Operator's Manual

Tektronix

VM700A
Option 21 Camera Measurement

070-8573-02

Please check for change information at the rear of this manual.

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Certificate of the Manufacturer/Importer

We hereby certify that the VM700A Option 21 Camera Measurement complies with the RF Interference suppression requirements of Amtsbl.–Vfg 1046/1984.

The German Postal Service was notified that the equipment is being marketed.

The German Postal Service has the right to re–test the series and to verify that it complies.

TEKTRONIX

Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheinigt, daß der/die/das VM700A Option 21 Camera Measurement in Übereinstimmung mit den Bestimmungen der Amtsblatt–Verfügung 1046/1984 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtgung zur Überprufüng der Serie auf Einhalten der Bestimmungen eingeräumt.

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NOTICE to the user/operator:

The German Postal Service requires that Systems assembled by the operator/user of this instrument must also comply with Postal Regulation, Vfg. 1046/1984, Par. 2, Sect. 1.

HINWEIS für den Benutzer/Betreiber:

Die vom Betreiber zusammengestellte Anlage, innerhalb derer dies Gerät eingesetz wird, muß ebenfalls den Voraussetzungen nach Par. 2, Ziff. 1 der Vfg. 1046/1984 genugen.
1 der Vfg. 1046/1984 eingehalten werden.

NOTICE to the user/operator:

The German Postal Service requires that this equipment, when used in a test setup, may only be operated if the requirements of Postal Regulation, Vfg. 1046/1984, Par. 2, Sect. 1.7.1 are complied with.

HINWEIS für den Benutzer/Betreiber:

Dies Gerät darf in Meßaufbauten nur betrieben werden, wenn die Voraussetzungen des Par. 2, Ziff. 1.7.

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OPERATOR SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Protective ground (earth) terminal.

SAFETY INFORMATION

Use the Proper Power Source. This product is intended to operate from a power module connected to a power source that will not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Ground the Product. This product is grounded through the grounding conductor of the power module power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power module power cord is essential for safe operation.

Danger May Arise From Loss of Ground. Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the Proper Fuse. To avoid fire hazard, use only the fuse of correct type, voltage rating, and current rating as specified in the parts list for your product. Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres. To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Do Not Operate Without Covers. To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

Section 1
INTRODUCTION

The following Camera Testing measurements are available with Option 21 of the VM700A:

- **Colorimetry:** measures the color fidelity of a camera's output (CCD or tube cameras).
- **Defects:** identifies defective cells in CCD devices (CCD cameras only).
- **Detail:** measures the artificial sharpening transitions added to the video in both the horizontal and vertical directions as a percentage of transition amplitude (CCD or tube cameras).
- **Fixed Pattern Noise:** identifies unwanted signal nonuniformities correlated to CCD cells (CCD cameras only).
- **Frequency Response:** measures the degradation in waveform amplitude as the frequency of modulation increases (CCD or tube cameras). Measures aliasing components for CCD cameras.
- **Gamma:** measures the input-to-output light transfer characteristic of an imaging or display device (CCD or tube cameras).
- **Geometry and Registration:** measures geometric distortions in camera imaging elements (CCD or tube cameras).
- **Shading:** measures variation in camera output luminance levels when light input is constant (CCD or tube cameras).
- **Vertical Smear:** measures the camera's ability to handle excess light (CCD cameras only).

Section 2, "Configuration," tells you how to set up the VM700A configuration files to use the Camera Testing measurements.

Section 3, "Using the Camera Testing Measurement Tools," explains the operation of each of the four measurements listed above. For each measurement, this section describes: the purpose of the measurement; the lighting and chart setup required for the measurement to produce accurate results; the measurement's display(s), and the meanings of data shown in the display; the measurement's softkeys and their functions.

Section 4, "Remote Commands and Keywords," tells how to use Option 21 in remote mode. This section explains the keywords, application names, and softkey names used with Camera Testing measurements.

Section 2
CONFIGURATION

INTRODUCTION TO CONFIGURING THE OPTION

The approach to configuring the VM700A's Camera_Testing measurement option is similar to that used for its other video functions. A series of files and directories provide default parameters that the VM 700A uses to measure video signals. If your application requires parameters other than the defaults supplied with the VM700A, you may configure the Camera_Testing option to suit your preferences. To configure and use new parameters in Camera_Testing measurements, you must perform these steps:

1. Create your own Camera_Testing file (i.e., "CamLimits") and configure it with your parameter values.
2. Create your own Video Source file (i.e., "CamSource") and select "CamLimits" as the limits file to be used.
3. Configure the Source_Selection Video file to select the "CamSource" file as a source file for one or all of the channels (A, B, or C), as needed for your measurements.

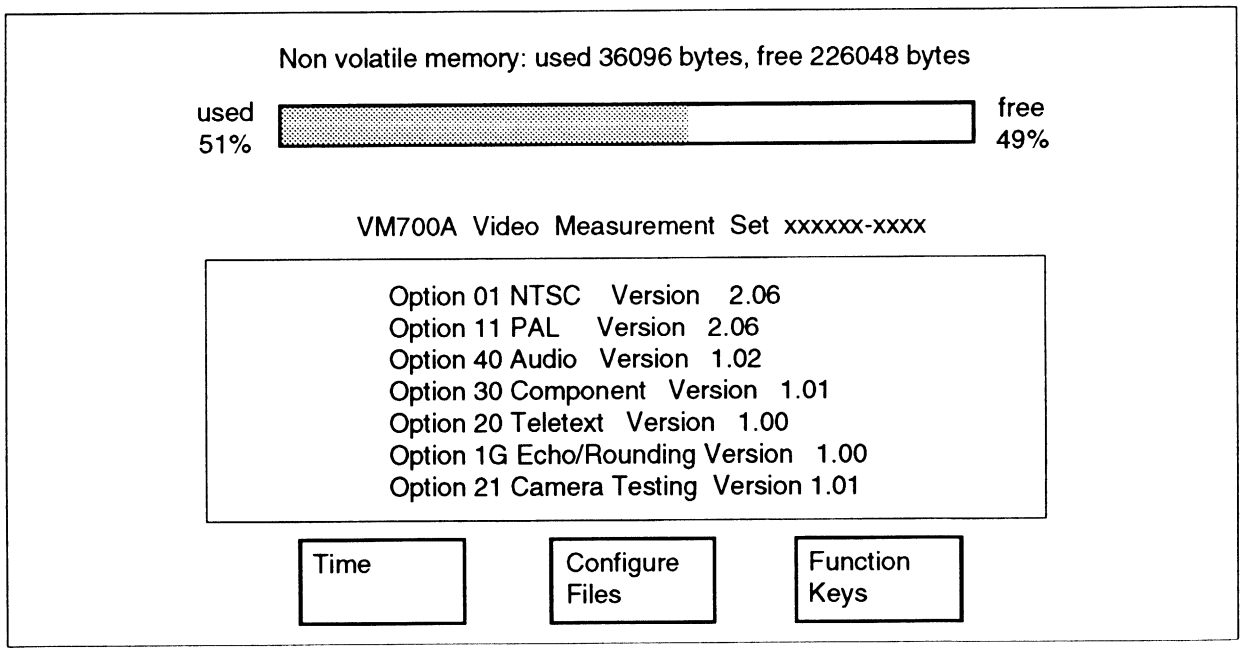

Figure 2-1. The Configure menu.

The following text describe these steps.

Begin configuration of the Camera_Testing measurement option by pressing the Configure button. The screen displays a memory use indicator, information about instrument option versions, and three softkeys (touch-screen buttons). See Figure 2-1.

Press the Configure Files softkey to begin configuration.

The screen now displays a series of soft-key options in a window. Scroll the window to view all the menu choices by turning the front panel knob. The following sections describe the procedure for configuring the VM700A Camera_Testing measurement option.

THE CAMERA TESTING CONFIGURATION FILE

Touch the **Camera_Testing** softkey to enter the Camera_Testing file directory. The screen displays the System Default file and user files (if any have been created). See Figure 2-2. You may press a softkey to view the parameters in any file, but the System Default file parameters cannot be modified.

If the parameters in the System Default file are acceptable, the VM700A uses them (if this file is the selected file) for making measurements on the input video signals. If you must modify the Camera_Testing measurement parameters, use the procedures given in the following text.

To modify the System Default file, you must do the following:

- Create a new file using the System Default file as a template
- Name the file you are creating
- Edit the information in the new file as necessary
- Accept the edits
- Save the new file

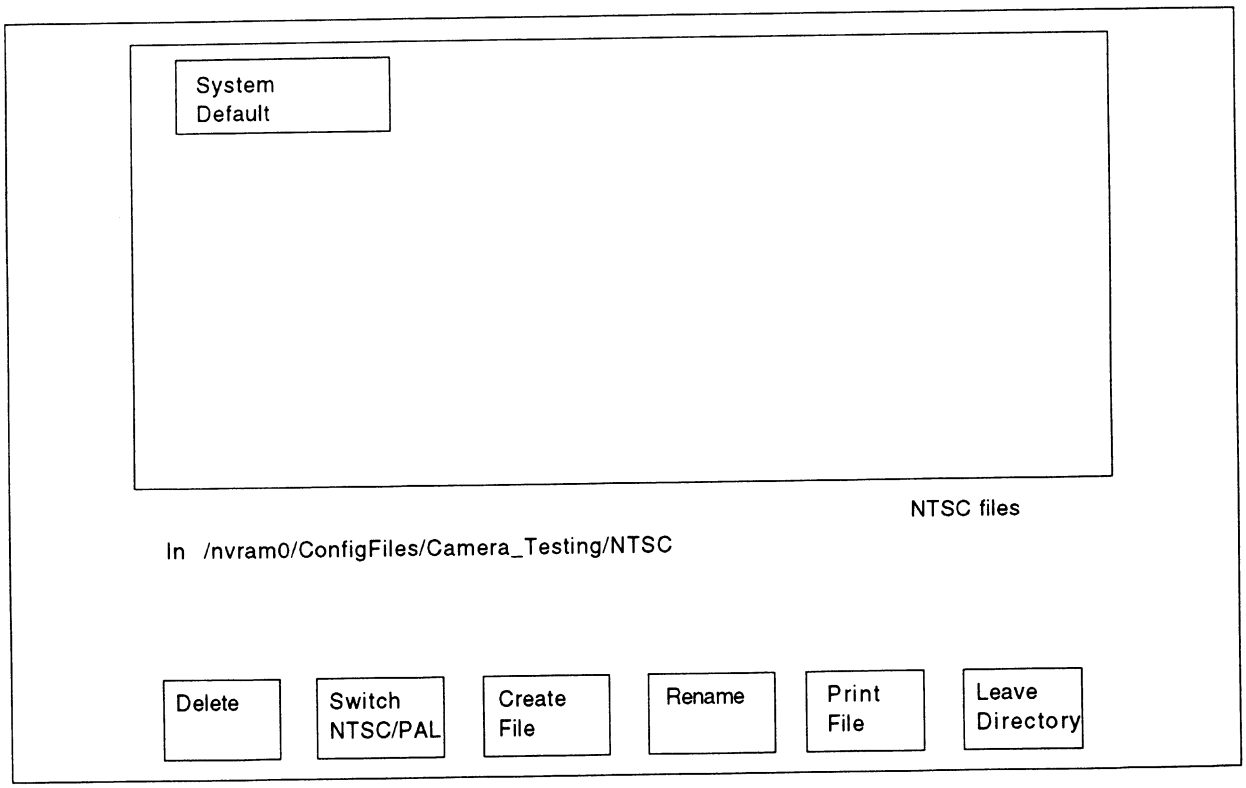

Figure 2-2. Camera_Testing measurement limit menu choices.

CREATING A CAMERA TESTING Configuration FILE

1. Touch the Create File softkey.

The query line (the top line of the display) asks you to select a file to be used as a template for your new file.

2. Touch the appropriate softkey (for example, System Default).

3. The screen displays a keyboard, from which you may type a name for your new file.
4. When you have named the file, touch the Done softkey.

The VM700A now displays the new file containing the Camera_Testing parameters from the file you selected as the template. You may edit the parameters in this file.

Editing a Camera Testing Configuration Parameter

Table 2-1 shows the editable choices in a user created Camera_Testing measurements limit file.

Table 2-1
Editable Fields in the Camera_Testing File

Editable Item	Choices
System Camera Testing Option Configuration defaults	Name of file identification line can be changed for the measurement reports. This does not change the file's name.
Camera Output Standard	**NTSC Choices:** Composite Composite with Setup GBR 700 (system default) GBR 700 Setup GBR 714 GBR 714 Setup YPbPr SMPTE/EBU YPbPr 714 Betacam Setup YPbPr 714 Betacam YPbPr 700 MII Setup **PAL Choices:** Composite GBR YPbPr SMPTE/EBU
Frequency response results	dB or percent.
Zone selection	Circular or octagonal.
Frequency Response Packets	6 to 12
Packets X to X beyond 6 MHz	Choice for both X's is 1 to 12.
Location Field and Line Frequency Response or Locations: Frequency Response Line	NTSC Choices Field 1 or 2 Line 1 to 262 PAL Choices 1 to 625

Table 2-1 (cont.)
Editable Fields in the Camera_Testing File

Editable Item	Choices
Limits Upper and Lower	Limits for the frequency response reference and all the packets may be set. The Reference voltage limit is 0 to 999.9 mV, lower to upper. The packet limits are -40 to +40 dB. Any limit may be set to undefined.
Custom illuminant light source	Color temperature (°K); X, Y, Z coordinates
CIE Coordinates	Y, u', v' values for 100 colors. Note: reference white is defined by the VM700A to have a Y value of 100.00.

To change a Camera_Testing parameter, use the following procedure:

1. Rotate the knob to highlight the line containing the parameter you wish to change. This includes the title line in the configuration file. Use a descriptive file name for help in identifying it later.
2. Select the parameter you want to change by touching it.
3. Rotate the knob to increase or decrease the parameter's value.
4. Touch the Accept Input softkey to accept the change.

NOTE

If you change a parameter and then decide you don't want to keep the change, press the No change & Exit softkey. The VM700A verifies that you want to exit without changing anything by asking you to touch the No change & Exit softkey again.

To return to the file you created, touch the softkey on the display (the file you created now appears there).

If you are making extensive changes to the file, you may avoid losing all your changes by pressing the Update & Exit softkey after each change and then re-entering the file. That way, if you make a mistake and must exit the file, your earlier work will be retained while the most recent change (or mistake) is eliminated.

DELETING A CAMERA TESTING Configuration FILE

You may delete a modified Camera_Testing file with this procedure:

1. In the Camera_Testing files directory, touch the Delete softkey.

The query line (the top line of the display) asks you to select a file to be deleted.

2. Select the file to be deleted by touching its softkey.

The VM700A begins the deletion process.

NOTE

You may halt file deletion by pressing the Cancel softkey (in the same position as the Delete softkey before the deletion process started). You may also halt file deletion by touching the screen image of the file. Nothing happens to a file whose deletion process is halted.

CONFIGURING THE VIDEO SOURCE FILES

Touch the Video_Source Files softkey to enter the Video Source Files directory. The screen displays the video source files. One file is always the System Default file

You may select and press a softkey to display the parameters in a System Default file, but the parameters in this file may not be modified. To modify file parameters, you must do the following:

- Create a file using an existing file as a template (usually the System Default file)
- Name the file you created
- Edit the information in the new file as necessary
- Accept the edits

If the system default video source file is acceptable, the VM700A will use this file as it performs video measurements. If you must modify the video source file, read the following paragraphs.

Editing the Video Source File

To modify the Video Source file, follow this procedure:

1. Touch the Create File softkey.

The query line (the top line of the display) asks you to select the file to be used as a template for your new file.

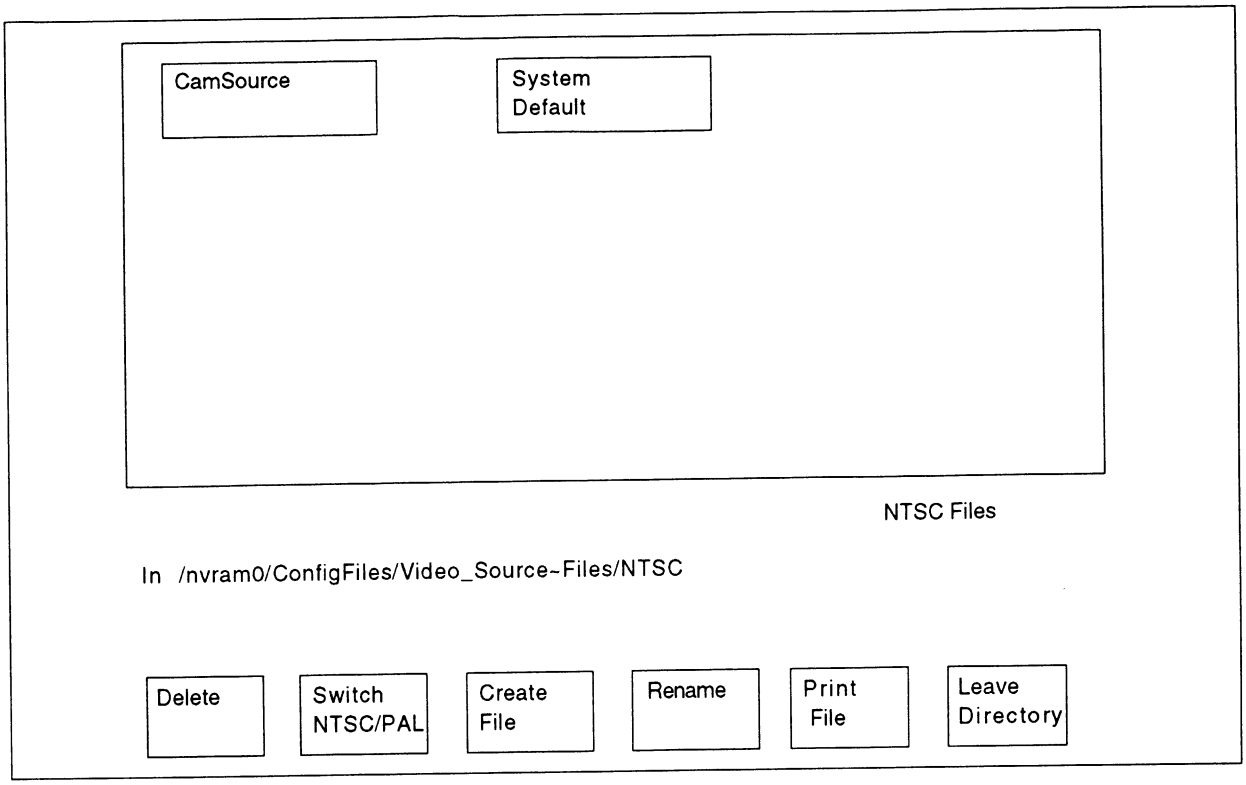

Figure 2-3. Selecting a file to use as a template.

2. Touch the appropriate softkey for the file you want to use (for example, System Default).
3. The screen displays a keyboard, from which you may type the name for your new file.
4. Press the Done key.

The VM700A now displays the contents of the new file containing the video source data from the file you selected as the template. You may modify the parameters in this file.

Changing Video Source File Parameters

Change the Video Source parameters using the following procedure:

1. Rotate the knob to highlight the line containing the parameter you want to change (in this case, you would highlight the line "Camera_Testing: System~Default").
2. Select a parameter by touching it (touch "Camera_Testing: System~Default").
3. Rotate the knob to change the parameter or value (select the name of the new Video Source file).
4. Touch the Accept Input softkey to accept the change.

NOTE

If you change a parameter and then decide you don't want to keep the change, press the No change & Exit softkey. The VM700A verifies that you want to exit without changing anything by asking you to touch the No change & Exit softkey again.

To return to the file you created, touch the softkey on the display (the file you created now appears there).

If you are making extensive changes to the file, you may avoid losing all your changes by pressing the Update & Exit softkey after each change and then re-entering the file. That way, if you make a mistake and must exit the file, your earlier work will be retained while the most recent change (or mistake) is eliminated.

For more information about the other selections in the Video Source file, refer to the operator's manual for your NTSC, PAL, or dual-standard VM700A.

CONFIGURING SOURCE SELECTION VIDEO

The video limit files used by the VM700A for video measurements are configured in the Video Limit Files directory and specified in the Video Source Files directory. Likewise, the video source files are configured in the Video Source Files directory and specified in the Source Selection Video directory.

In the Source Selection Video file you may select a video source file (if you intend to use a source file other than the system default) for each of three sources.

Specifying a Video Source File

To specify a video source file, use the following procedure:

1. Touch the Source_Selection Video softkey.
2. Rotate the front panel knob to highlight the source for which you are specifying a video source file (source A, B, or C).
3. Touch the highlighted source file to select it.
4. Rotate the front panel knob to change the video source file selection.
5. When you have selected a video source file, touch the Accept Input softkey.
6. If the change is correct, touch the Update & Exit softkey, otherwise, touch the No change & Exit softkey.

NOTE

If you change the video source file and then decide to exit the directory and cancel the change, you must press the Accept Input softkey, followed by the No change & Exit softkey. The VM700A verifies that you want to exit the Source Selection Video directory and cancel any changes by asking you to touch the No change & Exit softkey again.

Camera Testing measurements that need all three input channels (e.g., Colorimetry) use the Channel A configuration. Camera Testing measurements that need only one input channel use the configuration for the channel indicated by the lighted VM700A front-panel button.

TEST CHARTS

Some applications discussed in this manual require that the camera under test be pointed at a test chart. Types of charts required for this option include: the Macbeth ColorChecker chart for Colorimetry; the RETMA registration chart for Geometry and Registration; a gray scale chart for Gamma and Detail; and a Sinewave Multiburst chart for Frequency Response.

Vertical Smear requires a simple target chart (described in the section on using Vertical Smear) that you can make when it is needed. The remaining camera testing applications don't require charts.

The Macbeth ColorChecker chart is supplied with the Camera Testing application; the remaining charts (and replacement copies of the Macbeth ColorChecker chart) may be procured from:

Porta Pattern
15755 S. 169 Hwy.,
Olathe, Kansas 66062 USA

The Porta Pattern toll-free telephone number is 1-800-825-8070, and the FAX number is 913 780-5148.

