less gamma correction is applied). There are 4 different choices that the user can choose/select from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)
The gamma correction is applied by using a exponential curve = X exp(VALUE) – depending on the "VALUE" we get different CONTRST (gamma correction settings) :
a)   AUTO :   This causes the camera to automatically set the contrast level.   (Low gamma correction)
                 Curve = X exp(VALUE)   -VALUE is determined by the camera
b)   HIGH :   Will increase the contrast level of the picture taken.
                 Curve = X exp(0.8)

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c) NORMAL : Maintains average level of contrast level of the picture taken.
           Curve = X exp(0.6)

d) LOW :   Will decrease the contrast level of the picture taken.   (High gamma correction)
           Curve = X exp(0.45)

Choice 3) <u>WHITE</u> – This allows the setting of the cameras lighting environment. There are 6 different choices that the user can choose/select from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

a) AUTO: This causes the camera to automatically set the lighting environment.

b) FLRSCENT: Selected for Fluorescent lighting environments.

c) TUNGSTEN: Selected for Tungsten lighting environments.

d) SUN: Selected for naturally sun lighted environments.

e) SHADE: Selected for shaded areas.

f) OFF: Turns this setting off.

NOTE!! Please leave this setting at AUTO.
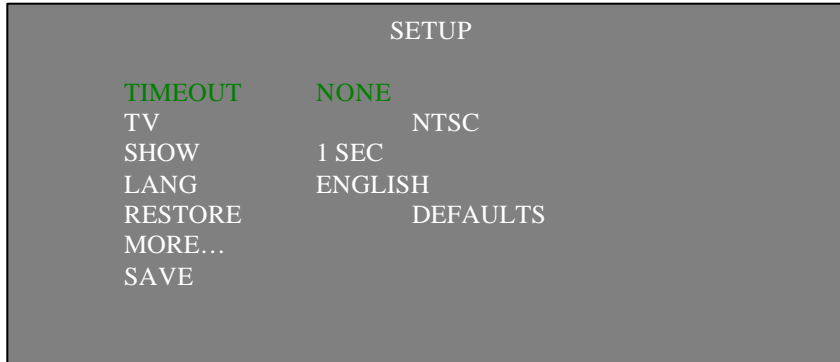
TO SAVE & EXIT - Highlight "SAVE" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

NOTE!! Please don't forget to SAVE before exiting.

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2.5 SETUP

Selecting "SETUP" from the Main menu brings up a menu/screen like the one below (see Figure 2.5). From this Menu, there are a further 6 choices:

```
                        SETUP

      TIMEOUT        NONE
      TV                     NTSC
      SHOW          1 SEC
      LANG          ENGLISH
      RESTORE              DEFAULTS
      MORE…
      SAVE
```

Figure 2.5 Setup screen

To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2).

Choice 1) TIMEOUT – this allows the setting of the cameras automatic Power down time. There are 5 pre-set auto shutoff times the user can choose from:
(To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

    a)   90 seconds automatic shutoff.
    b)   60 seconds automatic shutoff.
    c)   30 seconds automatic shutoff.
    d)   15 seconds automatic shutoff.
    e)   NONE – No Auto power down.

Choice 2) TV – this allows the setting of the Camera-Video monitor interface. There are 5 pre-set video monitor interfaces the user can choose from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

    a)   NTSC
    b)   PAL-B
    c)   PAL-M
    d)   PAL-N
    e)   PAL-CN

NOTE!! Has capability of supporting PAL video systems, but has not been tested.

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Choice 3) <u>SHOW</u> – this allows for the setting of the Slide Show time intervals (used in the REVIEW MODE). There are 5 pre-set time intervals that the user can choose from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

     a)   5 Seconds
     b)   4 Seconds
     c)   3 Seconds
     d)   2 Seconds
     e)   1 Seconds

Choice 4) <u>LANG</u> – this allows for the setting of the language used in the menus. There 4 pre-set languages that the user can choose from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

     a)   English
     b)   Francais
     c)   Deutsche
     d)   Espanol

NOTE!! Please use English as the language. Other languages have not been tested.

Choice 5) <u>RESTORE DEFAULTS</u> – this allows for the RESETTING of all the Menu items to DEFAULT values. To activate, press the SELECT/ENTER KEY when ready to restore the default values)

NOTE!! This action will be carried out as soon as it is SELECTED. Does not need to be SAVED first before it takes action.

Choice 6) <u>MORE</u>… -when selected, will bring up another screen, which will further give the user more choices.

