Black and Frozen Frame Detection

WFM6120/7020/7120 & WVR6020/7020/7120
Version 5.0.2 Software

How To Guide

Tektronix®

Figure 1. Input Monitor Mode Configuration.

What is Black and Frozen Frame Detection?

Processing equipment within the broadcast chain may choose to freeze on the last active image or go to a black image when a signal is lost. The transmission system considers this image as an active signal and may not alert the operator to the fault within the system. With firmware version 5.0.2, Tektronix waveform monitors and rasterizers can be configured to detect black and/or frozen frames, triggering an alarm when one of these conditions occur. This and other alarm conditions can be reported within the error log and time stamped to the internal time of the waveform monitor or timecode if present.

How to Configure Black Frame Detection

1. Press the **CONFIG** button to access the configuration menu.

2. Using the up and down arrows keys navigate to **Input Monitor Mode** and press the **SEL** button to enter sub menu.

3. Using the general knob or up/down arrow keys navigate to and select **Single Black/Frozen** mode as shown in Figure 1.

4. Select one of the tiles (1, 2, 3 or 4) and press the **STATUS** button.

5. Push and Hold the **STATUS** button to enable the menu.

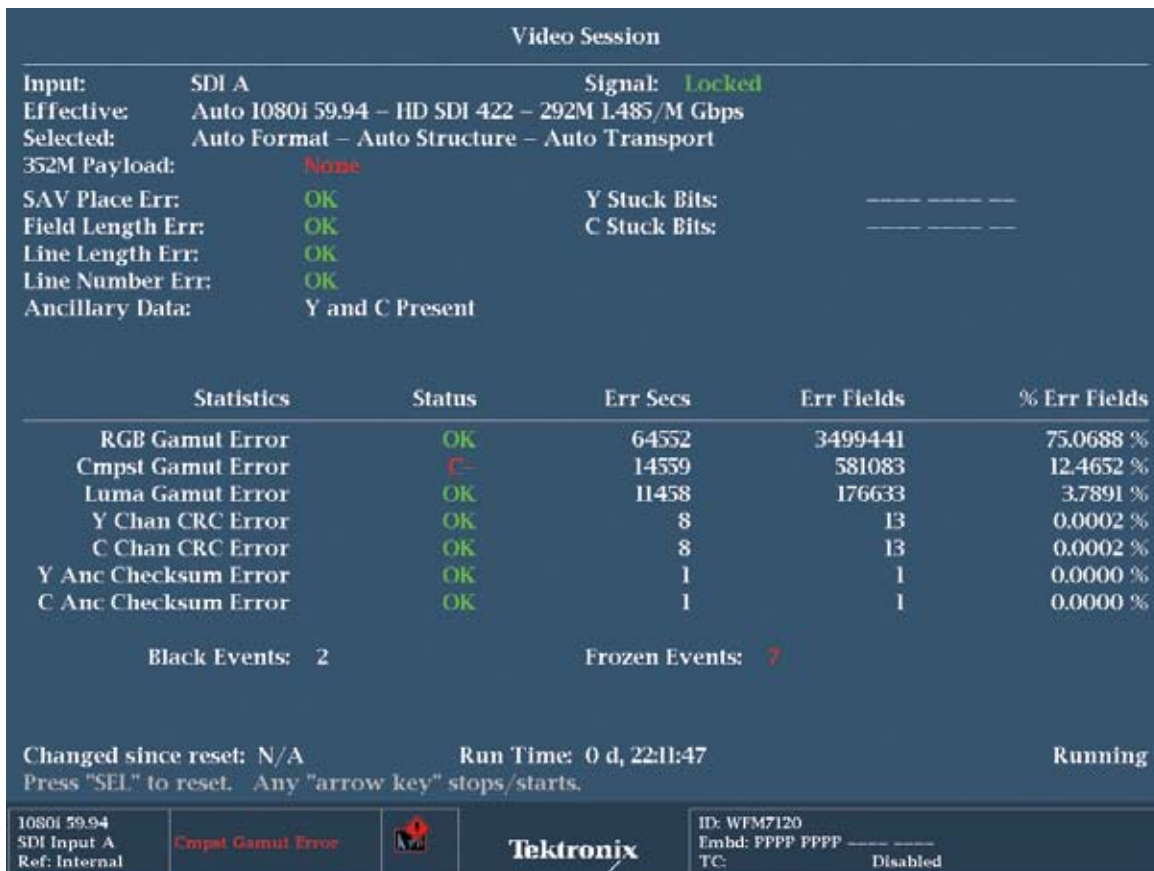**Figure 2.** Status Display Type Menu.

