

X-Rite® 381

Scanning Densitometer

Operation Manual



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Congratulations!

We at X-Rite, Incorporated are proud to present you with the X-Rite 381 Scanning Densitometer. This instrument represents the very latest in microcontrollers, integrated circuits, optics, and display technology. As a result, your X-Rite 381 is a rugged and reliable instrument whose performance and design exhibit the qualities of a finely engineered instrument, which is not surpassed.

To fully appreciate and protect your investment, we suggest that you take the necessary time to read and fully understand this manual. As always, X-Rite stands behind your 381 with a full one year limited warranty and a dedicated service organization. If the need arises, please don't hesitate to call us.

Thank you for your trust and confidence.

*Ted Thompson
Chairman of the Board, C.E.O.*

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What to do First

This page explains the necessary steps you should take to properly setup and use your X-Rite 381 densitometer.



Find out the basic functions and features of the 381, read General Description & Features.



Make sure that the unit is not damaged and all the accessories are enclosed, read Packaging Checklist.



Become familiar with the typographical conventions, display functions, and general terms used in the manual, read User Interface.



- Read Getting Started (Section 1), which explains:
- Applying power and battery charging techniques.
 - Keyboard operation and function.
 - Configuration of the unit (beeper, time/date, hospital name, etc.).
 - Setting process control parameters on the 381 to correlate it to the processor.



Install the film guide insert if required, read Film Guide Insert Installation (Section 2).



Measure processed reference films on your densitometer, read Reference Entry (Section 3).



Measure a processed control film and compare it to the reference values, read Taking Measurements (Section 4.1).



Learn how to view the density values of the strip you just measured, read Viewing Data (Section 4.2).



Continue reading the remaining sections to find out how to send data and other advanced features.

General Description & Features

Description

The X-Rite 381 Densitometer is an automated transmission instrument designed for the quality control of 21 step, sensitometric film strips exposed by an X-Rite Sensitometer.

Film strips are automatically measured using a motorized control mechanism. Data is sorted and available for viewing or transmitting via the RS232 port.

The densitometer is operated using 4 keys and a interactive 16 character/2-line Liquid Crystal Display. There are 16 channels for different processor monitoring. The unit saves the last 32 strips measured for each channel. Each strip measured includes 21 steps of density, time/date, and one manually entered temperature.

Reference data can be manually or automatically entered.

The densitometer measures and stores the absolute density of the steps. In addition, you can view the data as deviated from the reference values.

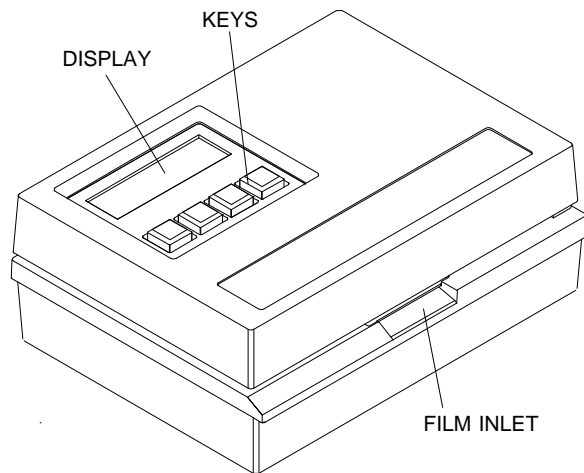
The densitometer comes preset with common process control equations for interpreting the data. Basic equations types are:

- Density at step number.
- Density at exposure level.
- Exposure level at density.
- Contrast.
- Gradient.

The densitometer has an Editor that allows you to set the Aim Value, Control Limit, Channel Name, and Equation format to best suit your individual requirements. The Editor also allows you to copy the setup of one channel to another channel. This is useful when you have two of the same type processors. You may also delete an individual unit or the entire database of a channel using the Editor.

Setting the Aim values and Control limits informs the densitometer when to display Go/No Go indications. After each measurement the unit will display if the limits were exceeded.

The densitometer can output to a dot matrix serial printer a sensitometric curve report or a clothes-line plot of three user defined equations along with temperature.



General Description & Features - continued

Features:

- Automated measurement of 21- step sensitometric control strips (8" and larger).
- 16 separate processor channels.
- Stores last 32 strips for each channel.
- 21 steps of density, processor temperature, time, and date is saved for each strip measured.
- Six user definable fields to interpret data.
- Print out of sensitometric curve (density vs. exposure) for last strip measured.
- Clothes-line plot for three of the user defined fields plus temperature.
- Display of density at step number.
- Automatic Data sorting
- Automatic calibration.
- Simple 4-key operation.
- Six rechargeable AA 1.2v NiCad batteries.
- External battery charger/eliminator.
- 16 character by two line, supertwist (Hi Contrast) LCD display.
- Control violations may be displayed for each strip measured to provide quick Go/No Go indication.
- RS232 output for RCI, computer, printer, or block I/O formats, with selectable Baud rates. For more information on RS232C and RCI protocol, order the 380 Series RS232C Interface Manual from X-Rite (P/N 380-506).

Packaging Check List

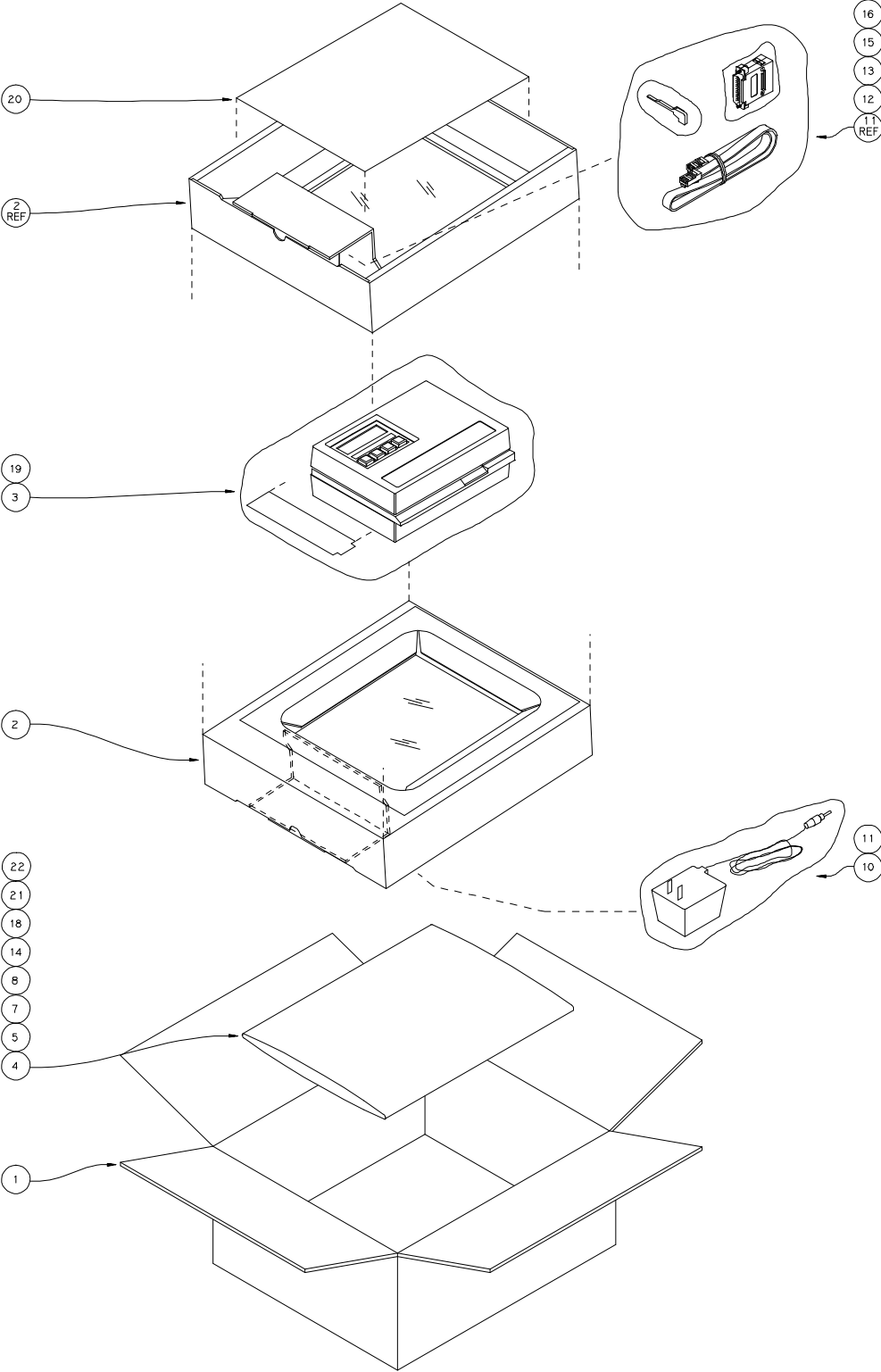
After removing the instrument from the shipping carton, inspect for possible damage. If any damage is noted, contact the transportation company immediately. Do nothing more until the carrier's agent has inspected the damage.

If damage is not evident, check and make sure that all items are included (Refer to the parts list below, and the following page for the packaging illustration).

Your 381 Densitometer was packaged in a specially designed carton to assure against damage. If reshipment is necessary, the instrument should be packaged in the original carton. If the original carton is not available, a new one can be obtained from X-Rite, Incorporated. Refer to the packaging drawing on the following page.

22	1	1	SD01-40	CERTIFICATE OF CALIBRATION
21	1	1	381-25	CALIBRATION VERIFICATION STRIP ASS'Y
20	1	1	381-511	UNPACKING NOTICE
19	1	1	SD200-25	SHIPPING SPACER
18	1	-	SD01-30	FLAT RATE POLICY BROCHURE
17	-	-	NOT USED	
16	1	1	381-70-01	INTERFACE ADAPTOR
15	1	1	SE108-69-01	INTERFACE CABLE
14	1	1	SD01-11	IMPORTANT NOTICE
13	1	1	SD65-03	PLASTIC BAG
12	1	1	380-25-02	FILM GUIDE INSERT
11	2	2	SD65-13	PLASTIC BAG
10	-	1	SE30-62	AC/DC ADAPTOR, 230VAC 50/60HZ
	1	-	SE30-61	AC/DC ADAPTOR, 115VAC 50/60HZ
9	-	-	NOT USED	
8	1	1	SD01-10	IMPORTANT NOTICE
7	1	1	SD01-04	WARRANTY REGISTRATION FORM
6	-	-	NOT USED	
5	1	1	381-500	OPERATORS MANUAL
4	1	1	SD68-10	PACKAGING ENVELOPE
3	1	1	SD65-07	PLASTIC BAG
2	2	2	SD200-880-06	CARTON INSERT
1	1	1	SD200-880-01	CARTON
ITEM	QTY-381	QTY-381X	PART NUMBER	DESCRIPTION
PARTS LIST				

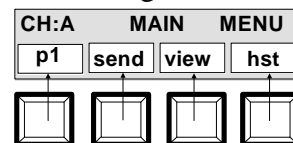
PACKING ILLUSTRATION



User Interface

This section will explain the typographical conventions, display functions, and general terms used in this manual.

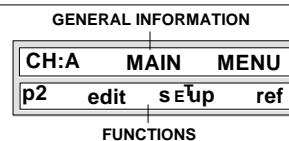
- » The characters in the display above each key dictate which function will be selected or what action will take place when that key is pressed.



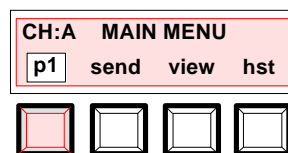
- » Information that will appear in the display will be printed in the manual with arrow marks on each side and in boldface. Ex., **<MEASURING STRIP>**



- » General messages and information telling you what channel, menu, etc. you have active are displayed in uppercase letters. Lowercase letters represent functions that can be activated, changed, etc.



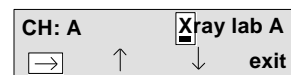
- » When a key is to be momentarily pressed, it will be printed in the manual with brackets on both sides and in boldface. Ex., **[P1]**. Note, in the illustration the function will have a white box around it and the key to be pressed will be tinted.



- » The symbols ↑ and ↓ represent the arrow symbols in the display used in the various edit functions. Pressing [↑] key increments and [↓] key decrements thru a list of numbers, letters, or symbols available for that function.



- » The term "cursor" is a black line that will appear below a character in the display. In most cases it means that character is active and can be edited via the [↑] and [↓] keys. The symbol → advances the cursor to the next character to edit.



- » When a procedure is continued on the next page an arrow will appear in the bottom right hand corner of the page.



- » Important notes will be indicated with a hand pointing at the message.



- » The term "Channel" is a quality control record of up to 32 measurements of density data. A letter (A thru L) is displayed to indicate which channel is being used. Ex., [CH:A]

- » The term "Channel Name" is a user defined 10 character name which identifies the processing unit being monitored.

- » The term "Equation" is a building block which allows the user to customize the fields to meet their application.

- » The term "Field" is a display which shows the density data interpreted by an equation. Fields can be named, defined by an equation, and the equations can be given values that describe where the equation is to be applied. Ex.,

B(ase)+Fog {it's name} = Density @ step one {it's equation & value}

1.

Getting Started

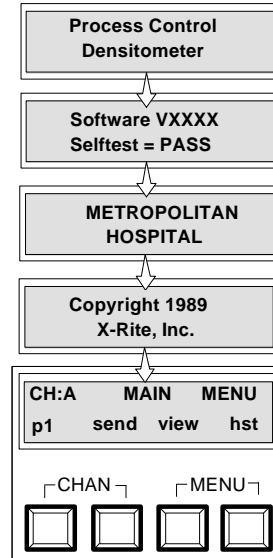
1.1. Applying Power/ Battery Charging

Applying Power

During battery operation power is applied when any key is pressed. The unit will automatically power down after two minutes of non-use (no keys pressed or measurements taken).

When the AC adaptor is connected the unit will not power down.

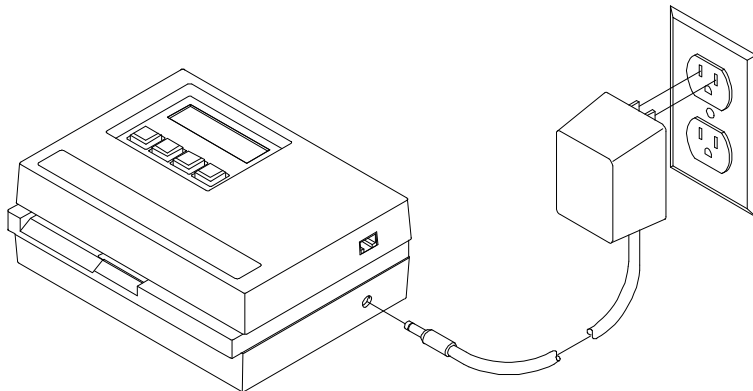
When the unit is awakened from a power down condition a diagnostics procedure is performed, and then the main menu is displayed.



Battery Charging

Before using: Make sure the voltage indicated on the AC adaptor complies with the AC line voltage in your area. If not contact your dealer.

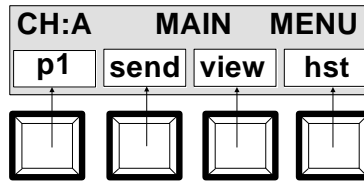
1. Plug the small connector end of the adaptor into side of unit.
2. Plug line cord end of adaptor into AC wall outlet.
3. Unit should be fully charged in 14 hours.
Note: If your unit has not been used for several weeks recharge for approximately 24 hours.



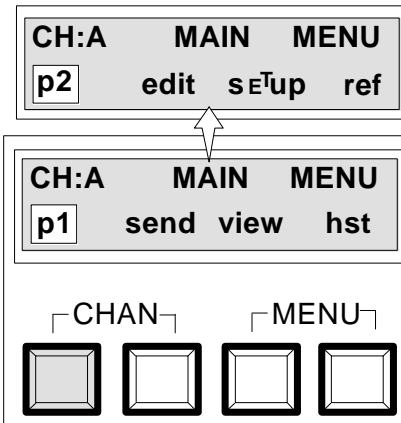
- > **The unit should be charged before use.** The unit can be operated while the batteries are being charged.

1.2 . Keyboard Functions

The characters in the display above each key dictate which function will be selected or what action will take place when that key is pressed.



The *main menu* is contained in two pages. To advance to the next page press [p1] or [p2].



send - allows you to transmit data out the RS232 port.

view - allows you to view the last strip measured. The data is contained in four different pages.

hst - allows you to view or print the previous strips measured in the database. The database can hold up to 32 different readings for each channel.

edit - allows you to set the Aim Value, Control Limit, Channel Name, and Equation format to best suit your individual requirements. The Editor also allows you to copy the setup of one channel to another channel. This is useful when you have two of the same type processors. You may also delete an individual unit or the entire database of a channel using the Editor.

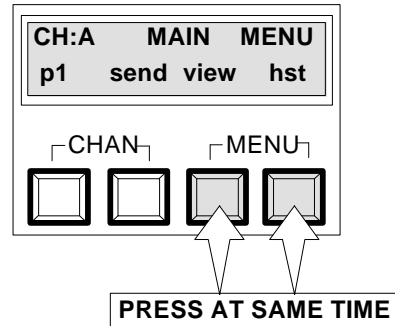
setup - allows you to set the tone, I/O parameters, time/date, hospital name, references, lamp monitor and temperature format.

ref - allows automatic entry and averaging of reference data by measuring reference films.

Keyboard Function - continued

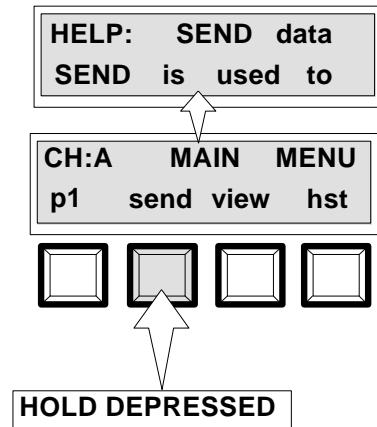


> If you want to return to page 1 of the Main Menu at any point in time, simultaneously press the two keys marked MENU.



