



FUJIFILM Medical Systems
CR Users Guide

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Technical Tips for FCR Readers

1. Select the proper menu for the exam being done, and remember to check the next page for additional menu's.
2. Pediatric patients are considered to be those three (3) years old and under. Over the age of three, process as an adult.
3. Use the smallest Imaging Plate (IP) available for the exam.
4. The green stripe refers to the hanging protocol of the image and is generally oriented to the top (cephalic) or to the patient's right side.
 - For 8 X 10 only, the green stripe or green dots should be cephalic or to the patient's right side.
5. If a cassette has not been used in 48 hours, you should erase it using the Secondary Erasure. Use Primary Erase for direct x-ray exposures (exposure errors) on the IP.
6. When a body part thickness is greater than 10cm a grid is recommended, i.e., shoulders, knee, and c-spines.
7. Approximate kVp for Portable chest (non-grid) should be 70-85 kVp. Do not use above 90 kVp without a grid. Portable chests with a grid, the kVp should never be higher than 110.
8. Approximated kVp for Portable Abdomens with Grid should be 65-85 kVp.
9. Centering and positioning are very important! Keep the patient well-centered on the cassette.
10. When doing extremity work you can do two or more views on one cassette. Keep the views close together and use lead strips to mask the views. Take caution not to overlap exposure areas.
11. Collimate to the proper field size: avoid having extra anatomy in the image.
12. The Fuji CR reader is able to compensate in density for over- and under-exposure:
 - Underexposure is evident by a noisy or mottled appearance on the image, and a high "S" number >500.
 - Overexposure is evident only by a very low "S" number <75.

Erasure of Imaging Plates

The imaging plate is used to capture the patient image during an x-ray examination. Imaging Plates (IP's) are highly sensitive to radiation including natural background radiation. This ambient radiation can increase mottle within the image, lower contrast and affect "S" number reading. Therefore, it is recommended that any IP that has not be used within 48 hours be erased using the Secondary Erase Mode prior to clinical use.

Use the Primary Erase Mode for IP's with direct x-ray exposures (exposure errors) that need to be erased from an IP.

Erase Mode Procedures: The erase button must be pressed for each IP and prior to insertion of the cassette.

1. **FCR 5000 series readers-** on the status monitor of the FCR 5000 reader, press the reading mode icon, then select the erasure mode needed. Insert cassette to be erased. Upon completion of the erasure cycle, the reader reverts back to routine processing mode.
2. **FCR5501 Chest Reader** - select Erase IP at the IIP. This erases one IP. Repeat procedure if the second IP needs to be erased.

Imaging Plate and Cassette Selection

Images produced using Computed Radiography are first captured on the Imaging Plate (IP) inside the cassette. There are several factors involved in selecting the proper cassette and IP for an exam. The most important factors in selecting a cassette and imaging plate for an exam are the *TYPE* and *SIZE*. Frequency of use is another factor that also must be considered.

Types of Imaging Plates: ST -Standard & HR- High Resolution

The first portion of the barcode on each imaging plate will indicate the type. The barcode is visible through the ID window on the back of the cassette. It is recommended that these cassettes be marked on the outside to note HR plates when applicable. HR plates are available in limited sizes only and can be used for extremities, mammography and other exams to attain higher image sharpness than the ST plates. It should be noted that the HR plates, like detail film/screen combinations, require different exposure factors.

Imaging Plate Size

Digital images produced in Computed Radiography are displayed in a matrix of pixels. Pixel size is a factor in determining the resolution of the displayed image. Since the frequency with which the standard CR reader scans the plate is relatively constant (2K x 2K), using the smallest imaging plate possible for the exam will result in the highest sampling rate. For the FCR 5000 series and all other Fuji HQ readers the sampling rate is 10 pixels/mm. For all other Fuji CR systems see list below.

SIZE OF IMAGING PLATE	SAMPLING RATE
14 x 17 or 14 x 14	5 pixels/mm
10 x 12 or 24cm x 30cm	6.7 pixels/mm
8 x 10 or 18cm x 24cm	10 pixels/mm

In addition to pixel size, image size on hardcopy and softcopy is affected by cassette selection. Reduction of images done with a 14 x 14 or 14 x 17 IP is not always favorable. Using the smallest imaging plate for the exam eliminates scatter outside the initial collimation and will help create a more representative histogram during the reading. It also prevents the reader from including anatomy not in the primary region of interest in the histogram.

Frequency of Use

The Imaging Plates used in Computed Radiography are sensitive to all types of radiation, and when used infrequently can store enough naturally occurring radiation to adversely effect an image. It is recommended that an Erasure, using the Secondary Erasure Mode, or an IP change, using the Change IP function, be completed on any plate that has not been used in any given 48 hour period. Erasure or Change should also be performed on any imaging plate discovered in an area where it may have been exposed to scatter radiation.

Stationary Grids for Computed Radiography

Digital images such as those produced in Computed Radiography are displayed in a pattern of tiny rows of pixels. Grid lines projected on the imaging plate from the use of a stationary grid can generate a form of interference with the image, producing a wavy artifact known as a “moiré” pattern. Typical moving grids or bucky’s blur the grid lines, eliminating interference with the digital matrix. In order to reduce the interference caused by stationary grids, attention should be paid to their proper selection. The important factors in the selection of a grid are frequency, ratio, focus, and size.

Stationary Grid Recommendation for CR

Size of Imaging Plate	Grid Frequency
14x17 or 14x14	40 LP cm/103 LP inch or higher
10x12	60 LP cm/150 LP or higher
8x10	60 LP cm/150 LP or higher

Note: As opposed to the AC-1 series, models of CR readers such as the CR 9000, 9501 and AC-3 have a special filter design to suppress the occurrence of the moiré artifact on printed images, and the use of 103LP grids may be acceptable in the 14 x 17 size. However, these are not suitable for HQ images or 5000 series readers. If existing 103 line grids are currently being used in these accounts, good positioning skills help to reduce grid artifact caused by angulation or an off-center beam. The viewing of CR images on a monitor may show the moiré pattern because the process of sub-sampling reduces the original CR matrix size to a number suitable for CRT display. If this occurs, or in the case of HQ (4K x 4K) imaging or the use of an FCR 5000 series reader, the employment of grids of no less than 150 lines/inch is recommended for all sizes.

