Rx Frame Grab Application Notes

Overview

One of the most powerful aspects of the PHABRIX Rx system is the implementation and use of Frame Grab to capture test or reference material for play-out, to diagnose problems within the SDI data stream and to provide a permanent record of the events of a failure (especially important in a world of contract outside broadcast services and network feeds).

The Frame Grab function allows each Analyser module within an Rx system to capture video clips for analysis and playback. Each captured video clip contains the full SDI data frame including video data, metadata and audio data. A video clip can be recorded manually or can be triggered by a events such as EDH / CRC errors and audio level.

Frame Grab Controls within Picture instrument

When Frame Grab record mode is selected a rolling record buffer (holding approximately 70 frames of SD-SDI or 13 frames of HD-SDI) is started so that the full SDI data frames before and after the trigger point are available for analysis. When a manual or system trigger is received the record buffer is frozen to provide a video clip.

Once a video clip has been captured it can be played-back and navigated frame by frame using the transport controls within the image are of the Picture instrument.

The captured video clip (or current frame) can be saved for future reference and previously saved clips can be restored for analysis or play-out via a Generator module.

Applications

Closed Loop Testing

Frame Grab works independently on each Analyser module so on Rx systems where there are 2 or more Analyser modules, frame by frame comparisons can be made between one captured video clip and another 'reference clip (ie an ideal clip captured previously).

In this example two clips are being compared side by side to check the data values before and after image processing.

The Frame Grab transport controls can be used to step through the 2 video clips frame by frame to spot any inconstancies.
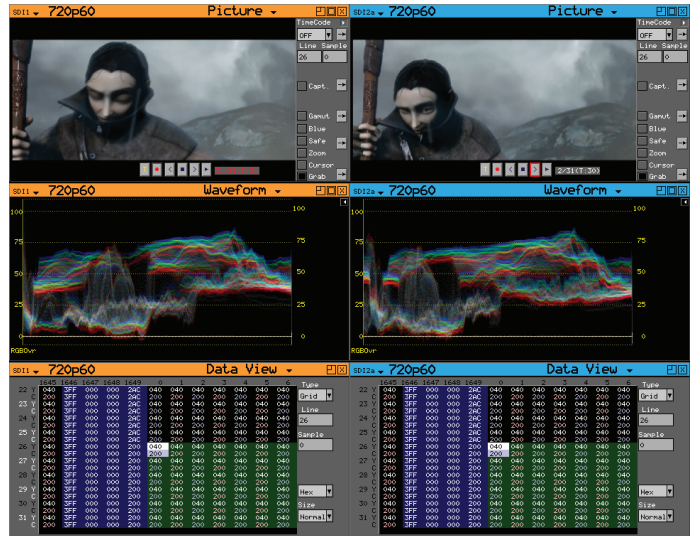
Testing Equipment Susceptibility

If a captured clip contains damaged video, audio or metadata it can be used to check other equipment's ability to cope with the damage. For example in the case of damaged Dolby metadata or audio, the ability of the receiving equipment to conceal or mute the audio damage.

As captured video clips can be saved for future use, a library of 'bad' clips could be created to ensure that equipment under test can be stressed to ensure that it functions as expected in all test cases.

Keeping a Permanent Record of Events

In a world of contract outside broadcast services and network feeds when there is a failure in a feed, due to user or natural causes, inevitably someone is blamed. If however you can record the event and prove that the feed was alright leaving you, or was wrong getting to you, your record can remain unblemished.