Figure 3. Video Session Display using Single Black/Frozen operating mode.

6. Using the up and down arrows to navigate to **Display Type** and press right arrow to select sub menu as shown in Figure 2.

7. Select **Video Session display** to show a summary of video parameters of the current video signal as shown in Figure 3.

Note only when the instrument is in Single Black/Frozen operating mode will the Black and Frozen log events be present within the Video Session or Alarm Status displays.
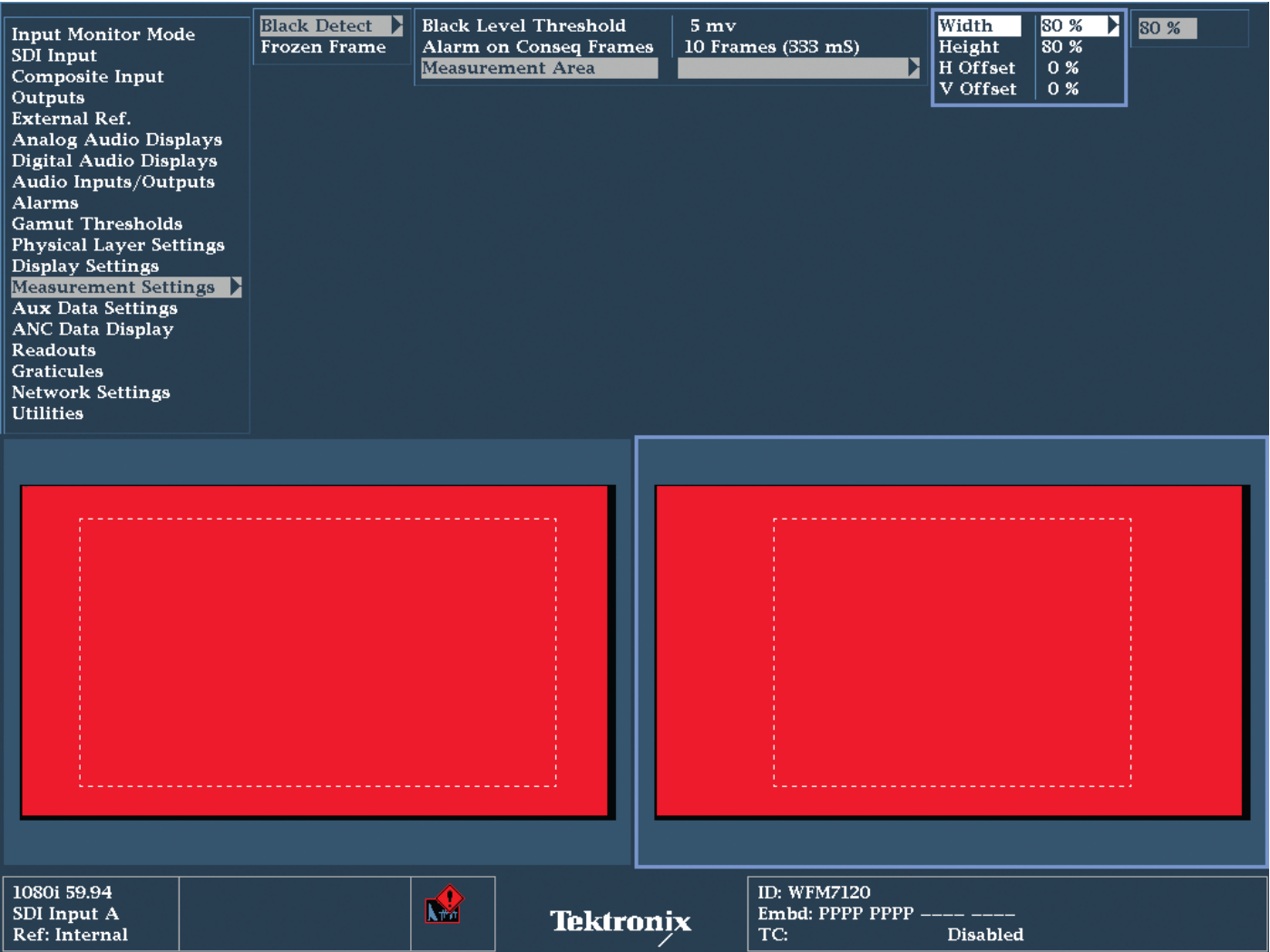
Figure 4. Black Detect Measurement settings.