I. Grid frequency

Grid frequency is expressed as lines per centimeter or lines per inch. The higher the frequency, (the more lines per inch), the thinner and less obtrusive the grid lines appear in the image. Most grids are between 80 and 152 lines per inch.

II. Grid ratio

Grid ratio is the relationship between the height of the lead strips and the space between the lead strips. The higher the grid ratio, the better the absorption of scatter radiation. The lower the grid ratio the more forgiving the grid becomes to positioning error. A 6:1 ratio would be a good choice for portable exams allowing superior ease of use with adequate cleanup. A 10:1 or 12:1 ratio would be a good choice in the radiology department where a multitude of exams may be performed under a more fixed geometry and at a higher level of kVp.

III. Focus

The most popular grid choices are parallel and focused. Parallel grids compromise image quality at the outer edges of the image and should not be used at distances less than 48 inches but are less critical to beam centering. In the focused grid design, the lead strips are angled to coincide with the geometry of the X-ray beam and must be used within distances specified by their focal range using a well-centered beam.

IV. Size

Size refers to the physical dimensions of the grid, however it is important to recognize that typically, smaller cassettes are read at higher sampling rates. Because of this, it is important to select a grid of high frequency when employing 10 x 12 inch or smaller cassettes. Consult the recommendation chart in the selection of the most appropriate grids for your use.

V. Obtaining grids and grid holders

Grids with holders are available for sale through our customer service department. All grids are 152 lines per inch with 40"-72" focal distance. Also available are two types of grid holders, which offer additional protection for the grid and support for the cassette. Contact our customer service department at 1-800-431-1850 for price and purchase information.

CR System Speed

As opposed to conventional screen/film (Fixed speed) systems, CR should be considered a multi-speed system. The image capture device (IP) used in CR employs a linear capture of exposure far exceeding the capabilities of any conventional film/screen system. For all imaging modes (except Fixed mode), the system centers the exposure data for processing, and optimizes density and contrast for display. Therefore, as exposure is increased or decreased, density and contrast will remain consistent as opposed to conventional film/screen systems.

As dose decreases in an electronic imaging system, noise from the amplified lower signal increases. It is the responsibility of each facility to establish exposure ranges that employ the lowest dose based on the image quality desired per examination. For example, many facilities employ multiple film/screen systems to optimize specific exams:

- 100 Speed high contrast extremity film and screens
- 200 Speed optimized low contrast chest system
- 400 Speed general contrast system for routine exams

CR promotes exposure ranges capable of optimizing image quality for all exams, typically employing the same imaging plate and cassette. CR offers a tool to help judge the exposure used on each exam. This tool is called the “S” number. For a thorough explanation of how to use this value to optimize image quality at the lowest dose, see pages 9-11.

Automatic Exposure Controls (AEC) are used in the same manner as with screen/film systems. Experienced CR users frequently utilize the AEC’s \pm density setting controls for optimizing image quality.

Note: Even when a phototimer is used, resulted mAs may change depending on the type of cassette and detector (mostly due to backscatter characteristics from the cassette/detector). If the phototimer was optimized for conventional screen/film, it should be checked and adjusted when starting to use CR systems.

The following procedure can be used to set up the AEC with CR:

1. Use a minimum of 10 inches of water or 6 inches of Plexiglas as an absorber.
2. Process the CR images under the Sensitivity Menu, which is found in the TEST Region.
3. Make exposures, processing under sensitivity menu, until you get “S” numbers of 200-300.
4. Then do a tracking run. Density will always stay the same, however the “S” number will change. Use the “S” number to judge tracking of the phototimer.
5. With a double exposure, the “S” number will be approximately $\frac{1}{2}$ the original value (“S” number is inversely proportional).
6. Cut the exposure by $\frac{1}{2}$ and the “S” number will approximately double.

Information on “S” Numbers

The “S” number is an indicator of the photostimulable luminescence (PSL) given off by the imaging plate (IP) while being scanned by the laser. The range of the “S” number is zero to 20,045. The values are inversely proportional to the amount of radiation that strikes the IP.

The calibration of the “S” number is based on a 1mR exposure at 80 kVp and a SID of 72”. With this exposure, the “S” number range should be about 200.

“S” numbers under 75 should be considered overexposed, even though they may look normal in appearance (see pages 11-13). If the “S” number goes **below 25** and the “L” value is typically greater than 2.0 image quality may be compromised. These grossly overexposed images could appear white (underexposed looking) due to overcorrection of the EDR.

Underexposure is exhibited by a high “S” number, generally greater than 500. An underexposed image will have a greater amount of quantum mottle (noise) in the image. The amount of mottle/noise on the image will be proportional to a high (>500) “S” number.

Exposure is not the only factor that affects the “S” number values. “S” number values can also be affected during patient examination. Other factors contributing to the “S” number are:

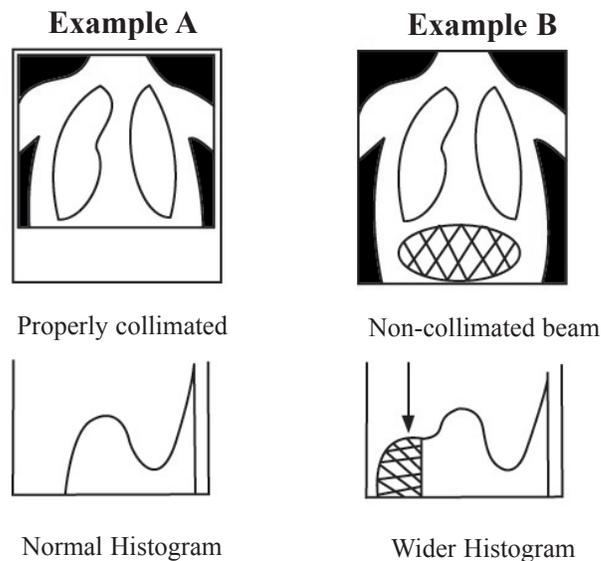
- Scatter (more scatter-higher “S” number)
- Distance - SID and OFD (dose and scatter)
- Collimation (good collimation reduces scatter)
- Examination selected at the IIP (due to histogram analysis)
- Delay in processing from time of exposure

Because of Exposure Data Recognition (EDR) auto mode (see page 14 for more information), the “S” numbers can vary significantly even under the same subject and exposure conditions. The following “S” number ranges should prove as an acceptable guide when accessing exposure recommendations.