Choice 7) <u>FORMAT</u>- Formats the entire memory.

TO SAVE & EXIT - Highlight "SAVE" and press the SELECT/ENTER KEY (Button 4- see section 1.2).

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2.6 ADVANCED

Selecting "ADVANCED" from the Main menu brings up a menu/screen like the one below (see figure 2.6). From this Menu, there are a further 6 choices:
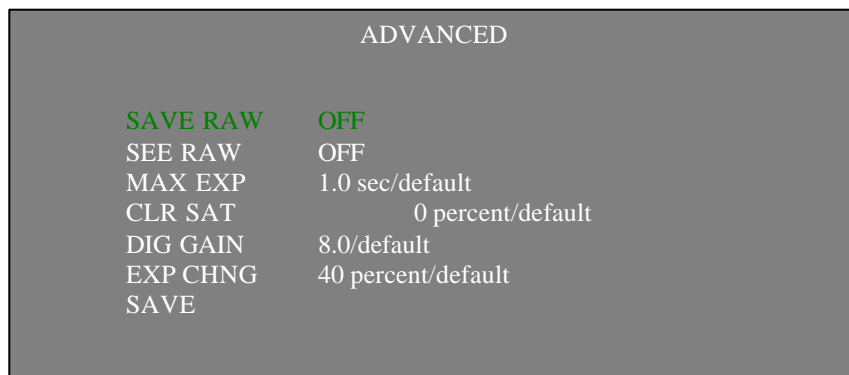
```
                        ADVANCED


        SAVE RAW        OFF
        SEE RAW         OFF
        MAX EXP         1.0 sec/default
        CLR SAT                 0 percent/default
        DIG GAIN        8.0/default
        EXP CHNG        40 percent/default
        SAVE
```

Figure 2.6 Advanced programming screen

To make a selection, just HIGHLIGHT the selection using the SCROLL KEY (Button 3 – see section 1.2) - then press the SELECT/ENTER KEY (Button 4- see section 1.2).

Choice 1) SAVE RAW – This allows the setting of the cameras RAW picture saving capability. When ON, the camera will save the RAW image as well as the JPG image. (To scroll between the ON/OFF choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

NOTE!! RAW images are significantly larger than the JPG images, and so when SAVE RAW is ON- it reduces the amount of memory/pictures that can be taken as compared to when it is turned OFF. Normally the camera has enough memory to save only 1 Raw image, but if you require to save 2 Raw images then turn the JPG compression to 50-40 *(see section 2.4 Choice 1).
The time required by the camera to save the 1st Raw image is around 1 minute, while the 2nd one may take several minutes.

Choice 2) SEE RAW – This allows the setting of the cameras RAW image viewing capability. When ON, the user will be able to view the RAW image. The image, however, when viewing it through the Video monitor will appear to be black – this is expected. However, this option also has to be turned ON, if the RAW images are to be downloaded and viewed on CAMERA DEMO. (To scroll between the ON/OFF choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

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Choice 3) <u>MAX EXP</u> – This allows the setting of the cameras Maximum Exposure time for the auto-exposure algorithm (If the auto exposure routine determines that the exposure time needed is more than what the MAX EXP is set at, the algorithm will still be forced to use the MAX EXP value as its maximum exposure time). Theoretically, the more exposure time the camera is set at , the brighter the pictures will be. There 10 pre-set values that the user can choose from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

    a)   1 second maximum exposure / Default value.
    b)   0.5 second maximum exposure.
    c)   0.25 second maximum exposure.
    d)   0.1 second maximum exposure.
    e)   20 millisecond maximum exposure.
    f)   5 millisecond maximum exposure.
    g)   2.5 millisecond maximum exposure.
    h)   1 millisecond maximum exposure.
    i)   500 microsecond maximum exposure.
   j)   250 microsecond maximum exposure.

Choice 4) <u>CLR SAT</u> - This allows the setting of the cameras Color Saturation level. Theoretically, the more saturated the colors are, the brighter/contrasted the individual colors become. There are 6 pre-set values that the user can choose from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

NOTE!! Typical setting is around 20%-30%
    a)   0 percent / Default value
    b)   10 percent
    c)   20 percent
    d)   30 percent
    e)   40 percent
    f)   50 percent