There are a variety of configuration selections for the Black and Frozen frame detection system that can be configured by the user. These parameters define the area of the active image that can be monitored for the black or frozen frame detection, the duration of the number of frames affected to trigger an event, and the threshold level that determines a black or frozen image. These parameters can be configured within the **CONFIG-Measurement** menu.

How to Configure Black Frame Detection Thresholds

1. Press the **CONFIG** button to access the configuration menu.

2. Using the up and down arrows keys to navigate to **Measurement Settings** menu and press the **SEL** button to enter sub menu.

3. Using the general knob or up/down arrow keys and navigate to **Black Detect** menu and press **SEL** to enter the sub menu as shown in Figure 4.

The following Black Detect parameters can be configured by the user.

Black Level Threshold has a default of 5 mv and can range from 0 mv to 100 mv. This threshold value determines the video level that is considered to be the black level of the video signal. For instance a video signal received off-air may contain noise that can affect the black threshold algorithm. In this case the user may wish to increase the video level such that this background noise level is consider within the range of the black detection threshold.

Alarm on Consecutive Frames has a default of 10 frames and can range from 1 to 1200 frames. The duration of this value is also shown in second based on the video frame rate of the video input. When the video signal is within the black level threshold it must occur for the number of consecutive frames set by user before the alarm will trigger an event.

Measurement Area has a default value of 60% **Width** and 80% **Height** for the active video region that will be used for detection with zero **H offset** and **V offset**. The values can range from 0 to 100% for each setting. The user can enable a black graticule within a picture display to help define the measurement area. For instance a logo or bug maybe present within a corner of the display and the user may want to limit the measurement area such that this logo or bug is not included within the black detection measurement area.
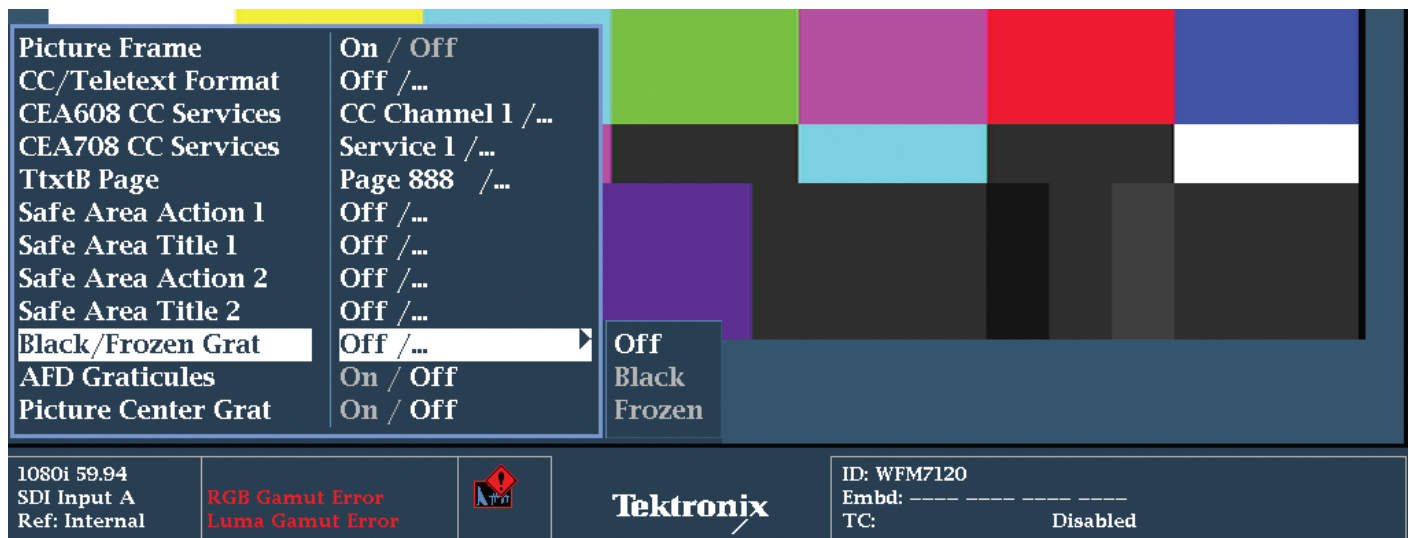
Figure 5. Picture Menu Black/Frozen graticule selection.