Skull:	100-400	Chest, General:	200-600
Abdomen:	100-400	Chest, Portable:	100-400
Spine:	100-400	Chest, Pediatric:	200-700
GI:	100-300	Abdomen, Pediatric:	200-700
Extremities:	75-200		

Information on “S” numbers continued...

Many times it is not desirable to include all the anatomy that can be physically covered by an IP. For example, a typical chest x-ray on a smaller patient may include a large section of the abdomen in the non-collimated beam. Inclusion of this extra tissue increases scatter radiation as well as influencing the shape of the histogram, which further reduces image quality on the finished radiograph.



Example A demonstrates a well-collimated and exposed chest image. From this image a typical histogram appearance occurs. The width of the usable histogram is measured in decades of dose. Example A demonstrates a histogram with an “L” value of 2.0.

Example B, the non-collimated view, contains additional abdomen image information. The inclusion of this unnecessary information produces a wider histogram of 2.5 decades of dose. This wider histogram reduces image quality and alters the “S” number. “S” number is the center of the usable histogram. Even though the same exposure factors were used on both images, the inclusion of the abdominal region on Example B increased the “L” value and subsequently increased the “S” number.

“L” values are as important as “S” numbers when critiquing images. On most studies “L” values typically range between 1.7 to 2.3. Abnormal “L” values will create abnormal “S” numbers. Images should not be rejected or repeated because of “S” number alone. Image quality should be judged on the hardcopy or diagnostic workstation. If you have questions about gross under-exposure or over-exposure, see Acceptable Exposure Range for CR Plates. Other factors that should be considered when critiquing CR images are collimation, kVp, mAs, positioning and the processing menu selected.

Acceptable Exposure Range for Fuji CR Imaging Plates

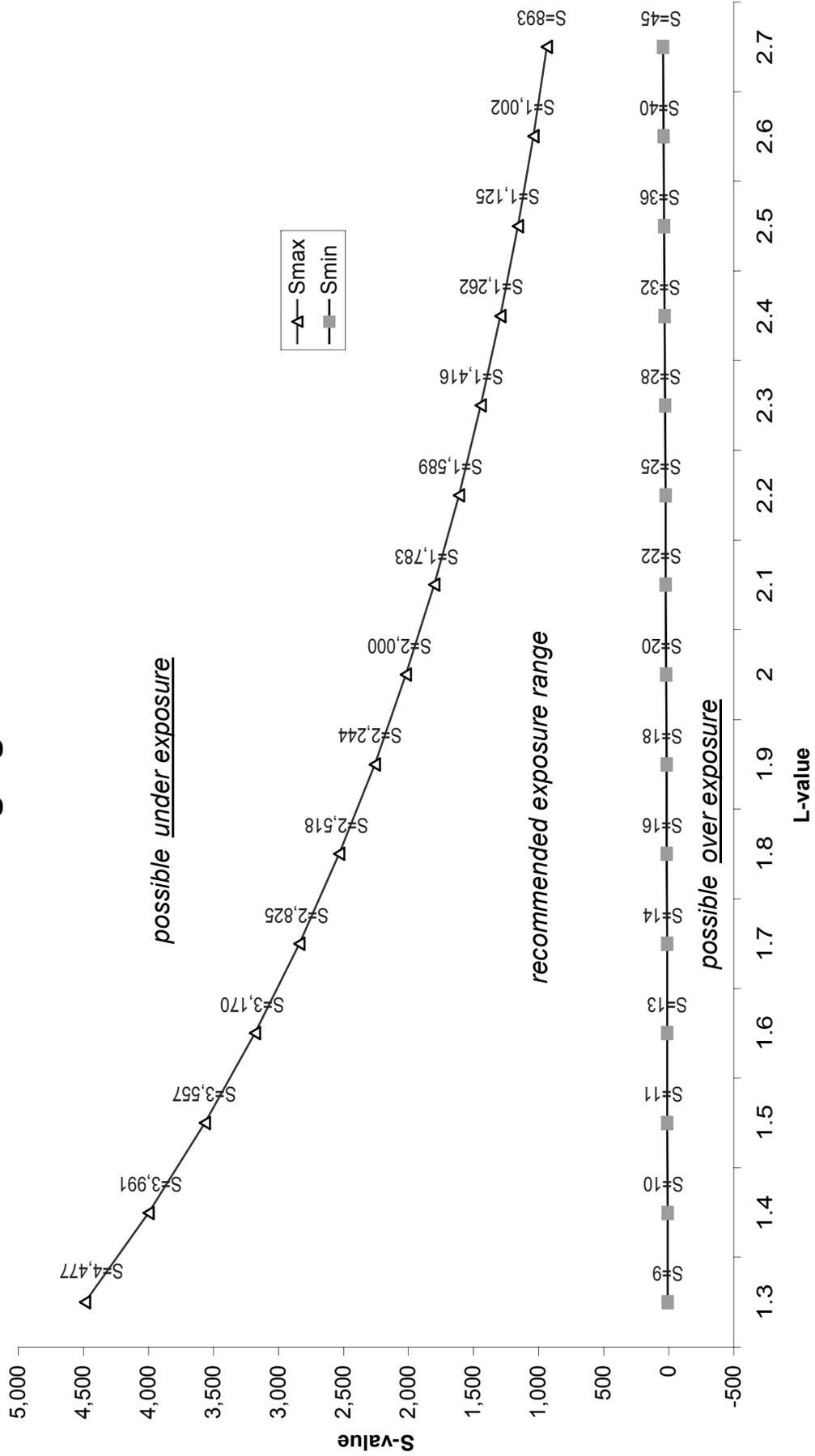
Although the dynamic range of Fuji Computed Radiography is extremely wide, it is possible to acquire the image with so little or so much exposure as to exceed the recommended range. Exposures falling outside this range may compromise image quality - underexposing the imaging plate might produce excess noise (mottle), while gross overexposure may result in the loss of image data (this will be most noticeable as a loss of contrast in less dense body structures).

Unlike standard screen/film systems which indicate over or underexposure by obviously dark or light radiographs, density compensation (a functioning of EDR) makes exposure errors less obvious. As a result, image quality can be severely reduced without the obvious “red flag” of light or dark films.