Section 3
USING THE CAMERA TESTING MEASUREMENT TOOLS

The following Camera Testing measurements are available with Option 21 of the VM700A:

- **Colorimetry:** measures the color fidelity of a camera's output (CCD or tube cameras).
- **Defects:** identifies defective cells in CCD devices (CCD cameras only).
- **Detail:** measures the artificial sharpening transitions added to the video in both the horizontal and vertical directions as a percentage of transition amplitude (CCD or tube cameras).
- **Fixed Pattern Noise:** identifies unwanted signal nonuniformities correlated to CCD cells (CCD cameras only).
- **Frequency Response:** measures the degradation in waveform amplitude as the frequency of modulation increases (CCD or tube cameras). Measures aliasing components for CCD cameras.
- **Gamma:** measures the input-to-output light transfer characteristic of an imaging or display device (CCD or tube cameras).
- **Geometry and Registration:** measures geometric distortions in camera imaging elements (CCD or tube cameras).
- **Shading:** measures variation in camera output luminance levels when light input is constant (CCD or tube cameras).
- **Vertical Smear:** measures the camera's ability to handle excess light (CCD cameras only).

For each measurement, this section describes: the purpose of the measurement; the lighting, and chart setup (if any) required for the measurement to produce accurate results; the measurement's display(s), and the meanings of data shown in the display; the measurement's softkeys and their functions.[1]

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[1] Certain applications require the use of special charts if camera testing is to be successfully performed. For information on procuring these charts, see the section "Procuring Test Charts" in the Configuration section of this manual.

COLORIMETRY

Colorimetry measures the color fidelity of a CCD or tube camera's output. Measurement results include all the parameters defined in the CIELUV color space,[2] as well as the additional color differences derived from the CIELUV color space. A weighted RMS result provides a single parameter that indicates the color reproduction capabilities of the camera.

Colorimetry Setup

In setting up to make a Colorimetry measurement, check the following:

- All three camera output channels should be connected to input channels on the VM700A.

  For GBR output, the camera's G output should be connected to VM700A input channel A, the camera's B output to VM700A input channel B, and the camera's R output to VM700A input channel C.

  For YPbPr output, the camera's Y output should be connected to VM700A input channel A, the camera's Pb output should be connected to VM700A input channel B, and the camera's Pr output should be connected to VM700A input channel C.

- For composite output, the camera's Y output should be connected to VM700A input channel A.

- The Camera Testing Option configuration file, in directory /nvram0/ConfigFiles, must be set to the correct camera output format. Choose the camera output format from the following list:

  For NTSC: Composite; Composite with Setup; GBR 700; GBR 700 Setup; GBR 714; GBR 714 Setup; YPbPr SMPTE/EBU; YPbPr 714 Betacam Setup; YPbPr 714 Betacam; YPbPr 700 MII Setup.

  For PAL: Composite, GBR, YPbPr SMPTE/EBU.

  Once the Camera Testing Option configuration file is set to the correct camera output format, make sure that the current Video Source File points to the correct Camera Testing Option configuration file. Then, make sure that the Source Selection Video file points to the correct Video Source File. See Chapter 2, "Configuration," for information about setting up these files.

- After white-balancing the camera, use the VM700A's Waveform application to set the average voltage level of the white chip on the color chart as shown in Table 3-1. This table shows the recommended voltage levels for reference white on the Macbeth ColorChecker chart, as a function of output format and gamma correction applied by the camera. "Linear gamma" means the camera applies no gamma correction. "Nominal gamma" means the camera applies a gamma correction factor of 0.45.

2 "Colour Science in Television and Display Systems, W.N. Sproson, 1983"

Table 3-1
White chip settings for colorimetry measurement (Macbeth ColorChecker chart only)

Format	Linear Gamma	Nominal Gamma
SMPTE/EBU, GBR700, MII	619 mV	662 mV
GBR714, Betacam	631 mV	675 mV
MII w/ setup, GBR700 w/ setup[a]	625 mV	665 mV
Betacam w/ setup, GBR714 w/ setup[a]	637 mV	678 mV

[a]GBR signals coming directly from a camera normally do not have setup.

When setting the average voltage level of the white chip with GBR camera output, Tektronix recommends that you use the "green" input channel on the VM700A (channel A). When setting the average voltage level of the white chip with YPbPr camera output, you MUST use the "Y" input channel on the VM700A (channel A).

- If using a standard Macbeth color chart, aim the camera so that the cross-hairs in the camera viewfinder fall between the four center color chips on the chart. (These chips are moderate red, purple, red, and yellow.) Set the camera's magnification so that the leftmost and rightmost edges of color chips on the chart lie within the viewing area. Because of the differing aspect ratio between the Macbeth chart and the video camera, leave approximately equal space above the top and below the bottom of the chart within the viewing area. See Figure 3-1.
- If using a custom color chart, center the camera on the chart. Set the camera's magnification so that the leftmost and rightmost edges of color positions on the chart lie within the viewing area. Leave approximately equal space above the top and below the bottom of the chart within the viewing area. Be sure to tell the VM700A the locations of the colors on the chart, using the Acquire & Charts/Custom Charts/Special Position softkey menu. (See "Using a Custom Chart," later in this section.)
- Within the Colorimetry application, tell the VM700A what light source is being used. To do so, press the Menu button to display the Colorimetry menu. Press the Meas. Condition soft key, press the "Illum." softkey, then press the softkey corresponding to the light source being used. The "Illum. D65" softkey refers to daylight at 6500°K color temperature. The "Illum. 31K" softkey refers to studio light at 3100°K ± 100°K color temperature. The "Custom Illum." soft key refers to the custom light source defined at configuration.
- Within the Colorimetry application, tell the VM700A what phosphor the camera uses. To do so, press the Menu button to display the Colorimetry menu. Press the "Phosphors" softkey, then press the softkey corresponding to the phosphor on the camera (NTSC, EBU, or SMPTE).
- Within the Colorimetry application, tell the VM700A what gamma correction the camera uses. To do so, press the Menu button to display the Colorimetry menu. Press the "Gamma" softkey, then press the softkey corresponding to the appropriate gamma correction. "Linear Gamma" means the camera is performing no gamma correction. "Nominal Gamma" means the camera is applying a camera correction factor of 0.45. "Measured Gamma" means the gamma measured and stored by the Gamma application.

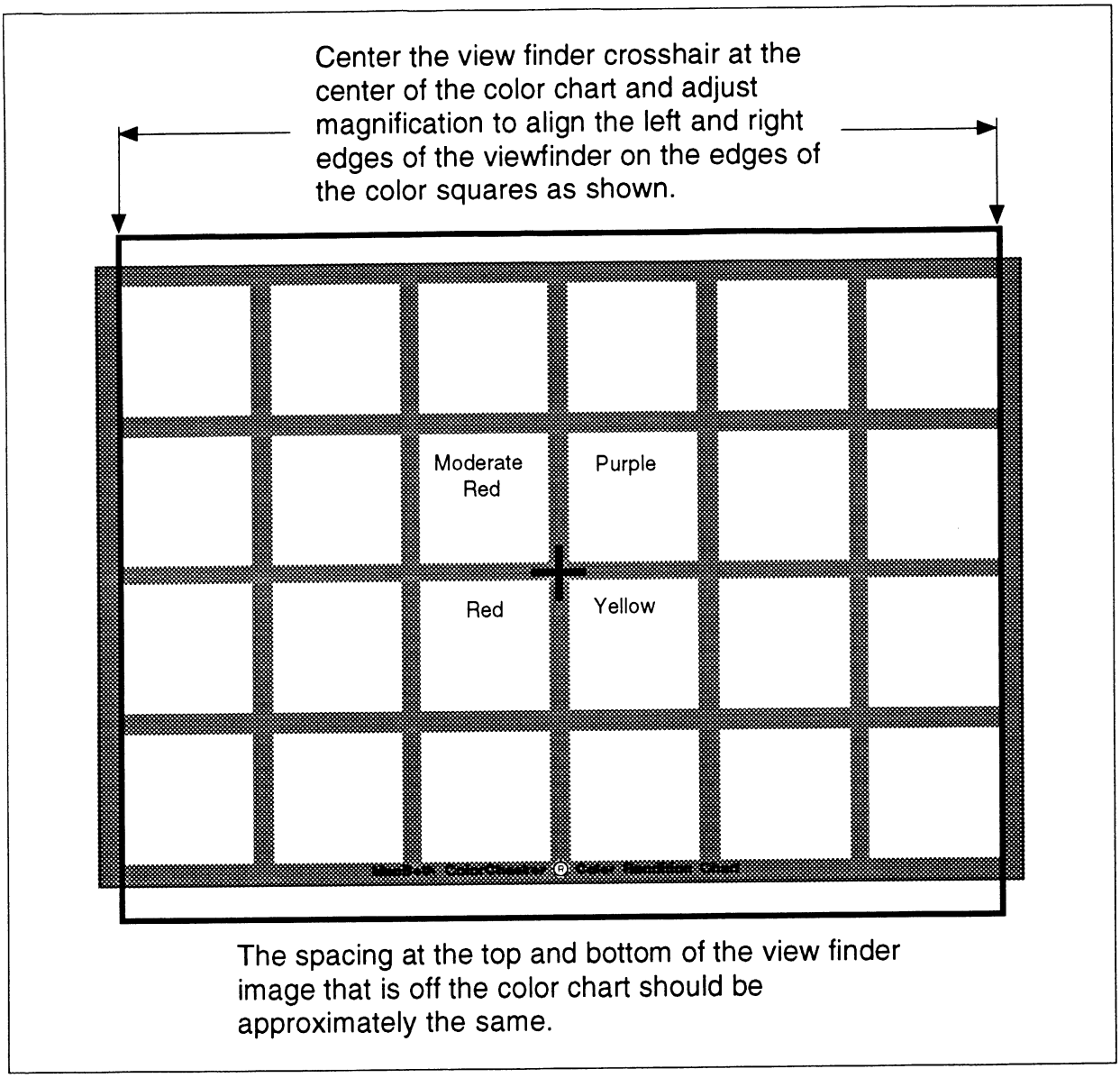

Figure 3-1. Macbeth ColorChecker camera setup for colorimetry measurement.

Colorimetry Display

Figure 3-2 shows a typical Colorimetry display in Color Measurement mode (acquisition is not continuous). This display contains a list of colors whose names appear at the right side of the display. You can use the knob to scroll through this list of colors. As you scroll through the list, the parameters measured for the currently highlighted color appear on the screen to the right of center.

Reference color data supplied with the VM700A is furnished in terms of the CIE 1976 L^*, u^*, v^* (CIELUV) color model. The following color parameters measured are shown for each color, along with their reference values:

L^* Lightness. This is a measure of a color's lightness relative to reference white.

u^* This is a chromatic parameter that describes the degree of redness ($+u^*$) or greenness ($-u^*$) found in a color. It is also a function of Lightness. Neutral grey colors have a u^* value of 0.0.

v^* This is a chromatic parameter that describes the degree of yellowness ($+v^*$) or blueness ($-v^*$) found in a color. It is also a function of Lightness. Neutral grey colors have a v^* value of 0.0.

C^* Chroma. This parameter gives an indication of a color's vividness or saturation. This is a function of both u^* and v^*.

h Hue angle. This is essentially an indicator of the "color family" in which a color falls. This is most commonly associated with a color name, such as red, green, purple, etc.

ΔE Color difference. This is a distance in CIELUV space that accounts for both luminance and chromatic variations between two colors. This value is computed by means of the following formula:

$$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta u^*)^2 + (\Delta V^*)^2}$$

where

$$\Delta L^* = L^*_{meas} - L^*_{ref}$$

$$\Delta u^* = u^*_{meas} - u^*_{ref}$$

$$\Delta v^* = v^*_{meas} - v^*_{ref}$$

ΔH Hue difference. This is a distance in CIELUV space that represents the difference between the hues of two colors. This is a chromatic difference only. This value is computed by means of the following formula:

$$\Delta H^* = \sqrt{2C_1C_2\,(1 - \cos\Delta h)}$$

where

$$C_1 = \sqrt{(\Delta u^*_{meas})^2 + (\Delta v^*_{meas})^2}$$

$$C_2 = \sqrt{(\Delta u^*_{ref})^2 + (\Delta v^*_{ref})^2}$$

$$\Delta h = h_{meas} - h_{ref}$$

RMS values for ΔE and ΔH, the overall quality of the colors on the chart, are also displayed.

A plot of u' versus v' appears on the left half of the screen. The measured position of the selected color is shown by a solid box on this plot. An open box represents the reference position for the color. The position of white is also shown as a small circle marked with a "W". For ease of

interpretation, the positions of green, red, and blue are also shown on the display and form a triangle on the screen.

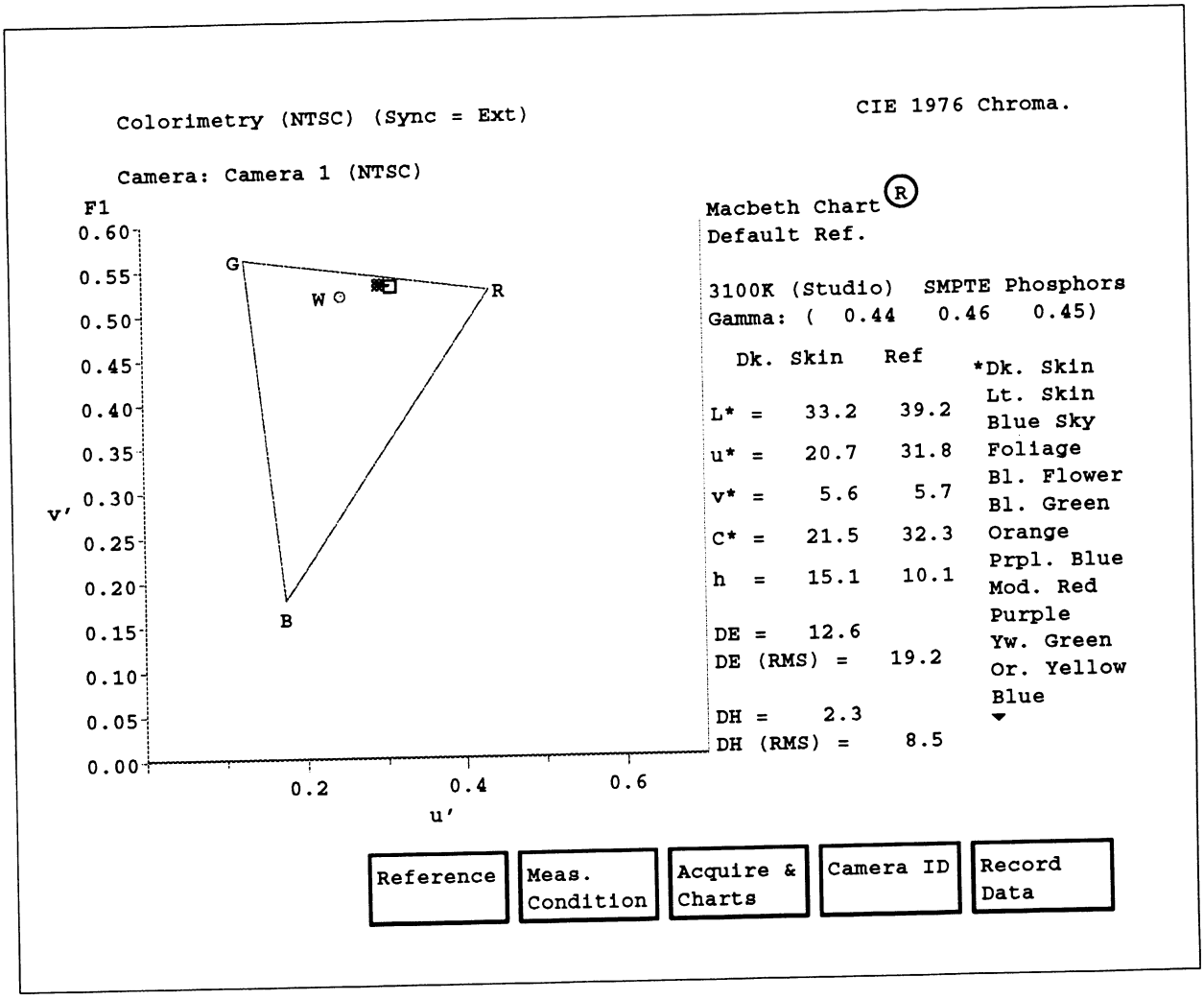

Figure 3-2. Colorimetry Measurement Display in Color Measurement mode.

Figure 3-3 shows the Colorimetry display in Continuous Acquisition mode. In this mode you may make on-camera adjustments while monitoring measured results. Up to six colors may be monitored continuously. The display contains three graphs that show color-patch lightness, hue, and measured error.

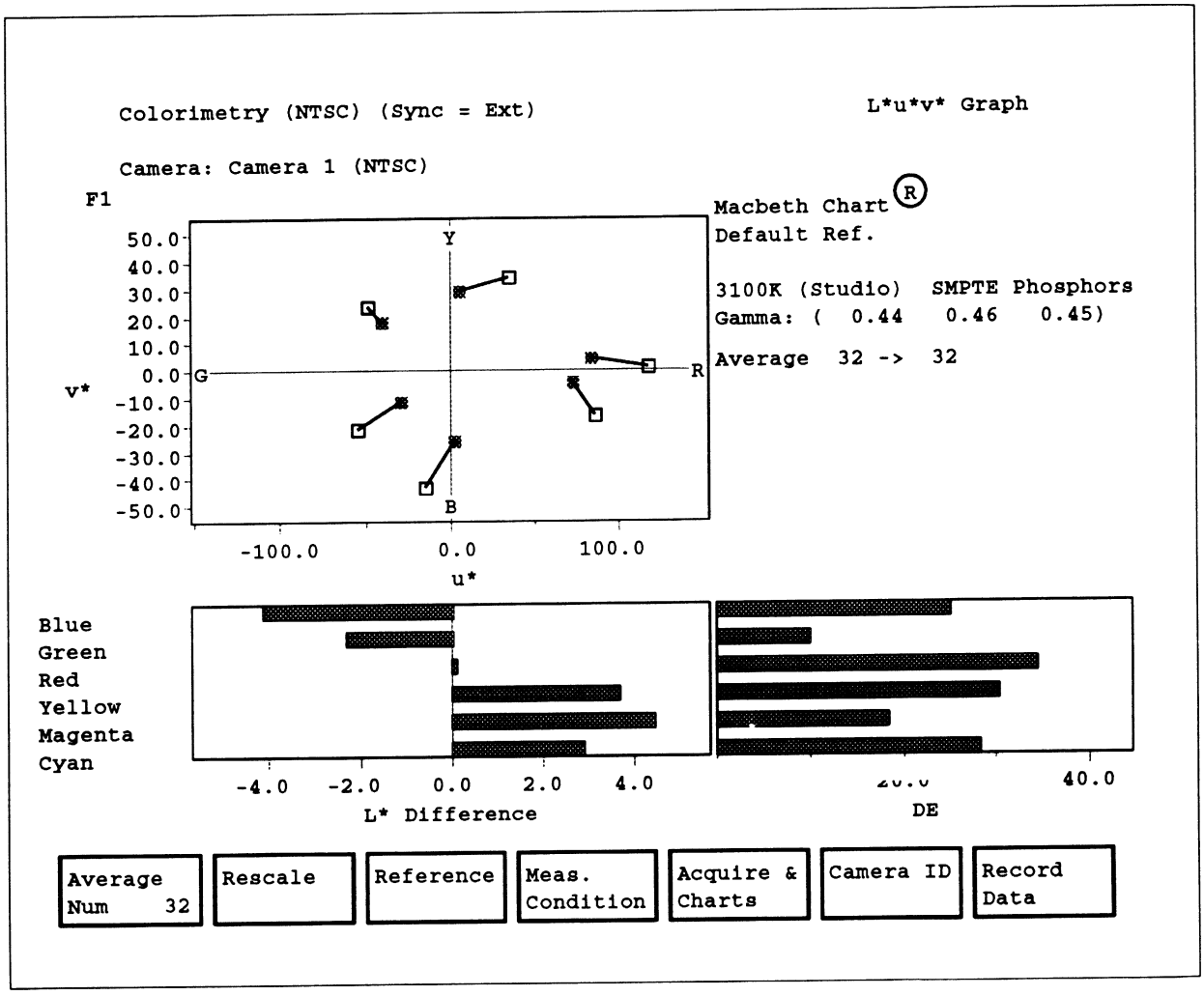

Figure 3-3. Colorimetry measurement display in Continuous Acquisition mode.

Colorimetry Menu

Pressing the Menu button when the Colorimetry measurement is running brings up the Colorimetry main menu. The Colorimetry menu tree is shown in Figure 3-4.