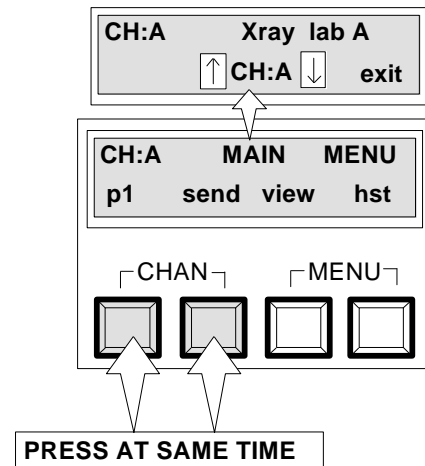
Help Messages:

Most of the functions have a built-in "HELP " message. To activate the help message simply hold the key depressed until the message is displayed, then release. The message can be temporarily paused by pressing the key back down while the message is scrolling.



Channel Selection:

There are 16 channels (A thru P) to select from. To activate channel selection simultaneously press the two keys marked CHANNEL. Press [↑] to increment and [↓] to decrement through the available selections. After selecting a channel, press [exit].



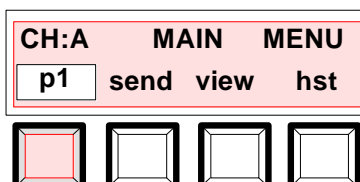
1.3. Setting Up Your 381

Your 381 should be setup (tone, date/time, etc.) before proceeding to reference entry or strip measurement. The procedures for setting up the unit are shown on the following pages. Refer to Appendix A7 for 381 setup definition.

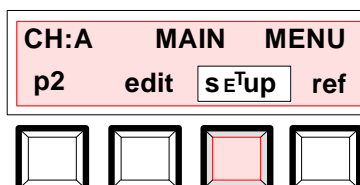
1.3.1 Beeper Loudness

Tone adjusts the beeper loudness (loud, soft, or off).

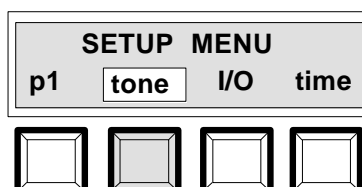
1) Press **[p1]**.



2) Press **[setup]**.



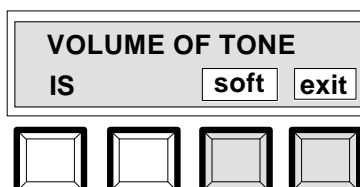
3) Press **[tone]**.



4) Select loud, soft, or off, press **[soft]**.

Press **[exit]** to continue.

Select another setup function or press MENU keys to exit setup.

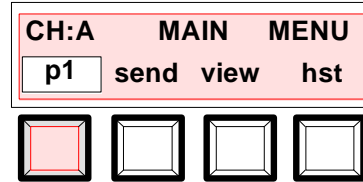


soft
loud
off

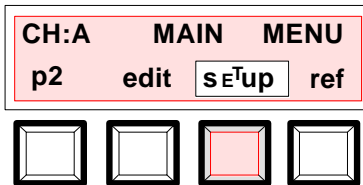
1.3.2 RS232C Setup

I/O allows you to set the RS232 parameters of the I/O port. You can select a preset setting (ex. Epson serial printer) and the 381 will preset all the necessary I/O parameters; or custom, where you have to individually set the I/O parameters (ex. baud, pin-5, format, etc). Refer to Appendix A7 for preset and custom parameter definitions.

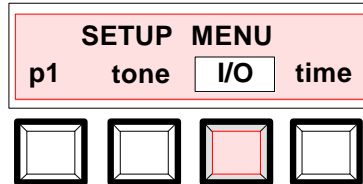
1) Press [p1].



2) Press [setup].



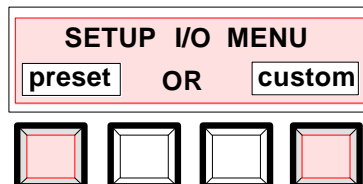
3) Press [I/O].



4) Select [preset] or [custom].

If **preset** is selected go to Step 5.

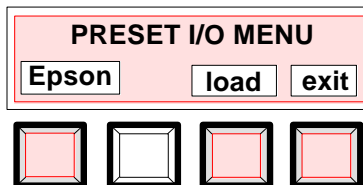
If **custom** is selected go to Step 6.



5) Select output format, press [Epson].

Press [load] to save selected preset and exit out of I/O preset, or press [exit] to not save selected preset and exit out of I/O preset.

Select another setup function or press the **MENU** keys to exit setup.



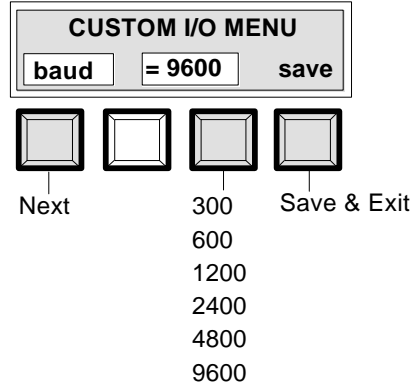
Epson
Diconix
Seiko
D.I.F.
301
180si



RS232C Setup - continued

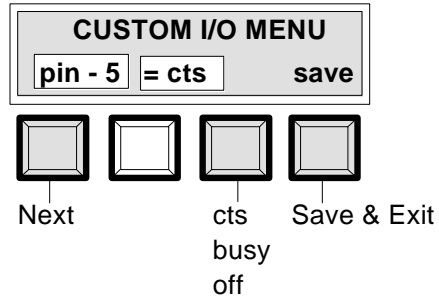
- 6) Select the baud rate, press [= 9600].

Press **[baud]** to go to next setup option (Step 7) or press **[save]** to exit setup.



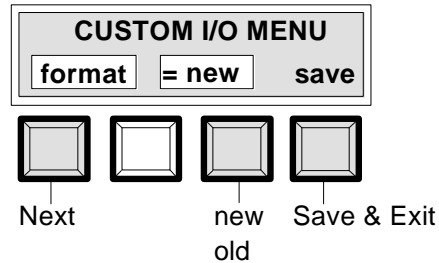
- 7) Select the status of pin-5, press [= cts].

Press **[pin-5]** to go to next setup option (Step 8) or press **[save]** to exit setup.



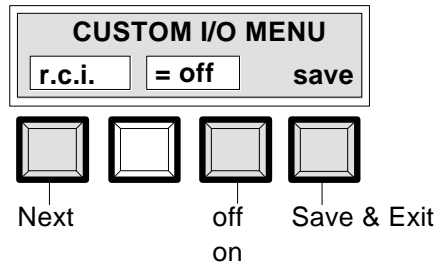
- 8) Select the format status, press [= new].

Press **[format]** to go to next setup option (Step 9) or press **[save]** to exit setup.



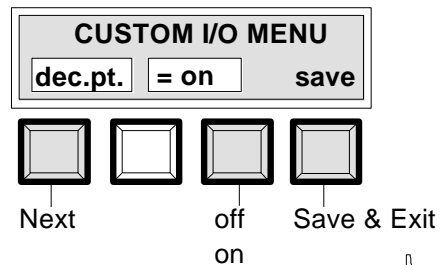
- 9) Select the R.C.I. status, press [= off].

Press **[r.c.i.]** to go to next setup option (Step 10) or press **[save]** to exit setup.



- 10) Select the decimal point status, press [= on].

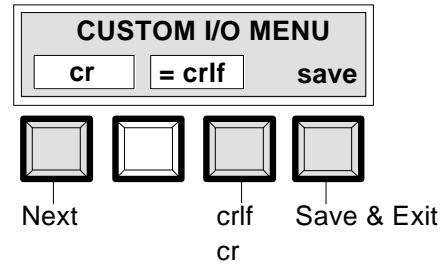
Press **[dec.pt.]** to go to next setup option (Step 11) or press **[save]** to exit setup.



RS232C Setup - continued

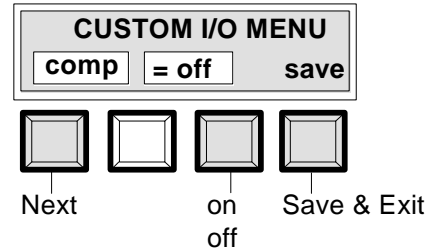
11) Select the delimiter status, press [= crlf].

Press [cr] to go to next setup option (Step 12) or press [save] to exit setup.



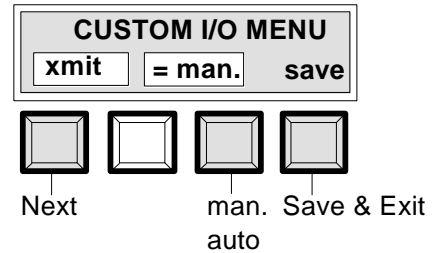
12) Select the comp status, press [= off].

Press [comp] to go to next setup option (Step 13) or press [save] to exit setup.



13) Select the xmit status, press [= man].

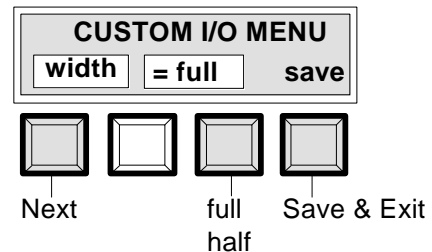
Press [xmit] to go to next setup option (Step 14) or press [save] to exit setup.



14) Select the width status, press [= full].

Press [width] to return to Step 6 or press [save] to exit custom setup.

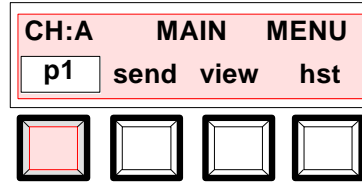
Select another setup function or press MENU keys to exit setup.



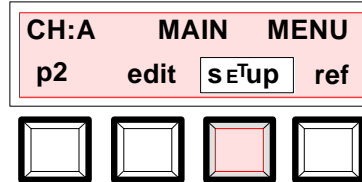
1.3.3 Time / Date Setup

Time allows you to set the time and date.

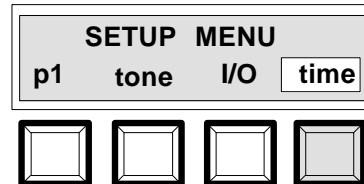
- 1) Press [p1].



- 2) Press [setup].



- 3) Press [time].



- 4) Enter the date and the time.

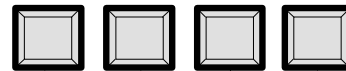
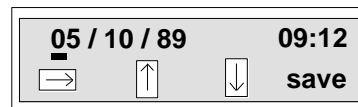
Press [→] to move cursor to next character

Press [↑] to increment the number.

Press [↓] to decrement the number.

Press [save] to exit.

Select another setup function or press MENU keys to exit setup.

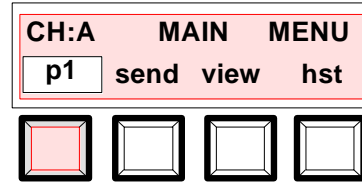


Cursor Up Down Save & Exit

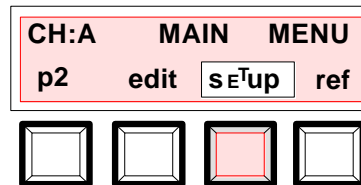
1.3.4 Name Setup

Name allows you enter the name of the unit (ex., Metropolitan Hospital). The name will be printed with the clothesline plot and characteristic curve each time they are transmitted.

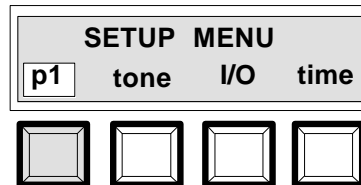
1) Press [p1]



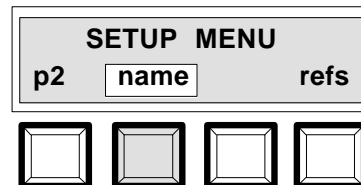
2) Press [setup].



3) Press [p1].



4) Press [name].



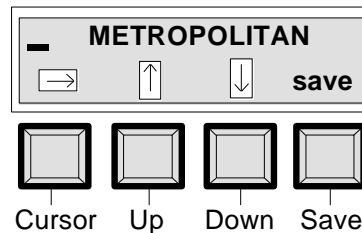
5) Enter the first line of the name (up to 16 characters).

Press [→] to move cursor to next character

Press [↑] to increment thru the character list.

Press [↓] to decrement thru the character list.

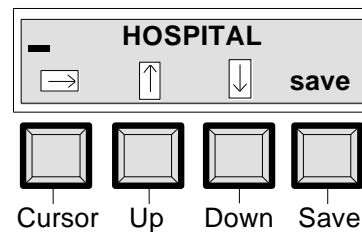
Press [save] to continue.



6) Enter the second line of the name (up to 16 characters).

Press [save] to exit.

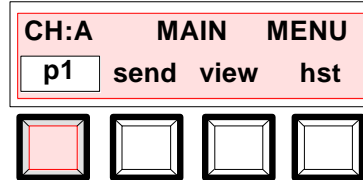
Select another setup function or press MENU keys to exit setup.



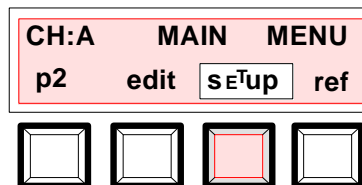
1.3.5 Reference Setup

Ref allows you to turn references on or off. If *references are on*, the densitometer will display if the limits were exceeded after each measurement. Also, when you enter view or history you are prompted to select either **meas** (measured) or **dev** (deviated from reference). If *references are off*, limit violation is not displayed and you are not prompted to select either **meas** or **dev** in the view or history functions.

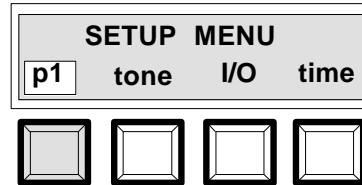
1) Press [p1]



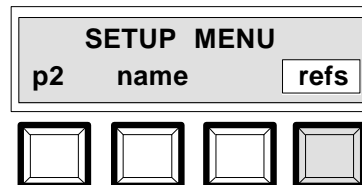
2) Press [setup].



3) Press [p1].



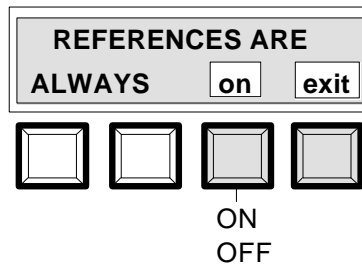
4) Press [ref].



5) Select reference on or off, Press [on].

Press [exit] to continue.

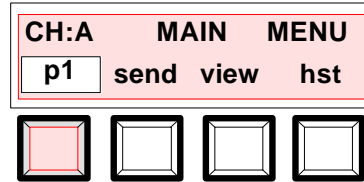
Select another setup function or press MENU keys to exit setup.



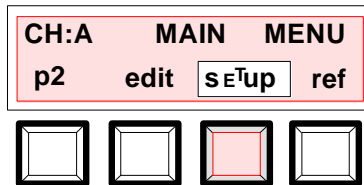
1.3.6 Lamp Counter Reset

Lamp allows you to view the lamp life percentage and reset the lamp hours back to zero. This reset should only be done after replacing the lamp.

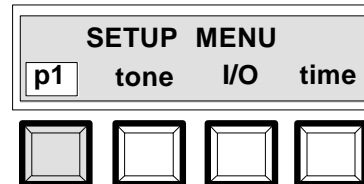
1) Press **[p1]**.



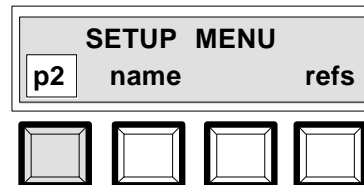
2) Press **[setup]**.



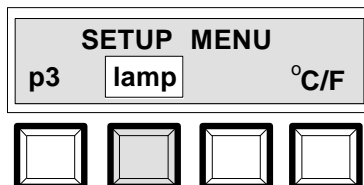
3) Press **[p1]**.



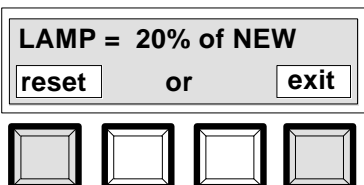
4) Press **[p2]**.



5) Press **[lamp]**.



6) Press **[reset]** to reset counter or press **[exit]** to exit without resetting counter.



If **[reset]** is pressed go to Step 7.



> If either **[reset]** or **[exit]** is pressed < CALIBRATING LAMP DRIFT > will display for approx. 20 seconds.



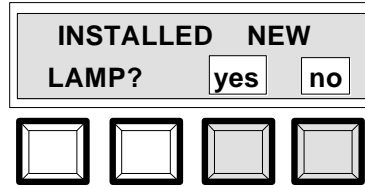
Lamp Counter Reset - continued

7) Select **[yes]** to reset lamp or **[no]**.

If yes is selected "Lamp Monitor Reset to 100%" is displayed.

If no is selected "Lamp Monitor Not Affected" will display.

Select another setup function or press MENU keys to exit setup.



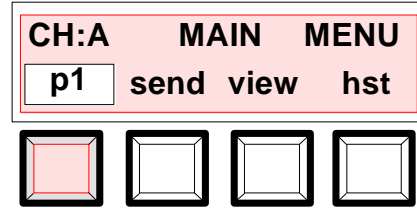
1.3.7 Temperature Units (°C/F)

°C/F allows you to select the temperature format to be used (celsius or fahrenheit).

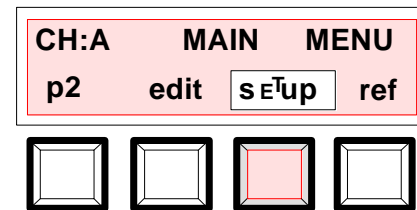


> If the temperature format is changed after data has been entered, temperature data becomes invalid and should be deleted using the delete function (see Section 5.3.).