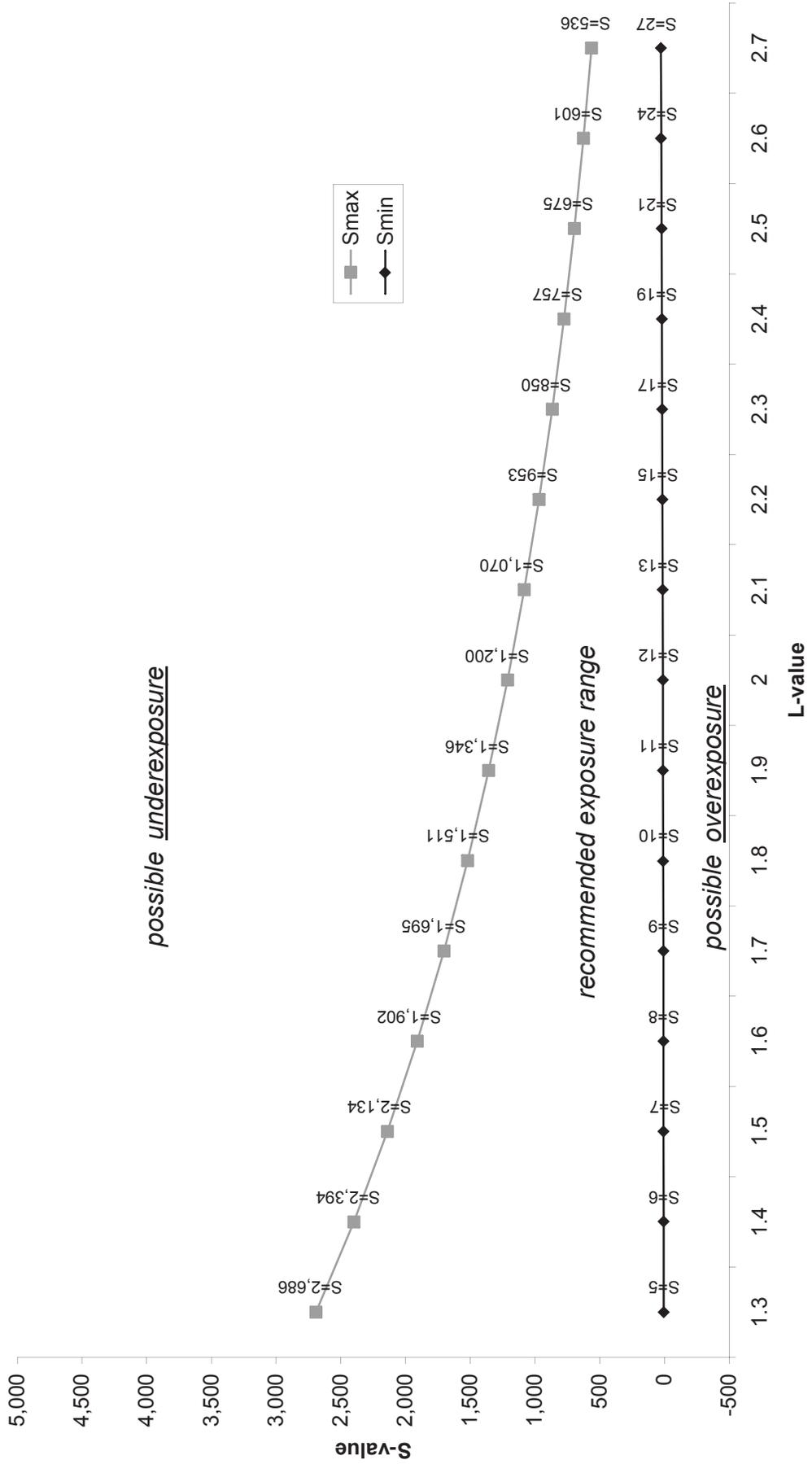
The “S” and “L” values printed on a computed radiograph can be useful in determining if exposure conditions have caused a loss in image quality. Relative to the anatomy being imaged, “S” serves as an indicator of average exposure level, and “L” represents the exposure’s latitude. The following table indicates the acceptable and unacceptable “S” & “L” combinations. Combinations outside the acceptable range should be reviewed and the exposure repeated if a lack of contrast or excessive mottle is apparent.

Please post the following two charts near your CR Reader(s) for technologist reference.

**FCR (AC-1 or later)
Standard Reading Range
ST Imaging Plate**



**FCR (AC-1 or later)
Standard Reading Range
HR Imaging Plate**



Understanding EDR- Auto Mode

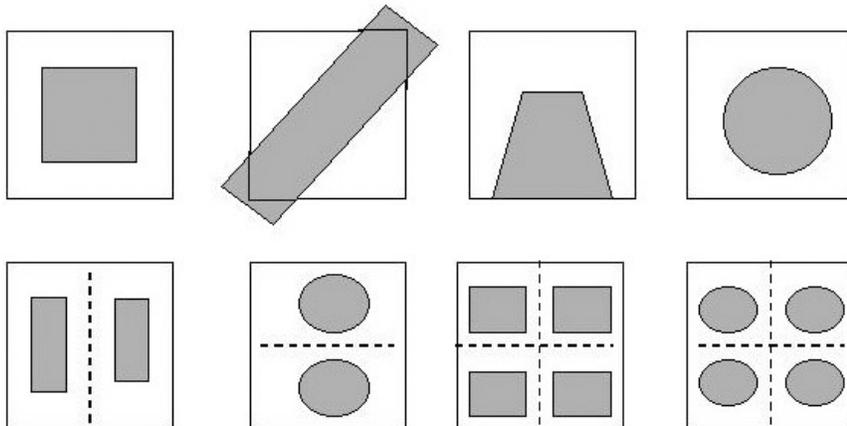
The Auto processing mode will adjust both the density and the contrast. Auto processing mode is used for the majority of examinations in CR.

Auto mode processing allows for image data on the IP to be sampled and uses the Exposure Data Recognizer (EDR) to determine optimal reading conditions. A histogram is created using the raw image data. The histogram data will be processed in a manner consistent with the anatomical menu choice. For this reason, it is important that the menu selected on the IIP corresponds with the patient examination. If the density and contrast appear to be incorrect for the particular examination, verify that the IP was processed under the proper anatomical menu.

More than one view can be exposed on a single IP. In Auto processing mode, collimated borders are detected with a function known as split exposure recognition processing. For the best results, the collimated borders should be sharp and well defined. This ensures that unnecessary information, such as scatter, outside the collimated edges will be eliminated from the histogram analysis. This process is often referred to as PRIEF (Pattern Recognizer for Irradiated Exposure Field).