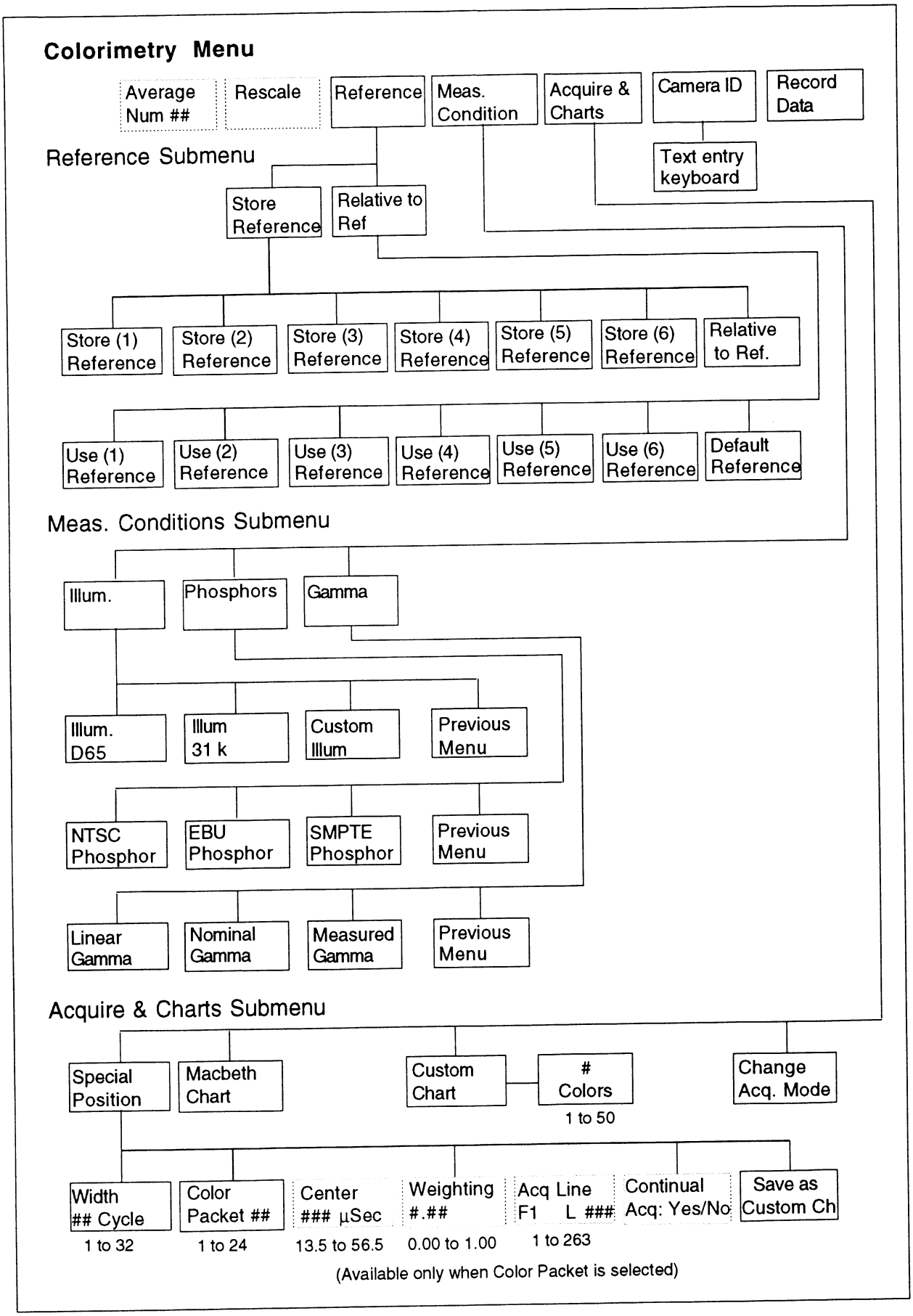
Colorimetry Menu
Average Num ##
Rescale
Reference
Meas. Condition
Acquire & Charts
Camera ID
Record Data
Text entry keyboard
Reference Submenu
Store Reference
Relative to Ref
Store (1) Reference
Store (2) Reference
Store (3) Reference
Store (4) Reference
Store (5) Reference
Store (6) Reference
Relative to Ref.
Use (1) Reference
Use (2) Reference
Use (3) Reference
Use (4) Reference
Use (5) Reference
Use (6) Reference
Default Reference
Meas. Conditions Submenu
Illum.
Phosphors
Gamma
Illum. D65
Illum 31 k
Custom Illum
Previous Menu
NTSC Phosphor
EBU Phosphor
SMPTE Phosphor
Previous Menu
Linear Gamma
Nominal Gamma
Measured Gamma
Previous Menu
Acquire & Charts Submenu
Special Position
Macbeth Chart
Custom Chart
Colors
1 to 50
Change Acq. Mode
Width ## Cycle
1 to 32
Color Packet ##
1 to 24
Center ### µSec
13.5 to 56.5
Weighting #.##
0.00 to 1.00
Acq Line F1 L ###
1 to 263
Continual Acq: Yes/No
Save as Custom Ch
(Available only when Color Packet is selected)

Figure 3-4. Colorimetry Menu Tree.

MAIN MENU

Average Num ##	**Average Num.:** specifies the weighting factor to be used for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the Average Num softkey to highlight it, rotate the knob until the desired weighting factor appears, then press the Average Num softkey again.
Rescale	**Rescale:** restores the display to the optimum scale.
Reference	**Reference:** brings up a sub-menu that allows you to store, examine, or make use of reference data values.
Meas. Conditions	**Meas. Conditions:** brings up a sub-menu that lets you to inform the VM700A about the illumination, camera phosphor, and gamma correction being used for the measurement.
Acquire & Charts	**Acquire & Charts:** brings up a sub-menu that lets you specify acquisition locations, and provides other acquisition control.
Camera ID	**Camera ID:** brings up an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.
Record Data	**Record Data:** stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Colorimetry.N, where N is one greater than the previously highest-numbered Colorimetry file. (The file names start with Colorimetry.0.)

REFERENCE SUB-MENU

Store Reference	**Store Reference:** brings up a sub-menu that allows you to save current data values as a reference.
Relative to Ref	**Relative to Ref:** brings up a sub-menu to make measurements relative to a selected reference.

STORE REFERENCE SUB-MENU

Store (N) Reference	**Store (N) Reference:** stores the current measurement result as reference N.
Relative to Ref	**Relative to Ref:** brings up a sub-menu to make measurements relative to a selected reference.

USE REFERENCE SUB-MENU

Use (N) Reference	**Use (N) Reference:** compares the current measurement result with the selected reference.
Default Reference	**Default Reference:** compares the current measurement result with "default" reference values, which are derived assuming perfect testing conditions. If you are using custom charts, pressing this soft key causes the VM700A to read the custom chart reference numbers defined at configuration.

MEAS. CONDITIONS SUB-MENU

Illum.	**Illum.:** brings up a sub-menu that tells the VM700A what kind of lighting is being used for the measurement.
Phosphor	**Phosphor:** displays a submenu that tells the VM700A what kind of output phosphor the camera is adjusted for.
Gamma	**Gamma:** brings up a sub-menu that tells the VM700A what kind of gamma correction the camera uses.

ILLUM. SUB-MENU

Illum. D65	**Illum. D65:** tells the VM700A that the measurement is being made using daylight as a light source (color temperature 6500°K).
Illum. 31K	**Illum. 31K:** tells the VM700A that the measurement is being made using a studio light as a light source (color temperature 3100°K ± 100°K).
Custom Illum.	**Custom Illum.:** tells the VM700A that the measurement is being made using a custom illuminant as a light source. The color temperature and x, y, and z coordinates for a custom illuminant may be specified in the Camera_Testing file at configuration.
Previous Menu	**Previous Menu:** returns to the previous menu.

PHOSPHOR SUB-MENU

NTSC Phosphor	**NTSC Phosphor:** tells the VM700A that the camera is adjusted for an NTSC phosphor.
EBU Phosphor	**EBU Phosphor:** tells the VM700A that the camera is adjusted for an EBU phosphor.
SMPTE Phosphor	**SMPTE Phosphor:** tells the VM700A that the camera is adjusted for a SMPTE phosphor.
Previous Menu	**Previous Menu:** returns to the previous menu.

GAMMA SUB-MENU

Linear Gamma	**Linear Gamma:** tells the VM700A that the camera does not perform any gamma correction.
Nominal Gamma	**Nominal Gamma:** tells the VM700A that the camera uses a gamma correction factor of 0.45.
Measured Gamma	**Measured Gamma:** tells the VM700A that the camera uses the gamma measured and stored with the Gamma application.
Previous Menu	**Previous Menu:** returns to the previous menu.

ACQUIRE & CHARTS SUB-MENU

Special Position	**Special Position:** brings up a sub-menu to define the acquisition location.
Macbeth Chart	**Macbeth Chart:** sets locations to those appropriate to the Macbeth ColorChecker chart.
Custom Chart	**Custom Chart:** sets locations to those appropriate to a custom chart previously defined by the user. If a custom chart has not been defined, brings up other softkeys to allow a custom chart to be defined.
Change Acq. Mode	**Change Acq. Mode:** toggles the display from Continuous Acquisition to Color Measurement mode (a non-continuous acquisition mode). In Continuous Acquisition mode you may make adjustments on the camera while continuously monitoring measured results. In Color Measurement mode you may measure all colors on the chart and examine each in depth.

SPECIAL POSITION SUB-MENU

Width	**Width:** sets the width of the measurement area. To change the width, select the softkey and turn the knob.
Color Packet	**Color Packet:** selects the packet to re-define. To change the packet number, select the softkey and turn the knob.
Center 14.3 usec	**Center:** defines the center of the measurement area. To change the location, select the softkey and turn the knob. Available only when Color Packet is selected.
Weighting 1.00	**Weighting:** assigns a weighting factor, ranging from 0.0 to 1.0, to the color packet. To change the weighting factor, select the softkey and turn the knob. Available only when Color Packet is selected.
Acq.Line	**Acq. Line:** sets the color packet to start acquisition on the current line. Available only when Color Packet is selected.
Continual Acq.	**Continual Acq.:** selects continuous acquisition of an individual color. Available only when Color Packet is selected.
Save As Custom Ch.	**Save As Custom Ch.:** saves the current parameters as the custom chart.

Field Toggle

Field Toggle: displayed when the Select Line hard key is pressed. This soft key toggles the display between field 1 and field 2

Default Line

Default Line: displayed when the Select Line hard key is pressed. Selects the line specified as the default at configuration.

NOTE

You may exit and re-enter the application while defining or changing a custom chart without losing entered information. However, special positions (entered via the Acquire & Charts submenu) are not saved for function playback. If a custom chart is selected during function playback, chart information is read from data stored in NVRAM.

Using a Custom Chart

To use a custom color chart with the Colorimetry measurement, you must do two things:

1. position the camera correctly on the chart, and
2. tell the VM700A where to make the measurements for the various colors within the active video area.

This section tells you:

- how to position the camera to use a custom chart;
- how to specify the number of colors on a custom chart;
- how to specify the acquisition line for a color packet;
- how to specify the measurement location (within a line) for a color packet;
- how to specify the measurement width (in cycles) for all color packets on a custom chart; and
- how to specify the weighting factor for a color packet on a custom chart.

POSITIONING THE CAMERA FOR A CUSTOM CHART

Position the viewfinder so that its crosshairs point at the center of the chart, both horizontally and vertically. Adjust magnification so that the left and right edges of the image align with the leftmost and rightmost edges of chart colors. There may be space remaining at the top or bottom of the viewfinder image. Make the space at the top and at the bottom approximately equal.

SETTING UP A CUSTOM CHART

To specify the number of colors on a chart, the acquisition line for a color packet, or the measurement location (within a line) of a color packet:

1. Start the Colorimetry measurement
2. Press the "Menu" button
3. Touch the "Acquire & charts" softkey
4. Touch the "Custom Chart" softkey

Then, follow one of the procedures listed below.

To specify the number of colors on a custom chart:

1. Touch the "Colors" softkey to highlight it.
2. Turn the knob to set the number in the softkey to the number of colors on your chart.

To change the acquisition line for a color packet on a custom chart:

1. Touch the "Special Position" softkey
2. Touch the "Color Packet" key to highlight it.
3. Turn the knob until the number of the color packet whose acquisition line you wish to change appears in the softkey.
4. Press the "Acq Line" button.
5. Turn the knob until the desired line appears on the soft key and in the upper left of the display.
7. Touch the "Save As Custom Ch" softkey.

NOTE

Setting the acquisition line for a color packet re-sets the acquisition line for all higher-numbered color packets that were not previously set. For example, if you were using a custom chart with 25 colors on it and re-set the acquisition line for color packet 22, then the acquisition lines for color packets 23, 24, and 25 would also be re-set to that line, UNLESS YOU HAD SPECIFICALLY SET THEM FIRST. The suggested method of operating is to specify the number of colors in the chart, then set the acquisition line for the lowest-numbered color packet first (that needs resetting), then for the next lowest, and so on.

To change the location of measurement (within a line) for a color packet on a custom chart:

1. Touch the "Special Position" softkey.
2. Touch the "Color Packet" key to highlight it.
3. Turn the knob until the number of the color packet whose acquisition line you wish to change appears in the softkey.
4. Touch the "Center" softkey to highlight it.
5. Turn the knob until the desired location appears in the softkey.
6. Touch the "Save As Custom Ch" softkey.

To change the measurement width (in cycles) for all color packets on a custom chart:

1. Touch the "Special Position" softkey.
2. Touch the "Width" key to highlight it.
3. Turn the knob until the desired width, in cycles, appears within the softkey.
4. Touch the "Save As Custom Ch" softkey.

In the Colorimetry measurement, each color packet has a weighting factor, which is used in computing the overall color difference. You can give each color on your custom chart a weighting factor from 1 (full weighting) to 0 (no weighting, i.e., not included in the color difference computation).

To change the weighting factor for a color packet on a custom chart:

1. Touch the "Special Position" softkey.
2. Touch the "Color Packet" key to highlight it.
3. Turn the knob until the number of the color packet whose acquisition line you wish to change appears in the softkey.
4. Touch the "Weighting" softkey to highlight it.
5. Turn the knob until the desired weighting factor appears within the softkey.
6. Touch the "Save As Custom Ch" softkey.

USING A CUSTOM COLOR CHART

Once you have set up the Colorimetry measurement for a custom chart, you can use it just like a Macbeth chart. The colors listed on the right side of the Colorimetry display are shown as "Color 1," "Color 2", etc.

DEFECTS

The Defects measurement identifies defective cells in a CCD device.

Defective CCD cells can generate a high voltage output when the light input is low, or a low voltage output when the light input is high. They can also produce a varying output when the light input is held steady. Under some conditions, an aberration in luminance level of even a single pixel can be quite noticeable on a TV monitor.

Searching for CCD defects manually is a very time-consuming task. An operator must examine the output from the camera, searching through every line for voltage deviations while the light input is held steady. This must be done twice, once with the camera capped, once with the camera pointing at an evenly illuminated white chart.

The Defects measurement automates this tedious process, looking over every line in the active video area and reporting the defects found.

Defects Setup

In setting up to make a Defects measurement, check the following:

- The source selection hard keys are used to select and measure each channel separately.

  The application accepts GBR/color difference (YPbPr)/composite video, but does not distinguish between the different formats.

- Use the VM700A's Waveform application to set the average voltage level of the signal with the camera pointed at an evenly illuminated white field. The camera should be defocused so that any possible light blemish is not picked up. For NTSC measurements, for the white field, set the average voltage level to 50 IRE. For PAL measurements, set the average voltage level to 350 mV. With the camera lens capped (black), check that the voltage level is above the black clip.

NOTE

We recommend that this measurement be made twice: once for black camera (lens capped) and once for white camera (camera pointed at an evenly illuminated white field).

Defects Display

Figure 3-5 shows the Defects measurement screen and waveform display. Figure 3-6 shows the Defects measurement bar graph display.

The "screen" part of the screen and waveform display shows all defects found in the tested video area. For NTSC, the tested area starts at 11 µsec from the leading edge of sync, and extends for 49.5 µsec. For PAL, the tested area starts at 11.6 µsec from the leading edge of sync, and extends for 49.5 µsec.

The "waveform" part of the screen and waveform display shows the measured voltage of each pixel for the current line. To change the current line, press the Select Line button and turn the knob. To change the magnification of the waveform display, use the Move/Expand and arrow buttons as necessary, and turn the knob. (Touching the screen sets the Move/Expand button to Expand; touch the screen and turn the knob to change the waveform display magnification.)

The Bar Graph display plots the number of clusters (i.e., groups of adjoining defective pixels) against the possible sizes of the clusters. Clusters of up to 120 pixels can be plotted. You can use the knob to scroll the x and y axes of the Bar Graph display.

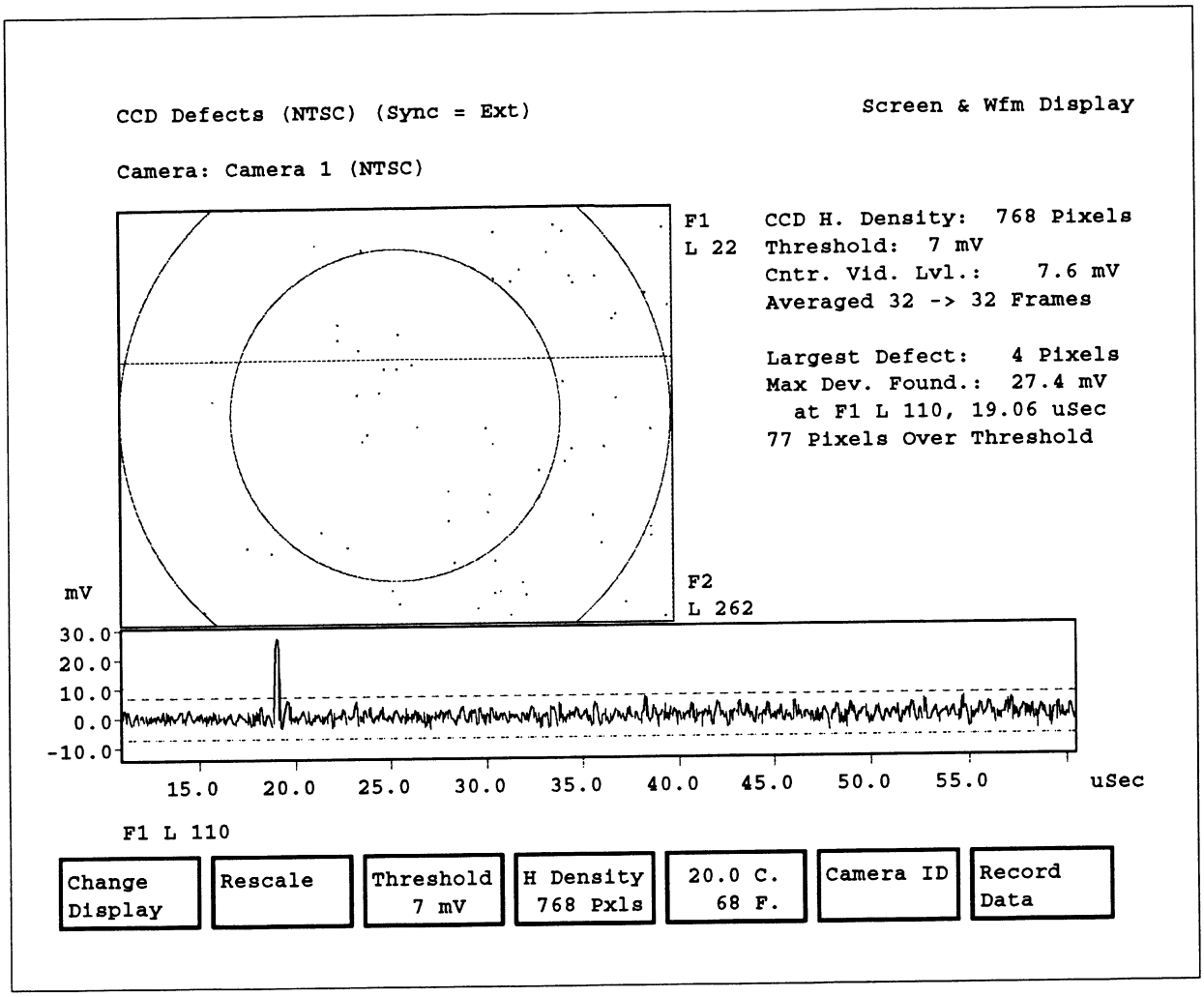

Figure 3-5. Defects Measurement Screen and Waveform Display.

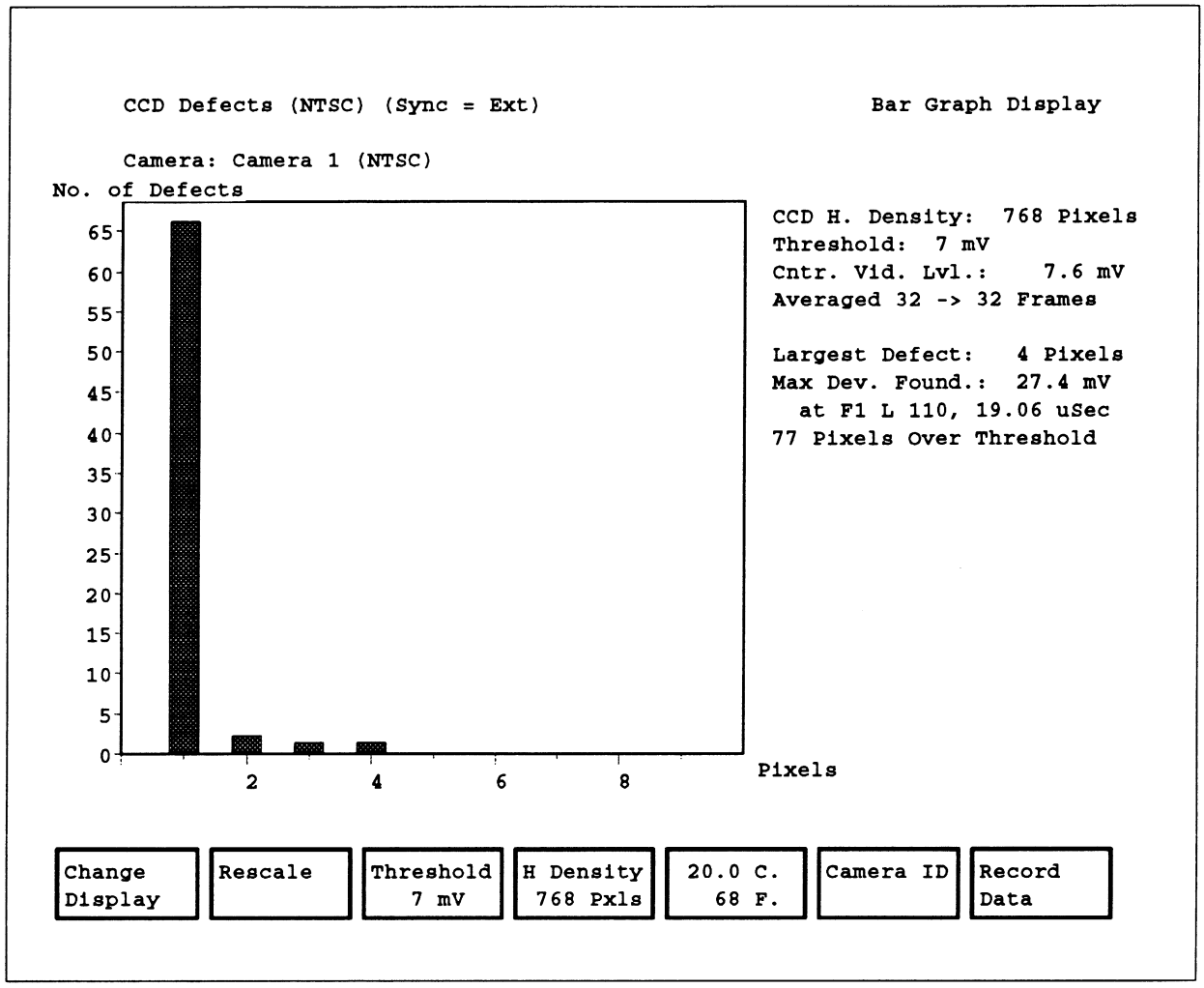

Figure 3-6. Defects Measurement Bar Graph Display.