Choice 5) <u>DIG GAIN</u> - This allows the setting of the cameras digital gain level. This gain refers to the maximum gain that can be applied to the picture by the software – i.e. post sensor processing. There are 10 pre-set values that the user can choose from: (To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)

    a)   1.0   **Small Gain**
    b)   2.0
    c)   3.0
    d)   4.0
    e)   5.0
    f)   6.0
    g)   7.0
    h)   8.0 / Default Value
    i)   9.0   **Large Gain**
    j)   10.0
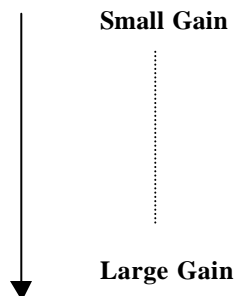
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Choice 6) <u>EXP CHNG</u> – This allows the setting of the cameras maximum exposure change per frame by frame basis which is used determine the exposure time of the camera even when idle. The larger the value that this setting is set at, the quicker the time required by the camera to settle in on an appropriate exposure rate. Therefore, as expected the smaller the value the longer time is required. NOTE! There is a possibility of overshooting the expected exposure rate, if too larger a value is used in this setting. This will create either over or under exposed pictures. **(To scroll between these choices use the SCROLL KEY - then press the SELECT/ENTER KEY when ready to select the option.)**

NOTE!! Used as a place holder. Will be utilized later

 a) 0 percent
 b) 10 percent
 c) 20 percent
 d) 30 percent
 e) 40 percent / Default Value
 f) 50 percent
 g) 60 percent
 h) 70 percent

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3.0 USB Mode

When in this mode, it allows the user to view pictures, as well as enables the programming of certain logic parameters via the latest USB TWAIN Driver (supplied by Motorola). T**o be in this mode, ONLY the USB cable should be CONNECTED to the camera.**

NOTE!! IF THE COMPACT FLASH CARD IS INSERTED INTO THE ROADRUNNER – ONLY FILES/IMAGES CONTAINED ON THE COMPACT FLASH CARD WILL BE DISPLAYED.

3.1 Twain

The TWAIN driver menu enables the user to retrieve images directly from the Cameras flash memory. Its utilizes the USB connection as the main transport mechanism between the PC and Camera.

NOTE!! Although the TWAIN Driver can be installed and used on a variety of Graphics software programs, for demonstration purposes, this manual utilizes Camera Demo to illustrate the use of the TWAIN driver menu .
(**Camera Demo is a software application designed by Motorola to enable the end user to execute 4 key camera functions: control, capture, processing and analysis of camera images- a copy of Camera Demo software is available on the Roadrunner Installation CD or upon request**).

3.2 Twain Menu

Once the user has completed taking pictures and has attached the camera to a PC via USB and has opened up a graphics software application containing Motorolas Twain driver, in this case Camera Demo - To retrieve images from the camera using Twain, click on "Twain" from the main menu.

Step 1) Select the "Select Source" from the Twain sub menu. Choose "Motorola Coyote Twain Driver" from the list of sources. Then press SELECT. (See figure 4-13 below)
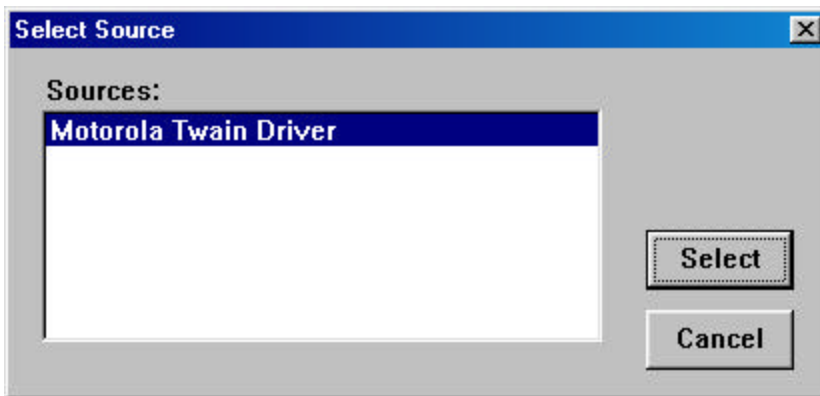