Acceptable Patterns of Exposure Recognitions are:

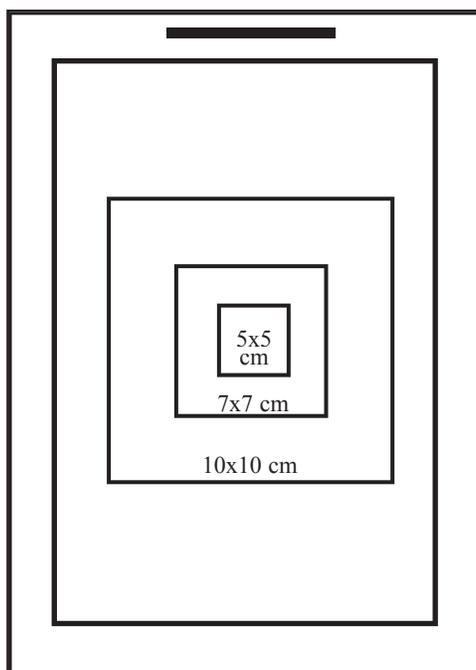
In difficult circumstances, where proper collimation and good positioning seem impossible to obtain, Semi, Semi-X, or Fixed modes might be a better EDR choice.



Understanding EDR- Semi Mode

The Semi processing mode should only be used when centering and positioning can be assured. The Semi processing mode will make the proper density adjustments with a fixed latitude, independent of collimation. The Semi mode offers an advantage over the Automatic mode, in that an EDR over-correction, due to collimation recognition can be completely avoided. This mode can be useful for: Odontoid, L5/S1 spot, sinuses, or any other tightly collimated exam where scatter will reach the plate outside the area of interest.

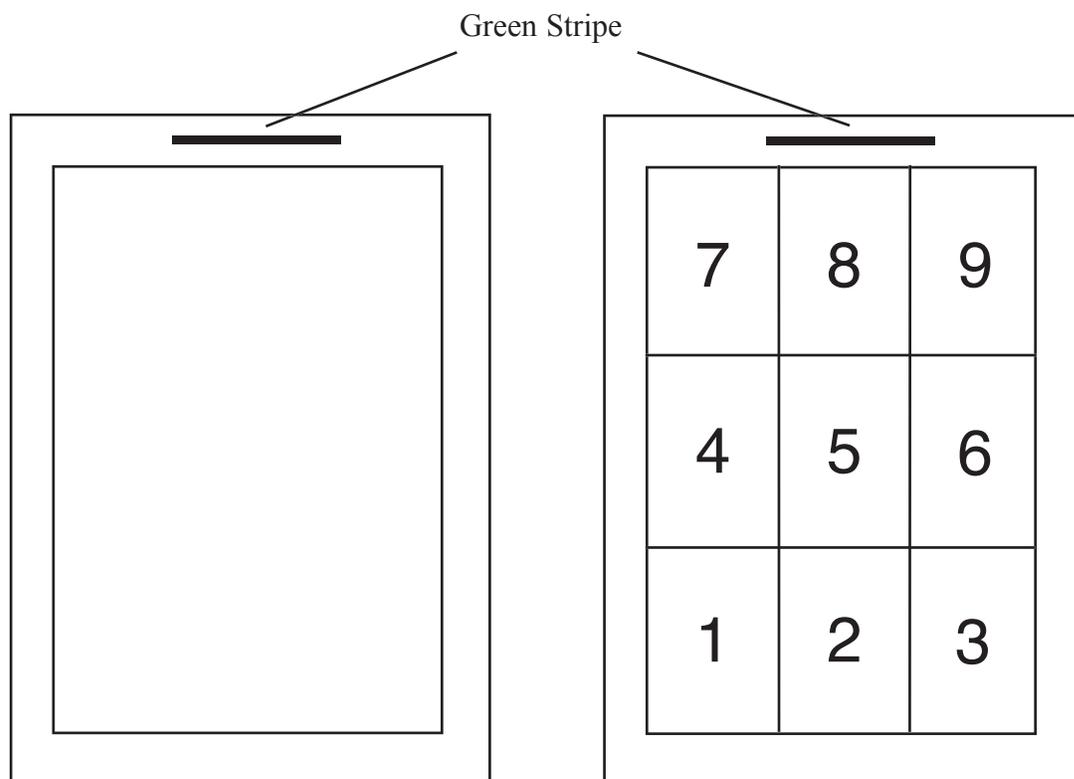
Green Stripe



The size of the center reading area varies with menu selection. However, it is always based on the physical center of the imaging plate. If the primary area of interest is not positioned to the center of the cassette, improper densities may be displayed. The Semi mode is not recommended when a high absorption object, such as metal prosthesis, is located in the center region of the cassette. These situations are better handled in the Auto or Fixed modes.

Understanding EDR- Semi-X

The Semi-X mode, like the Semi mode, will make the proper density adjustments with a fixed latitude value, independent of collimation. The Semi-X mode offers an advantage over Semi mode in that the area of interest does not have to be positioned in the center of the cassette. This mode can be useful when doing cross-table work such as hips or lateral c-spines, where positioning to the center of the cassette can be difficult.



It is important to always remember the orientation of the cassette. Was the green stripe up during the exam? This is most important for specifying the area of interest. Semi-X mode is selected at the IIP, under the EDR mode. This gives you a picture of the drawing on the top right. Select the sector you want to use as the central location for correcting the output density of the anatomical position. This usually corresponds to the thickest portion of the anatomical view. Use the keyboard to enter the value. To change the output average density, press the DENSITY key and input the density value (0.3-2.64). In most cases the default of 1.2 will work well.

***If you make DENSITY too high, the result may be a noisy and dark image.
Strive for the best density without darkening the whole image.***

Understanding EDR- Fixed Mode

The Fixed mode will give the image a light or dark appearance based on the amount of exposure that is used. This is similar to a screen/film system when a manual technique is used.

How do you correct for a light or dark image in the fixed mode? By adjusting your technique and/or reprocessing the image at the Fuji workstation.

When to use the Fixed Mode

The fixed mode is best used for the problem image, for example:

- X-Table Hips
- C7-T1 Laterals
- Any Body Part with a lot of Metal Hardware
- Any Image you Cannot Center Properly

How to use the Fixed Mode

Fixed Mode is found under the EDR (Exposure Data Recognition) function. The EDR is normally in the AUTO mode. To enter the Fixed Mode, press the button next to Fixed. Over time, facilities will develop typical "S" number ranges for each exam type. Input a value representing the "S" number that you wish to emulate. Enter a fixed "S" number relative to the procedure performed. Press <enter>. Process the IP. Adjust the radiographic exposure as necessary or reprocess the image at your workstation.