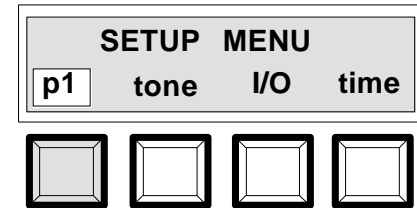
1) Press [p1].



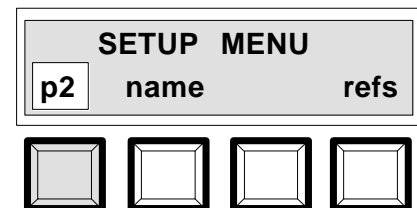
2) Press [setup].



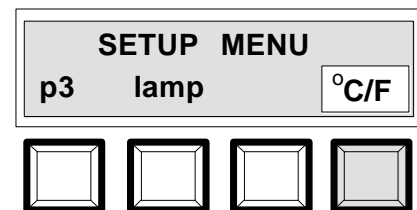
3) Press [p1].



4) Press [p2].



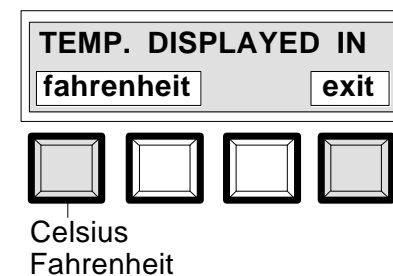
5) Press [°C/F].



6) Press [fahrenheit] to select temperature in celsius or fahrenheit.

Press [exit] to continue.

Select another setup function or press the MENU keys to exit setup.



1.4. Process Control

1.4.1 Film Response to Exposure

The 381 densitometer measures film exposed by all X-Rite sensitometers with 21 steps. The sensitometer exposes film with a known quantity of light through a 21-step light modulator. The maximum light is emitted from Step No. 21. Each successive step emits 70.7% of the light emitted from the step adjacent to it (.15 log exposure). The film responds to this exposure in a predictable way called the D-Log E Curve, (Density-Log Exposure Curve). Figure One shows the response of a typical radiographic film exposed by a sensitometer. The portion of the curve that changes most with variations in processing is called the "straight line portion" of the curve.

It is not necessary to plot D-Log E Curves to monitor automatic processors in normal laboratory environments. A simpler method is to record the three values (base+ fog, speed index, & contrast index) on the D-Log E Curve which contain most of the data.

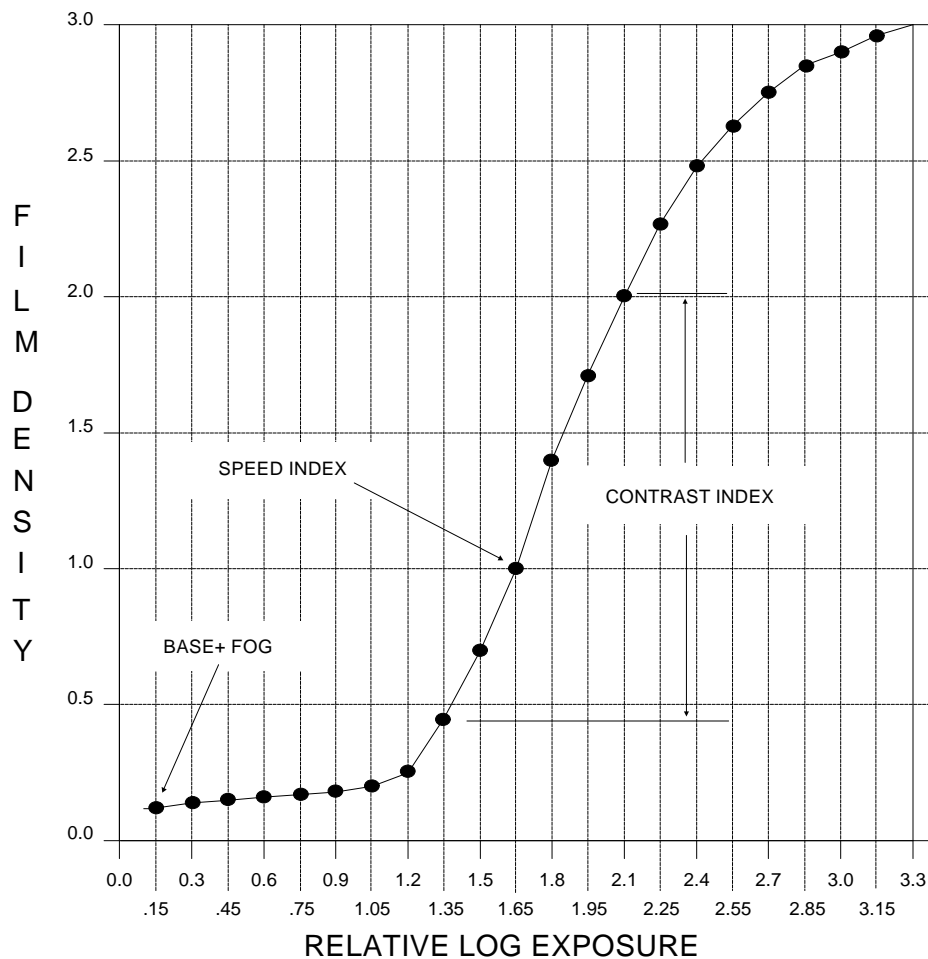


Figure 1. D-Log E Curve

Film Response to Exposure - continued

Base+ Fog:

The least exposed portion of the film is called Base+ fog. It is the base support density plus any silver emulsion density developed in the area where negligible exposure should occur. The 381 is factory preset with Base+ Fog being measured at step 1.

Speed Index:

The step on the exposed film with a density nearest 1.0D+ Base+ fog is called Speed Index. This step is a direct indicator of film speed. Variations in processor conditions are monitored on this step. The 381 is preset to read step 11 as Speed Index.

Contrast Index:

The slope of the straight-line portion of the D-Log E Curve is called Contrast Index. Select the step closest to but not larger than 2.20D. Subtract from this step the step closest to but not lower than 0.45D. Contrast Index is used to monitor processor variations in conjunction with the Speed Index. The 381 is preset to read step 13 as the high density and step 9 as the low density.

1.4.2 Setting Process Control Parameters

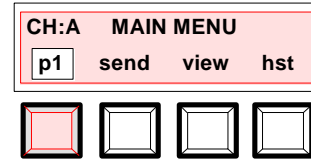
When using a sensitometer with adjustable exposure times (X-Rite 383 or 334), the sensitometer should be adjusted to expose step 11 with density closest to 1.0+ base+ fog. If the sensitometer is not adjustable or the proper densities cannot be located at the correct step numbers, the 381 can be setup to read the densities at different step numbers.

Use the following procedures to change Speed Index and Contrast Index measurement locations, if necessary.

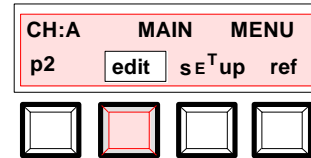
Speed Index Step Selection

Select the channel to edit (refer to Sec. 1.2 for channel selection)

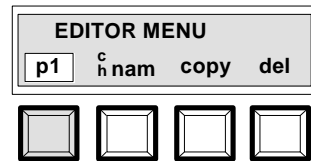
1) Press [p1].



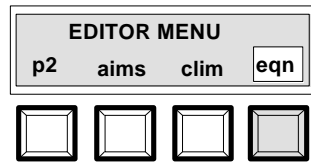
2) Press [edit].



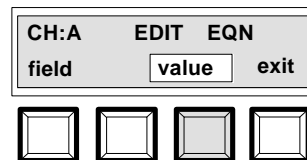
3) Press [p1].



4) Press [eqn].

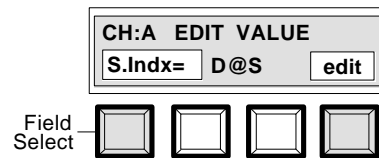


5) Press [value].



6) If < S.Indx= > is not displayed, press field selection key until it is.

Press [edit] after selecting the Speed Index field.



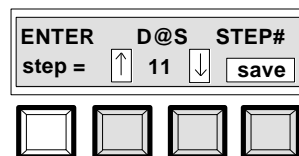
7) Enter the desired step# for speed index.

Press [↑] to increment number.

Press [↓] to decrement number.

Press [save].

Press the two MENU keys to exit to Main Menu.



Contrast Index Hi & Lo Step Selection

Select the channel to edit (refer to Sec. 1.2 for channel selection)

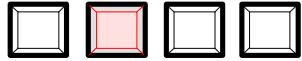
1) Press [p1].

CH:A MAIN MENU
p1 send view hst



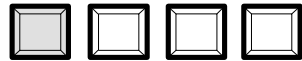
2) Press [edit].

CH:A MAIN MENU
p2 edit sE↑up ref



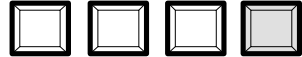
3) Press [p1].

EDITOR MENU
p1 c h nam copy del



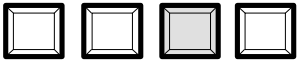
4) Press [eqn].

EDITOR MENU
p2 aims clim eqn



5) Press [value].

CH:A EDIT EQN
field value exit



6) If < C.Indx= > is not displayed, press field selection key until it is.

Press [edit] after selecting the Contrast Index field.

CH:A EDIT VALUE
C.Indx= Cont edit



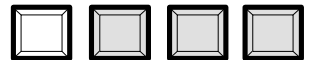
7) Enter the desired step# for Low density.

Press [↑] to increment number.

Press [↓] to decrement number.

Press [save].

ENTER Cont Lo-S#
step = ↑ 09 ↓ save



8) Enter the desired step# for Hi density.

Press [↑] to increment number.

Press [↓] to decrement number.

Press [save].

Press the two MENU keys to exit to Main Menu.

ENTER Cont Hi-S#
step = ↑ 13 ↓ save



1.4.3 Monitoring a Processor

The 381 can monitor a processor on each of its 16 channels (A thru P). The channel names which appear on the print-outs are preset to "Xray Lab A" thru "Xray Lab P." These ten character names may be changed if desired (refer to Section 5.1 Channel Name of the Advanced Users Section).

Reference Entry

Aim values for Base+ Fog, Speed Index, and Contrast Index must be established for each processor being monitored. This is done automatically by measuring several (3-5) reference strips that are exposed and processed when the processor is operating in an optimum fashion. Refer to Section 3 for the procedure on measuring the reference strips.

Running Daily Strips

Control Strips should be processed and measured daily. The 381 will automatically measure the 21 densities, calculate the process control parameters, and indicate whether or not the measured strip is within control limits. Refer to Section 4.1 for procedure on measuring strips.

Viewing or Plotting History

History allows you to view all the information on each strip in the database, or print the process control record. When the process control record is printed, processor and film information must be manually recorded at the top of the form (see example of printer plot at the end of Section 4.4, History Usage).

A box of film should be set aside from regular stock for exclusive process monitoring. New film stock will require measuring new reference strips, because small density changes are possible between film batches.



- › One new set of references may be entered for each data set (32 measurements). The date the new references are entered will be indicated on each field of the process control record as a vertical dotted line. The corresponding new aim value will also be printed below each field.
- › No more than two sets of references may be entered for each data set (32 measurements) or invalid history plot data will result.

1.4.4 Troubleshooting Film

You should always keep Channel "P" of your unit open so that it can be used as a "scratch pad" when troubleshooting a processor. This will allow you to run film strips and correct the processor problem without interfering with the monitoring channels.

The following procedure is recommended for troubleshooting out-of-tolerance processors.

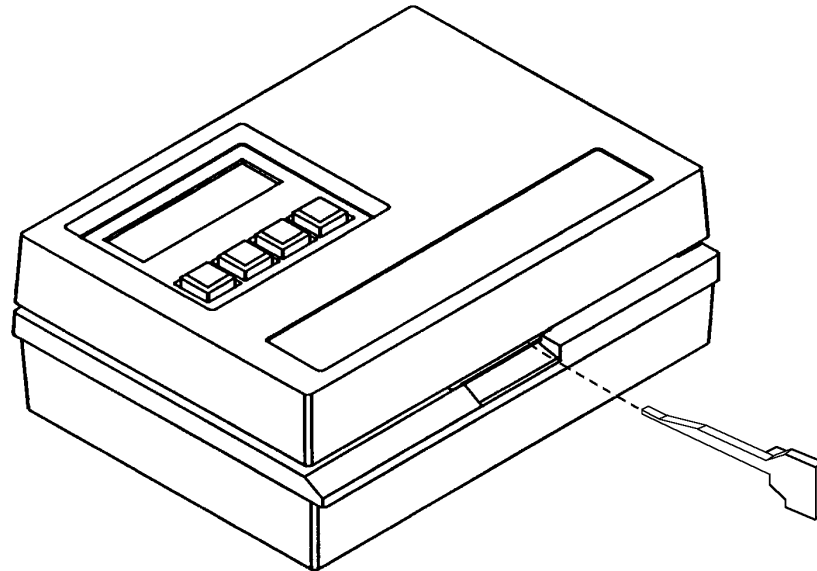
1. Copy the channel being monitored to Channel "P" (refer to Section 5.2 to copy eqn, name, ref, and data).
2. Measure films on Channel "P" and adjust processor as required.
3. When the processor is back in control measure a film on the original channel to verify correction.

2.

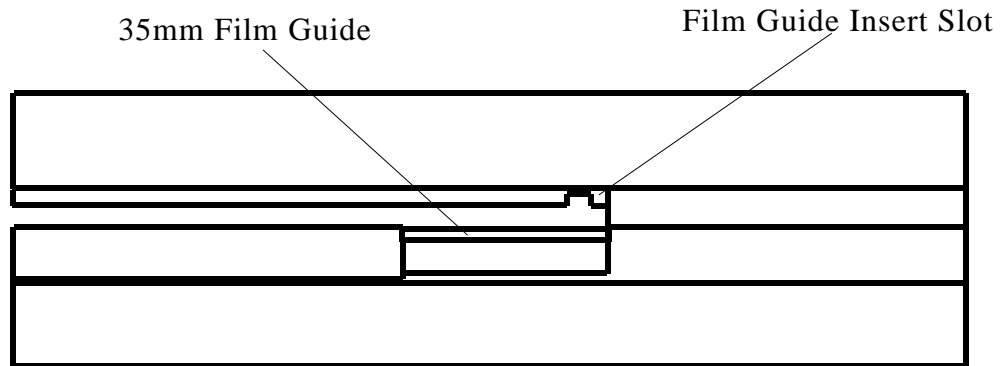
Film Guide Insert Installation

The film guide insert must be installed if the X-Rite model 303, 333, or 334 sensitometer was used to expose the film being measured.

- Install film guide insert by sliding into slot just above 35mm film guide (right hand side), see below.



Film Guide Insert



FRONT VIEW

3.

Automatic Reference Entry

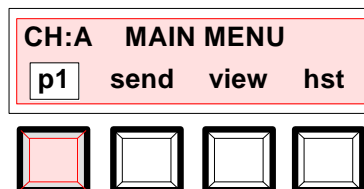
The *Automatic Reference Entry* procedure is the recommended method of entering in reference values. This method will average the reference films measured and load all 21 steps of reference data (aim values) and entry of a reference processor temperature.



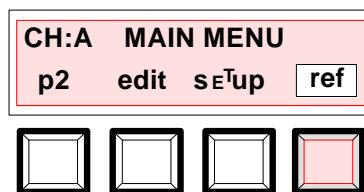
- > To provide a better overall average, it is recommended to read five reference strips.
- > The reference temperature is the center temperature which appears on the history plot. It is not an aim value used for determining control limits.

3.1. Read - Automatic Reference Entry

1) Press [p1].



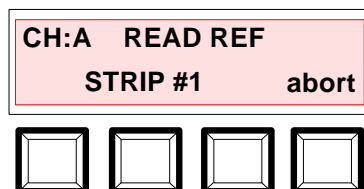
2) Press [ref].



3) Read the 1st reference strip. (See Section 4.1 for proper film insertion technique.)



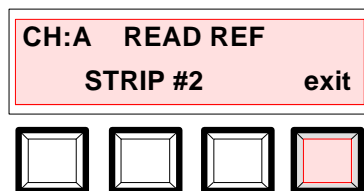
- > Press [abort] to end the procedure without entering any reference data.



4) Read the 2nd reference strip.



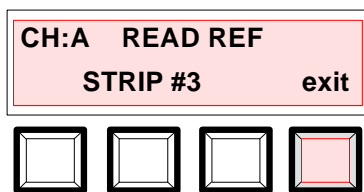
- > Press [exit] if you do not want to read the 2nd strip and end the procedure.



5) Read the 3rd reference strip.




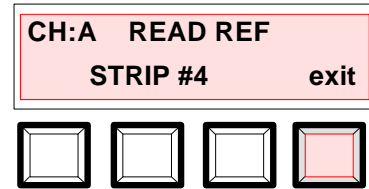
- > Press [exit] if you do not want to read the 3rd strip and end the procedure.




Read - Automatic Reference Entry - continued

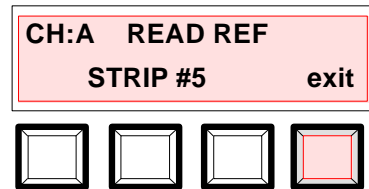
6) Read the 4th reference strip.

 > Press **[exit]** if you do not want to read the 4th strip and end the procedure.

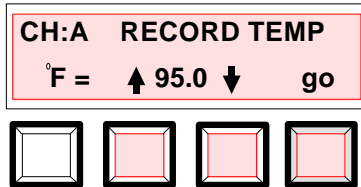


7) Read the 5th reference strip.

 > Press **[exit]** if you do not want to read the 5th strip and end the procedure.