Figure 4-13

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Step 2) Then select "Acquire" from the submenu. From this menu, there is a list of functions, which can be carried out, they are as follows: (See Figure 14-4 below)
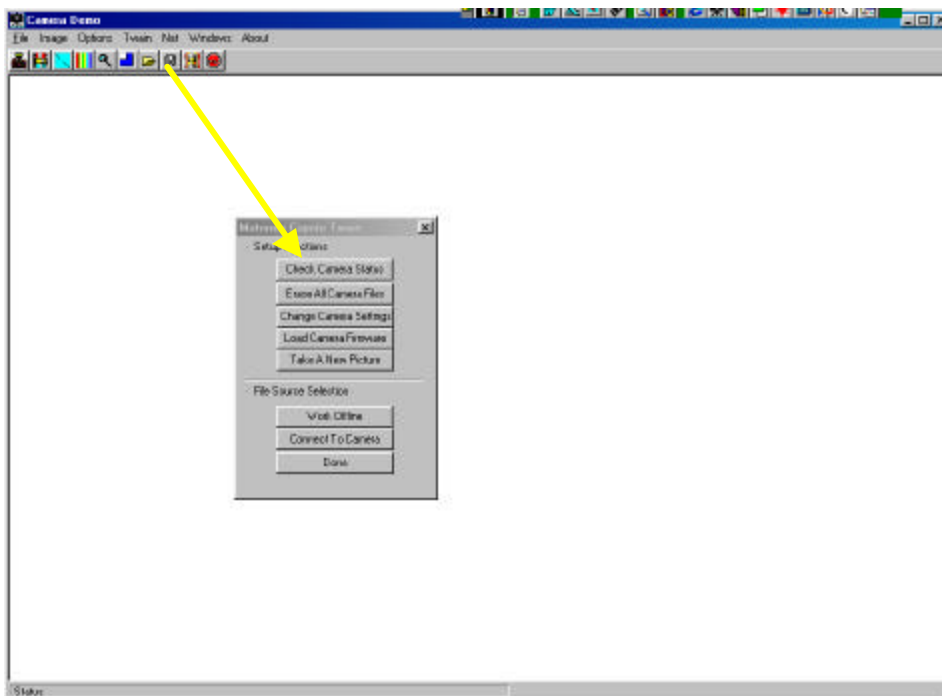

Figure 14-4

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3.3 Using The Twain Menu

This section documents the various functions available via using the Twain Menu. The Twain Menu acts as the main user I/O between the Roadrunner and the PC via USB.
The functions available via Twain menu are as follows:

3.3.1   Check Camera Status – Displays the current status information for the camera. This screen can be used to tell if the Camera is online.
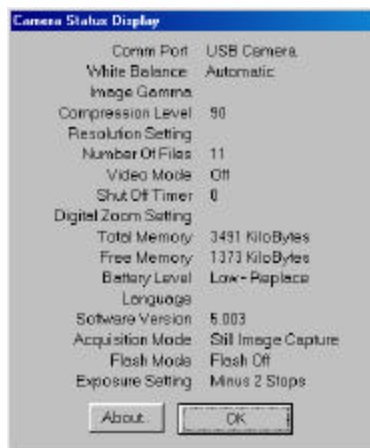

Figure 1 4-5

3.3.2   Erase All Camera Files – Erases all images (Raw and Jpeg) in the camera. (see figure 14-6 below)
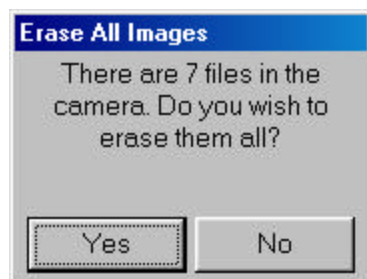

Figure 14-6

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3.3.3   Change Camera Settings – Displays the current Image Capture Settings on the camera. It also allows the user to change and save some of these settings in real time while connected to the camera via USB.

   Note !! The Parameter/settings which can be changed are highlighted in White.

Figure 14-7

NOTE- Placing the cursor over the Input Box of each item displays the different Input Value Options for each of the Image Capture Settings. [DON'T ENTER ANY OTHER VALUES OTHER THAN THE ONES PREDEFINED].

1) **AUTO_OFF** – this allows the setting of the cameras automatic Power down time. There are 5 pre-set auto shutoff times the user can choose from:

   0- 90 seconds automatic shutoff.
   1- 60 seconds automatic shutoff.
   2- 30 seconds automatic shutoff.
   3- 15 seconds automatic shutoff.
   4- NONE – No Auto power down.