Using Standard Imaging Processing Parameters

The following seven parameters represent the standard imaging processing parameters that control contrast, density and spatial resolution. All seven of these factors interact. The most common image quality modifications are; contrast-GA, density-GS, and enhancement-RE.

Contrast Resolution

- GA Rotation Amount:** adjust image contrast. Subtle contrast change at GC.
Range from 0.6-1.4, with increments of 0.1.
- GT Contrast Type:** offers linear and non-linear gradation curves to vary the toe and shoulder portions of the curve. Curve selections from A-P.
- GC Rotation Center:** used when contrast is to be varied and density remains the same. Defines density point of GA.
Range of 0.3-2.6, with increments of 0.1.
- GS Density Shift:** to optimize density
 - + = More overall density
 - = Less density (lighter or soft tissue image)Range of -1.44 to +1.44 with increments of 0.1.

Spatial Frequency Resolution:

- RN Frequency Rank:** set to suit the anatomical structure size being visualized (enhanced). Low # = large organs; higher # = bone trabeculae.
Range of 0-9, with increments of 1.0.
- RT Frequency Type:** controls the degree of enhancement for each density to reduce image graininess. Curves selection from F, P-V.
- RE Frequency Enhancement Degree:** varies low to high
 - 0.0 = no edge enhancement at all, much like screen/film
 - 16.0 = maximum amount availableRange from 0.0 to 9.9, with increments of 0.1.
Range from 10-16, with increments of 1.0.

Note: Care must be taken when making adjustments to processing parameters. It is possible to degrade image information if the algorithms are improperly applied. Contact your local imaging specialist for more information on these adjustments.

Using Dynamic Range Control (DRC)

The use of DRC will allow the visualization of either high or low-density regions for specific radiographic exams. This type of processing is controlled by three processing parameters that are described below.

- DRN** Rank of Dynamic Range Control (0-9). This parameter defines the unsharp mask, and should be kept at a relatively large kernel size with regards to the kernel (RN) being used by the regular processing parameters. This number is inversely proportional. “0” being the most unsharp and “9” being the sharpest.
- DRT** Type of Dynamic Range Control (A-H). For visualizing the necessary density range. This type is to transform the smoothed signal. Curves “A” through “D” represent high density, radiopaque areas. Curves “E” through “H” represent a low density, radiolucent area. The range is A<B<C<D high density, E<F<G<H low density.
- DRE** Enhancement of Dynamic Range Control (0.0-2.0). For controlling visualized density. This parameter defines the weight (affect) with which the unsharp mask is applied to the original image.

Using Tomographic Artifact Suppression (TAS)

TAS is a one-dimensional unsharp mask used to suppress the artifact, which occurs from linear tomography. This processing is controlled by three different processing parameters described below.

- ORN** Rank of Tomographic Artifact Suppression (0-9). This is used for setting spatial frequency. This parameter defines the one-dimensional unsharp mask. This number should be kept relatively large so it will have more affect on the artifact and will not increase the grain or mottle of the image.
- ORT** Direction of Tomographic Artifact Suppression (0-1). This number is for setting the direction of the cassette. Zero “0” for the cassette in the vertical position and one “1” for the cassette in the horizontal position.
- ORE** Enhancement of one dimension spatial frequency (0.0-9.9, 10-16). This parameter defines the weighting factors of which the TAS is applied to the original image.

When using the TAS the edge enhancement (RE) of the original image should be set relatively low to decrease the mottle or grain of the image.

Note: Care must be taken when making adjustments to processing parameters. It is possible to degrade image information if the algorithms are improperly applied. Contact your local imaging specialist for more information on these adjustments.

Printed CR Film from a Fuji Laser

Name of Institution

Image Plate #

Menu Code
(MPM)

Image #

GENERAL HOSPITAL

02367855 A0200 A019

EDR Mode

CR Device

**FUJI COMPUTED
RADIOGRAPHY
IMAGE**

G 1.2 O #1.6 -0.25 R 4 R 0.5

CHEST, GENERAL

L 1.9 S 200 C *1.0, *1.0 201865

098551316

SMITH, JAMES

EXP.JAN.3.1996 [08:33]

COMMENT

[M] AUG. 25, 1960 B

SCALE: 100% RT-01

Processing Parameters

Exam Name

L# / S# / Contrast and Density Shift

Patient ID #

Req. Number / Patient Name

Date / Time of IP processing

Film Mark

[Sex] Date of Birth

Image Size - Routine

Definitions of Alphanumerics

Name of Institution: A user defined twenty-character field of alphanumerics and symbols.

Image Plate Number: This is the barcode number of the plate used to capture the displayed image.

Exposure Mode: This single letter represents the EDR mode selected at the IIP

A = Automatic	M = Manual
S = Semi or Semi-X	F = Fixed

Menu Code (MPM): This is a four-digit code that corresponds to the exam name chosen at the IIP.

CR Device: A user defined single letter that identifies the CR device from which the image was produced. Typically the letter A is chosen for the first reader and B for the second, etc.

Image Number: This number is a Fuji CR accession number. The number starts at 001 and runs continuously from 12:00:01 A.M. to 12:00:00 P.M. creating a daily log.

Processing Parameter: This list of letters, numbers and symbols represent the default processing parameters. NOTE: If the parameters are followed by the star symbol (*), this is an indication that the parameters have been changed from the default values.

Exam Name: This name corresponds to the Menu Code at the top of the film. The name for each exam is user defined.

L Number: This number represents the latitude of the image displayed on film.

S Number: This number represents the photostimulable luminescence (sensitivity) given off by the imaging plate while being scanned in the reader.

Contrast and Density Shift: Following the letter C on this line of information are two numbers separated by a comma. Preceding each of these numbers is either a (*) which represents positive values, or a (/) which indicates negative values. The defaults are set at *1.0, *1.0 and represent no change in contrast or density from default values.

Requisition Number: An Eight-character user defined field. Input for this field is done at the IIP.

Information on definitions continued...

Patient Identification Number: A Ten-character user defined field. Input for this field is done at the IIP.

Patient Name: A twenty-character user defined field. Input for this field is done at the IIP.

Date and Time of Processing: This represents the time the Imaging Plate was processed and not the exposure time.