How to Configure Black Frame Detection Measurement Area

1. Select one of the tiles (1, 2, 3 or 4) and press the **PICTURE** button.

2. Push and Hold the **PICTURE** button to display the menu.

3. Using the up and down arrows to navigate to **Black/Frozen Grat** and press right arrow to select sub menu as shown in Figure 5.

4. Navigate to Black menu item to display the black measurement area within the picture display.

5. Press the **CONFIG** button to access the configuration menu. The configuration menu will obscure the non active tiles when in 4 tile display mode. Since the active tile should be the picture display this will allow the user to see the changes they make to the measurement area within the picture display.

6. Using the up and down arrows keys navigate to **Measurement** menu and press the **SEL** button to enter sub menu.

7. Using the general knob or up/down arrow keys navigate **Black Detect** menu and press **SEL** to enter the sub menu as shown in Figure 4.

8. Navigate to **Measurement Area** and enter the sub menu by pressing **SEL**.

9. Navigate to the **Width** or **Height** and press **SEL** to enter the menu.

10. Using the General knob or up and down arrow to change the value and observe the graticule within the picture display change.

11. If the user wishes to move the measurement area from the center of the display this can be achieved. By select of the **H Offset** or **V Offset** menu items within the measurement area controls.
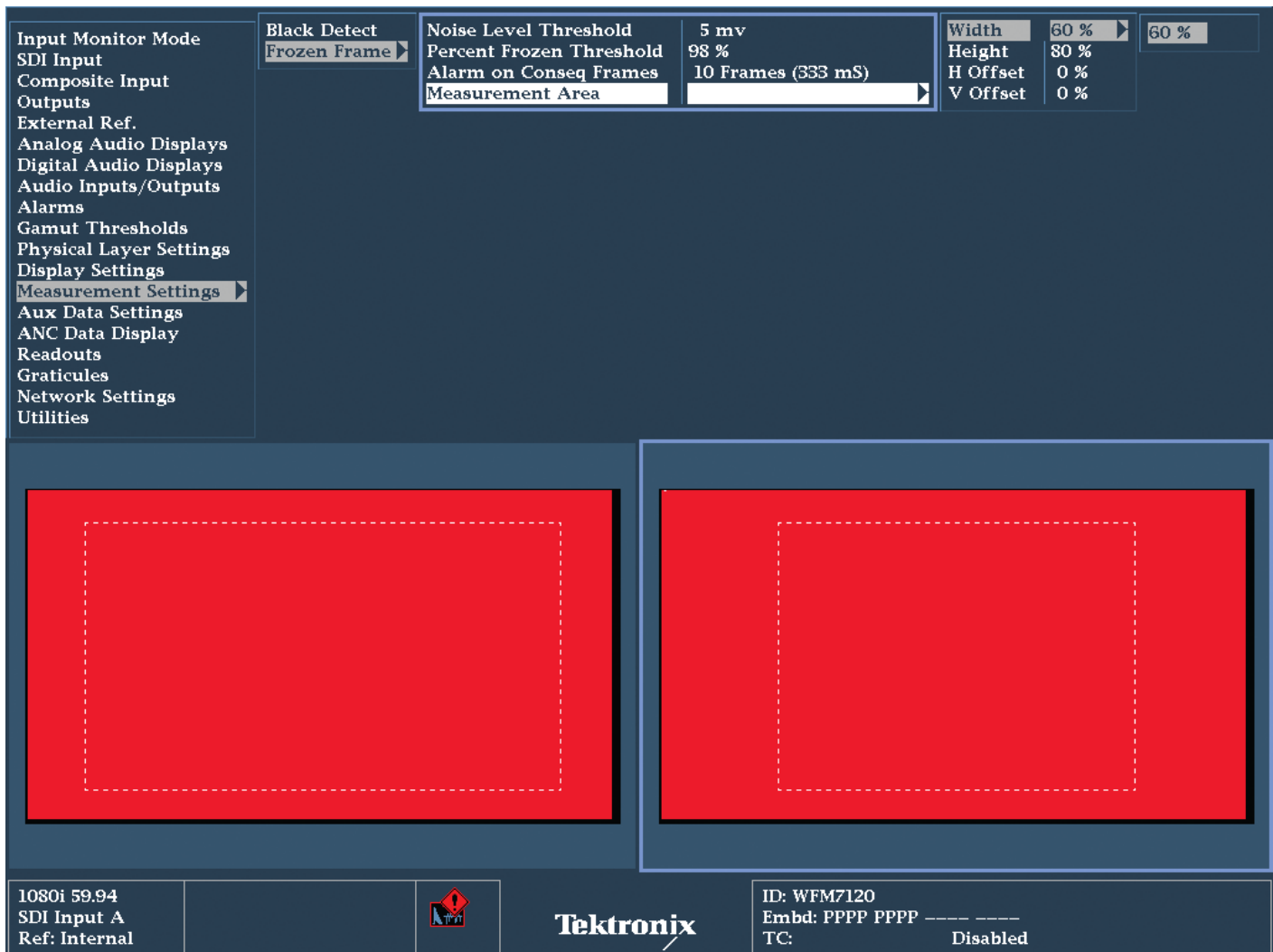
Figure 6. Frozen Frame Measurement settings.

How to Configure Frozen Frame Detection Thresholds

1. Press the **CONFIG** button to access the configuration menu.

2. Using the up and down arrows keys navigate to **Measurement Settings** menu and press the **SEL** button to enter sub menu.

3. Using the general knob or up/down arrow keys navigate to the **Frozen Frame** menu and press **SEL** to enter the sub menu as shown in Figure 6.

The following Frozen Frame parameters can be configured by the user.

Noise Level Threshold has a default of 5 mv and can range from 0 mv to 100 mv. This threshold limits determines the video voltage level difference between frames that can be considered frozen images. For instance a video signal received off-air may contain noise that can affect the frozen threshold algorithm. In this case the user may wish to increase the video level such that this background noise level is consider within the range of the frozen detection algorithm.

Percentage Frozen Threshold has a default value of 98% and can range from 0 to 100%. This threshold determines the percentage similarity between frames in order for the frozen threshold algorithm to consider the frames identical. For instance when a device produces a frozen frame because of the loss to the signal there may be slight difference between the fields/ frames and this threshold can be used to determine how similar the frames have to be in order for the frozen frame algorithm to detect the event. For example, an MPEG decoder problem may produce different macroblocks in certain parts of the picture although most of the image is frozen. To be able to detect this type of problem the percentage frozen threshold may need to be decrease in order for the percentage of similarity between frames to be detected as a frozen event.