Defects Menu

Pressing the Menu button when the Defects measurement is running brings up the Defects main menu. The Defects menu tree is shown in Figure 3-7.

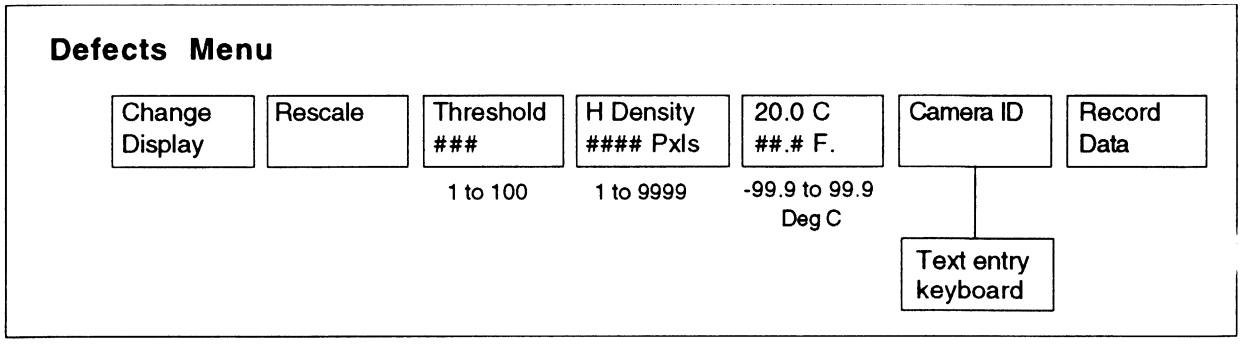

Figure 3-7. Defects Menu Tree.

MAIN MENU

Change Display

Change Display: toggles the display between a bar graph and a monitor with a one-line waveform.

Rescale

Rescale: restores the display to its default scale.

Threshold at 10 mV

Threshold: specifies the minimum amplitude deviation to search for as a defect. To change the threshold, turn the knob while touching the softkey.

H Density 700 Pxls

H. Density nnn Pxls: specifies the number of cells in each line of the CCD device under test. To change the number of cells, turn the knob while touching the softkey.

NOTE

If H Density is not set correctly (i.e., if it does not correspond to the number of cells in each line of the CCD camera being tested), erroneous or misleading results may occur. Note that the H Density value is entered by the user, not measured by the VM700A.

20.0 C. 68 F

C/F: informs the VM700A of the ambient temperature when the Defects measurement is being made. To change the indicated temperature, turn the knob while touching the softkey. Temperature information is stored with measurement results in a results file for future reference.

NOTE

Ambient temperature is entered by the user, not measured by the VM700A.

Camera ID

Camera ID: brings up an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.

Record Data

Record Data: stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Defects.N, where N is one greater than the previously highest-numbered Defects file. (The file names start with Defects.0.)

DETAIL

Detail is the artificial sharpening transitions added to the video in horizontal and vertical directions. The detail added is measured as a percentage of transition amplitude.

The measurement uses any chart that contains a white patch, such as a window or a grayscale chart with a white chip. The camera's white clip circuit should be disabled while performing this measurement.

Detail Setup

In setting up to make a Detail measurement, check the following:

- The source selection hard keys are used to select and measure each channel separately.

  The application accepts GBR/color difference (YPbPr)/composite video, but does not distinguish between the different formats. The measurement should be made on GBR input, because GBR input lets you measure how well the three channels track each other.

Detail Display

Figure 3-8 shows the Detail display. Two separate screen displays graph the horizontal and vertical waveforms (line rate and field rate displays, respectively). This application measures vertical and horizontal detail and reports results as a percentage of transition amplitude.

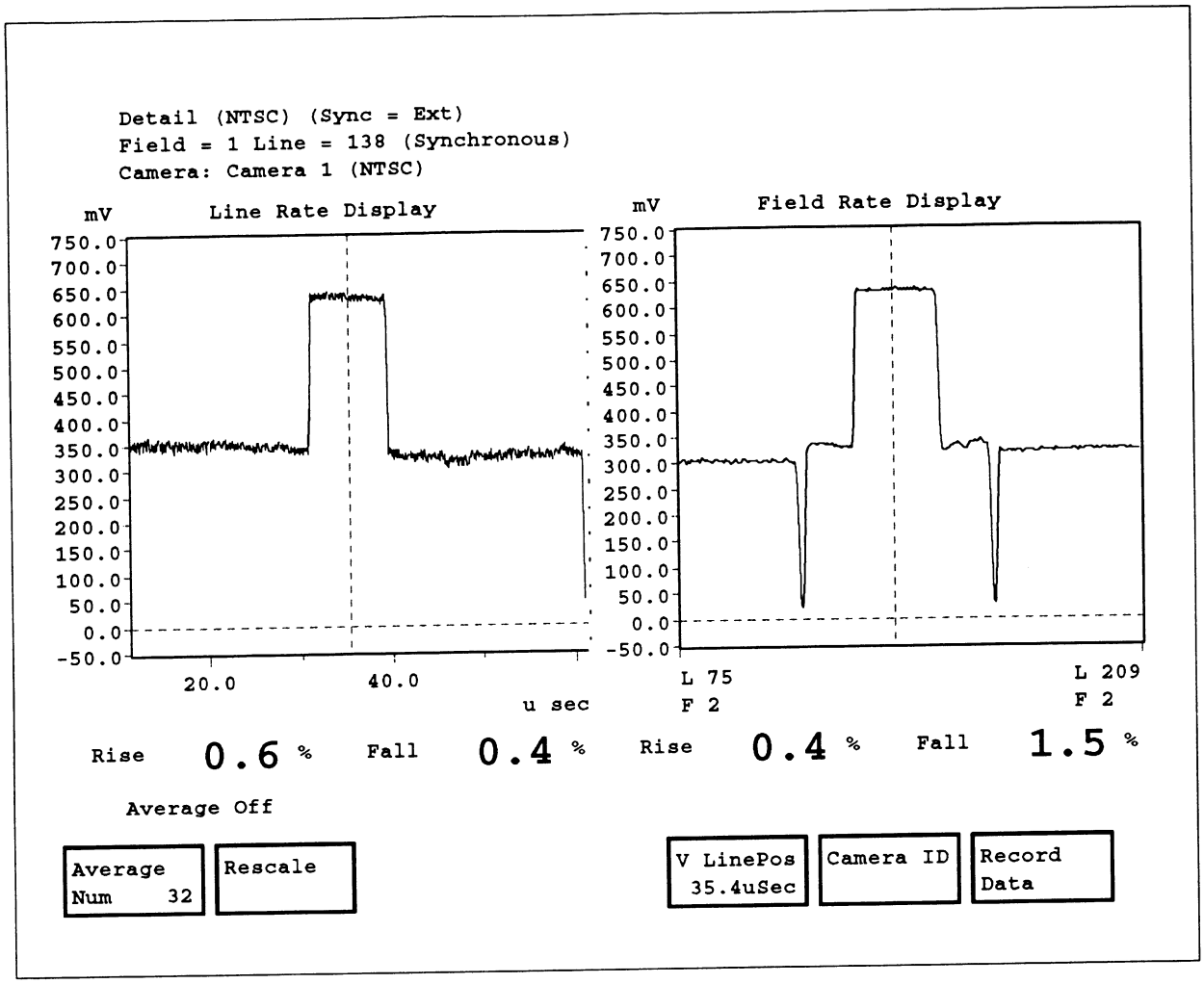

Figure 3-8. Detail measurement screen and waveform display.

NOTE

Figure 3-8 shows the Detail display and menus. The signal shown may not represent the type of signal normally used to perform this measurement.

Detail Menu

Pressing the Menu hard key when the Detail measurement is running displays the Detail main menu. Figure 3-9 shows the Detail menu tree.

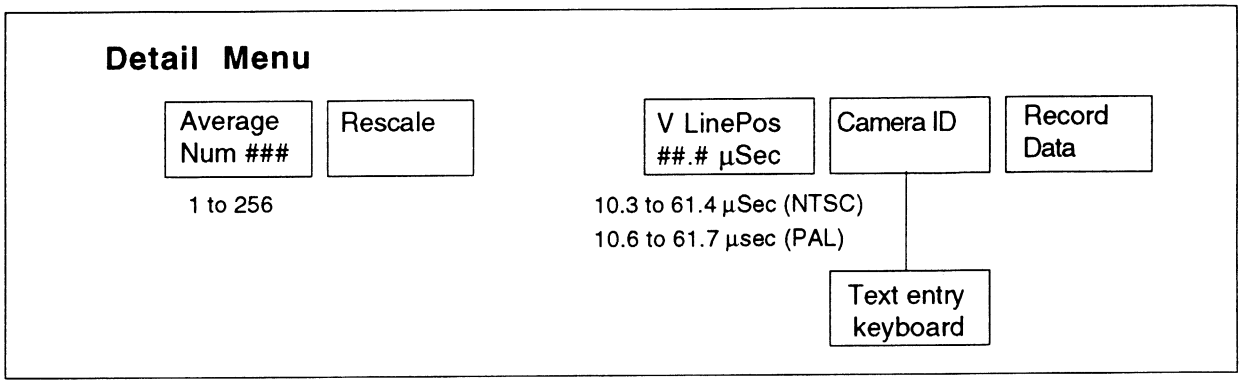

Figure 3-9. The Detail menu tree.

Detail Menu

Average Num 32

Average Num.: specifies the weighting factor to be used for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the Average Num softkey to highlight it, rotate the knob until the desired weighting factor appears, then press the Average Num softkey again.

Rescale

Rescale: restores the display to its default scale.

V LinePos ##.# µsec

V LinePos: places the horizontal detail measurement position at the center of the bar (at the location of the white chip the in the line rate display).

Camera ID

Camera ID: brings up an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.

Record Data

Record Data: stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Detail.N, where N is one greater than the previously highest-numbered Detail file. (The file names start with Detail.0.)

Pressing the Line Select hard key places the vertical detail measurement position at the center of the bar (at the location of the white chip in the field rate display).

FIXED PATTERN NOISE

The Fixed Pattern Noise measurement identifies signal non-uniformities that can be correlated to the CCD cell array. Fixed pattern noise (FPN) can create observable patterns, such as the "vertical blinds" effect. FPN can also create effects that appear to be random (like snow), but that do not change from one frame to the next.

There are two types of FPN: foreground FPN and background FPN.

Foreground FPN is measured with the camera pointed at an evenly illuminated white field. The primary sources of foreground FPN are variations in aperture among individual photo sensors, and structural defects within CCD devices.

Background FPN is measured at very low luminance or with the camera capped. (The black clip circuit should be turned off, or set so that it does not interfere with video output.) The primary sources of background FPN are variations in dark current within individual pixels, or clock crosstalk. Background FPN also increases with temperature.

Fixed Pattern Noise Setup

In setting up to make a Fixed Pattern Noise measurement, check the following:

- The source selection hard keys are used to select and measure each channel separately.

  The application accepts GBR/color difference (YPbPr)/composite video, but does not distinguish between the different formats.

- Use the VM700A's Waveform application to set the average voltage level of the signal with the camera pointed at an evenly illuminated white field. The camera should be defocused so that any possible uneven lighting effects will not be picked up. For NTSC measurements, for the while field, set the average voltage level to 50 IRE. For PAL measurements, set the average voltage level to 350 mV. With the camera lens capped (black), check that the voltage level is above black clip.

NOTE

We recommend that this measurement be made twice: once for black camera (lens capped) and once for white camera (camera pointed at an evenly illuminated white field).

Fixed Pattern Noise Display

The Fixed Pattern Noise measurement produces three added displays: the Histogram display, the Spectrum display, and the Expanded Picture display. The Waveform display and the regular "monitor" display are also available.

Figure 3-10 shows the Fixed Pattern Noise histogram display.

Figure 3-11 shows the Fixed Pattern Noise spectrum display.

Figure 3-12 shows the Fixed Pattern Noise expanded picture display.

The RMS noise level is always shown in the upper left corner of the display. Below that is a plot of the noise detected in the active video area. This plot is created using a simple pixel on/off selection scheme. Pixels whose noise value is higher than a specified threshold appear white; pixels whose noise value is lower than the threshold appear dark. The threshold value is controlled by the histogram display (described below).

Beneath the noise plot of the entire active video area is the wave form plot for the selected line. This plot appears in the lower left portion of the screen on all displays. The selected line is shown as a solid line in the plot of the active video area. To change the selected line, press Select Line and turn the knob.

The histogram display shows the distribution of noise in the active video area. This display controls the noise threshold value for the plot that appears to its left. To change the threshold value, touch the histogram and turn the knob. Pixels whose measured noise value is greater than the new threshold value will be highlighted in the display to the left.

The spectrum display plots noise level vs. frequency for the line selected.

The expanded picture display zooms in on a small portion of the noise display of the entire active video area, to allow closer examination. To change the position or dimensions of the area zoomed in on, touch the expanded picture display, then use the Move/Expand and arrow buttons.

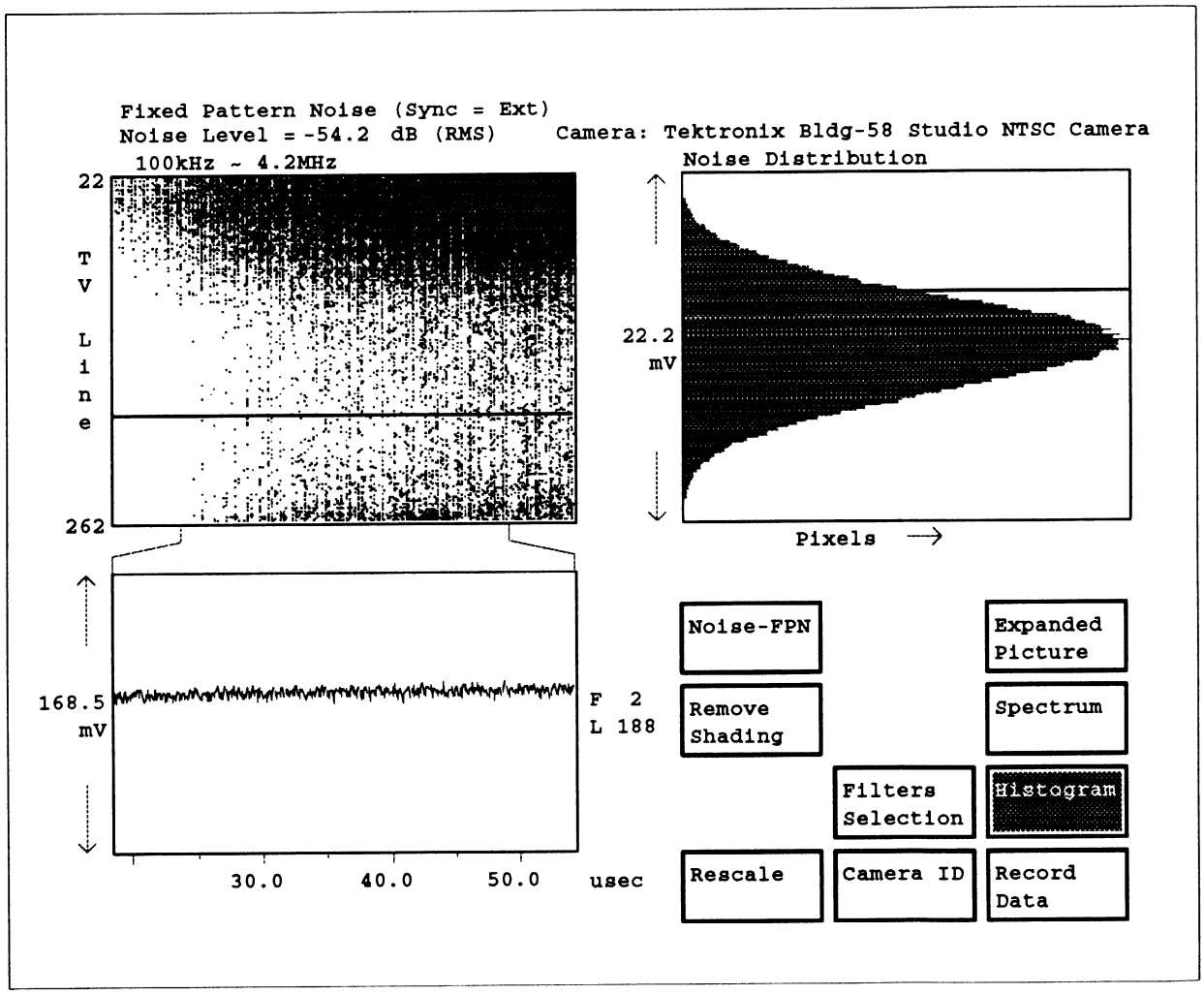

Figure 3-10. Fixed Pattern Noise Measurement Histogram Display.

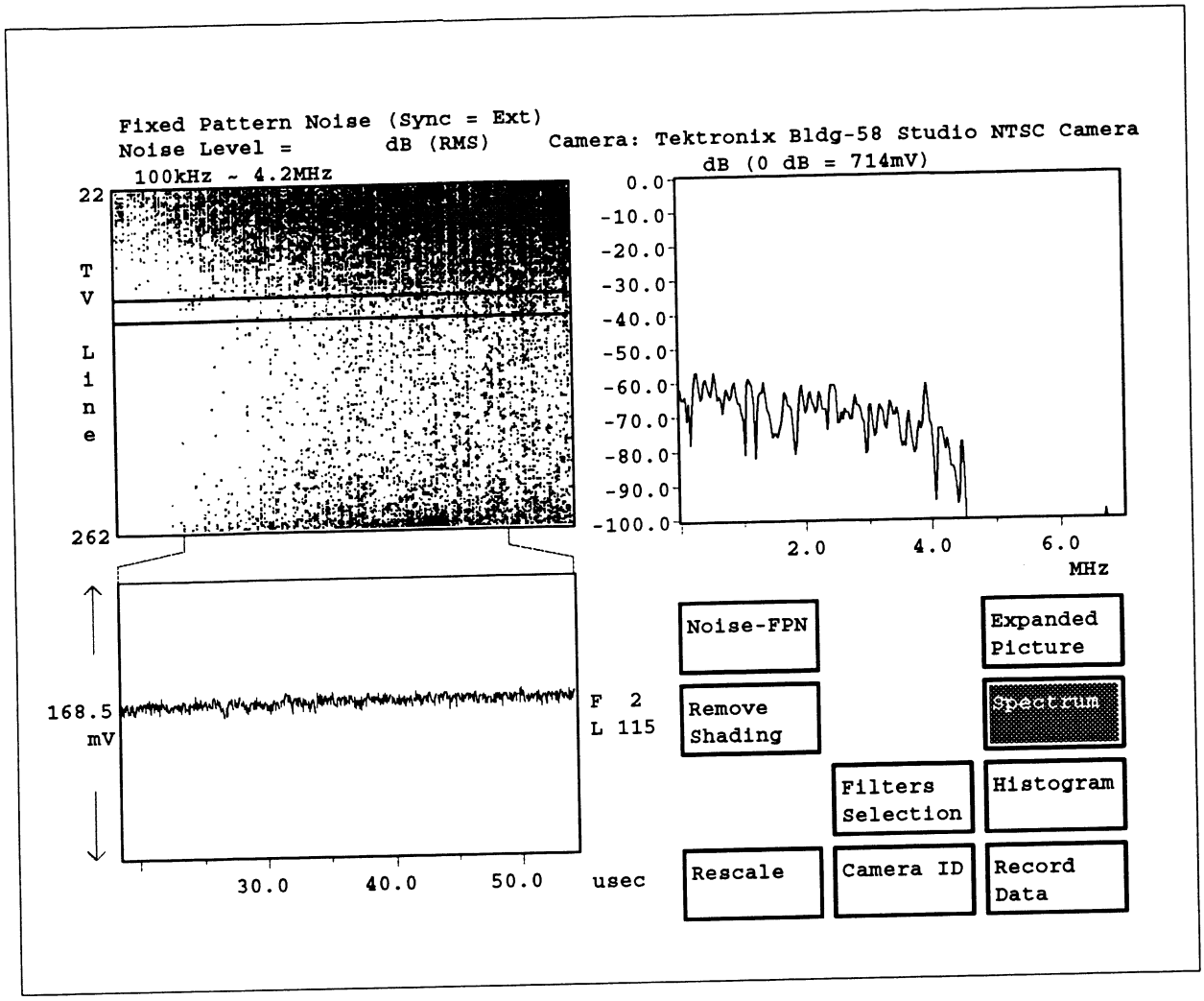

Figure 3-11. Fixed Pattern Noise Measurement Spectrum Display.