8) Press **[↑]** to increase or **[↓]** to decrease temperature. Press **[go]** to continue to next screen.



After measuring the last strip **< NEW REFERENCE INSTALLED >** is momentarily displayed and the unit returns to Step 2 (Main menu - p2).



4.

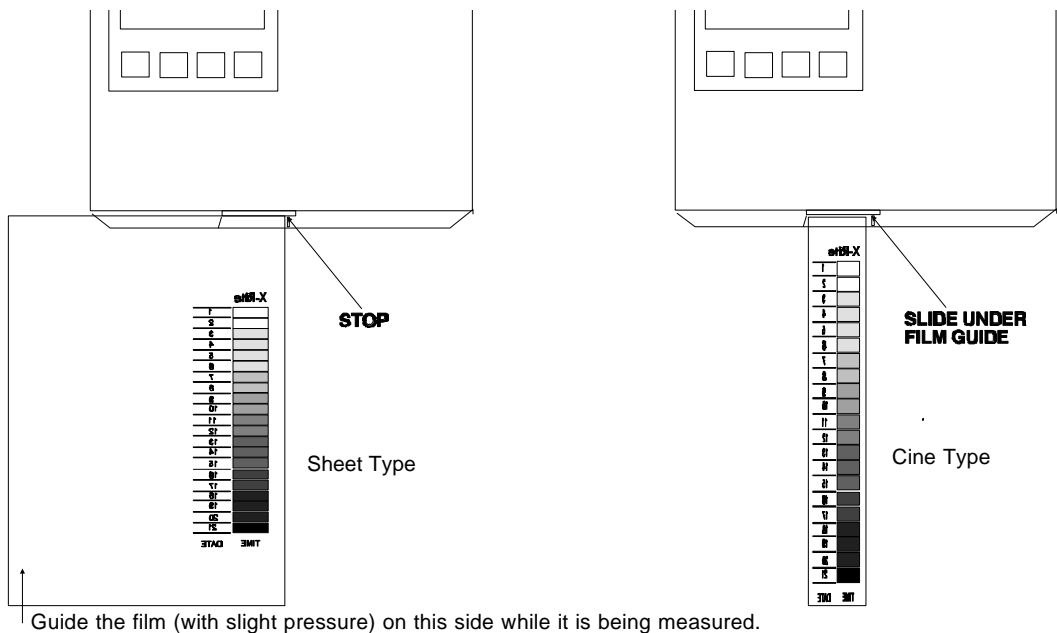
Operation

4.1. Taking Measurements



- > When inserting strips into unit, there must be at least a 1.1 inch (28mm) leader before the outside edge of the first step. Refer to your Sensitometer Operation Manual for the proper method for exposing film.
- > When measuring single emulsion films, insert the strip with the emulsion side down.
- > Before measuring, inspect the film for any pin spots or flaws on the 21 steps. If there is a flaw or spot on a step, it could cause an inaccurate measurement.
- > The exposed film must have a sensitometric exposure with a gamma of .7 or greater on steps 7 thru 15. There must be a visible density difference between each step (density must increase by at least .11D between those steps).
- > To ensure accurate measurement results, step 1 of the film must be inserted into the densitometer first (low density end) if the film was exposed with an X-Rite 303/333 or a Cronex® sensitometer.

- 1) ***For Sheet type film:*** Position the side of the strip with the exposed steps tightly up to the stop, then insert film (emulsion side down for single emulsion film) until it rests against the drive rollers and the motor is activated. **Do not release the film**, with slight pressure continually hold the film against the stop (guiding it to prevent any skewing) while the film is being measured. ***For Cine type film:*** Insert film (emulsion side down) into 35mm slot under the film guide until it rests against the drive rollers, and release when the motor takes hold.



Guide the film (with slight pressure) on this side while it is being measured.



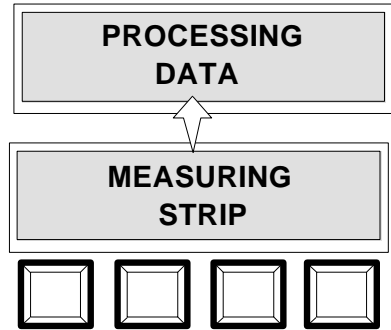
- > If the X-Rite model 303, 333, or 334 sensitometer was used to expose the film, the filmguide insert must be installed in the 381 to allow for proper film positioning (see Section 2). Cine film exposed on the 303, 333, or 334 must also be guided against the insert (same as sheet film).

Taking Measurements - continued

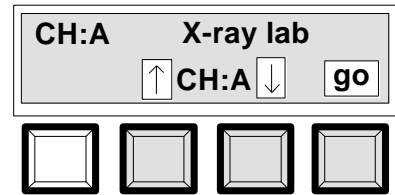
2) < **MEASURING STRIP** > and then < **PROCESSING DATA** > is momentarily displayed.



> If < **INVALID READING** > is displayed, it means that the unit was not able to recognize all 21 steps. It does not mean that the limits were exceeded. Insert film again, if still not recognized, refer to Appendix A3 for more information.



3) Select the channel you want to store the data in using the [↑] or [↓]. Press [go] to advance to next step.



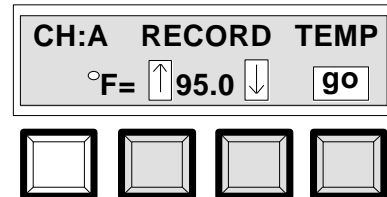
4) The time and date are momentarily displayed.



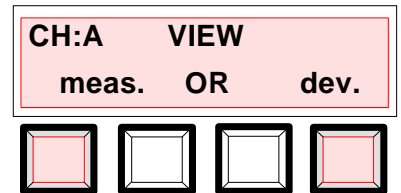
> If references are entered the unit will momentarily display < **WITHIN LIMITS** > or < **LIMITS EXCEEDED** > .



5) The unit prompts you to enter the temperature of the processor solution, using the [↑] or [↓]. Press [go] to store data and advance to next step.

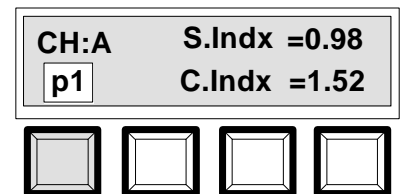


6) Select [meas.] (actual measured data) or [dev.] (deviated from reference). Ignore this step if reference is turned off in setup.




7) Press [p1] thru [p4] to view the measured data. Refer to section 4.2 for further information on viewing data.

Press the two MENU keys to exit to Main Menu.

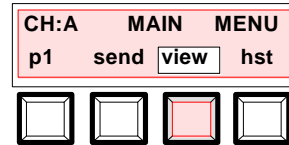


4.2. Viewing Data


After a film is measured, all 21 steps of density are stored in memory. View allows you to view the 21 density values, gamma (slope of the curve at density value) at .1D increments, and six user definable fields. These values can be viewed as measured or deviated from the references. Fields 1-6 are preset with common process monitoring equations (see Appendix A4, Factory Presets).

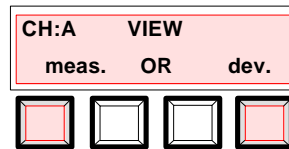
 > Disregard steps 1 and 2 if you are viewing data directly after a measurement.

1) Press **[view]**.



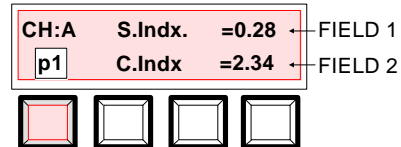
2) Press **[meas]** or **[dev.]**.

 > If reference is turned OFF in setup, skip this step.



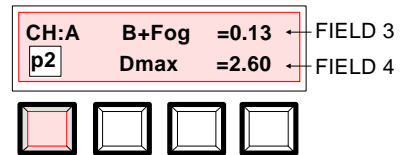
3) Speed Index and Contrast Index values are displayed.

Press **[p1]**.



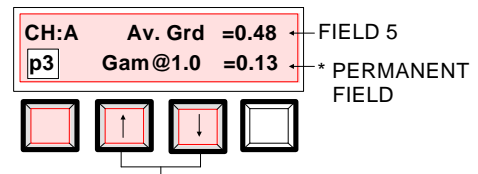
4) Base+ Fog and Density Maximum values are displayed.

Press **[p2]**.



5) Average Gradient and Gamma values are displayed. Other gamma values may be viewed by pressing **[↑]** to increase or **[↓]** to decrease density value.

Press **[p3]**.

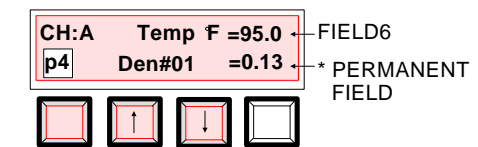


Increases/Decreases the density at which gamma is calculated. The density changes in 1/10th increments.


6) Temperature and density step values are displayed. Other density step values may be viewed by pressing **[↑]** to increase step number or **[↓]** to decrease step number.

Press **[p4]** to return to page 1, or press the two MENU keys to exit view and return to Main Menu.

* Permanent fields are not user definable.



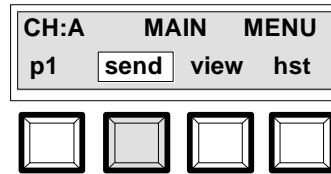
Increments/Decrements thru steps 1-21

 > Temperature will always appear as absolute temperature even **[dev]** is pressed.

4.3. Sending Data

Send allows you to manually transmit the last measurement taken to a printer. You can select print (sends the 21 density steps), or plot (sends the characteristic curve). The data transmitted is dependant on the printer selected (see Section 1.3.5). Refer to Appendix A6 for serial printer setup and connection.

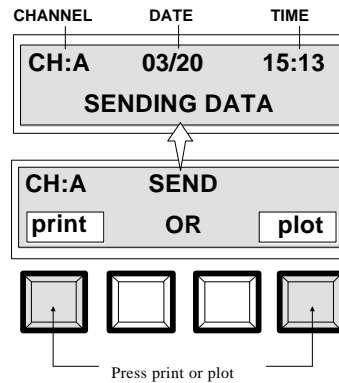
1) Press **[send]**.



2) Press **[print]** or **[plot]**.

If **[print]** was pressed, see print example below.

If **[plot]** was pressed, see plot example on following page.



Print Example

step 01 =	0.15
step 02 =	0.15
step 03 =	0.15
step 04 =	0.15
step 05 =	0.16
step 06 =	0.17
step 07 =	0.20
step 08 =	0.27
step 09 =	0.49
step 10 =	0.94
step 11 =	1.44
step 12 =	1.83
step 13 =	2.15
step 14 =	2.37
step 15 =	2.57
step 16 =	2.71
step 17 =	2.78
step 18 =	2.89
step 19 =	2.94
step 20 =	3.02
step 21 =	3.06

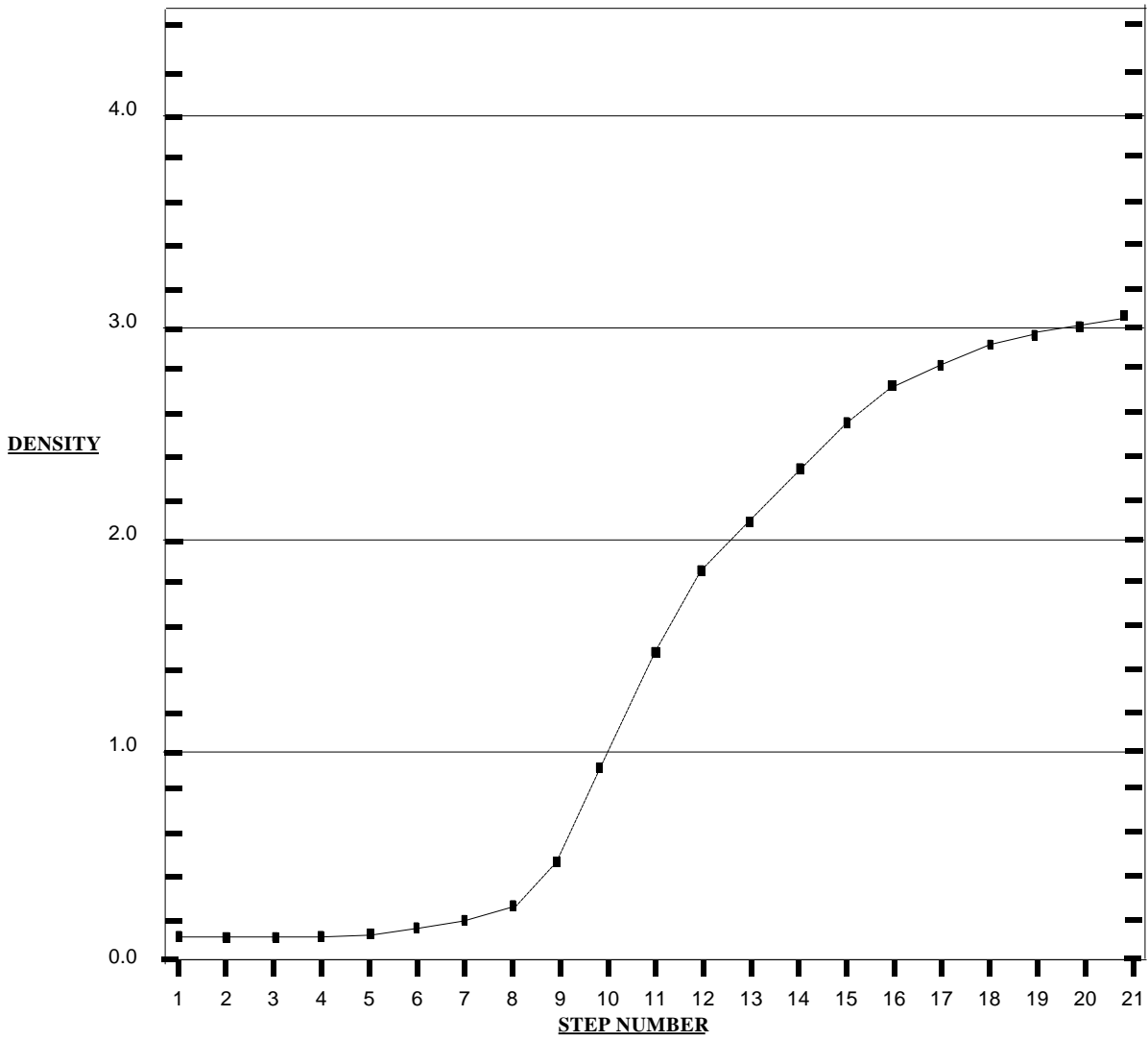


Plot Example

X-RITE Process Control Densitometer METROPOLITAN HOSPITAL

LOCATION: Xray lab A	EXPOSURE DATE: XX/XX/XX	GRAPH DATE: XX/XX/XX
TYPE OF FILM: _____	EMULSION NUMBER: _____	EXPIRATION: _____
PROCESSOR: _____	PROCESSING TIME: _____	
DEVELOPER: _____	REPLENISHMENT: _____	TEMPERATURE: 95.0 F.
FIXER: _____	REPLENISHMENT: _____	
EXP. COLOR: BLUE or GREEN	EXP. TYPE: DUAL or SINGLE	

GRAPH OF DENSITY VS. STEP NUMBER




S.Indx = 1.44
C.Indx = 1.66

B+fog = .15
Dmax = 3.06

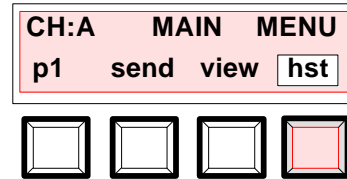
Av.Grd = 2.77

4.4. History Usage


History allows you to display/print the database (i.e., the last 32 strips measured). Additionally, you have the option of displaying the data in its measured form, or as deviated from the reference. Note, data is always stored in the densitometer in its measured form.

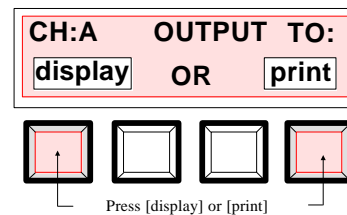
 > If print is selected, the densitometer must be connected to an appropriate printer (Appendix A6).

1) Press [hst].




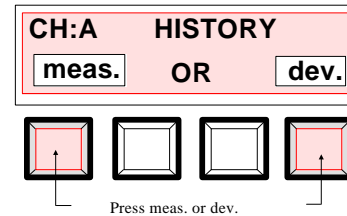
2) Press [display] to view data or [print] to transmit data.

 > If [print] is pressed, <SENDING DATA> will be displayed while data is being transmitted, and the procedure is completed. A sample print-out of the process control chart is shown on the following page.



3) Press [meas.] (measured) or [dev.] (deviated).


 > <PROCESSING DATA> is momentarily displayed, then continue with step 4.

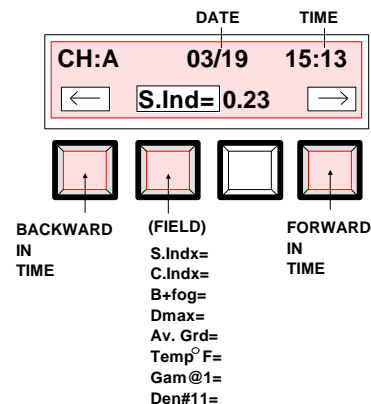


4) Press [←] to go backward in time, to view previously measured data.

Press [→] to go forward in time. Note, pressing [→] at the most recent measurement will cause a wrap-around (i.e., display strip 1 of last 32 strips measured).

Press [S.Ind=] to select a different field.

 > If no reference is installed or references are turned off, the reference temperature will become the first reading of the last set (i.e., one set = 32 readings).