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2) **NTSC_PAL_STATE** – this allows the setting of the Camera-Video monitor interface. There are 5 pre-set video monitor interfaces the user can choose from:

   0- NTSC
   1- PAL-B
   2- PAL-M
   3- PAL-N
   4- PAL-CN

3) **SLIDE_SHOW** - this allows for the setting of the Slide Show time intervals (used in the REVIEW MODE while reviewing images on the NTSC monitor – see section 2.0). The choices are any time intervals from 0 to 60 seconds

4) **FLASHMODE** – this allows for the Strobe module to be turned On or Off. When turned ON – the strobe will automatically be fired in low lighting conditions. The choices are as follows:
   0- Strobe Module Off
   1- Strobe Module On – automatically fires in low lighting environments**.**
   (Fires when Exposure time is approximately 170+ ms).
   2- Fill Flash- Not Supported
   3- **Red Eye – Not Supported**

5) **GAMMA** - This allows the setting of the CONTRAST level. The higher the level that this is set at, the more the contrast between the light and dark areas will be. (Less gamma correction is applied). There are 4 different choices that the user can choose/select from: The gamma correction is applied by using a **exponential curve = X exp(VALUE)** – depending on the "VALUE" we get different Contrast (gamma correction settings) :
   0- AUTO : This causes the camera to automatically set the contrast level
   Curve = X exp(VALUE) -VALUE is determined by the camera
   1- HIGH : Will increase the contrast level of the picture taken.
   Curve = X exp(0.8)
   2- NORMAL : Maintains average level of contrast level of the picture taken.
   Curve = X exp(0.6)
   3- LOW : Will decrease the contrast level of the picture taken.
   Curve = X exp(0.45)

6) **JPEG** - This allows the setting of the JPG Compression level. The higher the number this is set at, the lower the compression level. There are 6 different choices that the user can choose/select from:
   a) 90
   b) 80
   c) 70
   d) 60
   e) 50
   f) 40
   g) 30
   h) 20
   i) 10

7) **IMAGE NUMBER INDEX** – This allows the user to set what the next MOT_XXX image number will be.

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8) **RES_FACTOR** – This allows the user to select the size of the image being captured.0

   Please don't make any changes to this item at this time.

9) **SPEAKER** – **Please don't make any changes to this item.**

10) **WHITE_BAL** - This allows the setting of the cameras lighting environment. There are 6 different choices that the user can choose/select from:

   a) AUTO: This causes the camera to automatically set the lighting environment.
   b) FLRSCENT: Selected for Fluorescent lighting environments.
   c) TUNGSTEN: Selected for Tungsten lighting environments.
   d) SUN: Selected for naturally sun lighted environments.
   e) SHADE: Selected for shaded areas.
   f) OFF: Turns this setting off.

11) **SAVE RAW** – This allows the setting of the cameras RAW picture saving capability. When ON, the camera will save the RAW image as well as the JPG image.
NOTE!! RAW images are significantly larger than the JPG images, and so when SAVE RAW is ON- it reduces the amount of memory/pictures that can be taken as compared to when it is turned OFF. Normally the camera has enough memory to save only 1 Raw image, but if you require to save 2 Raw images then turn the JPG compression to 50-40 *(see section 2.4 Choice 1).
The time required by the camera to save the 1st Raw image is around 1 minute, while the 2nd one may take several minutes.

12) **DOVFORMAT** – **Please don't make any changes to this item – Default Value "0".**

13) **MODEL DEPENDENT** - **Please don't make any changes to this item – Default Value "0".**

14) SEE RAW – This allows the setting of the cameras RAW image viewing capability. When ON, the user will be able to view the RAW image. The image, however, when viewing it through the Video monitor will appear to be black – this is expected. However, this option also has to be turned ON, if the RAW images are to be downloaded and viewed on CAMERA DEMO.

15) **SATURATION** - This allows the setting of the cameras Color Saturation level. Theoretically, the more saturated the colors are, the brighter/contrasted the individual colors become. There are 6 pre-set values that the user can choose from:
   a) 0 percent / Default value
   b) 10 percent
   c) 20 percent
   d) 30 percent
   e) 40 percent
   f) 50 percent

16) **MAX EXPOSURE** - This allows the setting of the cameras Maximum Exposure time for the auto-exposure algorithm (If the auto exposure routine determines that the exposure time needed is more than what the MAX EXP is set at, the algorithm will still be forced to use the MAX EXP value as its maximum exposure time). Theoretically, the more exposure time the camera is set at , the brighter the pictures will be. They're 9 pre-set values that the user can choose from:

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a) 250 microseconds
b) 500 microseconds
c) 1000 microseconds
d) 2500 microseconds
e) 20000 microseconds
f) 100000 microseconds
g) 250000 microseconds
h) 500000 microseconds
i) 1000000 microseconds