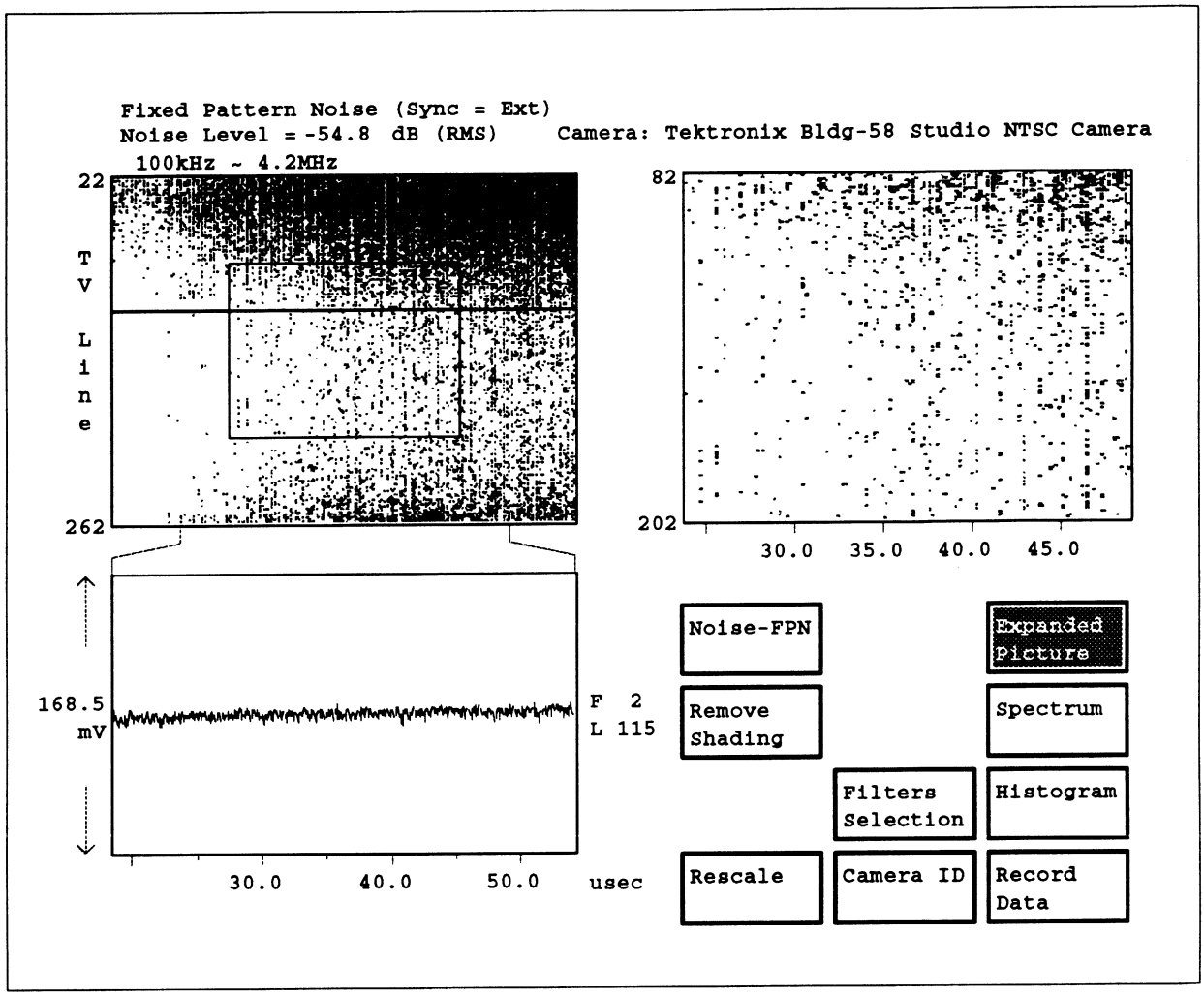

Figure 3-12. Fixed Pattern Noise Measurement Expanded Picture Display.

Fixed Pattern Noise Menu

Pressing the Menu button when the Fixed Pattern Noise measurement is running brings up the Fixed Pattern Noise main menu. The Fixed Pattern Noise menu tree is shown in Figure 3-13.

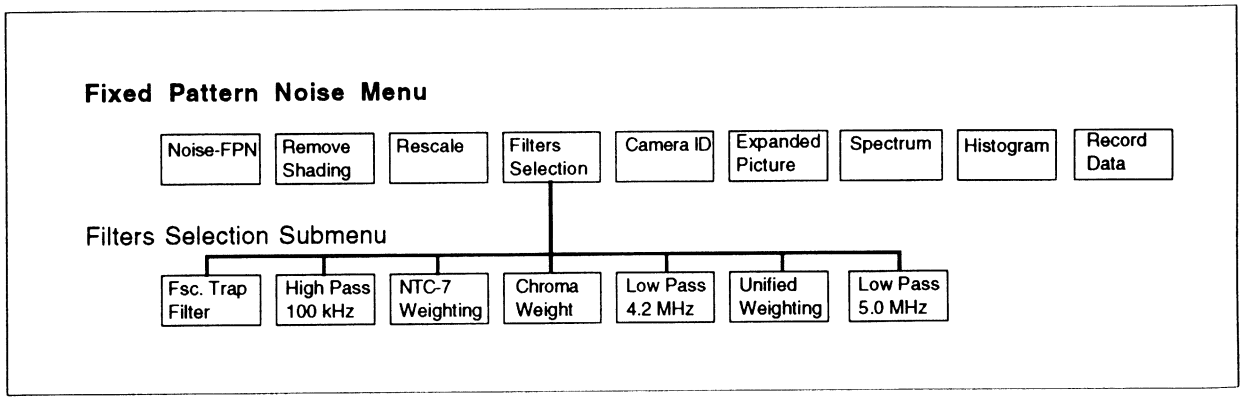

Figure 3-13. Fixed Pattern Noise Menu Tree.

MAIN MENU

Noise-FPN

Noise-FPN: acquires one more frame of data, computes total noise, and subtracts Fixed Pattern Noise previously calculated to derive the random noise in the input video. This noise is displayed in the upper-left rectangle on the screen.

Remove Shading

Remove Shading: removes horizontal shading when highlighted.

Rescale

Rescale: restores the display to its default scale.

Filters Selection

Filters Selection: brings up a sub-menu to select one or more noise filters.

Camera ID

Camera ID: brings up an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.

Expanded Picture

Expanded Picture: selects the Expanded Picture display.

Spectrum

Spectrum: selects the Spectrum display of the selected line.

Histogram

Histogram: selects the histogram (noise distribution) display.

Record Data

Record Data: stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Fixed_Pattern~Noise.N, where N is one greater than the previously highest-numbered Fixed_Pattern~Noise file. (The file names start with Fixed_Pattern~Noise.0.)

FILTERS SELECTION SUB-MENU

Fsc. Trap Filter	**Fsc. Trap Filter:** selects the frequency-at-subcarrier trap filter.
High Pass 100 kHz	**High Pass 100 kHz:** selects the 100-kHz high-pass filter.
NTC-7 Weighting	**NTC-7 Weighting:** (NTSC standard only)selects the standard NTC-7 weighting filter.
Chroma Weight	**Chroma Weighting:** (PAL standard only) filters the signal to display approximately 3 Mhz to 6 Mhz.
Low Pass 4.2 MHz	**Low Pass 4.2 MHz:** selects the 4.2-MHz low-pass filter.
Unified Weighting	**Unified Weighting:** selects the standard CCIR unified weighting filter.
Low Pass 5.0 MHz	**Low Pass 5.0 MHz:** selects a 5- or 6-MHz low-pass filter. To change the frequency, touch and hold the softkey, turn the knob until the new frequency is displayed, then release the softkey.

FREQUENCY RESPONSE

Also known as Depth of Modulation (DOM), this application measures wave form amplitude degradation as modulation frequency increases. For camera testing, this test is usually done with a chart that contains packets of square wave or sine wave bursts at various frequencies.

In CCD cameras, aliasing is a direct result of the image sampling process. The input image at frequencies above one half the sampling rate is represented only as aliased components. While the camera still produces an output image, the image is not a true representation of the input (this phenomenon is not present in tube cameras).

The measurement uses charts that contain packets of sine- or square-wave bursts of different frequencies. However, for the aliasing measurement, a sine wave chart is recommended.

The measurement accepts any chart with six to twelve multiburst packets. Because of VM700A band width limitations, you must note the packets that are out of the band width (6 MHz).

The following circuits must be disabled while making this measurement: gamma, knee, black compression and expansion (stretch), and detail. The light level should be set to allow optimum performance from the camera. This means that the iris setting, focus, and focal length (for zoom lenses) must be set near the center of their adjustment ranges.

The framing of the chart is important for the measurement since multiburst packets are designed to be at specific frequencies (or lines per picture height) when the chart is appropriately framed.

For the DOM measurement, the amplitude of each multiburst packet is measured relative to a user-selected reference packet. Measurement results are presented in either dB or percent, selected at configuration. The results for the packets that are out of the VM700A band width are displayed on the dimmer bit plane.

The packets that are out of the VM700A band width are used for the aliasing measurement. The aliased components are measured and their frequencies and amplitudes are reported. The Aliased component amplitude is referenced to the user-selected reference packet.

Frequency Response Setup

In setting up to make a Frequency Response measurement, check the following:

- For GBR output, all three camera output channels should be connected to input channels on the VM700A. The camera's G output should be connected to VM700A input channel A, the camera's B output to VM700A input channel B, and the camera's R output to VM700A input channel C.
- For YPbPr output, the camera's Y output should be connected to VM700A input channel A, the camera's Pb output should be connected to VM700A input channel B, and the camera's Pr output should be connected to VM700A input channel C.
- For composite output, the camera's Y output should be connected to channel A.
- The Camera Testing Option configuration file, in directory /nvram0/ConfigFiles, must be set to the correct camera output format. Choose the camera output format from the following lists:

  For NTSC: Composite; Composite with Setup; GBR 700; GBR 700 Setup; GBR 714; GBR 714 Setup; YPbPr SMPTE/EBU; YPbPr 714 Betacam Setup; YPbPr 714 Betacam; YPbPr 700 MII Setup.

  For PAL: Composite, GBR, YPbPr SMPTE/EBU.

Once the Camera Testing Option configuration file is set to the correct camera output format, make sure that the current Video Source File points to the correct Camera Testing Option configuration file. Then, make sure that the Source Selection Video file points to the correct Video Source File. See Chapter 2, "Configuration," for information about setting up these files.

- Use the VM700A's Waveform application to set the average voltage level of the signal with the camera pointed at an evenly illuminated white field. The camera should be defocused so that any possible light blemish is not picked up. For NTSC measurements, for the white field, set the average voltage level to 50 IRE. For PAL measurements, set the average voltage level to 350 mV. With the camera lens capped (black), check that the voltage level is above the black clip.

NOTE

We recommend that this measurement be made twice: once for black camera (lens capped) and once for white camera (camera pointed at an evenly illuminated white field).

Frequency Response Display

Figure 3-14 shows the Frequency Response Measurement display when the camera is outputting GBR signals. Figure 3-15 shows the Frequency Response Measurement display when the camera is outputting YPbPr signals. The screen shows amplitude vs. packet number for each of the G, B, and R channels in GBR systems, or for the Y channel in YPbPr signals.

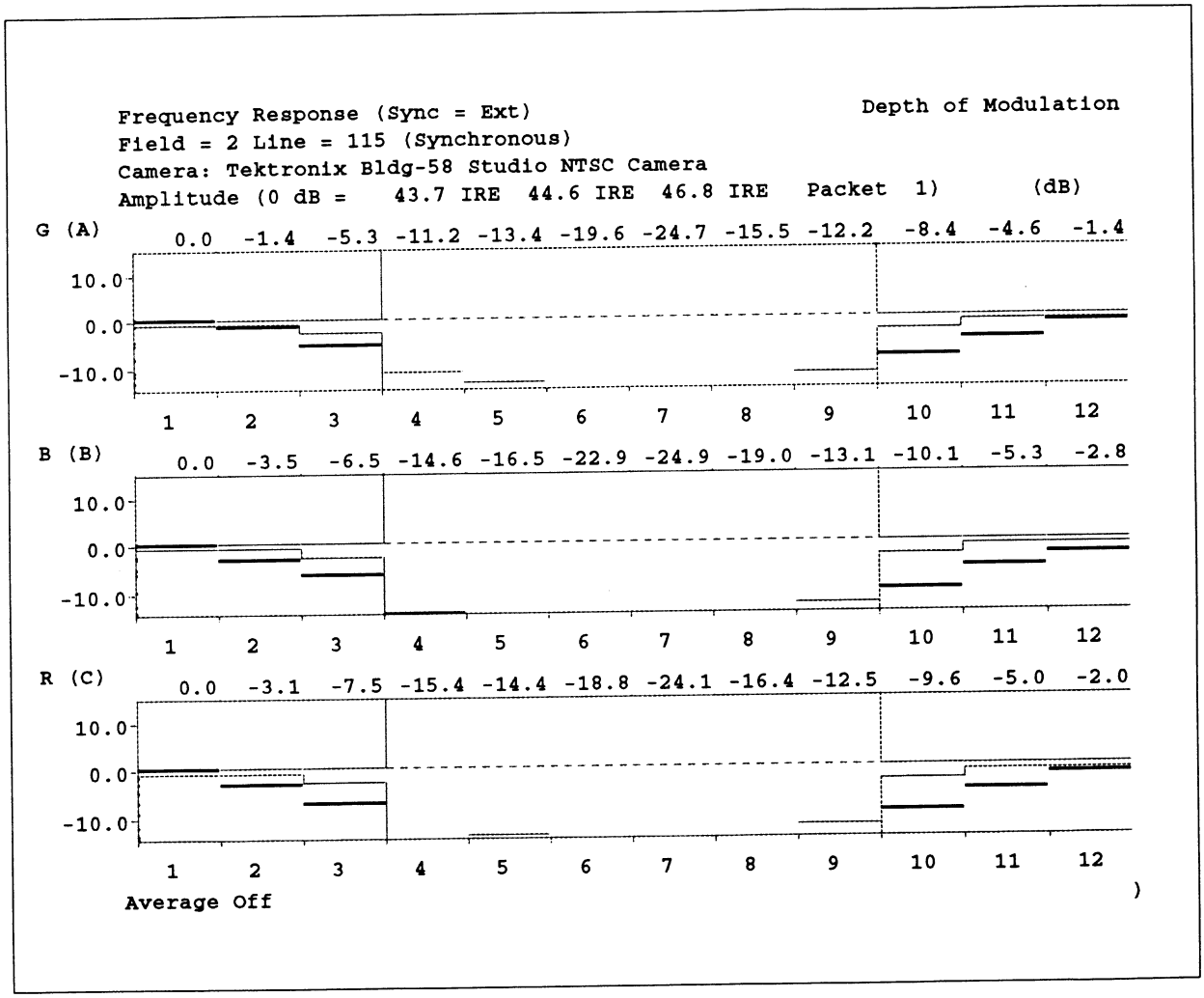

Figure 3-14. Frequency Response Measurement GBR Output Display.

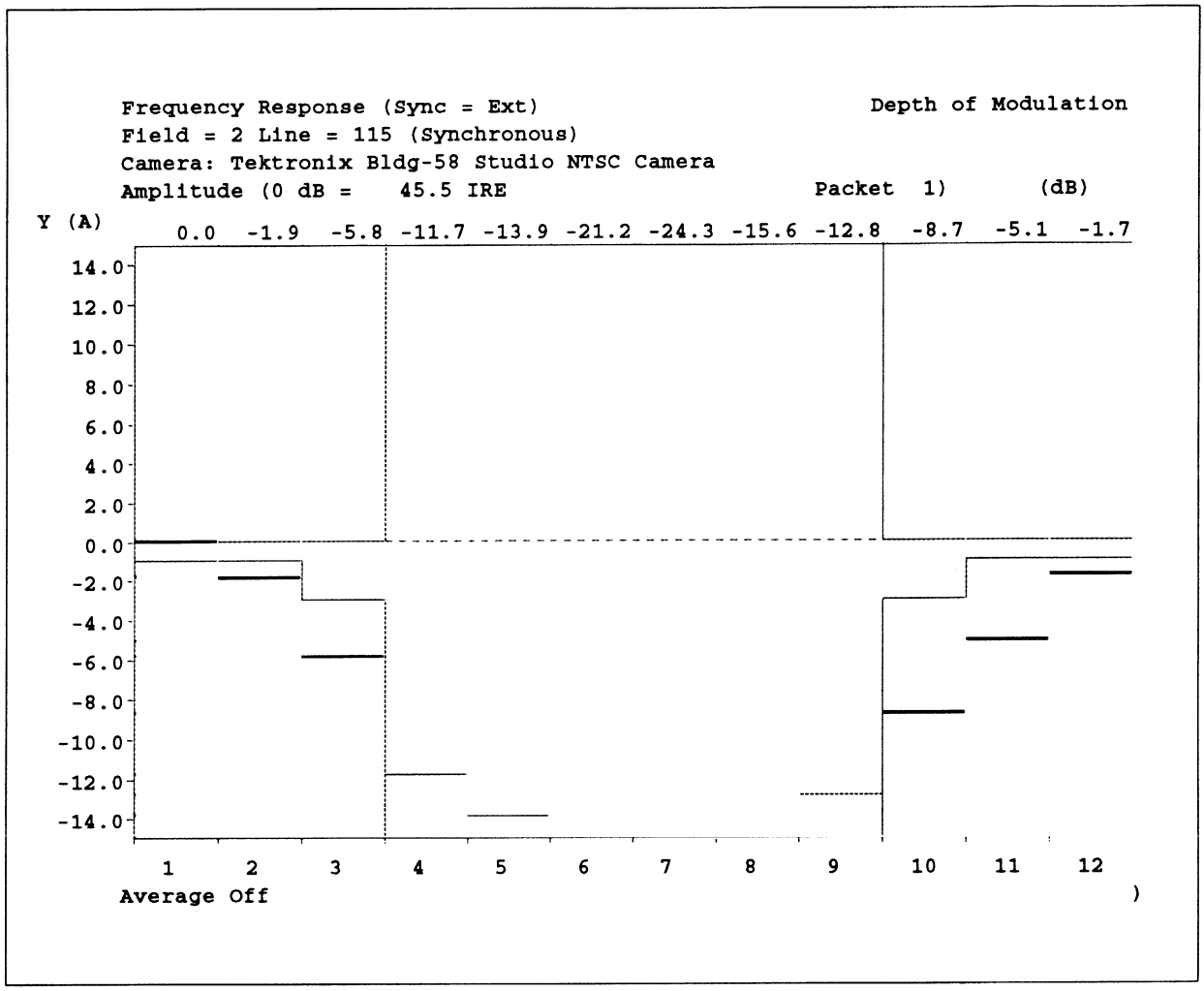

Figure 3-15. Frequency Response Measurement YPbPr Output Display.

Frequency Response Menu

Pressing the Menu button when the Frequency Response measurement is running brings up the Frequency Response main menu. The Frequency Response menu tree is shown in Figure 3-16.

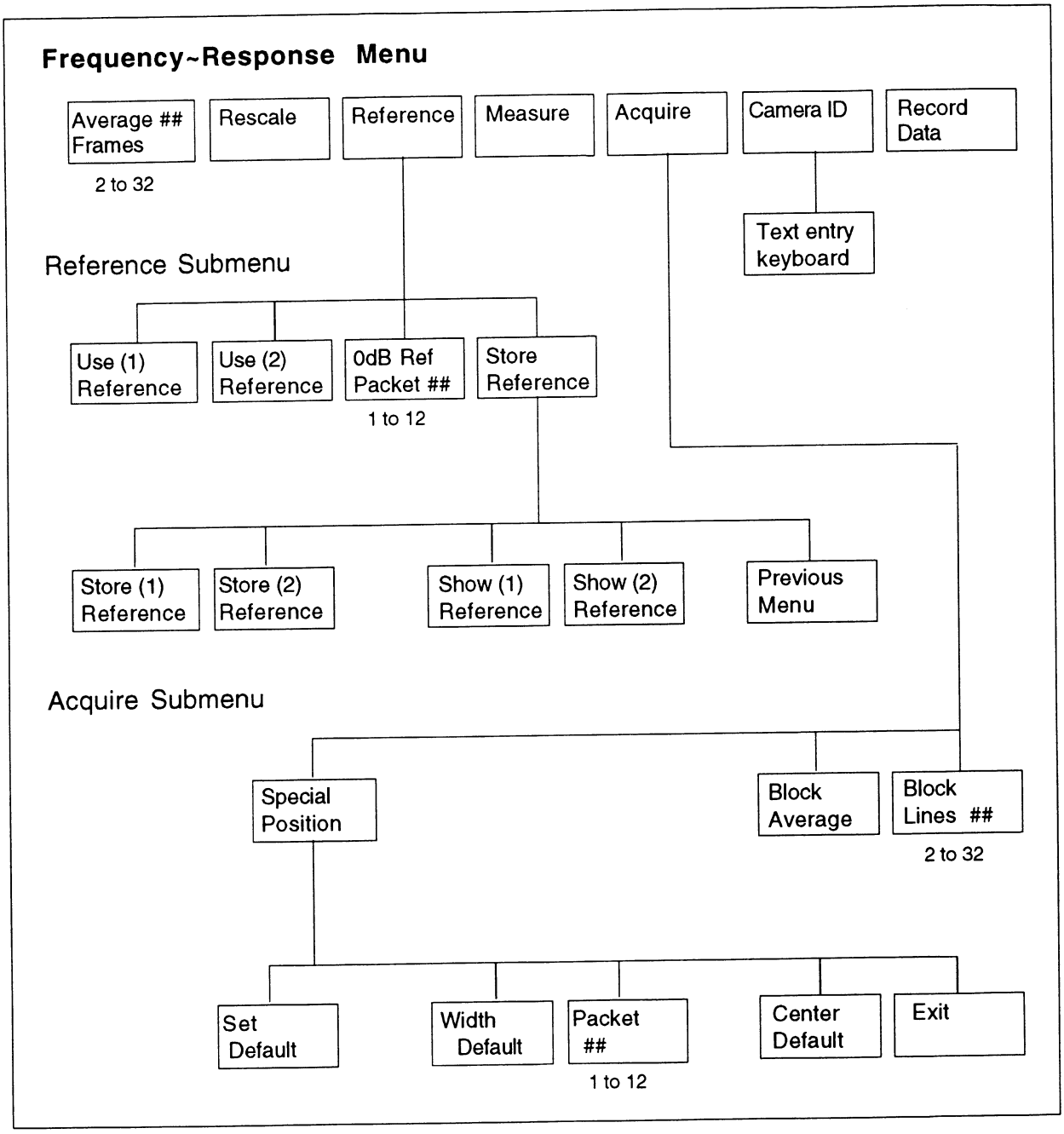

Figure 3-16. Frequency Response Menu Tree.

MAIN MENU

Average Num 32	**Average Num.:** specifies the weighting factor to be used for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the Average Num softkey to highlight it, rotate the knob until the desired weighting factor appears, then press the Average Num softkey again.
Rescale	**Rescale:** restores the display to an optimum scale.
Reference	**Reference:** brings up a submenu to show, store, or use references.
Measure	**Measure:** displays a submenu with two soft keys, where you may select between Depth of Modulation or Aliasing modes. The currently selected mode is shown in the upper right corner of the display.
Acquire	**Acquire:** brings up a submenu where you may specify acquisition locations and blocks of lines on which to acquire and average data.
Camera ID	**Camera ID:** brings up an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.
Record Data	**Record Data:** stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Frequency~Response.N, where N is one greater than the previously highest-numbered Frequency~Response file. (The file names start with Frequency~Response.0.)