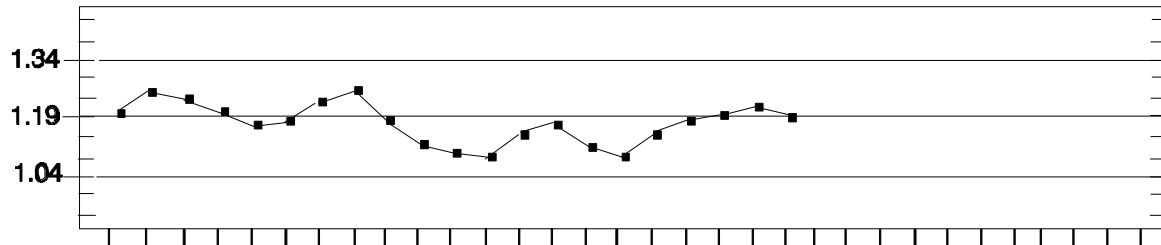


The process control chart plots the data viewed in fields 1,2, & 3, and the temperature.

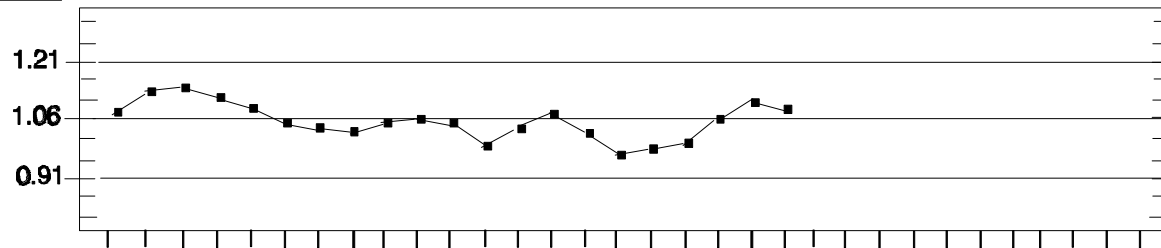
**X-RITE Process Control Densitometer
METROPOLITAN
HOSPITAL**

LOCATION: Xray lab A	BEGIN DATE: XX/XX/XX	GRAPH DATE: XX/XX/XX
TYPE OF FILM: _____	EMULSION NUMBER: _____	EXPIRATION: _____
PROCESSOR: _____	PROCESSING TIME: _____	
DEVELOPER: _____	REPLENISHMENT: _____	
FIXER: _____	REPLENISHMENT: _____	
EXP. COLOR: BLUE or GREEN	EXP. TYPE: DUAL or SINGLE	

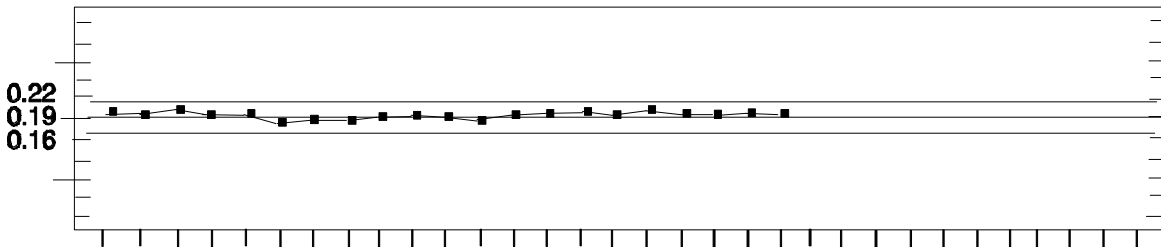
S. Indx



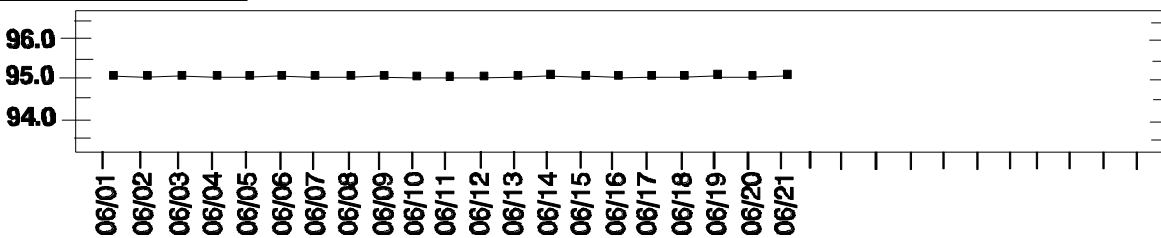
C. Indx



B+fog



Developer Temperature





> The densitometer comes from the factory with the control limits and equations already preset. In most cases, you will only use the editor to set the channel names. Only advanced users should attempt to edit the aim values, control limits, equations, and use the copy and delete functions. Refer to Appendix A4 for factory presets.

The Editor allows you to set the Channel Name (**ch nam**), Aim Values (**aims**), and Control Limits (**clim**).

Setting the Aim values and Control limits informs the densitometer when to display Go/No Go indications. After each measurement the unit will display if the limits were exceeded.

The Editor also allows you to **copy** the setup of one channel to another channel. This is useful when you have two of the same type processors or when you want to monitor the processor while correcting the problem, without entering data into the actual data channel.

You may also delete an individual unit or the entire database of a channel using the (**del**) Editor.

The Equation Editor (**eqn**) allows you to define the equations to be displayed by the densitometer. The equation editor has two main sections, **field** and **value** editing. If you select field, you can edit the entire field (name, equation type, and equation data) in one pass. If you select value, you can only edit the equation data.

The six fields come preset from the factory as:

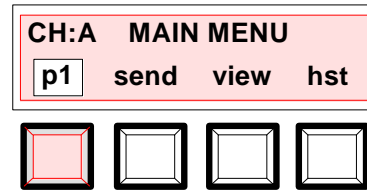
- S.Indx (Speed Index)
- C.Indx (Contrast Index)
- B+Fog (Base Plus Fog)
- Dmax (Density Maximum)
- Av.Grđ (Average Gradient)
- Temp°F (Temperature Fahrenheit)

5.1. Channel Name (ch nam) Editor

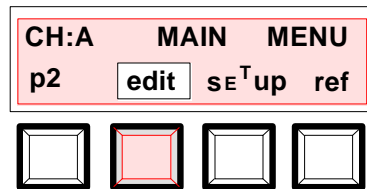


> Select the channel you want to edit (refer to Section 1.2 for channel selection). In this example Channel A will be edited. Refer to Appendix A4 for Factory Presets.

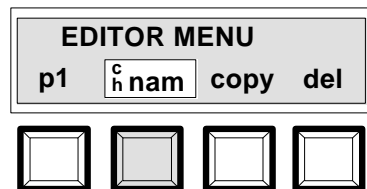
1) Press **[p1]**.



2) Press **[edit]**.



3) Press **[CH nam]**.



4) Enter the channel name (up to 16 characters):

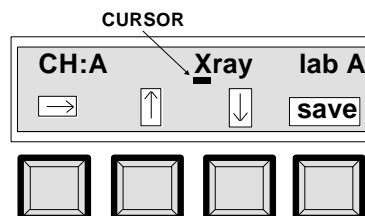
Press **[→]** to move cursor to next character.

Press **[↑]** to increment thru character list.

Press **[↓]** to decrement thru character list.

After entering the channel name, press **[save]** to save the name and return to step 3.

At step 3 you can select another channel to edit by pressing the channel keys (see Section 1.2), or return to the main menu by pressing the MENU keys.



5.2. Copy Channel (copy) Editor - For advanced users



> In this example Channel A's setup (aims, clim, field name, & equations) is going to be copied to Channel P.

1) Press **[p1]**.

CH:A MAIN MENU			
p1	send	view	hst
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2) Press **[edit]**.

CH:A MAIN MENU			
p2	edit	seTup	ref
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3) Press **[copy]**.

EDITOR MENU			
p1	c _h nam	copy	del
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4) Press **[ch:A]** to select which channel you want to copy *from*.

Press **[ch:P]** to select which channel you want to copy *to*.

Press **[cpy]** to continue with procedure.

CHAN INFO COPIER			
chA	→ chP	cpy	exit
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FROM	→ TO		

5) Press **[yes]** if you want to copy the equation and name, or press **[no]** to return to step 3.

<COPY EQN & NAME COMPLETE> is momentarily displayed.

COPY EQN & NAME?			
C_HA	TO C_HP	yes	no
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6) Press **[yes]** if you want to copy the reference and data.

<COPY REF & DATA COMPLETE> is momentarily displayed and you return to step 3.

At step 3 you can copy another channel or return to the main menu by pressing the menu keys.

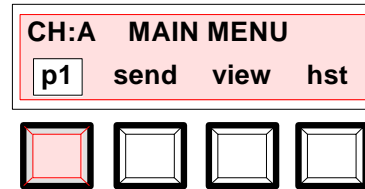
COPY REF & DATA?			
C_HA	TO C_HP	yes	no
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5.3. Delete (del) Editor - For advanced users

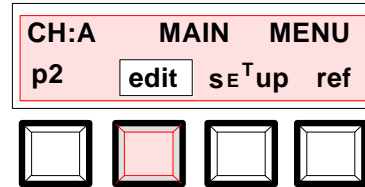


> Select the channel you want to delete data from (refer to Section 1.2 for channel selection). In this example Channel A will be edited.

1) Press [p1].



2) Press [edit].



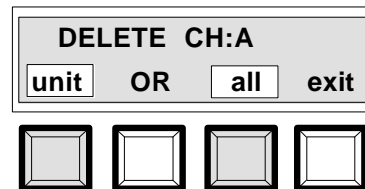
3) Press [del].



4) Press [unit] to delete one unit (go to step 5).

or

Press [all] to delete all data in the selected channel (skip step 5 & go to step 6).



5) Select the unit you want to delete:

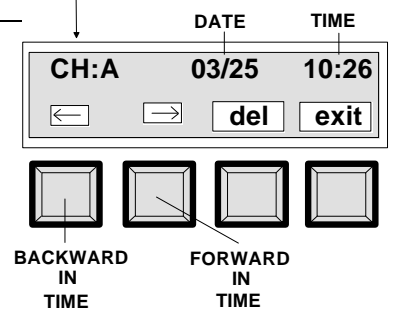
Press [→] to go forward in time.

Press [↑] to go backward in time.

Press [del] to delete the selected unit.

Press [exit] to return to step 3.

At step 3 you can return to the main menu by pressing the menu keys.



6) Press [yes] to delete the data and return to step 3.


or

Press [no] to return to step 3, without deleting the data.

At step 3 you can return to the main menu by pressing the MENU keys.



5.4. Aim Value (aims) Editor - *For advanced users*

 > Select the channel you want to edit (refer to Section 1.2 for channel selection). In this example Channel A and the S.Indx field will be edited.

> Manually editing aim values will delete any values automatically entered.

1) Press **[p1]**.

CH:A MAIN MENU			
p1	send	view	hst
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2) Press **[edit]**.

CH:A MAIN MENU			
p2	edit	sE ^T up	ref
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>


3) Press **[p1]**.

EDITOR MENU			
p1	h ^c nam	copy	del
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4) Press **[aims]**.


EDITOR MENU			
p2	aims	clim	eqn
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5) Press **[yes]** to replace auto aims and continue, or press **[no]** to return to step 4.

 > This message only appears if references were automatically entered using ref.

REPLACE AUTO AIM			
W/ MANUAL	yes	no	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6) Select field to edit, press **[S.Indx]**.

 > Available fields as set by the factory are: S.Indx, C.Indx, B+fog, Dmax, Av.Grd.

Press **[edit]** after selecting the field name, or **[exit]** to return to step 4.

CH:A EDIT AIMS			
S.Indx	edit	exit	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7) Enter the aim limit:

Press [\uparrow] to increase the value.

Press [\downarrow] to decrease the value.

Press **[save]** to save the aim value and return to step 6. At step 6 select a different field and enter aim value, *or* press **[exit]** to go to step 4, *or* press MENU keys to go to main menu.

ENTER	S.Indx	AIM	
AIM =	\uparrow 1.38	\downarrow	save
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5.5. Control Limit (clim) Editor - For advanced users



> Select the channel you want to edit (refer to Section 1.2 for channel selection). In this example Channel A and the S.Indx field will be edited. Refer to Appendix A4 for Factory Presets.

1) Press [p1].

CH:A MAIN MENU			
p1	send	view	hst
<input type="button" value="p1"/>	<input type="button" value="send"/>	<input type="button" value="view"/>	<input type="button" value="hst"/>

2) Press [edit].

CH:A MAIN MENU			
p2	edit	se ^T up	ref
<input type="button" value="p2"/>	<input type="button" value="edit"/>	<input type="button" value="se<sup>T</sup>up"/>	<input type="button" value="ref"/>

3) Press [p1].

EDITOR MENU			
p1	c ^c h ^h nam	copy	del
<input type="button" value="p1"/>	<input type="button" value="c<sup>c</sup> h<sup>h</sup> nam"/>	<input type="button" value="copy"/>	<input type="button" value="del"/>

4) Press [clim].

EDITOR MENU			
p2	aims	clim	eqn
<input type="button" value="p2"/>	<input type="button" value="aims"/>	<input type="button" value="clim"/>	<input type="button" value="eqn"/>

5) Select field to edit, press [S.Indx].



> Available fields as set by the factory are: S.Indx, C.Indx, B+fog, Dmax, & Av.Grd.

Press [edit] after selecting the field name.

CH:A EDIT C-LIMS			
S.Indx	edit	exit	
<input type="button" value="S.Indx"/>	<input type="button" value="edit"/>	<input type="button" value="exit"/>	<input type="button" value=""/>

6) Enter the negative control limit:

Press [↑] to increase the value.

Press [↓] to decrease the value.

Press [next] to continue.

ENTER		S.Indx	CLIM
-LIM =	↑	-.15	↓
<input type="button" value="ENTER"/>	<input type="button" value="↑"/>	<input type="button" value="S.Indx"/>	<input type="button" value="CLIM"/>
<input type="button" value="next"/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

7) Enter the positive control limit:

Press [save] to save clim value and return to step 5. At step 5 select a different field and enter control limits, or press [exit] to go to step 4, or press MENU keys to go to main menu.

ENTER		S.Indx	CLIM
+LIM =	↑	+15	↓
<input type="button" value="ENTER"/>	<input type="button" value="↑"/>	<input type="button" value="S.Indx"/>	<input type="button" value="CLIM"/>
<input type="button" value="save"/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

5.6. Equation (eqn) Editor - For advanced users

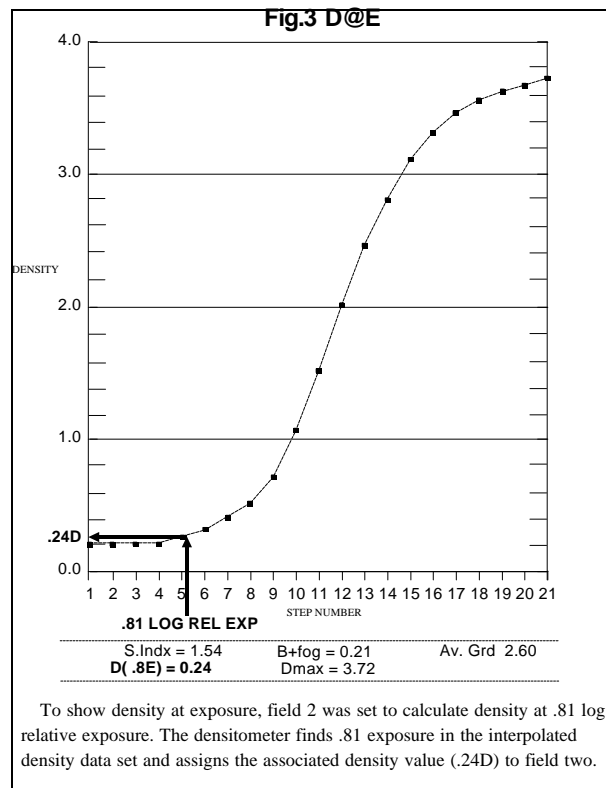
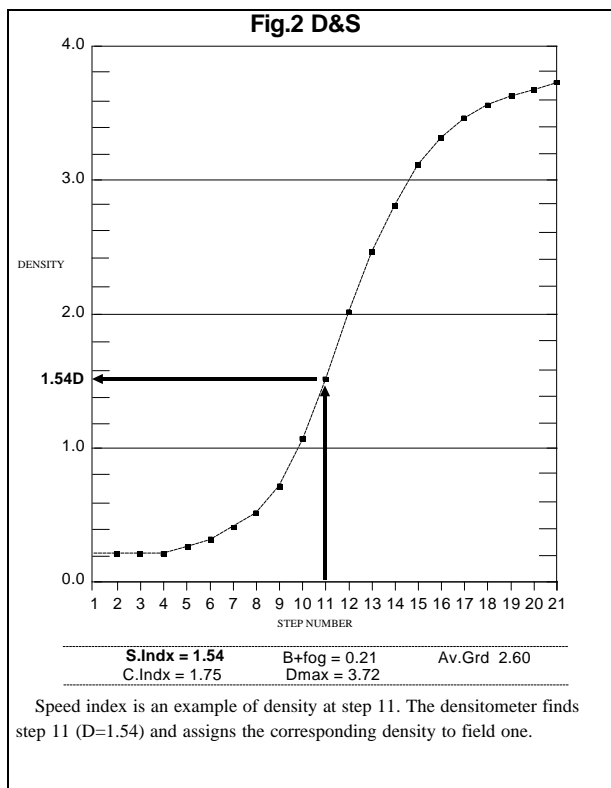
The Equation Editor (**eqn**) allows you to define the equations to be displayed in the six user definable fields (see Appendix A4 for Factory Presets).