Alarm on Consecutive Frames has a default of 10 frames and can range from 1 to 1200 frames (a value based on second is also shown within the display based on the video frame rate of the video input). When the video signal is within the frozen level threshold it must occur for the number of consecutive frame set by the user before the alarm will trigger an event.

Measurement Area has a default value of 60% **Width** and 80% **Height** for the active video region that will be used for detection with zero **H offset** and **V offset**. The values can range from 0 to 100% for each setting. The user can enable a frozen graticule within a picture display to help define the measurement area. For instance a logo or bug maybe present within a corner of the display and the user may want to limit the measurement area such that this logo or bug is not included within the frozen detection measurement area.

How to Configure Frozen Frame Detection Measurement Area

1. Select one of the tiles (1, 2, 3 or 4) and press the **PICTURE** button.

2. Push and Hold the **PICTURE** button to enable the menu.

3. Using the up and down arrows to navigate to **Black/Frozen Grat** and press right arrow to select sub menu as shown in Figure 5.

4. Navigate to **Frozen** menu item to display the frozen measurement area within the picture display.

5. Press the **CONFIG** button to access the configuration menu. The configuration menu will obscure the non active tiles when in 4 tile display mode. Since the active tile should be the picture display this will allow the user to see the changes they make to the measurement area within the picture display.

6. Using the up and down arrows keys navigate to **Measurement** menu and press the **SEL** button to enter sub menu.

7. Using the general knob or up/down arrow keys navigate **Frozen Frame** menu and press **SEL** to enter the sub menu as shown in Figure 6.

8. Navigate to **Measurement Area** and enter the sub menu by pressing **SEL**.

9. Navigate to the **Width** or **Height** and press **SEL** to enter the menu.

10. Using the General knob or up and down arrow to change the value and observe the graticule within the picture display change.

11. If the user wishes to move the measurement area from the center of the display this can be achieved. By selection of the **H Offset** or **V Offset** menu items within the measurement area controls.

Note when a black or frozen event occurs within the video signal and meets the threshold criteria this triggers the event and alarm reporting to occur. The instrument does not continually alarm on a black or frozen event once it has occurred since this would quickly fill-up the error log. So only the first detection of the frozen/black frame is recorded and is reset by the presence of active video within the image.

Error Status Log – SDI A				Page 3 of 4
Error Status		**Timecode**	**Date**	**Time**
RGB Gamut Error (Rr–gBb)		03:33:53:00	30–Jul–09	13:50:53
Luma Gamut Error (L1)		03:33:53:12	30–Jul–09	13:50:53
Frozen Frame Events		03:33:54:06	30–Jul–09	13:50:53
Frozen Frame Events		03:33:54:18	30–Jul–09	13:50:54
Frozen Frame Events		03:33:55:12	30–Jul–09	13:50:54
RGB Gamut Error (Rr——Bb)		03:33:55:24	30–Jul–09	13:50:54
Frozen Frame Events		03:33:56:06	30–Jul–09	13:50:59
Black Detect Events		03:33:56:18	30–Jul–09	13:51:00
Frozen Frame Events		03:33:57:24	30–Jul–09	13:51:00
RGB Gamut Error		03:33:58:18	30–Jul–09	13:51:00
Luma Gamut Error		03:33:59:12	30–Jul–09	13:51:00
Composite Gamut Error		03:33:59:24	30–Jul–09	13:51:00
Black Detect Events		03:34:00:08	30–Jul–09	13:51:28
Frozen Frame Events		03:34:04:08	30–Jul–09	13:51:28
Composite Gamut Error (C–)		03:34:05:14	30–Jul–09	13:51:28
Frozen Frame Events		03:34:05:26	30–Jul–09	13:51:28
Frozen Frame Events		03:34:11:16	30–Jul–09	13:51:32
Frozen Frame Events		03:34:11:24	30–Jul–09	13:51:33
Composite Gamut Error		03:34:11:24	30–Jul–09	13:51:33
Frozen Frame Events		03:34:11:25	30–Jul–09	13:51:37
Black Detect Events		03:34:11:24	30–Jul–09	13:51:37
Frozen Frame Events		03:34:12:02	30–Jul–09	13:51:37
Black Detect Events		03:34:12:02	30–Jul–09	13:51:37
Frozen Frame Events		03:34:13:22	30–Jul–09	13:51:37
Arrow Left – Previous, Right – Next, Up – First, Down – Last.				
1080i 59.94 SDI Input A Ref: Internal		Jul 30 13:52:29 **Tektronix**	ID: WFM7120 Embd: ———— ———— ———— ———— Anc TC: 03:34:38:05	