In installations where the Rx is being used, one analyser could be used to monitor the input feed and another analyser could be used to monitor the output feed. If both analysers are running Frame Grab and are setup to capture events, then when something fails the Rx will capture frames before and after the event. This captured video clip can be saved with date and time stamps which along with the Rx Event Log could provide indisputable evidence of your innocence.
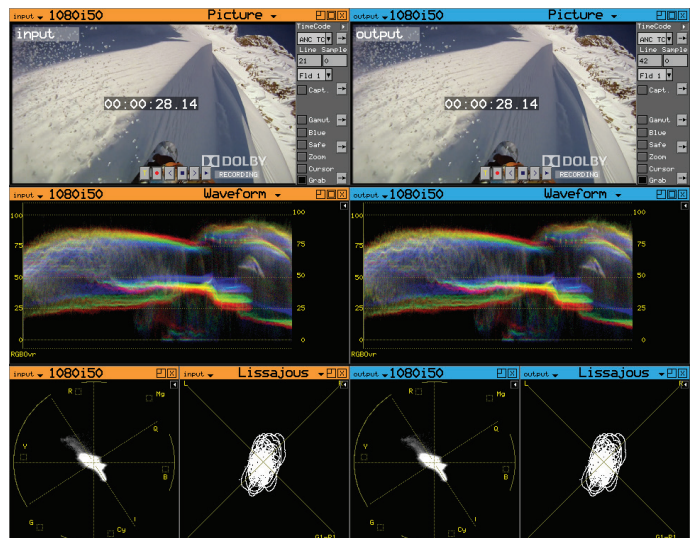

AV Delay Checking

The frame difference between the AV Delay Test pattern and audio tone provided by the Generator module can be checked using the Frame Grab system.

The AV delay check relies on the constant movement of the Clapper board on the AV Delay Test pattern and how far it has moved from the centre of the test pattern with respect to the audio tone.

The AV Delay Test Pattern displayed in the Picture instrument can be compared, frame by frame against the audio tone level displayed on the Meters.
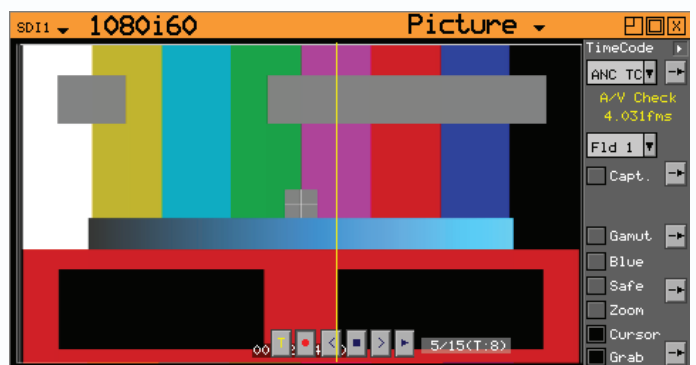
Frame Grab Operation

The Frame Grab controls are displayed by selecting the "Grab" check box in the Picture instrument menu. The arrow box to the right of the "Grab" check box is used to setup triggers and save video clips. When Frame Grab is selected the following transport controls will be displayed:

- T - manual trigger
- ● - start record buffer
- < - step backwards frame by frame.
- ■ - stop playing the captured video clip.
- > - step forwards frame by frame.
- ▸ - play captured video clip repeatedly.

The Frame Grab and Clip Play-out functions are independent but on the AG and AGE modules they share the same buffer for Record and Playback which provide additional benefits.

On an AG module if the Frame Grab record buffer is started, when Frame Grab is selected on the Generator its output will effectively be a synchronized version of the Analyser input but timed to the system reference used by the Generator.

When a video clip is captured or loaded into the Picture instrument it will automatically be routed to the Generator output.
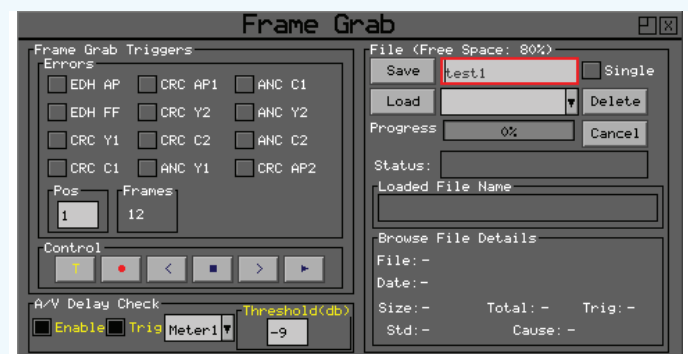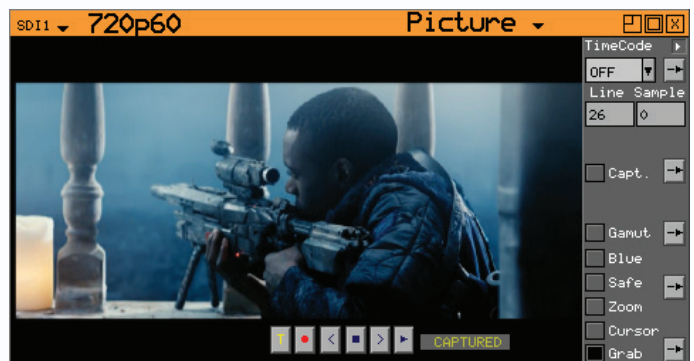
Selecting the < or > buttons when the Record Buffer is running will act as a freeze function. If the Generator (on the same AG module) is set to Frame Grab this will automatically display the frozen frame on the output. Note that the Save – Single function in the Frame Grab setup menu will save the current frozen for future use. This can be used to capture test patterns produced by other devices.