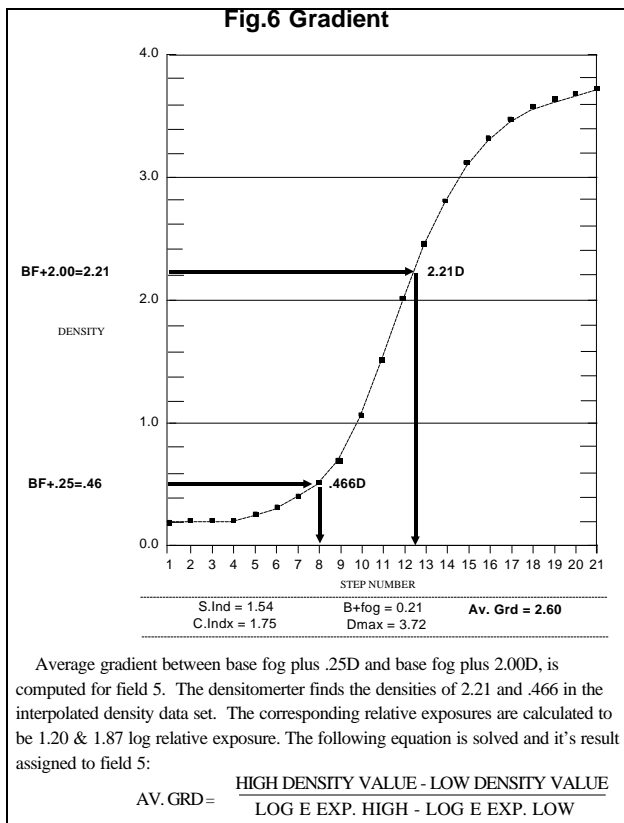
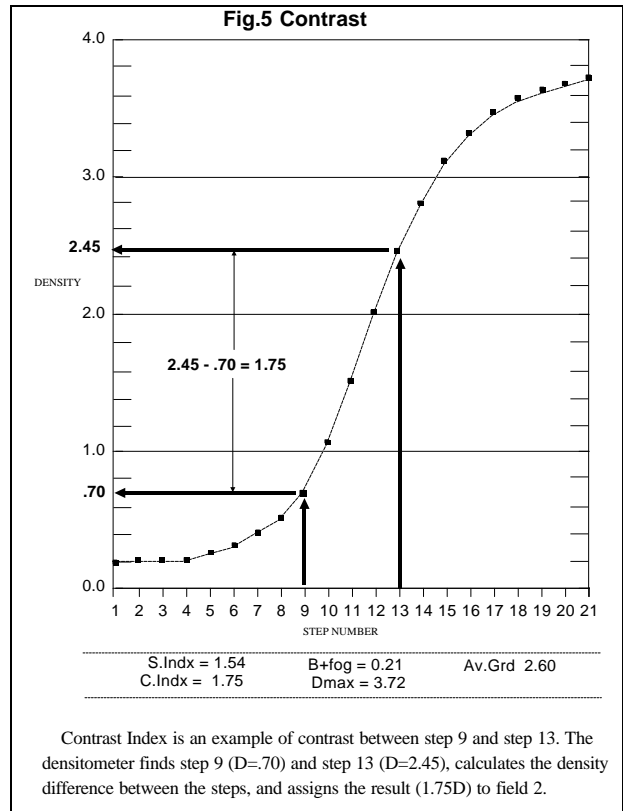
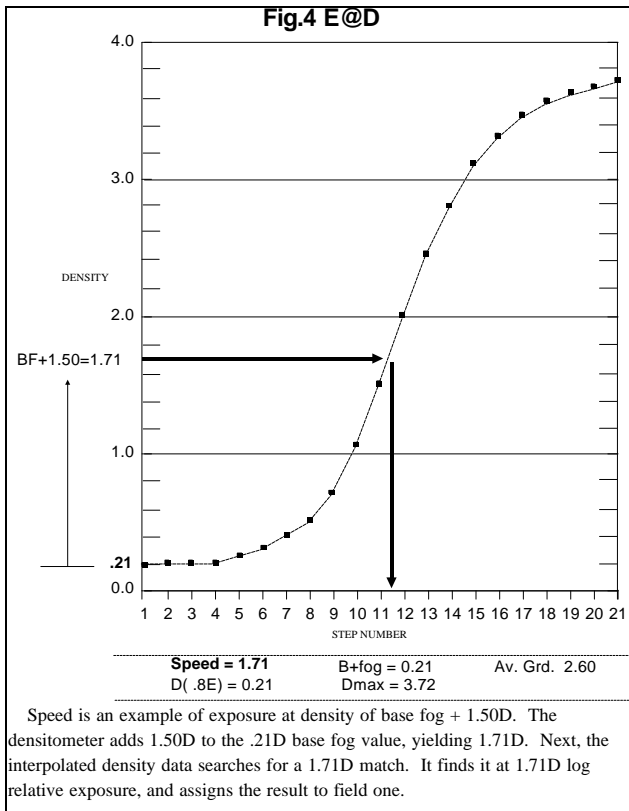
Basic equations types are:

- Density @ Step Number (D@S). Where you enter the Step number and the densitometer computes the Density.
- Density @ Exposure Level (D@E). Where you enter the Exposure Level and the densitometer computes the Density.
- Exposure Level @ Density (E@D). Where you enter the Density and the densitometer computes the Exposure.
- Contrast (Cont). Where you enter the Low Step# and High Step# and the densitometer computes the Contrast.
- Gradient (Grad). There are two methods for computing Gradient:
 - › Using Density = BaseFog + Low & High density (where you enter the Low density and the High density and the densitometer computes the Gradient.
 - › Using Density Absolute = Low & High density (where you enter the Low density and the High density and the densitometer computes the Gradient.
- Temperature (Temp). Sets field to display the temperatures that were manually entered with each measurement. Note, temp available for field 5 or 6 only.

You can individually set the six fields to any of the above equation types.

Figures 2 thru 6 graphically represent the five equations.

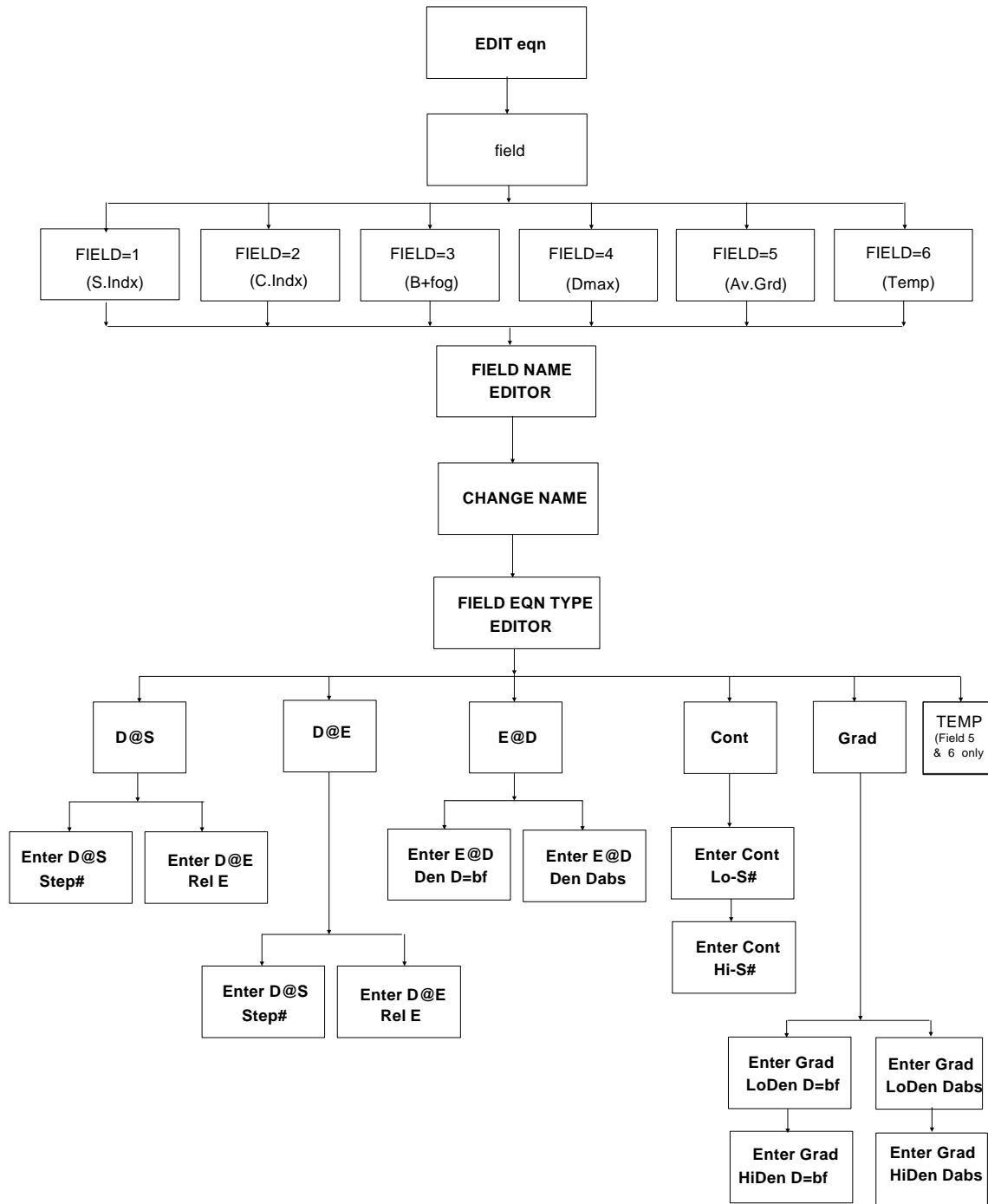




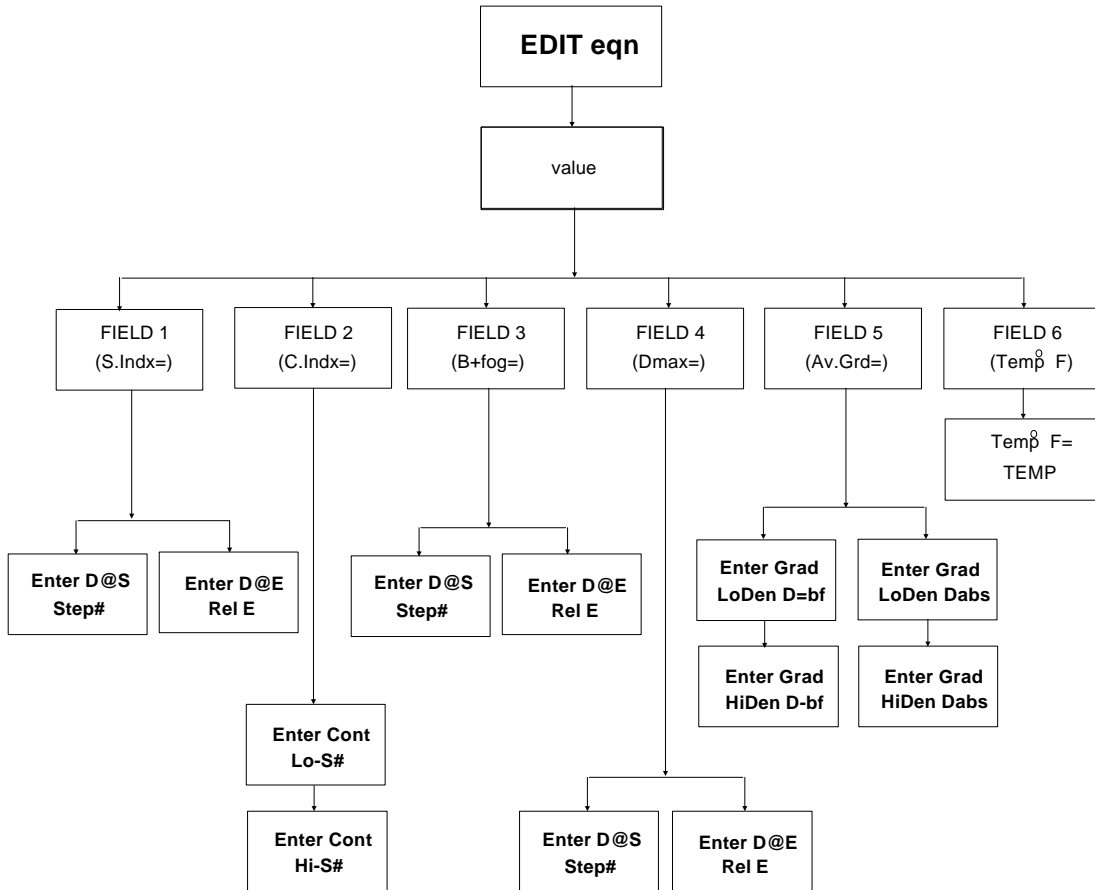
The equation editor has two main sections, *field* and *value* editing. If you select field, you can edit the entire field (name, equation type, and equation data) in one pass. If you select value, you can only edit the equation data.

A flowchart of the field and value edit functions (showing presets) are on the following two pages.

Equation Field Editor Flow Chart



Equation Value Editor Flow Chart (Factory Preset)



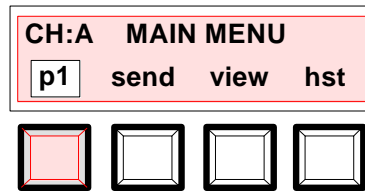
FIELD EDITOR

The Field Editor allows you to edit the entire field; name, equation type, and equation data.

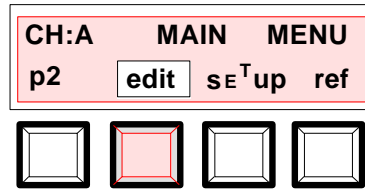


> Select the channel you want to edit (refer to Section 1.2 for channel selection). In this example Channel A is used. The field name=S.Indx, equation type=D@S, and step=11.

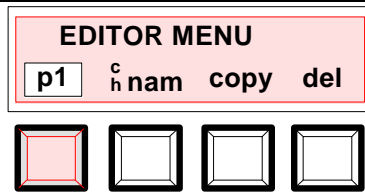
1) Press **[p1]**.



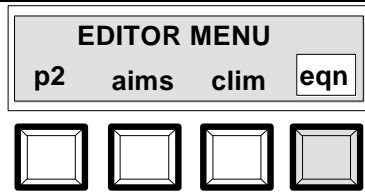
2) Press **[edit]**.



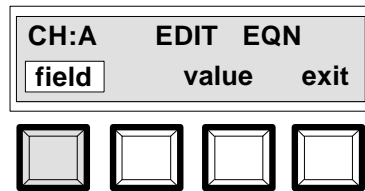
3) Press **[p1]**.



4) Press **[eqn]**.



5) Press **[field]**.

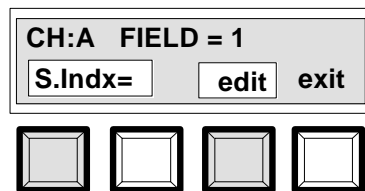


6) Select field to edit, press **[S.Indx]**.

> Available fields as set by the factory are: S.Indx, C.Indx, B+fog, Dmax, Av.Grd, & Temp.



Press **[edit]** after selecting the field.



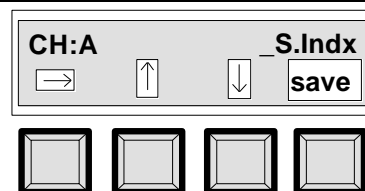
7) Enter the field name:

Press **[→]** to move cursor to next character

Press **[↑]** to increment thru character list.

Press **[↓]** to decrement thru character list.

After entering the channel name, press **[save]**.

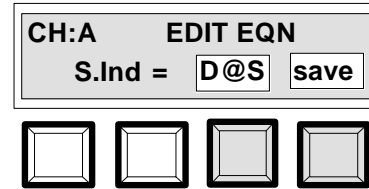


Field Editor - continued

8) Select the type of equation, press **[D@S]**.



> Available equations are: Grad (gradient), D@S (Density @ Step), D@E (Density @ Exposure), E@D (Exposure @ Density), and Cont (Contrast) **Refer to the Additional Notes at bottom of page.**



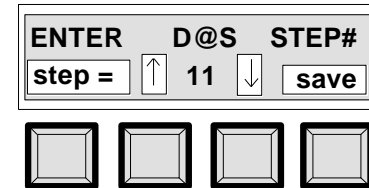
Press **[save]** key to continue.

9) Enter the step# for the equation.

Press **[↑]** to increment.

Press **[↓]** to decrement.

Press **[save]** to save equation data and go to Step 5.



At step 5 you can edit another equation, *or* press **[exit]** to go to step 4, *or* press MENU keys to go to main menu.



Additional Notes:

- > If you select D@S, you can change to D@E computation by pressing **[step]** at step 9.
- > If you select D@E, you can change to D@S computation by pressing **[exp]** at step 9.
- > If you select E@D, you can have density equal to density absolute or density + basefog by pressing **[Dabs]** or **[D=bf]** at step 9.
- > If you select Cont, you have to enter the Low Step# and the High Step# at step 9.
- > If you select Grad, you can have the low and high densities equal to density absolute or density +base fog, by pressing **[Dabs]** or **[D=bf]** at step 9.

VALUE EDITOR

The Value Editor allows you to edit only the equation data.



> Select the channel you want to edit (refer to Section 1.2 for channel selection). In this example Channel A is used. The field name=S.Ind, equation type=D@S, and step=11.

1) Press **[p1]**.

CH:A MAIN MENU			
p1	send	view	hst
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

2) Press **[edit]**.

CH:A MAIN MENU			
p2	edit	sE ^T up	ref
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

3) Press **[p1]**.

EDITOR MENU			
p1	c h nam	copy	del
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

4) Press **[eqn]**.

EDITOR MENU			
p2	aims	clim	eqn
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

5) Press **[value]**.

CH:A EDIT EQN			
field	value	exit	
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

6) Select field to edit, press **[S.Indx]**.

> Available fields as set by the factory are:S.Indx, C.Index, B+fog, Dmax, Av.Grd, & Temp.



Press **[edit]** after selecting the field name.

Refer to "Additional Notes" on previous page.

CH:A EDIT VALUE			
S.Indx=	D@S	edit	
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>

7) Enter the step# for the equation.

Press **[↑]** to increment.

Press **[↓]** to decrement.

Press **[save]** to save equation data and go to Step 5.

At step 5 you can edit another equation, *or* press **[exit]** to go to step 4, *or* press MENU keys to go to main menu.