Film Mark: Input for this field is done at the IIP using the MARK function. This field allows for custom annotation. NOTE: This field cannot be used to replace anatomical L/R markers.

Sex and Date of Birth: Input for these fields is done at the IIP. The field for patient sex is a single letter field for M or F, it can also be left blank. The format for date of birth is user defined, or the patients age can be substituted in this field.

Image Size: This scale represents the image size reduction if applicable.

Processing Mode- Routine: Batch processing information will be displayed.

Image Analysis

What to Check First-

1. Was the correct anatomical menu selected?
2. Was the body part well centered? Was the correct amount of collimation used?
3. Was scattered radiation controlled?
 - Use grid if the body part is over 10 cm. (This includes large portable chests). For grid recommendations see pages 6 and 7.
 - Lead strips should be used when doing more than one exposure on a cassette.
4. Was the correct kVp range used for the body part?
 - Do not use above 90 kVp without a grid.
 - Do not use less than 55 kVp for any general radiography exam.
5. Was the correct IP used? See page 5.
6. Was the “S” number within the acceptable range for this exam? See pages 9 and 10.
7. Was the “L” value within the acceptable range for the “S” number? See pages 10-13.
8. Has the IP been used within the last 24 hours? Was the IP exposed to scatter radiation prior to use?

Neonatal Specific-

1. Was the correct menu selected? Neonatal exams are different than pediatric.
2. Was the kVp at least 55? Was the mAs at least 1?
3. Was the smallest cassette used?
4. Was the body part positioned in the middle of the IP?
5. Are the “S” numbers and “L” values in the correct range? See pages 9-13.

Troubleshooting Guide

Image contrast and density

Contrast

<u>Problem</u>	<u>Possible Cause</u>	<u>Solutions</u>
Image contrast consistently too low.	Contrast parameter set too low	Increase the GA. A 10% change in contrast equals .10 change in the GA. Change the GT (gradient type). This change effects other parameters such as GA, GS, and GC.
Image contrast consistently too high.	Contrast parameter set too high	Decrease the GA. A 10% change in contrast equals .10 change in the GA. Change the GT (gradient type). This change effects other parameters such as GA, GS, and GC.
Image contrast inconsistently too low in contrast	Grid Cut-off	Improper alignment of grid.

Contrast and Density

<u>Problem</u>	<u>Possible Cause</u>	<u>Solutions</u>
Image contrast and density are too high or too low.	Improper selection of anatomical menu	Check to see that the image was processed under the correct menu name.
Image contrast and/or density increase or decrease day to day.	Film processing	Check the density calibration on the laser printer, adjust if needed. Check the chemicals for fatigue. Replenish or replace as needed.

Density

<u>Problem</u>	<u>Possible Cause</u>	<u>Solutions</u>
Image is inconsistently dark and flat	Improper exposure technique for EDR	Overlap of exposure when doing two on one exposures. Scatter radiation on the gap between split exposures. Blurred collimation edge. Improper split image pattern. See page 14
Image is white or unexposed	Gross overexposure	Reduce the radiographic exposure. If the “S” number goes below <25 and the “L” value is greater than 2.0 image quality may be compromised. See page 9-13 for more information.

Image Quality

Sharpness (appearance of unsharpness)

<u>Problem</u>	<u>Possible Cause</u>	<u>Solutions</u>
Image looks unsharp in certain areas of interest.	Image contrast and/or density set too low	A higher contrast or higher density may improve the impression on sharpness. Try a slight increase in the GA or GS.
	RE too low	Increasing the RE, increases sharpness. Note: Increasing the RE will increase the noise.

Sharpness continued...

Problem

Possible Cause

Solutions

RN too low

Higher frequency enhancement. Too much frequency enhancement will increase the graininess or artifacts.

RT not adequate for this menu

The following RT's (U, T, P, and F) may increase the sharpness, especially in the low-density (bright) regions. RT of F will be the sharpest.

Graininess

Problem

Possible Cause

Solutions

Overall image graininess for images in the same anatomical menu

RE set too high

RE should be 0.0 to 1.0 for an enhanced image (too low of RE can seem like an unsharp image).

RN set too high

Enhancement on a lower frequency.

RT not adequate for this menu

RT's of Q, R, S may decrease graininess especially in the low-density (bright) region.

Contrast too high

Lower the GA to decrease the contrast. The impression of graininess may improve with lower contrast. A slight increase in the GS might be necessary.

Graininess continued...

Problem

Possible Cause

Solutions

2K image data files
“blown” up to life size
images on larger
cassette size studies

This occurs due to high levels of noise induced by the magnification process used to enlarge an image capture in a 2K x 2K format. An increase in exposure, compared to the original manufacturer’s intentions may be required. Fuji HQ (4K x 4K) image capture is available to sites who require full resolution on all cassette sizes with no increase in exposure necessary.

Inconsistent Grainy Images

X-ray exposures too low

Increase X-ray exposure. As dose decreases X-ray noise (quantum noise increases). “S” numbers greater than 500-exhibit underexposure. *Note: Even when a phototimer is used, resulted mAs may change depending on the type of cassette and detector (mostly due to backscatter characteristics from the cassette/detector). If the phototimer was optimized for conventional screen/film, it should be checked and adjusted when starting to use CR system.*

Wrong anatomical menu

Use the proper anatomical menu for the body part.

Excessive Scatter on Image

Improper collimation. Only area of interest should be exposed, avoid including extra anatomy. Use a grid on thickness over 10cm.

Grid Cut-off

Improper alignment of grid.

Artifacts

<u>Problem</u>	<u>Possible Cause</u>	<u>Solutions</u>
Artifacts appear on the border high-contrast anatomies and materials, such as bone and metal	RE set too high	Strong enhancement may causes image processing artifact around high contrast edges.
White, irregular artifact appear on the image.	Mechanical damage to the phosphor	Check the surface of the IP, see if there mechanical damage of the same shape.
White, grain-like artifacts appear on the image.	Phosphor damage or dust	Check the surface of the IP and see if any dust has adhered to it. If so, wipe it away using the proper cleaning technique. See pages 30 and 31. If there is no obvious dust, check the color if the IP surface. If the IP has a slight yellowish color, it means that moisture has damaged the protective layer and phosphor itself. <i>Note: If liquid was left on the surface of the IP for a period of time, it might penetrate the phosphor. This usually happens if something other than anhydrous ethanol was used to clean the IP or if IP was put into the cassette before is was completely dried.</i>

Artifacts Continued...