Manual Capture

To manually capture a video clip, select the record button to start the record buffer ("RECORDING") and then press the T button to stop the record buffer ("CAPTURED").

The captured clip can then be played, stepped through frame by frame and saved for later use.

Triggered Capture

To capture a video clip on a trigger event, setup the event to be captured in the setup menu, press the record button to start the record buffer ("RECORDING"). As soon as the trigger event has occurred, "CAPTURED" is displayed to indicate that event has been captured as a video clip. The play, step forward and step backwards buttons can then be used to navigate through the SDI data frames.

The Event Triggers available in the Frame Grab setup window are hardware flags that occur when the Rx detects an error within the SDI data stream. For example the "CRC Y1" flag will be set when the cyclic redundancy check for link 1 luminance data fails.

Typically CRC errors indicate data corruption or SDI link failure and are therefore significant events to capture.

EDH AP – SD-SDI Error Data Handling Active Picture
EDH FF - SD-SDI Error Data Handling Full Field
CRC Y1 – cyclic redundancy check, link 1 luminance
CRC C1 – cyclic redundancy check, link 1 chrominance
CRC Y2 – cyclic redundancy check, link 2 luminance
CRC C2 – cyclic redundancy check, link 2 chrominance

CRC AP1 – cyclic redundancy check, link 1 active pic.
CRC AP2 – cyclic redundancy check, link 2 active pic
ANC Y1 – link 1 luminance ANC checksum error
ANC C1 – link 1 chrominance ANC checksum error
ANC Y2 – link 2 luminance ANC checksum error
ANC C2 – link 2 chrominance ANC checksum error

Saving the Captured Video

The File section of the setup menu allows the current video clip in the record buffer to be saved the Rx file system and allows previously saved video clips to be restored into the record buffer.

Save – saves the current video clip in the record buffer in the "\FCAP" folder using the name entered in the text box to the right of the "Save" button. The "Single" check box, if enabled, will cause on the current frame of the video clip to be saved.

Load – allows a previously saved video clip to be restored in to the record buffer. The drop down list box to the right of the "Load" buttons allows the required video clip to be selected. As video clips are selected in this list, their details will be displayed at the bottom of the menu.

Delete – allows the currently selected video clip in the drop down list to be deleted.

Frame Grab Play-out

Each Generator module within the system can play-out a video clip captured and saved using the Picture Frame Grab function. This can be used to play-out video clips captured manually or when an error condition occurred.

The Frame Grab play-out mode can be enabled by selecting Frame Grab from the test patterns drop down list.

Any .GRB video clip recorded using Frame Grab, and held in the "\FCAP" folder, will appear in the drop down list.

Once a video clip has been selected and loaded the transport controls can be used to play, stop, step forwards and set backwards.

The displayed video clip will be output via the Generator video output connection along with its audio and SMPTE 352 payload.

Note that the Generator video format and frame rate will automatically be set to that of the video clip being played.

Note also that Box and Indent cannot be used when a video clip is selected for play-out.

Analysis of captured video clip

All RX instruments, with the exception of Eye, Jitter and Timing, can be used to analyse the captured SDI data frame, its video data, metadata, audio data and structure.

The Frame Grab transport controls in the Picture instrument allow the captured video clip to be replayed repeatedly or stepped through frame by frame while the instruments are used to check for problems.