ENTER D@S STEP#			
step =	↑	11	↓
<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value=""/>	<input type="button" value="save"/>

6.

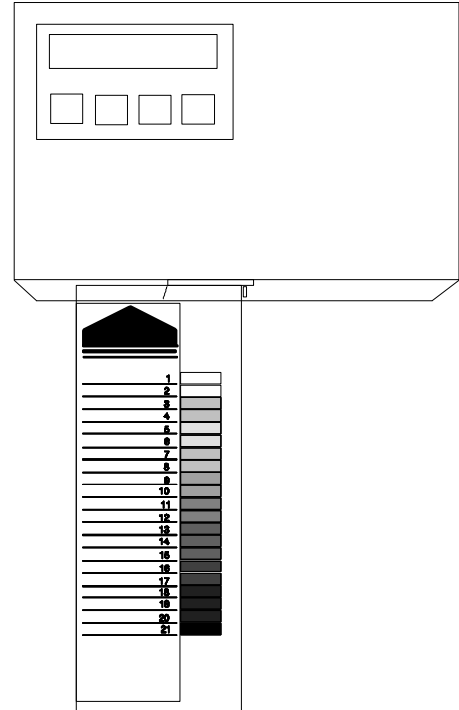
General Maintenance

6.1. Calibration Verification

The 381-25 Calibration Verification Reference is a 21 step film designed to be recognized by X-Rite Model 381 Auto-Scanning Transmission Densitometers. This instrument feature automatic calibration and do not require any manual adjustments by the user. The Calibration Verification Reference provides a method to periodically verify and document the performance of your scanning densitometer.

Verification Procedure

1. Insert the verification reference through the scanning densitometer in the direction indicated by the arrow at the top of the film. Refer to Section 4.1 for information on inserting films.
2. The density measured by the instrument may be viewed on the instrument display and compared to the density values printed on the verification reference to verify the calibration of the instrument. Refer to section 4.2 for information on viewing data.
3. A permanent record of the verification measurement can be printed to a serial printer. The printout should be dated and the reference density values recorded at the required steps. Refer to section 4.3 for information on printing data.
4. The values measured by the instrument should be within $\pm 0.03D$ or 2% whichever is greater, compared to the values printed on the reference label. If this is not the case, ensure that the film is not dirty or damaged and remeasure the film. If the values consistently exceed this limit clean the optics per instructions in Section 6.2. If the measured values still do not fall within the specified limit contact your field representative or X-Rite's Technical Service Department.
5. It is recommended that the calibration verification procedure be performed once a week. More frequent verification can be performed if required by local regulations.



- > Handle the transmission reference at the edges only. Fingerprints or any other foreign substance on the measurement area will cause errors. Attempts to dust or clean the surface with anything other than a soft camel hair brush may change densities. Minimize change by storing in a dark, cool, and dry place.

Calibration Verification - continued



- > This film is intended for use as a verification film for scanning densitometers and should not be used as a replacement for the transmission reference supplied with other densitometers.
- > The calibration scale on X-Rite scanning densitometers built prior to May, 1991 conformed to ANSI PH2.19-1976 and should be verified with density values converted to this scale per the instructions on the outside of the reference's envelope. Instruments with this calibration scale can be identified by the silver charger jack on the side of the unit. Current instruments have black charger jacks.

6.2. Troubleshooting Chart

Important! Before proceeding with the following troubleshooting chart:

- Make sure strip being measured has been properly inserted and is free of smudges, scratches, and blemishes. Make sure that strips and the unit are free of dust and lint.

Proper antistatic control must be used when replacing the lamp and batteries.

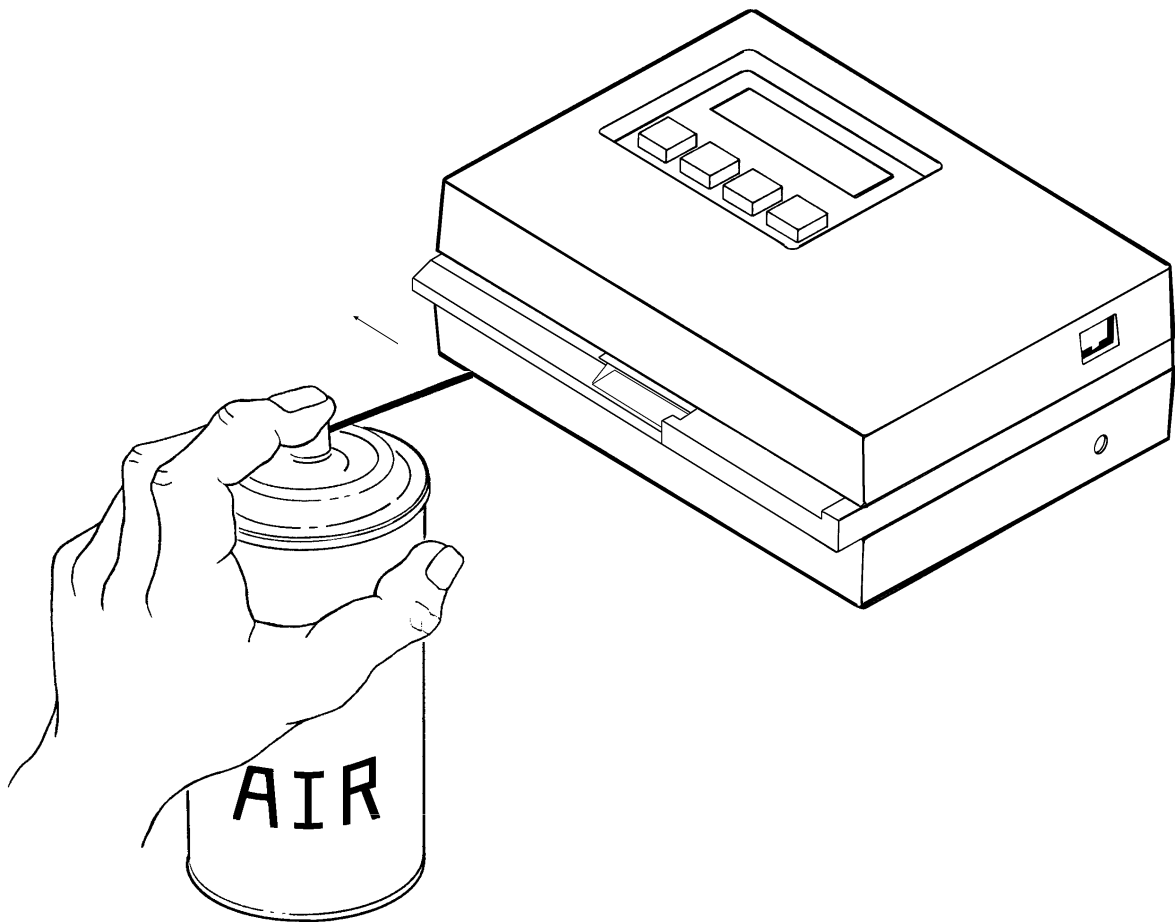
PROBLEM	CAUSE	SOLUTION
Measurement densities incorrect.	Read lamp weak.*	Replace lamp (see Sec. 6.4).
Measurement densities drift.	Read lamp weak.*	Replace lamp (see Sec. 6.4).
Read lamp not working.	Read lamp bad.*	Replace lamp (see Sec. 6.4).
Measurement densities unrepeatable/incorrect.	Film misaligned.	Reinsert strip.
	Film has blemishes or scratch.	Use different film strip.
< INVALID READING!> is displayed after measurement. (Refer to Appendix A3 for more invalid reading messages)	Film did not have long enough leader (1-1/8").	Use film with correct leader.
	Exposed region not properly aligned.	Make sure film feeds straight through unit and does not skew.
		Use film guide insert (see Section 2) if film was exposed with a X-Rite 303, 333, 334, or a Cronex sensitometer.
	One or more measurement patches are cloudy, have excessive gradients, or have flecks.	Process and measure a new film. Note: A small clear area in a high density patch causes large errors. This could be caused by dust specs in the sensitometer during exposure. If so, clean sensitometer and process another film.
	Motor drive roller slipping due to restraint or obstruction, or contamination of rollers from reading wet strips.	Remove restraint/obstruction or dry drive rollers with air.
Film did not meet required exposure criteria.	Adjust sensitometer exposure time to meet requirements (see Section 4.1).	
Unit will not hold a charge.	Nicad batteries are bad.	Replace batteries (see Sec. 6.5).

* The instrument has a failure monitor that in most cases will automatically indicate when the lamp needs replacement.

6.3. Optics Cleaning

To remove any dust and lint from the optics and drive wheel assembly, follow the procedure shown approximately once a week.

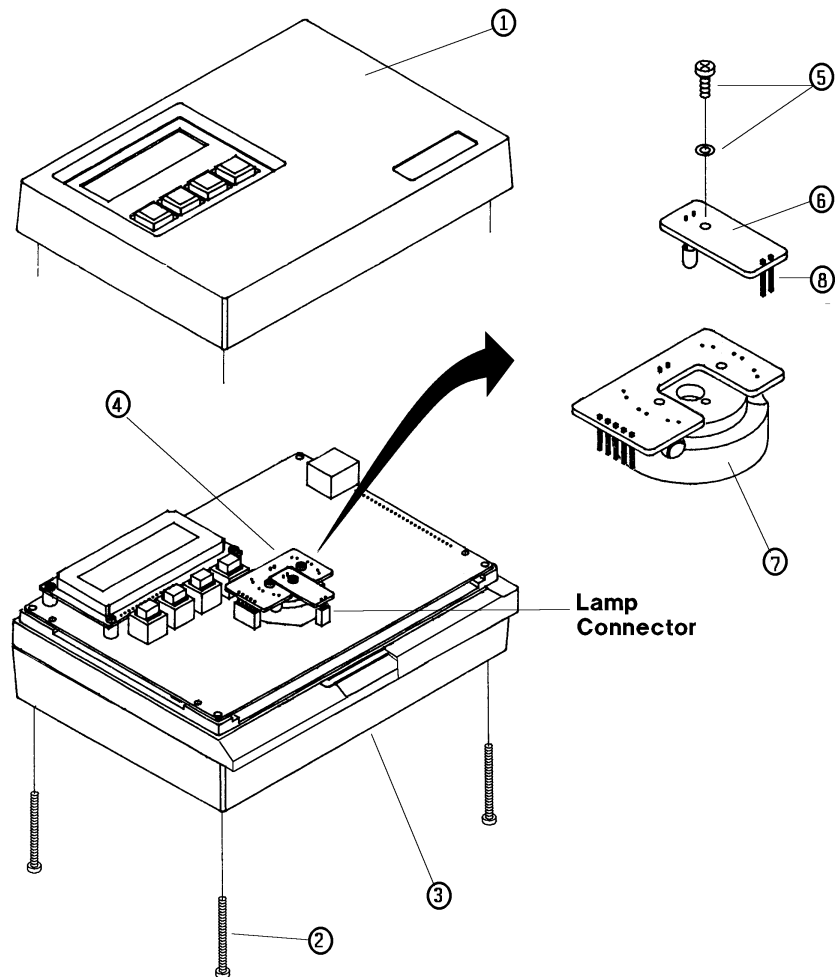
- 1) Holding can in upright position, insert tube from the canned air into film insertion slot (in front of unit). Make sure the air is clean and free of moisture.
- 2) With back and forth motion spray air into insertion slot from one end to the other. Do this several times. This should remove any accumulated dust and lint.



Make sure the air can remains upright.

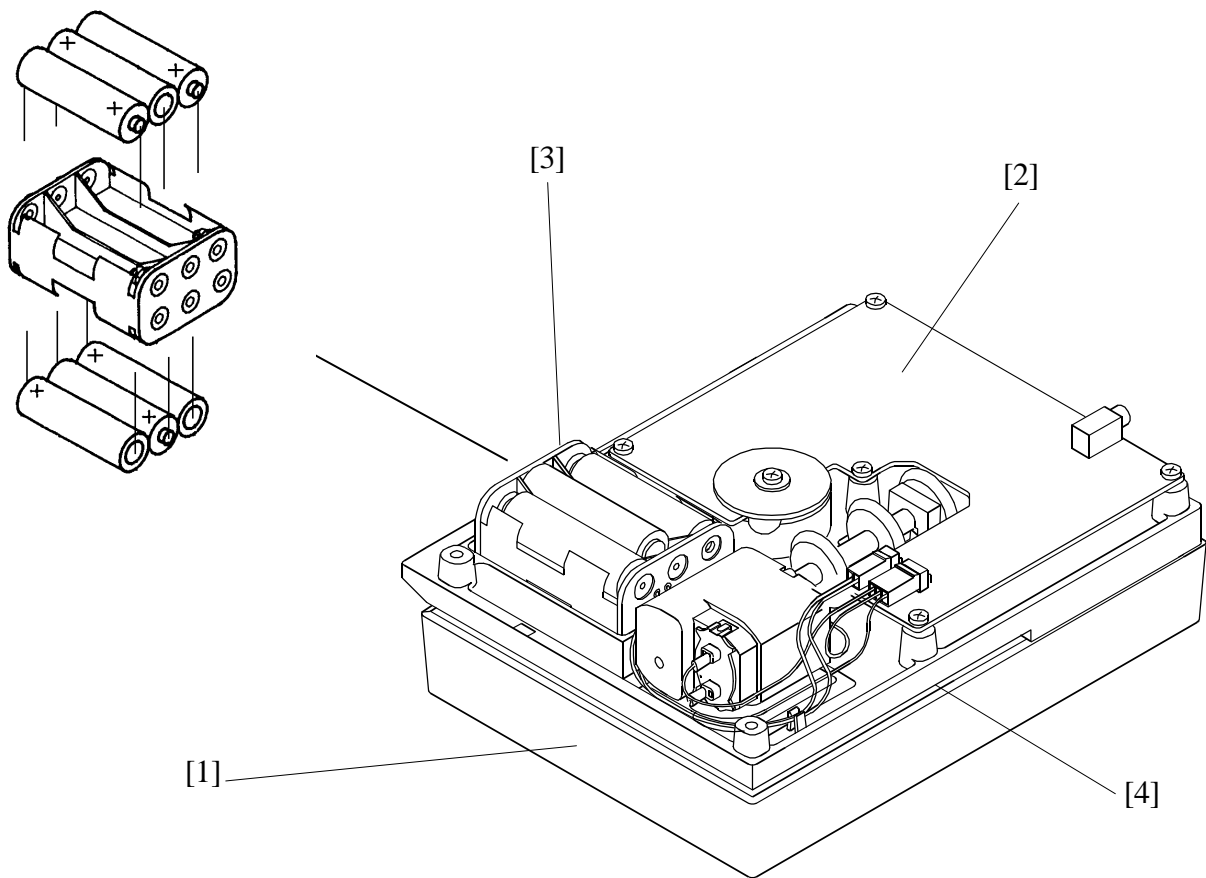
6.4. Read Lamp Replacement P/N 880-07

- 1) Remove four screws [2] holding bottom cover [3] with a phillips-head screwdriver. Leave bottom cover [3] on unit.
- 2) Holding top [1] and bottom [2] covers in place, turn unit over so it rests on the bottom cover [3]. Remove top cover [1].
- 3) Locate optics assembly [4] and remove screw and washer [5] in the middle of lamp assembly P.C.B. [6].
- 4) Lift out old lamp assembly [6] and discard.
- 5) Install new lamp assembly [6] by carefully inserting lamp [6] into housing [7] and lamp pins [8] into lamp connectors. Press down gently to make sure connector pins [8] are properly seated.
- 6) Secure lamp screw and washer [5] in place.
- 7) Carefully clean any dust or plastic chips off circuit board and top cover [1] using compressed air. Place top cover [1] on unit.
- 8) Holding the top and bottom covers in place, turn unit over so that it rests on the top cover [1].
- 9) Remove bottom cover [3]. Clean circuit board and bottom cover [3] with compressed air then place bottom cover [3] back on instrument.
- 10) Secure bottom cover [3] to instrument with four screws [2] using a phillips-head screwdriver. Make sure that the two long screws go on the end with the battery eliminator jack.
- 11) After lamp is installed, refer to Section 1.3.6 to reset lamp percentage monitor.



6.5. Nicad Battery Replacement (P/N SE15-19 six required)

- 1) Remove four screws securing the bottom cover with a phillips-head screwdriver.
- 2) Carefully lift bottom cover upwards and set aside.
- 3) Lift out nicad battery holder [3] from bottom housing ass'y [4], and remove old batteries.
- 4) Install new nicad batteries in holder [3] (recognizing proper polarity) and reposition battery holder [3] back in bottom housing assembly [4].
- 5) Carefully clean any dust or plastic chips off circuit board [2] and bottom cover using compressed air. Place bottom cover on unit.
- 6) Holding the top [1] and bottom covers in place, turn unit over so that it rests on the bottom cover.
- 7) Remove top cover [1]. Clean circuit board and top cover [1] with compressed air then place top cover back on unit.
- 8) Turn unit over and secure bottom cover to instrument with four screws using a phillips head screwdriver. Make sure that the two long screws go on the end with the battery eliminator jack.