16) **MAX DIGITAL GAIN** - This allows the setting of the cameras digital gain level. This gain refers to the maximum gain that can be applied to the picture by the software – i.e. post sensor processing. There are 10 pre-set values that the user can choose from:

a) 1.0
b) 2.0
c) 3.0
b) 4.0
c) 5.0
d) 6.0
e) 7.0
f) 9.0
g) 10.0

Small Gain

17) **AEC CENTER POINT** – This allows the user to select the Automatic Exposure (AEC) algorithms center point. The entire dynamic range is a 10bit (0 – 1024 DN). The center point is entered as a percentage of the entire dynamic range. i.e. The normal median value that the AEC uses is 360 which is approximately 35%. There are 8 pre-set values that the user can choose from:

a) 25%
b) 30%
c) 35%
d) 40%
e) 45%
f) 50%
g) 55%
h) 60%

18) **COLFIX METHOD** – This allows the user to choose between two types of Fixed Pattern Column Noise (FPN). The default FPN is Method 1.
NOTE! If 2 Distinct Columns (Noise) are appearing on the left hand corner of the image – select/use Method 2.

19) **IMAGEPROCESSING** - **Please don't make any changes to this item – Default Value "1".**

20) STATS AREA – This allows the user to select which portion of the image captured is to be used for statistical gathering. These statistics are used by the Automatic Exposure (AEC) algorithm to determine the optimal exposure level for the image.

1- Whole Image – Ideal for Indoor images.
2- Southern Horizon – Ideal for bright outdoor images.
3- Quarter Center – Ideal for Portrait images.

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21) **LOSSLESS - Please don't make any changes to this item – Default Value "0".**

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22) **FIXED EXPOSURE**- This allows the user to overide the Automatic Exposure (AEC) algorithm by entering a value (in microseconds) that is smaller or equal to the value defined in MAX EXPOSURE. The range that can be entered is 1-1000 microseconds.
NOTE! Setting this value to "0" – switches the AEC ON again.

23) **COLOR/GRAYSCALE** – This allows the user to select between Monochrome or Color images.

      1- Color: Takes Color images
      2-Grayscale: Takes Black and White images

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3.3.4   Load Camera Firmware Via USB– Picks a camera firmware (binary) file and send its to the camera. Used to load another version of firmware into the camera : (before clicking on this button – follow the following download procedure).

[NOTE!! For instructions on Loading Camera Firmware VIA Compact Flash Card – see Section 1.5.2)]

<u>**Firmware Update Procedure**</u>
 (IMPORTANT - Please follow each step to its completion)

NOTE!! Make sure that the battery in the camera is new. If battery dies during firmware update, the FLASH Memory will be permanently corrupted.

Step 1) Copy the firmware update file (*.bin) to the PC.
Step 2) Cycle the power on the camera (USB cable should not be attached)
Step 3) Plug in USB cable.
Step 4) Run Camera Demo.
Step 5) Click on "Twain" from the main menu.
Step 6) Click on "Acquire" from the Twain Submenu.
Step 7) Click on "Check status" to verify connectivity between the camera and PC via the USB. (If status indicates no connection – check cable connection and try again)
   NOTE!! If no connection cannot be obtained between the camera and PC, DON'T GO ANY FURTHER.
Step 8) Click on "Load Camera Firmware"
Step 9) Browse until you locate the firmware file you copied onto the PC (i.e. the file you wish to download). (see figure 14-8 below)
Step 10) Select the file and click on "Open".
Step 11) DO NOT TOUCH THE CAMERA UNTIL –
   (a) **Camera Demo displays message indicating download is complete, and**
   NOTE!! This doesn't mean download process is complete!! Software is still being burnt into cameras firmware at this point)
   (b) **You have waited a further 2 minutes until the software is burnt in the cameras firmware.**
Step 12) Unplug USB cable from camera.
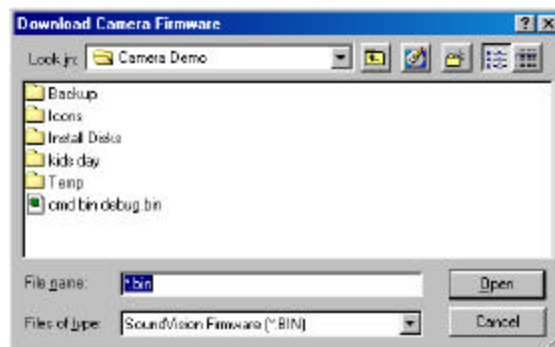**Step 13)** Cycle the power on the camera.