REFERENCE SUB-MENU

Use (1/2) Reference	**Use (1)/(2) Reference:** compares the current measurement result with the selected reference.
0dB Ref Packet 1	**0dB Ref:** selects the packet to use as the 0dB reference. To change the packet number, select the softkey and turn the knob.
Store Reference	**Store Reference:** displays a submenu where you may store or show the current measurement result.

STORE/SHOW REFERENCE SUBMENU

Store(1/2) Reference	**Store (1)/(2) Reference:** stores the current measurement result as a reference.
Show(1/2) Reference	**Show (1)/(2) Reference:** displays the stored reference.
Previous Menu	**Previous Menu:** returns to the previously selected menu.

ACQUIRE SUB-MENU

Special Position	**Special Position:** brings up a submenu to define the acquisition locations.
Block Average	**Block Average:** averages results from successive video lines on successive frames (the number of lines averaged is specified with the Block Lines soft key).
Block Lines ##	**Block Lines:** specifies the number of times successive frames are accessed to acquire one line of measurement data for the block averaging function (the range is 2 to 32 lines, which means that the application acquires one line from each of 2 to 32 successive frames, then returns to the first frame and performs the average function).

SPECIAL POSITION SUB-MENU

Set Default	**Set Default:** resets the acquisition position to its default location for the selected packet. If no packets are selected, all packets are reset to their default acquisition locations.
Width Default	**Width:** sets the width of the measurement area. To change the width, select the softkey and turn the knob.
Packet ##	**Packet:** selects the packet to re-define. To change the packet number, select the softkey and turn the knob.
Center Default	**Center:** defines the center of the measurement area. To change the location of the center, select the softkey and turn the knob.
Exit	**Exit:** returns to the Frequency Response or the Aliasing display, with no softkeys displayed.

GAMMA

Gamma is the input-to-output light transfer characteristic of an imaging or display device. CCD cameras are inherently linear, but the gamma adjustment is still necessary when considering the whole system, including the TV set.

The measurement requires a commonly available grayscale step chart with linear or logarithmic steps. This chart contains two rows of grayscale steps, one in increasing and the other in decreasing luminance levels.

The Gamma application characterizes the non-linear transfer function with the camera's gamma using the following equation:

$$\text{Video Level} = K(L + K1)^{\gamma} + K2$$

where K, K1, and K2 are constants and L is the light source.

The application measures luminance at specific points, fits a curve through the points, and defines gamma according to the equation. The measurement result is the gamma (exponent) measured on the camera's output.

NOTE

The camera's detail circuit should be disabled for this measurement.

Gamma Setup

In setting up to make a Gamma measurement, check the following:

- For GBR/color difference output, all three camera output channels should be connected to input channels on the VM700A. The camera's G output should be connected to VM700A input channel A, the B output to VM700A input channel B, and the R output to VM700A input channel C.
- For YPbPr output, the camera's Y output should be connected to VM700A input channel A, the Pb output to VM700A input channel B, and the Pr output to VM700A input channel C.
- For composite output, the camera's Y output should be connected to VM700A input channel A.
- The Camera Testing Option configuration file, in directory /nvram0/ConfigFiles, must be set to the correct camera output format. Choose the camera output formatfrom the following lists:

  For NTSC: Composite; Composite with Setup; GBR 700; GBR 700 Setup; GBR 714; GBR 714 Setup; YPbPr SMPTE/EBU; YPbPr 714 Betacam Setup; YPbPr 714 Betacam; YPbPr 700 MII Setup.

  For PAL: Composite, GBR, YPbPr SMPTE/EBU.

  Once the Camera Testing Option configuration file is set to the correct camera output format, make sure that the current Video Source File points to the correct Camera Testing Option configuration file. Then, make sure that the Source Selection Video file points to the correct Video Source File. See Section 2, "Configuration," for information about setting up these files.
- Although the application accepts other formats, the measurement should be made on GBR input. GBR input lets you measure how well the three channels track.

- Because of the algorithm selected to measure the gamma curve, the measurement is always made on the increasing grayscale steps. Both increasing and decreasing steps can be observed on the display.

Measurement results from this application can be passed to the Colorimetry application to measure color fidelity.

NOTE

Gamma results passed to the Colorimetry application should be in the video format used by that application. For example, if you specify YPbPr input format for a Gamma measurement and pass the results to the Colorimetry application, you should also measure colorimetry on a YPbPr input.

Gamma Display

Figure 3-17 shows the Gamma main menu. For the selected chart and light level, the display graphs the superimposed input signal levels for each input channel versus time, and shows the calculated gamma for each input channel.

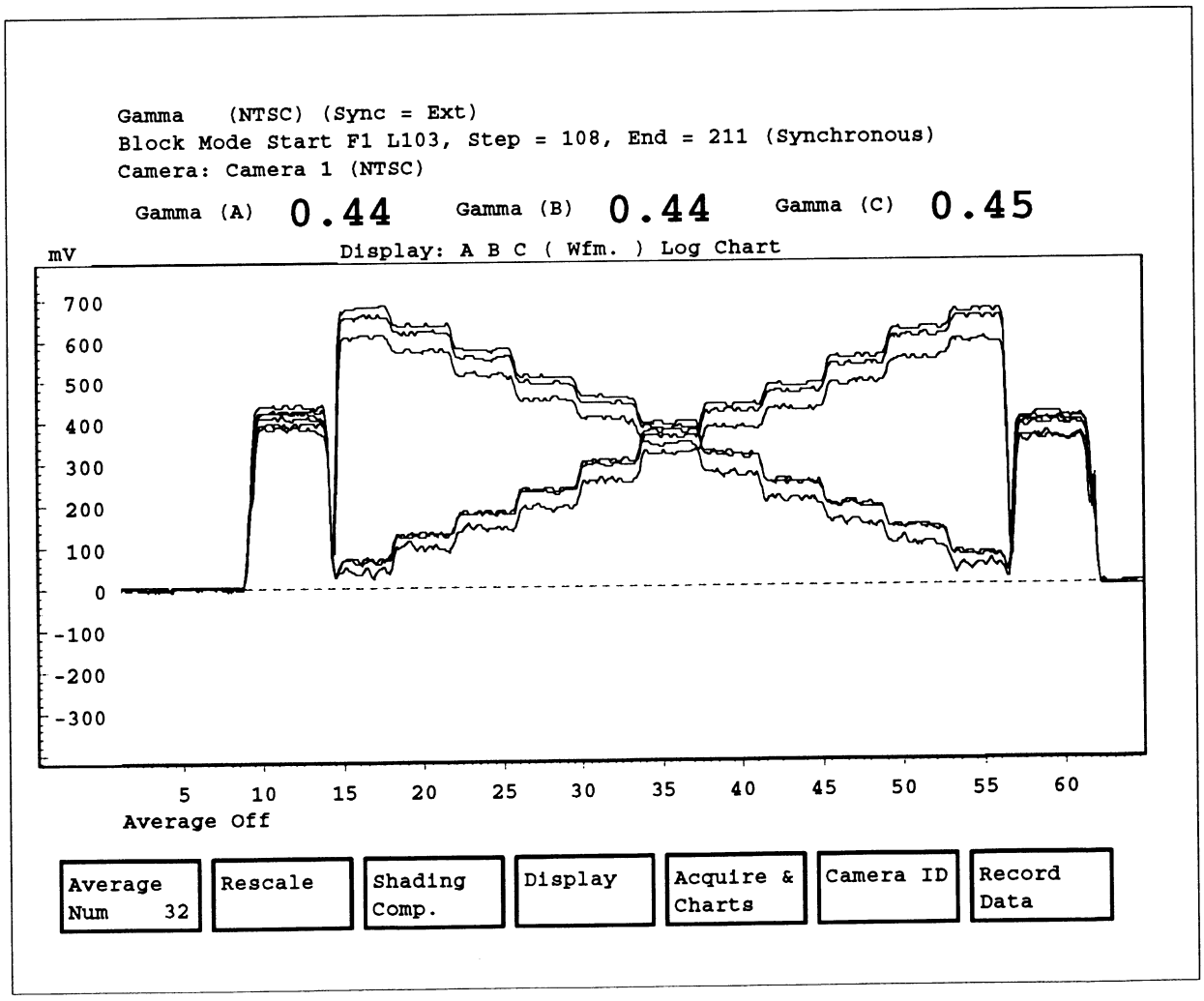

Figure 3-17. Gamma main menu and display.

Gamma Menus

Pressing the Menu button when the Gamma application is running displays the Gamma main menu. The Gamma menu tree is shown in Figure 3-18.

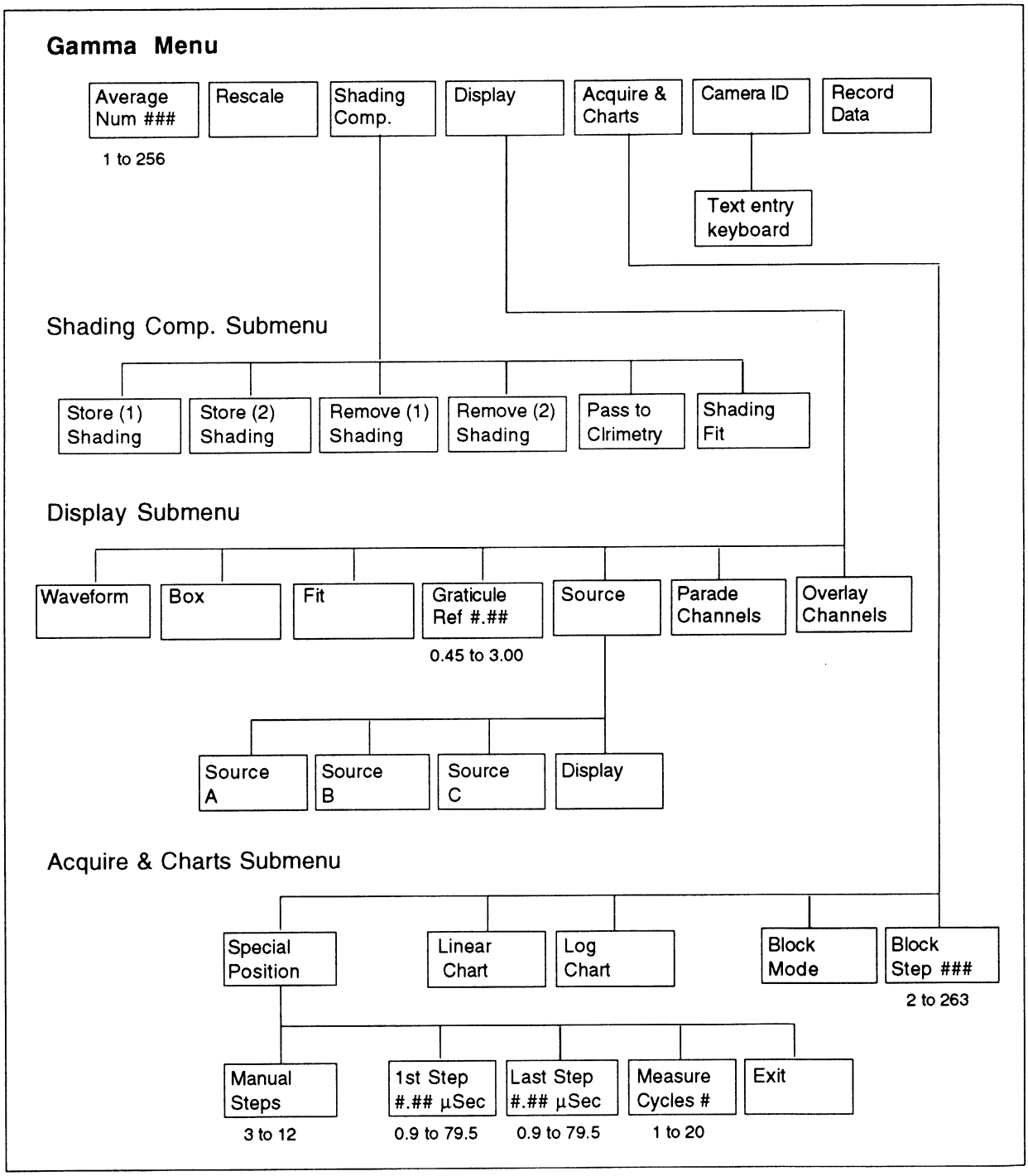

Figure 3-18. Gamma menu tree.

MAIN MENU

Average Num 32	**Average Num.:** specifies the weighting factor to be used for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the Average Num softkey to highlight it, rotate the knob until the desired weighting factor appears, then press the Average Num softkey again.
Rescale	**Rescale:** restores the display to its default scale.
Shading Comp.	**Shading Comp:** displays a submenu where you may measure, store, and remove the shading on the lines where gamma is measured. An evenly illuminated white field is necessary to store and remove the shading effect.
Display	**Display:** displays a submenu where you may select the desired displays. You can choose overlay or parade graphs, different sources, and how each source is graphed.
Acquire & Charts	**Acquire & Charts:** displays a submenu where you may specify the acquisition location, type of chart used, and the block of lines and index step for the measurement.
Camera ID	**Camera ID:** brings up an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.
Record Data	**Record Data:** stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Gamma.N, where N is one greater than the previously highest-numbered Gamma file. (The file names start with Gamma.0.)

SHADING COMP. SUBMENU

This submenu provides soft keys that let you store the current display to compensate for shading.

Store (1) Shading	**Store (1) Shading:** stores the current shading result as a reference.
Store (2) Shading	**Store (2) Shading:** stores the current shading result as a reference.
Remove (1) Shading	**Remove (1) Shading:** removes the shading provided by the pre-stored data.
Remove (2) Shading	**Remove (2) Shading:** removes the shading provided by the pre-stored data.
Pass to Clrimetry	**Pass to Clrimetry:** stores the measured results in a data file that can be accessed and used by the Colorimetry application.
Shading Fit	**Shading Fit:** displays the fitting curve for shading references.

DISPLAY SUBMENU

Waveform	**Waveform:** displays the acquired waveform.
Box	**Box:** displays measured amplitudes at positions as boxes.
Fit	**Fit:** displays the fitting curve with the measured gamma.
Graticule Ref. ##.#	**Graticule Ref. ##.#:** displays the reference curve for the specified gamma number.
Source	**Source:** displays a submenu that allows you to select the input signal source (channel A, B, or C).
Parade Channels	**Parade Channels:** displays input signals side-by-side for signal comparison.
Overlay Channels	**Overlay Channels:** superimposes input channel signals (the default).

ACQUIRE & CHARTS SUBMENU

Special Position	**Special Position:** displays a submenu where you may define acquisition locations.
Linear Chart	**Linear Chart:** causes the application to assume that the chart used is linear, rather than logarithmic.
Log Chart	**Log Chart:** causes the application to assume that the chart used is logarithmic (has a gamma of 2.2), rather than linear.
Block Mode	**Block Mode:** lets you select a block of lines in the current field on which to observe increasing and decreasing luminance steps.
Block Step ###	**Block Step:** lets you set the number of lines that are stepped in block mode when the application performs the measurement (the range is 2 to the end of the field).

SPECIAL POSITION SUBMENU

Manual Steps	**Manual Steps:** sets the number of luminance steps in the signal. With the soft key selected, rotate the knob to set the number of luminance steps (3 to 12).
1st Step ##.# µSec	**1st Step:** sets the position of the first luminance step edge of staircase. With the soft key selected, rotate the knob to set the position of the first luminance step edge of staircase (0.9 to 79.5).
Last Step ##.# µSec	**Last Step:** sets the position of the last luminance step edge of staircase. With the soft key selected, rotate the knob to set the position of the last luminance step edge of staircase (0.9 to 79.5).
Measure Cycles #	**Measure Cycles:** sets the number of chrominance subcarrier cycles measured in each step. The width of the displayed box shows the measurement area determined by the selected number of cycles. With the soft key selected, turn the knob to change the number of cycles (1 to 20).
Exit	**Exit:** exits the Special Position display and returns to the main measurement display.

Field Toggle

Field Toggle: displayed when the Select Line hard key is pressed. This soft key toggles the display between field 1 and field 2

Default Line

Default Line: displayed when the Select Line hard key is pressed. Selects the line specified as the default at configuration.

GEOMETRY AND REGISTRATION

Geometry uses the green channel to measure geometric distortion of a camera's imaging elements. In tube cameras, geometric errors often appear as a pincushion effect caused by the deflection circuits. In CCD cameras, geometric errors are caused by lens distortion.

Registration measures how well the blue and red channels track the green channel. This measurement is made with a registration chart consisting of black vertical and horizontal lines on a white background.

For CCD cameras, geometry and registration do not change over the life of the CCD device, since CCD chips are permanently bonded to prisms. Tube cameras, however, must routinely have geometry and registration checked and adjusted.

The geometry measurement is typically made with a ball chart and a grid-pattern generator and the error result is read from a TV monitor.

The advantage to using the VM700A for this measurement is that it eliminates the need for the ball chart and grid pattern generator. Instead, both geometry and registration measurements can be made using a VM700A and a chart that contains black vertical and horizontal lines on a white background.

To make these measurements, the camera's detail circuit must be disabled, the luminance level must be at least 100.0 mV (referenced to back porch), and the lens should be focused on the test chart being used.

The VM700A must be set for the chart used for the measurement so it can generate the proper grid on the display. The selected chart must be properly framed for this measurement to be valid.

The chart is set up by superimposing the camera input over the generated grid (much as was done with the ball chart and grid generator). While monitoring the VM700A display, the camera is tilted, panned, or zoomed to correctly frame the chart.

Default charts available include the Porta-Pattern registration chart and the EBU chart. You may also define a custom chart, but if you do so, the lines on the chart must be evenly spaced.

Geometry and Registration Setup

The Geometry and Registration application accepts only GBR input. Configuration information is always read from channel A. The source selection hard keys do not change the acquisition source. In setting up to make a Geometry and Registration measurement, check the following:

- Connect green to channel A, blue to channel B, and red to channel C.
- The Camera Testing Option configuration file, in directory /nvram0/ConfigFiles, must be set to the correct camera output format. Choose the camera output format from the following lists:

  For NTSC standard: Composite; Composite with Setup; GBR 700; GBR 700 with Setup; GBR 714; GBR 714 with Setup; YPbPr SMPTE/EBU; YPbPr 714 Betacam with Setup; YPbPr 714 Betacam; YPbPr 700 MII with Setup.

  For PAL standard: Composite, GBR, YPbPr SMPTE/EBU.
- Once the Camera Testing Option configuration file is set to the correct camera output format, make sure that the current Video Source File points to the correct Camera Testing Option configuration file. Then, make sure that the Source Selection Video file points to the correct Video Source File. See Chapter 2, "Configuration," for information about setting up these files.

Freeze and Average functions are disabled.

Geometry and Registration Display

Figure 3-19 shows the main Geometry and Registration display and menus (the Porta-Pattern chart is shown, but others can be used, as described earlier). The display shows the type of chart selected and the operating mode (Frame Chart at start-up; then the Geometry measurement followed by the Registration measurement).

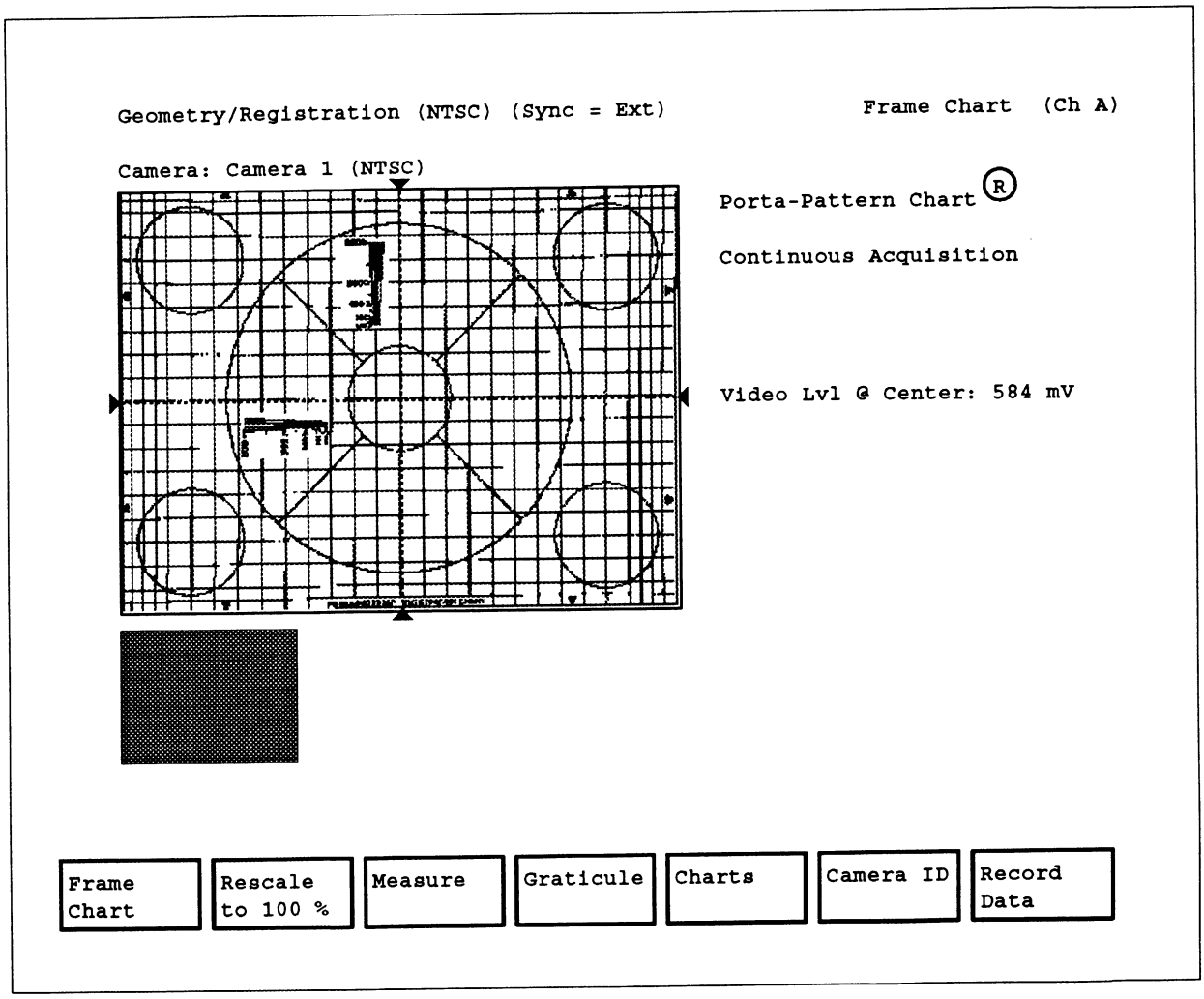

Figure 3-19. Geometry and Registration display in Frame Chart mode.