Figure 7. Error Log Display.

The error log can be viewed by the user to see when errors have occurred within the video and audio of the signal as shown in Figure 7. These error events are recorded related to the internal time of the instrument and to timecode if present within the signal. The error log can be downloaded from the instrument by a network connection to the instrument and printed or saved to a computer. The alarm status can also be used to display a view of the current state of the instrument.

How to View and Configure the Error Log display For events

1. Select one of the tiles (1, 2, 3 or 4) and press the **STATUS** button.

2. Push and Hold the **STATUS** button to enable the menu.

3. Using the up and down arrows to navigate to the **Display Type** and press **SEL** to enter the sub menu as shown in Figure 7.

4. Select the **Error Log** using the general knob or up and down arrows to make the selection.

5. Press the **STATUS** button to dismiss the menu.

6. The Status bar will indicate the presence of timecode within the video signal in the lower right of the display.

7. If timecode is disabled then the user can choose the appropriate timecode type from the configuration menu of **Aux Data Settings**.

Figure 8. Alarms Configuration menu.

For events to be shown in the event log the alarm functions should be enabled within the Alarms configuration menu.

1. Press the **CONFIG** button to access the configuration menu.

2. Using the up and down arrows keys navigate to **Alarms** menu and press the **SEL** button to enter sub menu as shown in Figure 8.

3. Using the general knob or up/down arrow keys the user can navigate **Video Content** menu and press **SEL** to enter the sub menu as shown in Figure 9.

4. Using the up and down arrows keys the user can navigate through the selection and press SEL to toggle an 'X' on or off within each of the selected boxes.

VIDEO CONTENT	Screen Text/Icon	Logging	Beep	SNMP Trap	Ground Closure
RGB Gamut	☒	☒	☐	☐	☐
Composite Gamut	☒	☒	☐	☐	☐
Luma Gamut	☒	☒	☐	☐	☐
Black Detect	☒	☒	☐	☐	☐
Frozen Frame	☒	☒	☐	☐	☐

■ Return

1080i 59.94 SDI Input A Ref: Internal			**Tektronix**	ID: WFM7120 Embd: ―――― ―――― ―――― ―――― TC: Disabled

Figure 9. Video Content Configuration menu.

The following selection indicate the presence of a video content alarm in the following ways:

■ **Screen Text/Icon:** A text message and icon appears on screen.

■ **Logging:** The instrument logs errors to the error log display.

■ **Beep:** An audible alarm is sounded from the instrument.

■ **SNMP Trap:** The instrument sends an SNMP trap to the SNMP manager.

■ **Ground Closure:** An output that can be used to drive a light or audible alarm. All selected alarms are "OR'ed" together so that if any alarm is triggered, the output is driven to ground.

To ensure that black and frozen alarms are shown in the error log, ensure the 'X' marks are selected for the logging function as shown in Figure 9.

References

- WFM6000/7000 Series Waveform Monitors

- WVR6000/7000 Series Waveform Monitors

Data Sheets, Fact Sheets and additional product materials can be found at www.tektronix.com/video_test/signal_monitors.html

For Further Information

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

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