Figure 14-8

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3.3.5   Grab a New Picture – Takes a RAW image and uploads it to the Graphic software application being used. Note!! This RAW image is not saved on the Roadrunner camera system. If the user wants the image saved it must be done on the PC side.

3.3.6   Work Offline – Opens a DCA archive file without attempting to talk to the camera.

3.3.7   Connect to Camera – Gets images from the camera or archive file selected. There are number of options available when this is selected: (See figure 14-9 below)

NOTE!! IF THE COMPACT FLASH CARD IS INSERTED INTO THE ROADRUNNER – ONLY FILES/IMAGES CONTAINED ON THE COMPACT FLASH CARD WILL BE DISPLAYED.

Figure 14-9

NOTE!!   To Select a image:
     i)   Point to the image
     ii) Right Click on the mouse button
   (A selected image has dark black borders surrounding it).

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a) **Xtr Camera Files** – Transfers Selected files from the camera memory to the computer directory of your choice.

      NOTE!! If a **RAW image** is to be uploaded and viewed in Camera Demo, it MUST first be transferred (saved) from the camera memory into the computer directory. Then it can be uploaded into Camera Demo using the **"Load Coyote Raw"** from the **Options Menu.**

b) **Open Camera** – Please Don't Touch this button.

c) **Scan Folder** – Please Don't Touch this button.

d) **Image Info** – displays various information on the Selected image. (if more than one image is selected- it will display info of one image at a time-see figure 14-10).
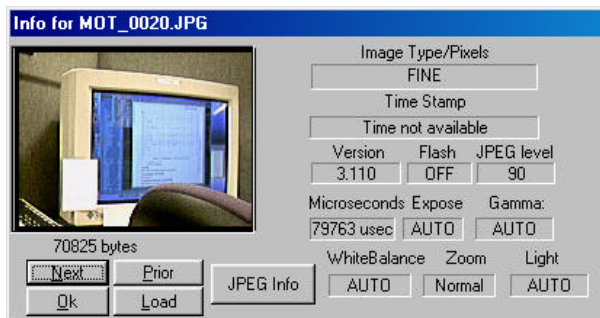

Figure 14-10

Further detailed information of that particular image can be retrieved by pressing the JPEG Info button. It will bring up a menu like illustrated in figure 14-11 below:
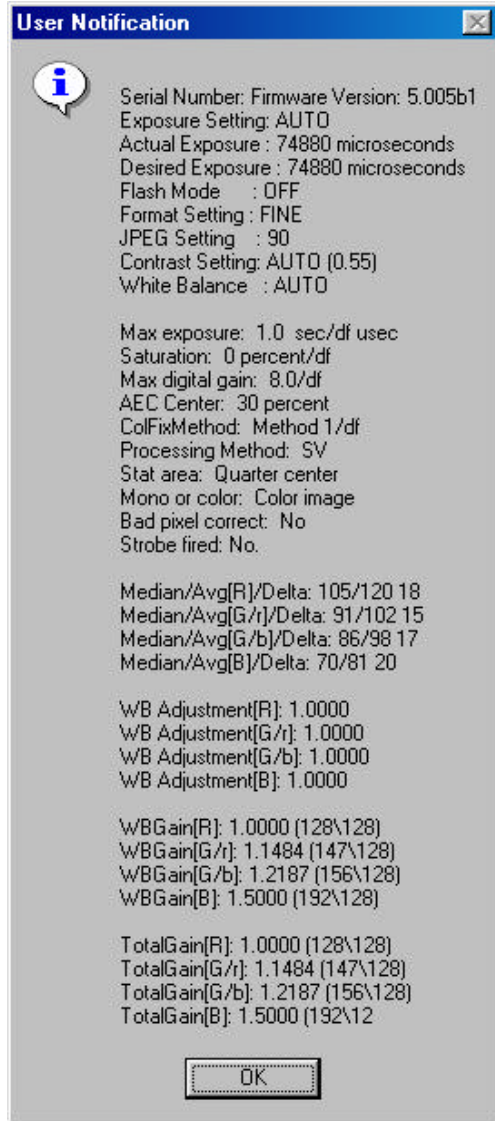
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ImageMOS™

User Notification

Serial Number: Firmware Version: 5.005b1
Exposure Setting: AUTO
Actual Exposure : 74880 microseconds
Desired Exposure : 74880 microseconds
Flash Mode   : OFF
Format Setting : FINE
JPEG Setting   : 90
Contrast Setting: AUTO (0.55)
White Balance : AUTO

Max exposure: 1.0 sec/df usec
Saturation: 0 percent/df
Max digital gain: 8.0/df
AEC Center: 30 percent
ColFixMethod: Method 1/df
Processing Method: SV
Stat area: Quarter center
Mono or color: Color image
Bad pixel correct: No
Strobe fired: No.