The application starts in Frame Chart mode. In this mode, the input is not averaged. Each field is acquired and displayed as quickly as possible to aid in framing the chart. Since speed is important, only the displayed area is acquired. If the camera's position relative to the chart is moving, it is important to use the Frame Chart soft key so the VM700A can accurately measure the relative location of the chart. By using the Expand function (zoom), you can accurately center and frame the camera relative to the chart.

The Geometry measurement can be made once the chart is framed. This measurement must be completed before registration can be measured. If the camera is moved relative to the chart, the measurement process, starting with chart framing, must be repeated.

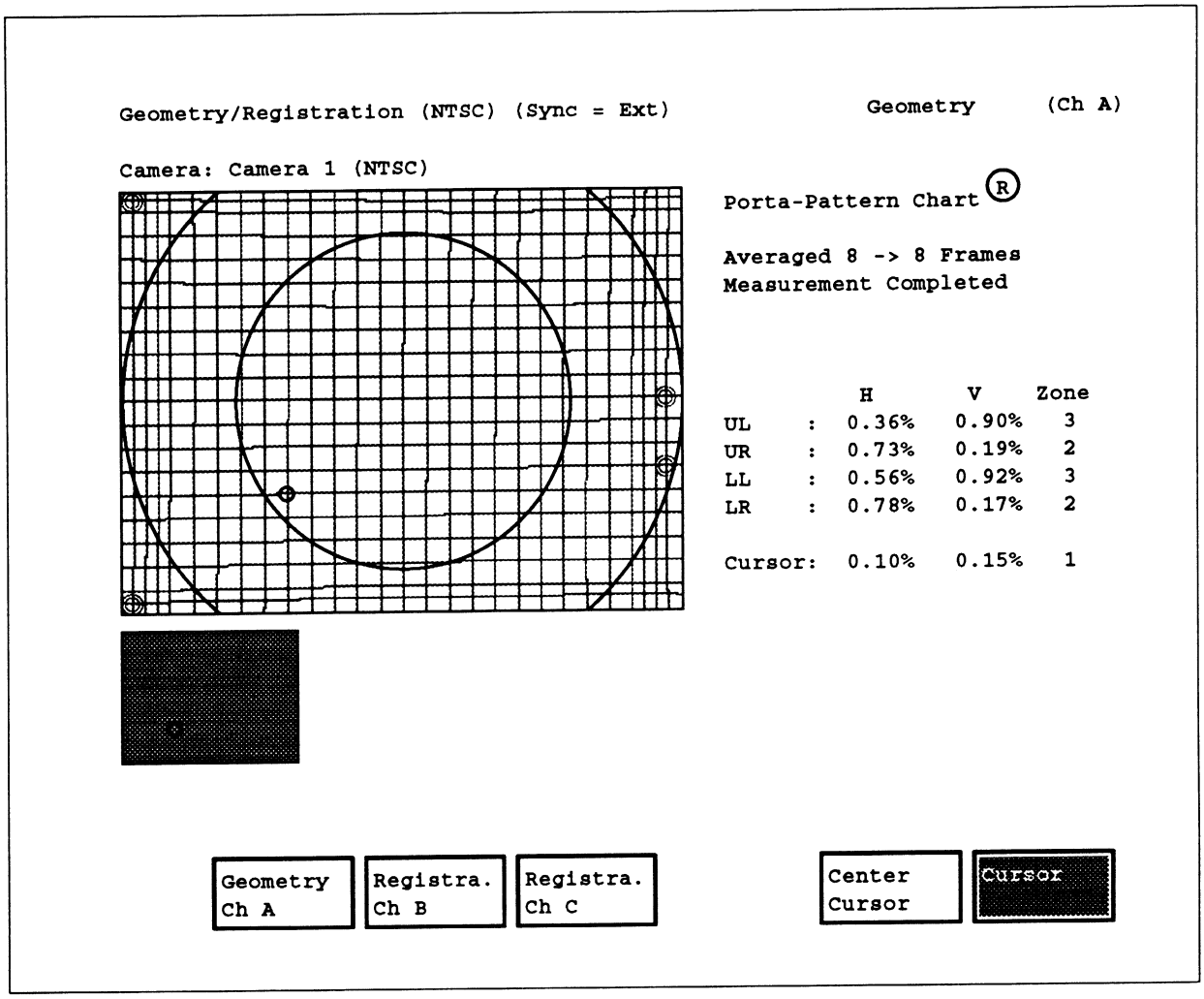

Figure 3-20. Geometry and Registration display in Geometry measurement mode.

The result is the monitor-like display shown in Figure 3-20. Worst errors in each quadrant — upper right and left, lower right and left — are reported. The locations of these errors are indicated on the graph and listed in the associated text readout. Errors are expressed relative to center as percent of screen height.

Pressing the Cursor soft key activates a cursor that may be moved over the active video area. Text on the display shows the error at the cursor location. The various zones are also graphed on the display. The zone type (circular or octagonal) can be specified in the Camera_Testing file at configuration.

Geometry and Registration Menus

Figure 3-21 shows the Geometry and Registration menu hierarchy.

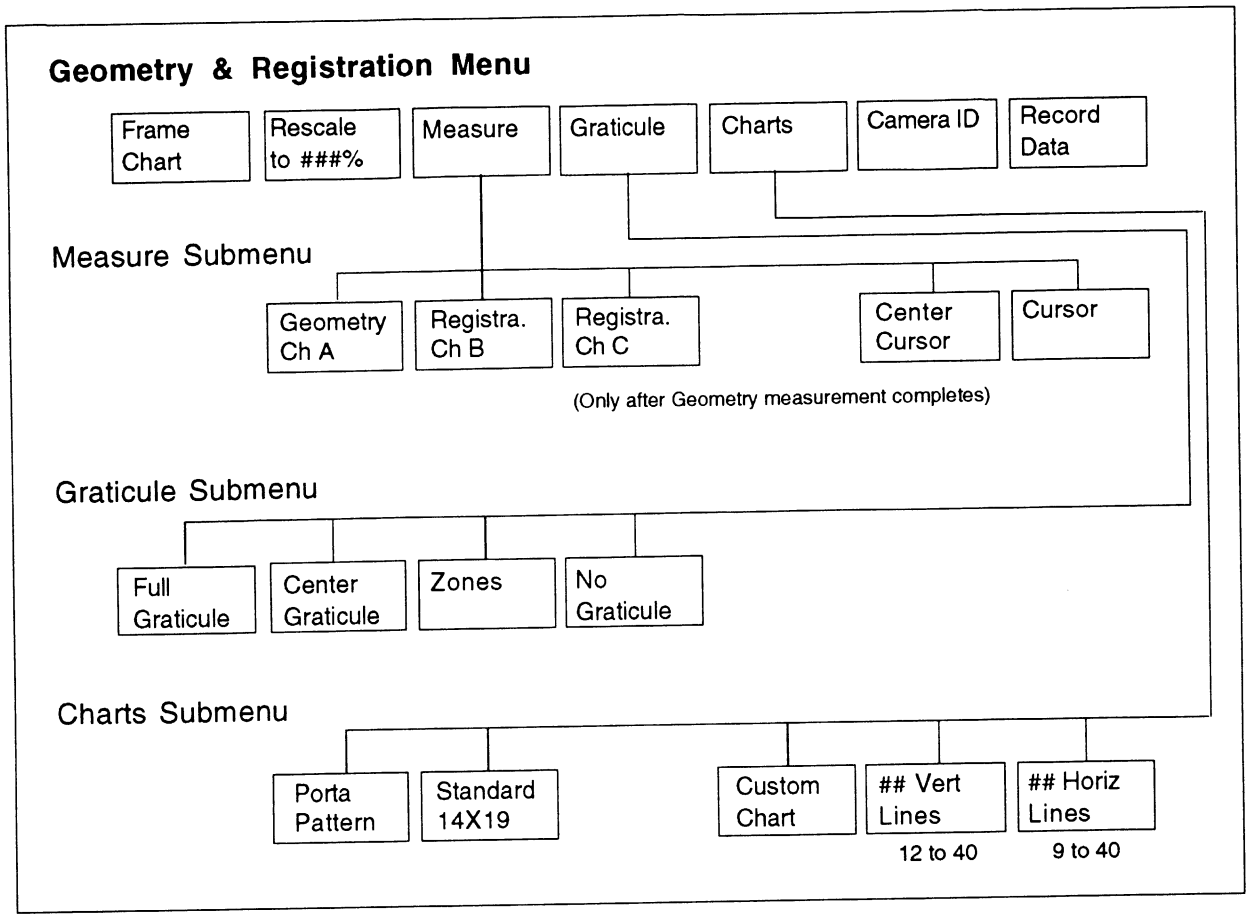

Figure 3-21. Geometry and Registration measurement menu tree.

Frame Chart	**Frame Chart:** forces acquisition of a data frame for accurate measurement of chart location relative to the camera.
Rescale to ###%	**Rescale to ###:** centers and rescales the display to some percent of the active video area. The percent of area displayed is selected by touching the Rescale soft key and turning the knob.
Measure	**Measure:** displays a submenu to select Geometry (measured on channel A) or Registration (measured on channels B or C). The Registration softkeys become visible only after the Geometry measurement completes successfully. The Measure submenu also includes the cursor mode soft key.
Graticule	**Graticule:** displays a submenu to select the desired graticule. Different graticules are appropriate during different phases of measurement.
Charts	**Charts:** displays a submenu from which you may select the chart to be used for the measurement. A custom chart can also be defined using this submenu.
Camera ID	**Camera ID:** displays an on-screen keypad, on which you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.
Record Data	**Record Data:** stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Geometry~Registration.N, where N is one greater than the previously highest-numbered Geometry and Registration file. (The file names start with Geometry~Registration.0.)

MEASURE SUBMENU

Geometry Ch A	**Geometry Ch A:** pressing this soft key starts the Geometry measurement, which is made against an absolute reference.
Registra. Ch B	**Registra. Ch B:** pressing this soft key measures channel B registration against channel A.
Registra. Ch C	**Registra. Ch C:** pressing this soft key measures channel C registration against channel A.
Center Cursor	**Center Cursor:** centers the cursor on the chart.
Cursor	**Cursor:** activates Cursor mode, allowing you to move the cursor on the chart display and read horizontal and vertical error at the cursor location.

CHARTS SUBMENU

Porta-Pattern	**Porta-Pattern:** selects the Porta-Pattern chart for the measurment.
Standard 14X19	**Standard 14X19:** selects a standard 14 x 19 chart for the measurement (this is the same as the EBU chart).
Custom Chart	**Custom Chart:** allows you to define a custom chart, when neither the Porta-Pattern nor the EBU chart are suitable. Pressing this soft key activates the Vert Lines and Horiz Lines softkeys.
## Vert Lines	**## Vert Lines:** allows you to specify the number of vertical lines in a custom chart. The range is 12 to 40 vertical lines.
## Horiz Lines	**## Horiz Lines:** allows you to specify the number of horizontal lines in a custom chart. The range is 9 to 40 horizontal lines.

GRATICULE SUBMENU

Full Graticule	**Full Graticule:** shows the full chart ovarlayed with input from the camera.
Center Graticule	**Center Graticule:** displays only the chart center graticule.
Zones	**Zones:** Displays zones to aid in characterizing deviations. Zone shape may be either circular or octagonal, and is specified at configuration (see *Configuration* for more information).
No Graticule	**No Graticule:** displays input from the camera, but without the superimposed graticule.

SHADING

Shading is the variation in camera output luminance levels when light input is constant. These peak-to-peak amplitude variations can be caused by the camera lens, camera circuitry, or by bias lighting in tube cameras. The measurement is made for line and field rate (horizontal and vertical shading), respectively.

Shading is measured under two conditions:

- Camera lens capped (black shading)
- Camera pointing at an evenly illuminated white field (white shading)

Shading is usually measured by using a waveform monitor and noting the maximum and minimum video levels with either black or white input. The Shading measurement requires no charts or special setup conditions.

Shading has two modes: Continuous acquisition and Average.

Continuous Acquisition mode lets you adjust camera circuitry while observing the shading effect. In this mode, each frame of video is acquired, processed, and displayed.

Average mode (selected with the Average hard key) is better for precise measurements, but is not suitable for use while adjusting the camera. Up to 32 frames of data can be averaged. When the selected number of frames are averaged, acquisition stops and you may examine the stored data.

Shading Setup

The shading measurement accepts input in any video format. Each channel is acquired and measured separately using the Source Selection hard keys.

Shading Display

Figure 3-22 shows the Shading application display. Horizontal and vertical shading (line rate and field rate) are displayed in two graphs. Measurement results are presented in the text readout and include vertical shading, maximum and average horizontal shading, and horizontal shading on the selected line. The results are displayed as percent error of peak white (the reading is in mV). Dashed lines show, within the window, where the vertical shading data is sampled and which line the horizontal shading shows (and where text information originates).

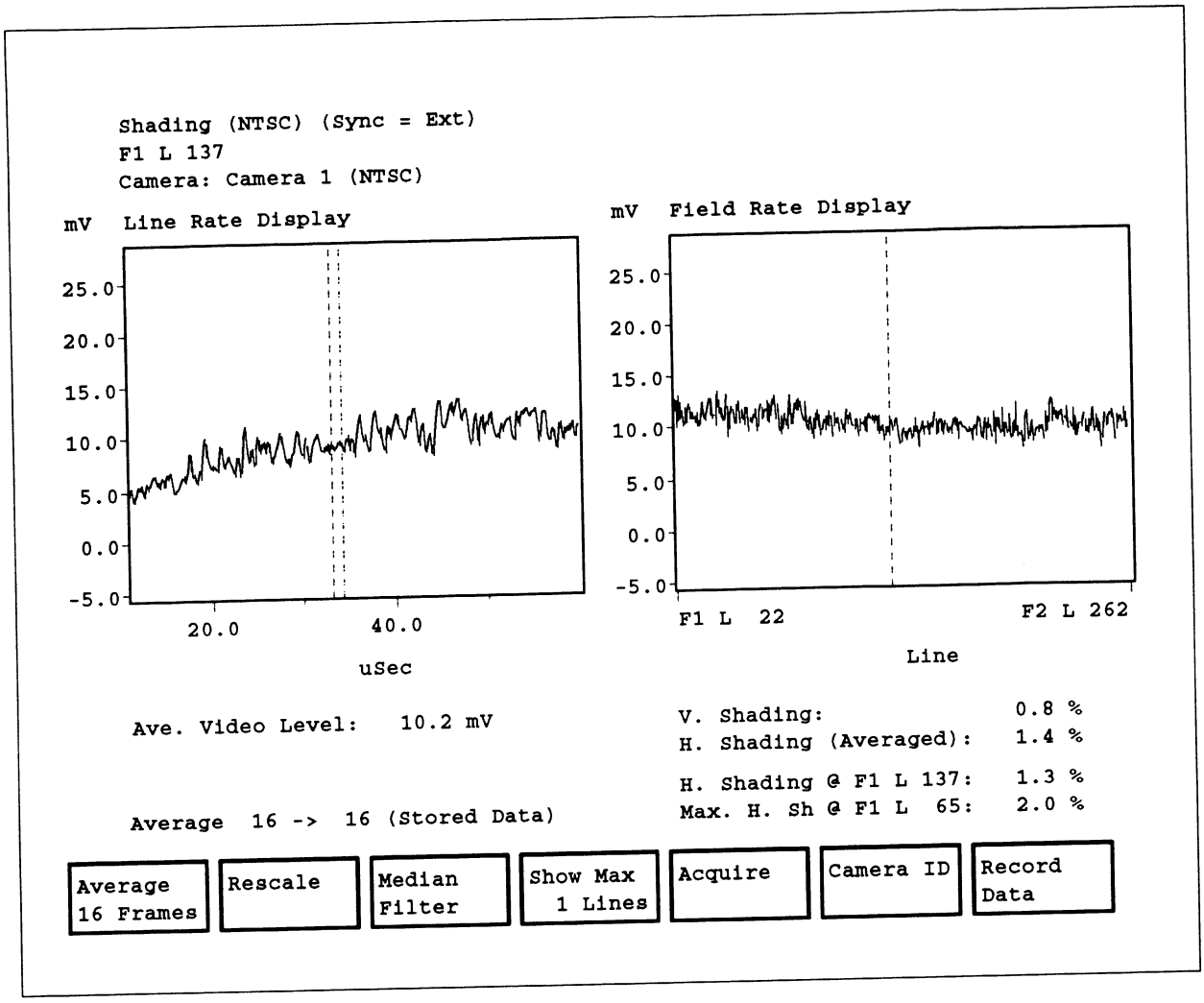

Figure 3-22. The Shading application display.

Shading Menu

Pressing the Menu button when the Shading application is running displays the Shading main menu. The Shading menu tree is shown in Figure 3-23.

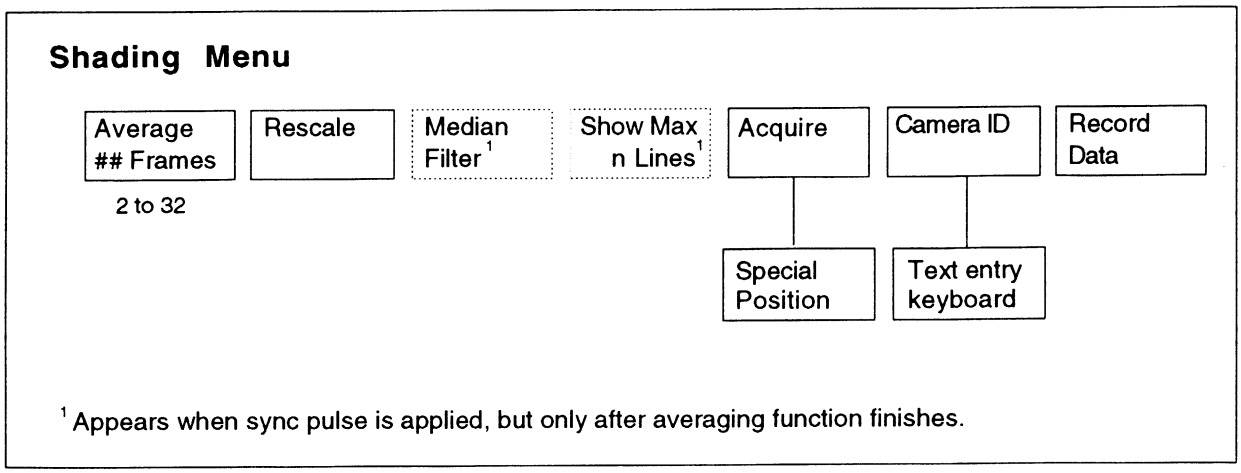

Figure 3-23. Shading menu tree

MAIN MENU

Average ## Frames

Average Frames: selects the number of frames to average in performing the measurement (the range is 2 to32). To change the Average Frames value, touch the Average Frames softkey to highlight it, rotate the knob until the desired number of frames appears, then press the Average Frames softkey again.

Rescale

Rescale: rescales the display.

Median Filter

Median Filter: uses a median filter to remove the high-frequency component of the video input. This removes the effect that CCD defects might have on measurement results.

Show Max Lines

Show Max Lines: produces a multiple-line display that lets you easily observe any horizontal shading trend in the field rate on the graph. Touch the soft key and rotate the knob to change the number of lines displayed.

Acquire

Acquire: lets you select where the signal for the field-rate display is acquired. Acquire Special Position lets you define where acquisitions are actually made

Camera ID

Camera ID: displays an on-screen keypad, where you can enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera Testing application to another, so you need not re-enter this string with each measurement unless you change cameras.

Record Data

Record Data: stores current measurement results in a data file. Each time you touch this softkey, a new data file is created, and stored in a file named Shading.N, where N is one greater than the previously highest-numbered Shading file. (The file names start with Shading.0.)

NOTE

Multiple-line display functionality is also supported for Copy mode, but remember that the more lines displayed, the more memory required for the Copy function.

VERTICAL SMEAR

Interline Transfer (IT) type CCD cameras have photosensitive cells interlaced with transfer cells. During vertical blanking, photosensitive cell charge is shifted into the transfer cells, which are clocked out. This type of physical structure allows excess charge from the photosensitive cells to leak into the transfer cells as charges are clocked out. On a TV monitor, this is seen as the vertical streaks that may be observed in the display of oncoming headlights.

Vertical smear is measured by pointing the camera at a light source and observing the camera output on a video line far from the light source. Smear is an unwanted lift in the video level on the observed line, and is expressed as dB error from a reference level.

Since camera iris movement is involved in making this measurement, the VM700A can't make the measurement in the usual sense. Instead, the application offers a more suitable visual display for making the measurement. The equation for deriving the dB error result is also standardized.

A black window chart provides the easiest method for making this measurement. Recommended for the purpose is an 8 inch x 10 inch black card with a small aperture (less than 1/2 inch x 1/2 inch) in the middle. Light is directed through the aperture.

The idea for the measurement is to overdrive the camera's light-sensitive elements and test its ability to handle the excess charge. For this reason, the camera's white clip, knee, and detail circuits must be disabled before making the vertical smear measurement.

The following steps may be used as a procedure for measuring and computing smear.

1. After deciding on the luminance levels for reference and smear threshold, enter the values with the application's soft keys.