Problem

Possible Cause

Solutions

Appearance of double exposed images

Double Exposed

The auto density adjustment of CR images will produce a radiograph with normal appearing density and contrast if a previously used IP is accidentally re-exposed.

Erasure systems malfunction

Contact the technical support hot line.

Routine Maintenance

- Daily:** Check density on the printer/processor.
- Weekly:** Clean air intakes on the CR reader.
- Monthly:** Inspect Imaging Plates and clean as needed. Inspect cassettes for any physical damage.
- Semi-annually:** Do Preventive Maintenance (PM) as per Service Manual.

Monthly Procedures

IP Cleaning: While wearing lint free cotton gloves, inspect the IP's visually; remove any dirt, hair, or lint. Use either a lint free cloth (photographic lens cloth) gently rubbing the surface of the IP, or brush the IP with a camel hair brush. If artifacts remain, use the recommended cleaning solution, always following the guidelines (MSDS) recommended by the distributor of the cleaning solution.

Anhydrous ethanol is the only solution used for cleaning IP's ST-V/HR-V generation or higher. (Do not use water, screen cleaner or isopropyl alcohol to clean IP's). Put a small amount of the solution on the lint free cloth and wipe the surface of the IP in a zigzag pattern to remove the artifacts. If an artifact cannot be removed by these methods or if physical damage is noted, the plate should be removed from service.

Cassette Inspection: Inspect cassettes for physical damage. (Insertion of a broken cassette into a CR reader can result in mechanical failure and system shutdown). Check cassette hinges, hinge rivets and clasps. Inspect lead backing for peeling or other physical damage.

Cassette Cleaning: CR cassettes can be cleaned with any of the cleaning solutions typically used for the cleaning of screen/film radiographic cassettes. Always remove the IP before cleaning. DO NOT immerse the cassette when cleaning.

A protective (plastic) bag should be used with the presence of blood or other body fluids. DO NOT insert a moist cassette into the CR reader. If necessary, remove the IP from wet cassette and insert (make sure the IP is dry) into a dry cassette. Blood or other body fluids should be cleaned with the appropriate germicidal agent. Always wear appropriate protective clothing when handling any solution.

Cleaning Solution for Imaging Plates ST-V/HR-V Generation and Higher

Imaging Plates that are generation ST-V/HR-V or higher should use **anhydrous ethanol** for routine cleaning. Anhydrous ethanol is a water free liquid unlike isopropyl alcohol. This solvent is a federally controlled HAZMAT. FMSU cannot inventory, sell, or provide this solution to the end user.

Hospital laboratories or pharmacies usually have this solution in stock for other uses, so we are recommending the radiology Q.C. department simply obtain their needed supply from their laboratory. In the event this is not the case, small quantities (5 gallons or less per year) can be purchased from:

Pharmco Products, Inc.
58 Vales Road
Brookfield, CT 06804
Contact: Nancy Smith (203) 740-3471 ext.116
Specify: Denatured Alcohol SDA3A 200 Proof

Isopropyl alcohol can only be used for cleaning IP's STIII generation and older.

CR Imaging Plate and Cassette Warranty Policy*

Fuji Computed Radiography Imaging Plate

FUJIFILM Medical Systems USA warrants Fuji CR Imaging Plates to be free from manufacturing defects for 1,000 exposures or one year from date of installation (or sale if installation is not documented), whichever comes first. This warranty is voided if the IP is not handled, exposed, cleaned or processed in the manner described in the FCR Reader Service and/or Operations Manual or if the IP is used in anything other than a Fuji-manufactured CR reader.

Fuji Computed Radiography Cassette

FUJIFILM Medical Systems USA warrants Fuji CR cassettes for a period of one year from date of installation (or sale if installation is not document).

The following terms apply to the warranty for both CR Imaging Plates and cassettes.

1. The product must have been purchased from FUJIFILM Medical Systems USA, or an authorized reseller.
2. Products honored under warranty, by FUJIFILM Medical Systems USA, become Fuji's property.
3. Products damaged through abuse, neglect, improper handling, unauthorized modification, or accident will not be replaced under warranty.

* This warranty policy is limited to Imaging Plates purchased directly from FUJIFILM Medical Systems USA.

Fuji Cares About the Environment*

FUJIFILM and its subsidiaries have tirelessly and steadily continued its efforts and activities in the realm of environment preservation. Fujifilm is dedicated to “preserving a green Earth and its environment, preserving health, and preserving safety.” As part of this effort, FUJIFILM Medical Systems USA is providing the following information on Fuji Computed Radiography (FCR) Imaging Plate disposal.

Fuji Imaging Plate Disposal

Many products used on a regular basis at healthcare facilities such as oil, fluorescent light bulbs, sharps, disposable surgical supplies, and test specimens must be disposed of in a specialized manner. Your FCR Imaging Plates (IP’s) contain a small amount of barium which must be discarded in accordance with the laws of you state and the U.S. Environmental Protection Agency (EPA). The disposal of used IP’s must be handled by a licensed transport and disposal company and must not be disposed of improperly.

Fuji Medical Will Help

FUJIFILM Medical Systems USA has provided this simple guide to assist you in the proper disposal of your IP’s, which should make compliance easier. Please call your local Fuji CR Specialist or call (800) 431-1850 and ask for the Environmental/Regulatory Affairs Department.

Your Responsibilities

Your facility may already have an EPA identification number. If you do not, you may need to apply for an EPA ID number from your state. Contact your state environmental protection agency for the appropriate forms. The used IP’s must be removed by an authorized transporter and disposal organization. Please remember that you are ultimately responsible for how the used IP’s are disposed.

* This information pertains to customers within the U.S.A. For customers outside the U.S.A., contact your appropriate environmental agency.



Information on Disposal of Fuji Imaging Plate continued...

Step by Step Instructions:

1. Apply for an EPA identification #, if necessary.
2. Have the used IP's removed by an authorized organization (your state environmental protection agency can help you locate an authorized and reputable disposal organization).
3. Prior to removal of the used IP's, ensure that the transporter has an accurate manifest.
4. Ensure that a copy of the manifest is forwarded to you within 35 days of the day the used IP's were accepted by the transporter.
5. Assure that you or your transporter provides copied of the manifest to both the origin and recipient states.
6. The paperwork must be maintained by your organization for a minimum of three years.



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