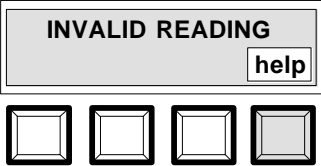
A1. Specifications

Film	Measures X-Rite 21- step sensitometer formats exposed on 8" length or longer films. The exposed sensitometric film must have a sensitometric exposure with a gamma of .7 or greater on steps 7 thru 15. There must be a visible density difference between these steps (density must increase at least .11 D between each step).
Measurement Speed	1.2" per second
Spectral Response	ANSI Visual
Density Range	0 - 4.5D
Density Accuracy	$\pm .02D$ (0 - 3.00D) (ANSI PH2.19-1986) $\pm 2.0\%$ (3.01D - 4.00D) When compared to other densitometers, density variations may exist due to calibration and spectral differences.
Density Repeatability	$\pm .01D$ (0 - 3.00D) $\pm 1.0\%$ (3.01 - 3.50D) $\pm 2.0\%$ (3.51 - 4.00D)
Voltage Requirements	120VAC Adaptor P/N SE30-61 230VAC Adaptor P/N SE30-62
Dimensions	7.2" x 6.0" x 2.75" 182.8mm x 152.4mm x 69.8mm

A2. Display Abbreviations

aims	- aim value
Av. Grd	- Average Gradient
B+ Fog/bf	- Base plus Fog
Ch/ch	- Channel
C.Indx	- Contrast Index
C-Lims	- Control Limits
cnfg	- configuration
cont	- (in equation setup) a basic contrast equation
cpy	- copy
Dabs	- Density Absolute
D@E	- Density at Exposure
del	- delete
Den	- Density
Dmax	- Density maximum
D@S	- Density at Step
E@D	- Exposure at Density
eqn	- equation
exp	- exposure
gam	- gamma
gam@D	- gamma at density
Grad	- (in equation setup) a basic gradient equation
HiDen	- High Density
Hi-S#	- High Step Number
hst	- history
INFO	- information
I/O	- Input/Output
Lcd	- liquid crystal display
+ Lim	- Upper Control Limit
LoDen	- Low Density
-Lim	- Lower Control Limit
Lo-S#	- Low Step Number
nam	- name
p1	- page 1
p2	- page 2
p3	- page 3
REF/ref	- reference
Rel E	- Relative Exposure
S.Indx	- Speed Index

A3. Error Messages

ERROR MESSAGE	REASON	SOLUTION
<p>Press [help] to receive one of the following six invalid reading messages.</p> 		
< UNRECOGNIZABLE STRIP>	Film did not have long enough leader (1 1/8").	Use film with correct leader.
	Exposed region not properly aligned.	Make sure film feeds straight through unit and does not skew. Use film guide insert (see Section 2) if film was exposed with a X-Rite 303, 333, or 334 Sensitometer.
	One or more measurement patches are cloudy, have excessive gradients, or have flecks.	Process and measure a new film. Note: A small clear area in a high density patch causes large errors. This could be caused by dust specs in the sensitometer during exposure. If so, clean sensitometer and process another film.
	Motor drive roller slipping due to restraint or obstruction, or contamination of rollers from reading wet strips.	Remove restraint/obstruction or dry drive rollers with air.
	Film did not meet required exposure criteria.	Adjust sensitometer exposure time to meet requirements (sec. 4.1)
< EARLY SWITCH RELEASE>	Switch was released before reading began.	Do not remove strip until after reading.
< FILM STRIP TOO LONG>	Film strip being measured is too long.	If excess film exists on either end of exposed area, cut off. Make sure to leave at least 1-1/8" leader from beginning of first region.
< TOO MANY REGIONS>	More than 28 regions on exposure. Mottled exposure areas often produce many regions.	1) Avoid placing these regions in leader; 2) feed in reverse direction; or 3) cut off mottled end.
< REQUIRED CALIBRATION>	Unit detected zero drift greater than $\pm .01D$.	381 automatically recalibrated after message was displayed. Run strip again.
< A/D HARDWARE FAILURE>	A/D conversion time failure.	If occurs repeatedly, service unit.



Error Messages - continued

ERROR MESSAGE	REASON	SOLUTION
< WARNING REPLACE LAMP!>	Lamp output is less than required intensity. Measurement accuracy of unit is questionable at this point.	Replace lamp immediately, see Section 6.3.
< WARNING! CHARGE BATTERIES>	Indicates that the batteries are getting low and will soon need to be charged.	Recharge batteries at a convenient time.
< PLEASE CONNECT THE CHARGER>	Indicates that the batteries are too low to operate the unit and must be recharged. This will be displayed until you begin the recharge cycle, thereafter, the unit will be functional and all previous data will be accessible.	Recharge batteries.
< CHECK PRINTER>	Incorrect printer selected in setup	Select correct printer, see Section 1.3.2.
	Printer is not connected or off line.	Connect printer or turn printer on line.

A4. Factory Presets

CHANNEL NAMES

"Xray lab A" - "Xray lab P"



> All sixteen channels (A-P) have the same name with corresponding letters.

<u>FIELD NO.</u>	<u>FIELD NAMES</u>	<u>EQN TYPE</u>	<u>EQN VALUE(S)</u>	<u>CLIMS</u>
1	"S. Indx"	D@S	Step 11	± .15
2	"C. Indx"	CONT	Step 9 & Step 13	± .15
3	"B+ Fog"	D@S	Step 1	± .03
4	"Dmax"	D@S	Step 21	0
5	"Av. Grd"	GRAD	.25D+ bf & 2.00D+ bf	0
6	Temp °F	TEMP	N/A	N/A



> When CLIMS are set to zero no control limits are checked.

HOSPITAL NAME

"METROPOLITAN HOSPITAL"

I/O PRESETS

Printer preset is "180si"

baud = 9600

pin-5 = cts

format = new

r.c.i. = off

dec. pt = on

cr = cr/lf

comp = off

xmit = man.

width = full


A5. Accessories

The following printers will interface to the 381 with the cable and DB adaptor supplied.


Diconix Model 150 & 150 Plus Serial Printer

Most Epson Printers with Serial Interface Cards

HP Think Jet Personal Printer

 > The HP Think Jet printer may be purchased from X-Rite (P/N 381-113)

Seiko DPU-411 Serial Printer

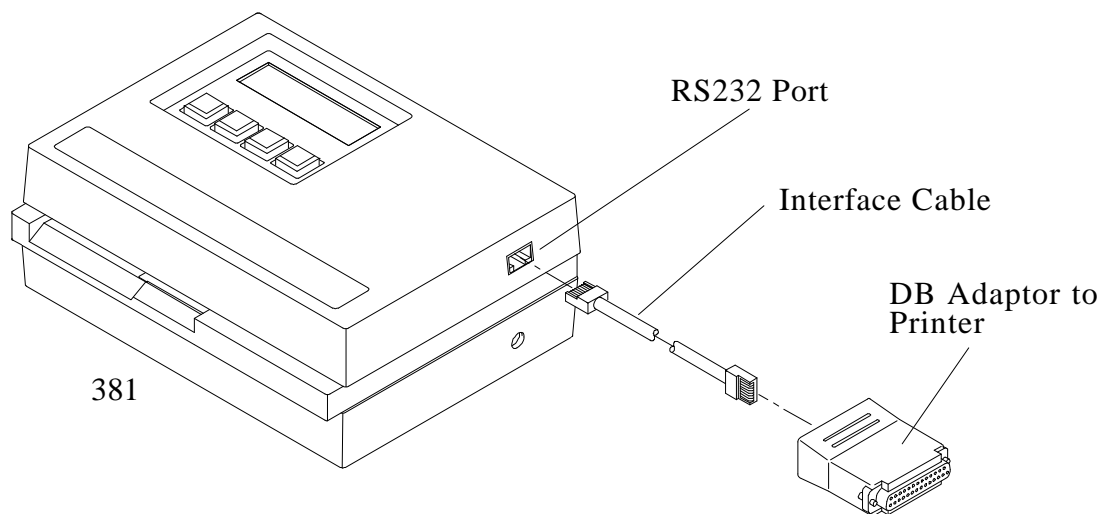
 > Adaptor P/N 881-280 must be purchased to interface the Seiko printer to the 381.
> The Seiko DPU-411 will not plot the process control chart.

X-Rite does carry a variety of "DB" type adaptors and cables to interface your densitometer to a computer or other serial printers. Ask your X-Rite representative or call X-Rite, Inc. to find out which adaptor or cable will best meet your requirements.

Diconix is a trademark of Diconix Inc.; Epson is a trademark of Epson Corp.; Seiko is a trademark of Seiko Instruments Inc.; HP is a trademark of Hewlett-Packard Co.

MISCELLANEOUS

380 Series RS232C Interface Manual P/N 380-506



A6. Serial Printer Configuration

Diconix Model 150 & 150 Plus Serial Printer Setup

Step 1 - Make sure your 381 is set to Diconix printer, refer to Section 1.3.2.

Step 2 - Set serial dip switches on printer, refer to Appendix A9 of printer manual.



> Dip switches are located inside the top cover on the left hand side.

<u>Dip Switch #</u>	<u>150</u>		<u>150 Plus</u>	
	<u>Position</u>	<u>Description</u>	<u>Position</u>	<u>Description</u>
1	OFF	9600 Baud	OFF	9600 Baud
2	OFF	" "	OFF	" "
3	OFF	" "	OFF	" "
4	Panel B ON	8 Bit Word	ON	8 Bit Word
5	OFF	No Parity	OFF	No Parity
6	OFF	" "	OFF	" "
7	OFF	Hardware Handshake	OFF	Hardware Handshake
8	OFF	" "	OFF	" "
9	ON	Disable Carrier Detect	ON	Disable Carrier Detect
10	Panel B ON	Disable Clear To Send	OFF	Enable Data Set Ready
11	OFF	Enable Data Set Ready	ON	Disable Clear To Send

Step 3 - Set mode dip switches on printer, refer to Section 2.6 of printer manual.



- > Dip switches are located under the top cover on the front side of the carriage opening.
- > All switches are factory set to zero (OFF).
- > Set switch five to one (ON) if high quality print is desired.

Diconix Model 180si Serial Printer Setup

Make sure your densitometer is set to 180si printer, refer to Section 1.3.2.

After "180si" is selected, the densitometer will automatically set the printer in the Epson Emulation mode.

Epson Model LX800 & LX810 Printer w/Intelligent Serial Interface # 8148

Step 1 - Make sure your 381 is set to Epson printer, refer to Section 1.3.2.

Step 2 - Set dip switches on the serial interface board. Refer to pages 4 thru 9 in the Intelligent Serial Interface Manual for additional information.

Serial Interface Selection Switch 1

<u>Dip Switch #</u>	<u>Position</u>	<u>Description</u>
1	OFF	8 Bit Word
2	OFF	No Parity
3	OFF	" "
4	OFF	N/A
5	OFF	9600 Baud
6	ON	" "
7	OFF	" "
8	OFF	" "

Serial Interface Selection Switch 2

<u>Dip Switch #</u>	<u>Position</u>	<u>Description</u>
1	ON	Serial Interface Enable
2	ON	Buffer Enable
3	OFF	Allow printing when 216 bytes are available in buffer.
4	OFF	" "
5	OFF	Self test Off
6	OFF	" "

Step 3 - Set jumper J8B on the serial interface board to Off (disconnected). This has the effect of disabling XON/XOFF flow control. Refer to pages 9 thru 11 in the Intelligent Serial Interface Manual.

Step 4 - Install serial interface card if not installed (refer to Intelligent Serial Interface Manual).



Epson Model LX800 & LX810 Printer w/Intelligent Serial Interface # 8148 - continued,

Step 5 - Set mode dip switches on the LX800 & LX810 printer. Refer to the Appendix D2 in the Printer Manual.



> Dip switches are located inside the top cover.

Dip Switch 1

<u>Dip Switch #</u>	<u>LX800</u>		<u>LX810</u>	
	<u>Position</u>	<u>Description</u>	<u>Position</u>	<u>Description</u>
1	OFF	10 cpi	OFF	10 cpi
2	OFF	Unslashed zero	OFF	Unslashed zero
3	OFF	Italic character table	OFF	Italic character table
4	ON	Short tear-off (invalid)	ON	Short tear-off invalid
5	OFF	Draft print speed (high)	OFF	Print quality = draft
6	ON	USA character set	ON	USA character set
7	ON	" "	ON	" "
8	ON	" "	ON	" "

Dip Switch 2

<u>Dip Switch #</u>	<u>Position</u>	<u>Description</u>
1	OFF	11 in. page length
2	OFF	Tractor feed mode
3	OFF	No skip over perforation
4	OFF	No Auto line feed

HP Think Jet Personal Serial Printer Setup

Step 1 - Make sure your 381 is set to Epson printer, refer to Section 1.3.2.

Step 2 - Set Mode dip switches on printer, refer to Appendix A in printer manual.



> Dip switches are located on the back of the printer.

Mode Dip Switch

<u>Dip Switch #</u>	<u>Position</u>	<u>Description</u>
1	OFF	Don't care (leave as shipped)
2	OFF	" "
3	OFF	No perf.
4	OFF	Page length = 11"
5	ON	Epson/IBM mode
6	ON	USA character set
7	OFF	" "
8	OFF	" "

Step 3 - Set RS232 dip switches on printer, refer to Appendix I in printer manual.

RS232 Dip Switch

<u>Dip Switch #</u>	<u>Position</u>	<u>Description</u>
1	ON	Handshake = DTR
2	OFF	8 Bit word no parity
3	OFF	" "
4	OFF	9600 baud
5	OFF	" "

A7. Setup Definition

The setup is contained in three pages: Page 1 (tone, I/O, & time); Page 2 (name & refs); and Page 3 (lamp & °C/F).

PAGE 1

- **Beeper Loudness** (tone) - adjust the beeper loudness (loud, soft, or off).
- **RS232 parameters** (I/O) - sets the parameters of the I/O port.

You can select a *preset* setting for a specific format output such as: Epson serial printer, Diconix serial printer, 180si serial printer, Seiko serial printer, 301 Format, Data Interchange Format (for exchanging data with programs such as: DBase, etc.). See chart on next page.

You can also select a *custom* setting, where you individually set the parameters:

- » **Baud Rate** - determines the output rate (characters per second) of the I/O port. Available rates are: 300, 600, 1200, 2400, 4800, and 9600.
- » **Pin5** - determines the status of pin 5 of the I/O port. It can be set to off, busy, or CTS (Clear To Send). Pin 5 should normally be set to off, if it is not going to be used.
- » **Format** - when set to old, the data will be output as: space, density, space, density. When format is set to new, the data will be output as: density, space, density, space.
- » **R.C.I.** - enables or disables Remote Control Interface. RCI allows the ability to remotely control the densitometer. Refer to the 380 Series RS232C Interface Manual (available from X-Rite, P/N 380-506) for further information on RCI.
- » **Decimal Point** - enables or disables the decimal point during output.
- » **Carriage Return/line Feed** - varies the delimiter at the end of each line. Can be set to carriage return and line feed or carriage return only.
- » **Computer** - when set to off, the data will be output as: step number, space, equals, space, density, and then the delimiter (as determined by the carriage return/line feed setting).

Ex. Step# 01 = n.nn < CR> Step # 02 = n.nn < CR>

When comp is set to on, the data will be output as determined by the format setting, and after the last step, the delimiter (as determined by the carriage return/line feed setting).

Ex. n.nn n.nn n.nn n.nn ... < CR>

- » **Transmit** - enables or disables data from being transmitted automatically after a reading is taken.
- » **Width** - when set to half width, will cause the printer to print the graphics at half the normal width. When set to full, the printer will print the graphics at full width.

You can load a preset and then use custom to change the individual settings of the selected preset.



I/O Preset Parameter Chart

I/O PRESET	BAUD	pin-5	FORMAT	r.c.i.	dec.pt	CR	COMP	XMIT	WIDTH
Epson	9600	CTS	NEW	OFF	ON	CRLF	OFF	MANUAL	FULL
Diconix	9600	CTS	NEW	OFF	ON	CRLF	OFF	MANUAL	FULL
Seiko	9600	CTS	NEW	OFF	ON	CRLF	OFF	MANUAL	HALF
D.I.F.	9600	BUSY	NEW	ON	ON	CRLF	OFF	MANUAL	FULL
301 (Emulation)	300	CTS	OLD	OFF	OFF	CR	ON	AUTO	FULL
180si	9600	CTS	NEW	OFF	ON	CRLF	OFF	MANUAL	FULL

- **Time/date (time)** - sets the time and date of the unit.

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- **Name of the unit (name)** - enters the name of the unit (ex., Metropolitan Hospital). The name will be printed with the clothesline plot and the characteristic curve plot.
- **Reference (ref)** - allows you to turn references on or off. If *reference is on*, the densitometer will display if the limits were exceeded after each measurement. Also, when you enter view or history you are prompted to select either **meas** (measured) or **dev** (as deviated from reference). If *reference is off*, limit violation is not displayed and you are not prompted to select either **meas** or **dev** in the view or history functions.

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- **Lamp counter (lamp)** - resets the lamp hours back to zero. This should be done after replacing the lamp. You can also check the percent of life remaining for the lamp.
- **Temperature Format (°C/F)** - allows either celsius or fahrenheit to be displayed and printed. Temperature format should be selected at initial setup and not changed. If the temperature format is changed after data is stored, all previous temperature data is invalid until the original format is reselected.

A8. Proprietary Notice

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A9. Warranty

X-Rite, Incorporated warrants each unit manufactured to be free of defects in material and workmanship for a period of twelve months. THERE ARE NO WARRANTIES OF MERCHANTABILITY OR FITNESS. THIS WARRANTY OBLIGATION IS LIMITED TO SERVICING THE UNIT RETURNED TO X-RITE, INCORPORATED FOR THAT PURPOSE AND EXCLUDES THE LAMP AND NICAD BATTERIES.

The unit shall be returned with transportation charges prepaid. If the fault has been caused by misuse or abnormal conditions of operations, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

A Warranty Registration Card is enclosed with each instrument. The purchaser should fill in the card completely and return it to X-Rite, Incorporated postmarked no later than ten (10) days from date of receipt. The card registers your system with us for warranty coverage. Once your unit is registered, we are able to maintain a file to help expedite service in case it is needed. Always include serial number in any correspondence concerning the unit. The serial number is located on the bottom of the unit.

X-Rite, Incorporated offers a flat rate repair program for instruments out of warranty. For more information, refer to your Flat-Rate Service Policy or contact X-Rite Technical Services Department.

This agreement shall be interpreted in accordance with the laws of the State of Michigan and jurisdiction and venue shall lie with the courts of Michigan as selected by X-Rite, Incorporated.