2. Adjust the camera lens iris to obtain the reference video level in the aperture area.

3. Note the lens f-stop with a soft key.

4. Adjust the iris again to obtain the smear threshold in the black areas monitored.

5. Now, note the lens f-stop again with the soft key.

The dB error result is derived from the f-stop values you entered. The equation used for the vertical smear computation is:

$$\text{Vertical Smear (dB)} = 20 \log \left(\frac{\text{Reference Level}}{\text{Threshold Level}}\right) + 20 \log \left(\left(\frac{\text{Reference Iris}}{\text{Threshold Iris}}\right)^2\right)$$

Vertical Smear Setup

The Vertical Smear measurement accepts input in any video format. Each channel is acquired and measured separately using the Source Selection hard keys.

Vertical Smear Display

The Vertical Smear application display is parade style, allowing you to observe three different areas in the active video. The video level at the aperture is used as the reference while the black areas above and below the aperture are monitored (the boxed area in each display shows where measurements are taken).

Figure 3-24 shows the Vertical Smear display.

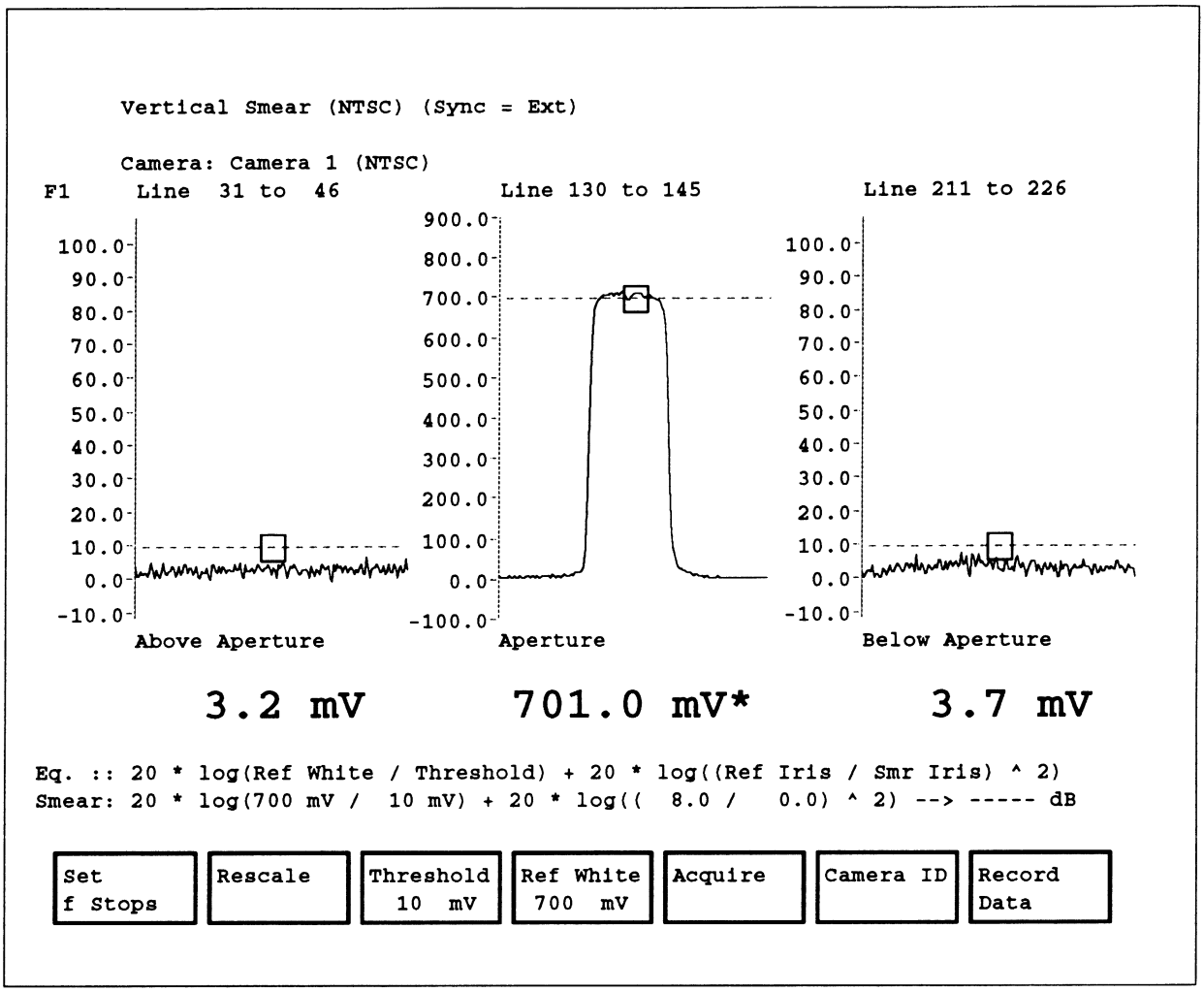

Figure 3-24. Vertcal Smear main menu and display.

Vertical Smear Menus

Pressing the Menu button when the Vertical Smear application is running displays the Vertical Smear main menu. The Vertical Smear menu tree is shown in Figure 3-25.

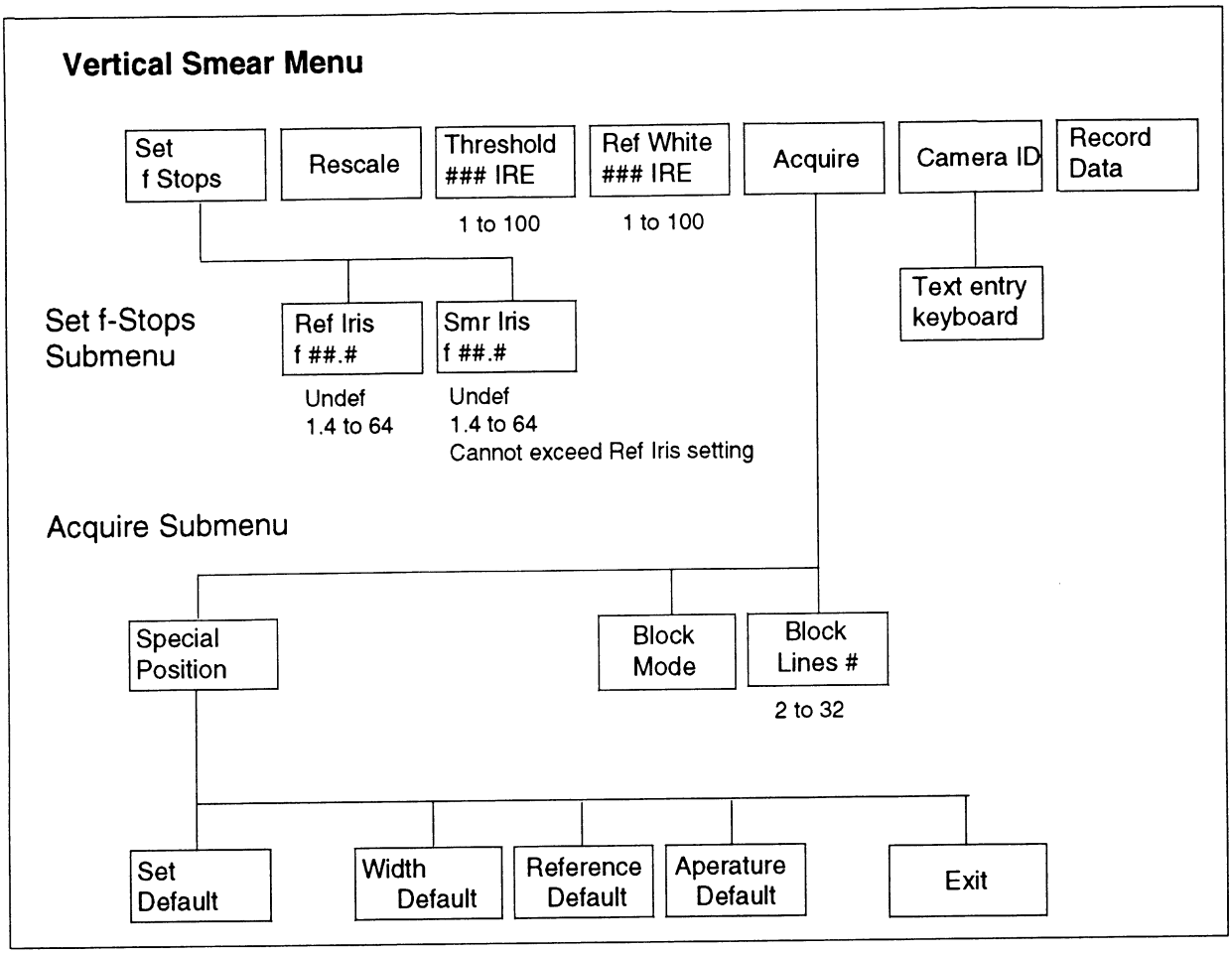

Figure 3-25. Vertical Smear menu tree.

MAIN MENU

Set f Stops	**Set f Stops:** displays a submenu of soft keys where you may enter the f-stop information needed for the measurement.
Rescale	**Rescale:** restores the display to its default scale.
Threshold ###	**Threshold:** specifies the smear threshold (the amount of lift that can be tolerated) for the measurement. To change the threshold, turn the knob while touching the softkey. Reading is in IRE or mV.
Ref White ###	**Ref White:** specifies the reference video level for the measurement. To change the reference video level, turn the knob while touching the softkey. Reading is in IRE or mV.
Acquire	**Acquire:** displays a submenu where you may specify acquisition locations.
Camera ID	**Camera ID:** displays an on-screen keypad, where you may enter an alphanumeric string to be used for camera identification. This string appears on all displays produced by the measurement, as well as on measurement results files and screen captures. It also carries over from one Camera application to another, so you need not re-enter this string with each measurement unless you change cameras.
Record Data	**Record Data:** stores current measurement results in a data file. Each time you touch this softkey, a new data file is created and stored in a file named Vertical~Smear.N, where N is one greater than the previously highest-numbered Vertical Smear file. (The file names start with Vertical~Smear.0.)

ACQUIRE SUBMENU

Special Position	**Special Position:** displays a submenu where you may specify acquisition parameters and defaults.
Block Mode	**Block Mode:** activates block mode, where you may specify a block of lines from which to acquire data. When Block mode is active, the line immediately under the camera identifier shows the block start and end lines.
Block Lines #	**Block Lines:** allows you to size a block by specifying the number of lines it contains. To specify the number of lines in a block, press the soft key and turn the knob. The range is 2 to 32 lines.

SPECIAL POSITION SUBMENU

Set Default

Set Default: pressing this soft key sets the default measurement window size. If the Width, Reference, or Aperture soft key is selected, pressing the Set Default soft key sets that selection to its system default.

Width Default

Width Default: sets the window width for the Vertical Smear measurement.

Reference Default

Reference Default: sets the black window position for the measurement.

Aperture Default

Aperture Default: sets the measurement window position.

Exit

Exit: returns to the main display, with no soft keys shown.

F-STOPS SUBMENU

Ref Iris f ##.#

Ref Iris f: sets the reference iris f-stop. Range is 1.4 to 64, or the setting may be left undefined.

Smr Iris f ##.#

Smr Iris f: sets the smear iris f-stop. Range is 1.4 to 64, or the setting may be left undefined.

Field Toggle

Field Toggle: displayed when the Select Line hard key is pressed. This soft key toggles the display between field 1 and field 2

Default Line

Default Line: displayed when the Select Line hard key is pressed. Selects the line specified as the default at configuration.

Section 4
REMOTE COMMANDS AND KEYWORDS

INTRODUCTION

Like other VM700A video functions, remote control of Component measurement functions is performed via the serial (RS-232C) ports on the VM700A rear panel. Using the remote control functions requires that you connect a terminal or computer to the VM700A via the RS-232C port with a correctly wired interconnect cable. If you use a computer, you will also need a suitable VM700A terminal program such as the Tektronix application VMT. VMT offers a choice of either menu selection or command-line entry of VM700A remote commands.

For information about configuring the VM700A serial ports for remote operation, see the *VM700A Programmer's Reference Manual*. The Programmer's Reference manual discusses the VM700A's RS-232C port requirements in detail and shows typical cable wiring configurations.

Capabilities available while operating the VM700A from a remote location include:

- Make a specific manual measurement or Auto mode series of measurements
- Execute and interrupt a function (Function Key)
- Temporarily change the configuration of a channel: limit files, selected measurement files, and measurement location files; printer type and port for each type of output (**Copy**, **Report**, **Log**); specify an "End of File" character for printer output

The remote commands used to access the Component measurement functions are the same as those used for other VM700A functions. The command arguments are listed and described below. The information in this section assumes that you are familiar with manual operation of the VM700A and understand the principles of remote VM700A operation. For information on working with VM700A remote control commands, see the *VM700A Programmer's Reference Manual*.

NOTE

Rather than being a complete discussion, the following material is an abbreviated explanation of the remote commands. It assumes that you understand the principles of remote VM700A operation and have access to the VM700A Operator's Manual and the VM700A Programmer's Reference Manual.

COMMAND FORMAT

The VM700A remote control commands use this form:

command [*argument(s)*]

The *command* is the actual command name. Literal command input is shown in **boldface** type. Variable values are shown in *italic*. Optional arguments are enclosed with [ ]. A discussion of command usage and arguments follows the command header.

Note that **VM700>** is a prompt (which you can change), not an input.

COMPONENT MEASUREMENT REMOTE COMMANDS

The following VM700A remote commands can be used with Component Measurements.

execute *application*

The execute command starts the specified VM700A application. An application is one of the executable files (with exceptions noted below) found in the **Instrument~Operations**, **VM700~Diagnostics**, **Video~Measurements**, **Audio~Measurements,** or **Video~Options** directories in the **Executable~ Files** directory. Selecting an operational mode application, such as Vector, is equivalent to pressing the front panel button: the LED on the selected button is lit. Selecting a measurement or diagnostic application is equivalent to touching the desired softkey.

Example:

```
VM700A> execute Colorimetry
```

You may run these Camera Testing measurement applications under remote control. Be sure to use the same capitalization and tildes (~) as shown:

Colorimetry
Defects
Detail
Fixed_Pattern~Noise
Frequency~Response
Gamma
Geometry~Registration
Shading
Vertical~Smear

get *keyword* [*channel-letter*]

The **get** command returns the configuration file value specified by *keyword* on the channel specified by *channel_letter*. The keywords available are listed in the following section. The channel_letters available are **A**, **B**, or **C**.

Example:

```
VM700A> get YCOS A
```

The above example returns the PAL Camera Standard for channel A.

getresults

The getresults command stores Measure or Auto mode measurement results in default files in the Measurement~Results directory. In Measure mode, entering getresults with no argument(s) stores the measurement results for the current measurement. If no measurement is currently being executed, the message "Request not supported" is returned. If a measurement is being executed, the message "Results in file: *filename*" is returned. After the file name has been returned, use the **show** "*filename* "command to view the results.

Example:

```
VM700A> getresults
Results in file: Colorimetry
```

hardkey *button_name*

The **hardkey** command indicates the press and release of the specified front panel button, *button_name*. **hardkey** is equivalent to entering **hardpress** and **hardrelease**; however, in general **hardkey** should be used instead of these commands.

Example:

```
VM700A> hardkey Menu
```

Front panel button names are listed in Table 4-1.

Table 4-1
Front Panel Button Names

Button Names		
A	Display	Picture
Auto	Freeze	SelectLine
Average	Graticule	Vector
B	Help	Waveform
C	Menu	XY (Arrow selector)
Copy	MoveExpand	

NOTE

The Configure, Function, and Measure buttons cannot be selected via remote.

set *keyword* [*channel_letter*] *value1* [*value2 ...*]

The **set** command defines the configuration values to be used during the remote session. The keywords available to use with **set** are listed in Tables 4-2 and 4-3. The channel_letter can be **A**, **B**, or **C**. The configuration values changed with **set** remain in effect until they are restored to their original (pre-remote) values with the **restoreconfig** command, or power to the instrument is switched off and back on. Note that the system line and other global variables can be changed with **set** but are not restored with **restoreconfig**.

Example:

```
VM700A> set YGDR A 0 600
```

The above example changes the PAL GDR reference voltage error limits for channel A from their previous values to 0 (lower limit) to 600 (upper limit) mV.

show *filename*

The **show** command returns the contents of the specified filename. The default path is the Measurement~Results directory, but other files can be specified with a full pathname or a path relative to the Measurement~Results directory.

Example:

```
VM700A> show /nvram0/ConfigFiles/Source_Selection~Video
       Video NTSC Video Source File Name     PAL Video Source File Name
-------------------------------------------------------------------------
Source A: NTSC System~Default                System~Default
Source B: PAL  System~Default                System~Default
Source C: NTSC System~Default                System~Default
Timed Events: System~Default
```

softkey *softkey_name*

The softkey command indicates the press and release of a specified softkey, such as Cursors. softkey is equivalent to entering softpress and softrelease; however, in general softkey should be used instead of these commands.

Example:

```
VM700A> softkey Change_Display
```

However, with certain softkeys, the press must be held to make a control change.

Example:

```
VM700A> softpress Set_Temperature
VM700A> knob -400
VM700A> softrelease Set_Temperature
```

NOTE

The knob command rotates the control knob a certain number of clicks from its present setting. For setting the temperature number, a number of 40 produces a 1°C change, 400 produces a 10°C change, and 8 produces a 0.1°C change. Use a minus sign to move the setting down.

With some exceptions, the general rule for forming a softkey_name is to take the spelling and capitalization from the softkey name on the display, omit the variable part and join the words with _ (underscore). For example, the softkey_name for the **H Density 700 pixels** softkey is H_Density. The exceptions for the Camera Testing option are given in Table 4-2.

For softkeys that perform toggle operations (such as on/off), the softkey name is followed by a colon (:). The softkey displays the current status of the toggle. The convention for naming toggle keys is to use the function name, with appropriate capitalization, up to (but not including) the colon.

Table 4-2
Exception Softkey Names for Option 21

Remote Softkey Name	Screen Softkey Name
Defects:	
Set_Threshold	Threshold
Set_Temperature	nn.n C. nn F.
Defects_Rescale	Rescale
Colorimetry:	
Width_Cycles	Width
Packet_Num	Color Packet
Acquire_Pos	Center
Save_As_Custom_Chart	Save As Custom Ch
Acquire_Charts	Acquire & Charts
Weighting_Factor	Weighting
Nr_Chips	Colors
White_Chip_Nr	Ref.White Packet
Measure_Conditions	Meas. Condition
Illuminant_D65	Illum. D65
Illuminant_31K	Illum. 31K
Store_Ref_Menu	Store Reference
Illuminants	Illum.
Temp_Custom_Chart	Temp. Custom Ch.
Frequency Response:	
DOM_Rescale	Rescale
0dB_Ref	0dB Ref Packet
Packet_Width	Width
Packet_Num	Packet
Packet_Location	Center

"GET" AND "SET" KEYWORDS

This section documents the Component measurement keywords used with the **get** and **set** commands (see Tables 4-3 and 4-4). For each **get/set** keyword, it gives the syntax of the **set** command and the **get** result, a description of what the keyword does and the upper and lower limits of its range.

For information on working with VM700A remote control commands, see the *VM700A Programmer's Reference Manual*.

Table 4-3
NTSC Keywords: for "get" and "set" commands

Keyword	Description	Range
XCOS	Camera Output standard	Composite Composite Setup GBR 700 (system default) GBR 700 Setup GBR 714 GBR 714 Setup YPbPr SMPTE/EBU YPbPr 714 Betacam Setup YPbPr 714 Betacam YPbPr 700 MII Setup
XSWP	Frequency Response Packets	6 to 12
XB6F	Packets beyond 6MHz -- From	1 to 12
XB6T	Packets beyond 6MHz -- To	1 to 12
XSWL	Frequency Response field and line	Fields 1 or 2 Lines 1 to 262
XGDR	Reference (mV)	0 to 999.9 mV
XG01 to XG12	Y (G) Packet # 1 (dB) to Y (G) Packet #12 (dB)	-40 to +40 dB
XBDR	Reference (mV)	0 to 999.9 mV
XB01 to XB12	(B) Packet # 1 (dB) to (B) Packet #12 (dB)	-40 to +40 dB
XRDR	Reference (mV)	0 to 999.9 mV
XR01 to XR12	(R) Packet # 1 (dB) to (R) Packet #12 (dB)	-40 to +40 dB

Table 4-4
PAL Keywords: for "get" and "set" commands

Keyword	Description	Range
YCOS	Camera Output standard	Composite GBR YPbPr SMPTE/EBU
YSWP	Frequency Response Packets	6 to 12
YB6F	Packets beyond 6MHz -- From	1 to 12
YB6T	Packets beyond 6MHz -- To	1 to 12
YSWL	Frequency Response line	Lines 1 to 625
YGDR	Reference (mV)	0 to 999.9 mV
YG01 to YG12	Y (G) Packet # 1 (dB) to Y (G) Packet #12 (dB)	-40 to +40 dB
YBDR	Reference (mV)	0 to 999.9 mV
YB01 to YB12	(B) Packet # 1 (dB) to (B) Packet #12 (dB)	-40 to +40 dB
YRDR	Reference (mV)	0 to 999.9 mV
YR01 to YR12	(R) Packet # 1 (dB) to (R) Packet #12 (dB)	-40 to +40 dB

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

Tektronix	MANUAL CHANGE INFORMATION	Group Code 21
	Date: 1–19–93 Change Reference: C1/193	
Product: VM700A Opt 21 Camera Measurements Ops Manual	Manual Part No: 070–8573–02	

DESCRIPTION

EFF. All Option 21 Versions.

TEXT CHANGES

Change Page 3–3: Add the following NOTE before the last paragraph on the page.

NOTE

The NTSC phosphor standard has been replaced by the SMPTE phosphor standard in most applications. Use the SMPTE phosphor standard for testing NTSC cameras.

Change Page 3–10: Change the PHOSPHOR SUB–MENU text to read as follows:

NTSC Phosphor	NTSC Phosphor: tells the VM700A that the camera is adjusted for an NTSC phosphor.

NOTE

The NTSC phosphor standard has been replaced by the SMPTE phosphor standard in most applications. Use the SMPTE phosphor standard for testing NTSC cameras.

EBU Phosphor	**EBU Phosphor:** tells the VM700A that the camera is adjusted for an EBU phosphor.
SMPTE Phosphor	**SMPTE Phosphor:** tells the VM700A that the camera is adjusted for a SMPTE phosphor. Use this phosphor setting for testing NTSC cameras.
Previous Menu	**Previous Menu:** returns to the previous menu.