Median/Avg[R]/Delta: 105/120 18
Median/Avg[G/r]/Delta: 91/102 15
Median/Avg[G/b]/Delta: 86/98 17
Median/Avg[B]/Delta: 70/81 20

WB Adjustment[R]: 1.0000
WB Adjustment[G/r]: 1.0000
WB Adjustment[G/b]: 1.0000
WB Adjustment[B]: 1.0000

WBGain[R]: 1.0000 (128\128)
WBGain[G/r]: 1.1484 (147\128)
WBGain[G/b]: 1.2187 (156\128)
WBGain[B]: 1.5000 (192\128)

TotalGain[R]: 1.0000 (128\128)
TotalGain[G/r]: 1.1484 (147\128)
TotalGain[G/b]: 1.2187 (156\128)
TotalGain[B]: 1.5000 (192\12

[OK]

Figure 14-11

e) **Select All** – Selects all the images displayed.

f) **Erase Selection** - Erases the current image selected. Note to Erase all the images-
first Select all and then Erase selection.

g) **Take New –** Takes a still image (JPEG Compressed) while the Camera is tethered to the PC.

h) **Load** – Please Don't Touch this button.

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i)   **Cancel** – Takes you back to the main Twain sub menu (see figure 14-4).

3.3.8   Done – Return to the application without an image.

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4.0 Simple Operational Instructions

This section outlines how to carry out some basic imaging operations on the Roadrunner system:

4.1 Taking a Picture/Image

To take an image on the Roadrunner and save it to the system either by its internal memory or via Compact Flash card –
1)   View picture through the viewfinder optics
2)   Wait until the Cameras Automatic Exposure has locked, i.e. LED1 (see section 1.3) has illuminated
3)   Press Button 4 (see section 1.2).
4)   Wait until LED 2 has stopped blinking before taking another image.

4.2 Taking an Image via USB

To take an image on the Roadrunner while it is tethered to a PC Via USB and save it to the system memory of Compact Flash- refer to section 3.37 (g).

4.3 Taking a RAW Image

To take a RAW image on the Roadrunner and save it to the system either by its internal memory or via compact flash card –
1)   **Attach the Roadrunner to the PC via USB and bring up the TWAIN Menu.**
2)   Under the "Change Camera Settings" on the TWAIN Menu (see section 3.3.3) **– Change the "SAVE RAW" setting from 0 to 1.**
3)   Also under the "Change Camera Settings" – **Change the "See RAW" setting from 0 to 1**
4)   **Unhook the Roadrunner from the USB cable and follow same procedure as in section 4.1.**

Note !! This will save both a RAW and JPEG image onto the Roadrunner system.

4.4 Taking a RAW Image via USB

To take an RAW image on the Roadrunner while it is tethered to a PC Via USB and save it to the system memory of Compact Flash- refer to section 3.35.

4.5 Viewing Images Via NTSC Video

To view images saved on the Roadrunner camera system on a Video monitor – refer to section 2.0 for more information.

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4.6 Viewing/Downloading Images Via USB on the PC

To view images saved on the Roadrunner camera system on a Video monitor – refer to sections 3.0 and 3.3.7 for more information.

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5.0 Contact Information

If you encounter any problems with the Roadrunner camera system, or if you have any further questions or comments regarding the system, please contact:

Image Capture Operations Systems Group
Mike Skow
1300N Alma School Road,
Chandler, Arizona.
USA
85224

Email: R39936@email.sps.mot.com

Telephone: (480) 814-3220

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6.0 Hardware References

1) For more information on the SXGA sensor (MM20027
   – refer to the MM20027ata sheet **[SXGA DATSHEET.pdf]**
2) For more information on the SXGA sensor (MM20014
   – refer to the MM20014 data sheet **[VGA DATSHEET.pdf]**

3) For more information on the Roadrunner camera systems
   - refer to "**Roadrunner Application Note"**

4) For more information on the CLARITY2 ASIC
   - refer **to "CLARITY2BRIEFDESCRIPTION.pdf"**
   - refer to **"CLARITY_2_ASIC_SPECIFICATIONS.pdf"**

**For more information and PDF versions of the aforementioned
documents can be found on our website:**

www.motorola.com/adc/imaging

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