As with all Rx instruments errors are displayed in red text so when you step through each frame, the one with the problem will be easy to spot. To help with the detection of the problem, the Frame Grab text field in the Picture instrument will turn red at the trigger frame (ie the frame where Rx detected a problem and the Record buffer was stopped).

Because the captured video clip contains all data and information about the SDI data frame, instruments such as the Data View and Metadata Analyser can be used to inspect the actual data values discrepancies.
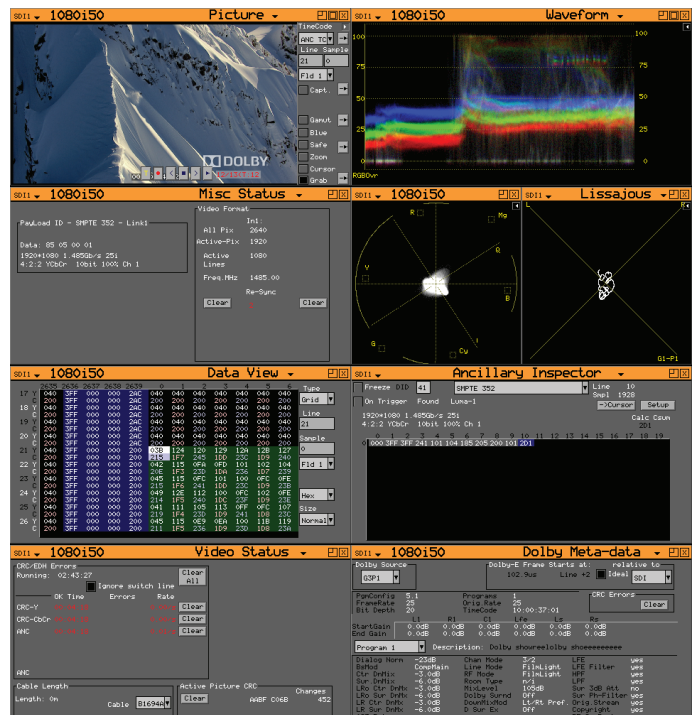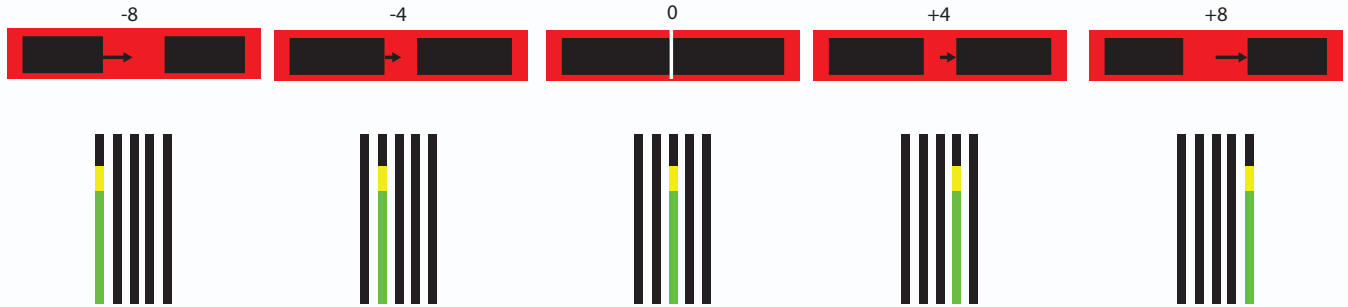
AV Delay Check

The frame difference between the AV Delay Test pattern and audio tone provided by the Generator module can be checked using the Frame Grab system. The AV delay check relies on the constant movement of the Clapper board on the AV Delay Test pattern and how far it has moved from the centre of the test pattern with respect to the audio tone displayed on the Meters.

The movement of the clapper board away from the centre line indicates an audio delay with respect to the video and the movement of the clapper board towards the centre line indicates an audio advance with respect to the video.

Note that the rate of movement of the clapper board is different for each video format (pixels and lines) and frame rate.

Enable the AV Delay Check in the frame grab setup menu, enable the "Trip" check box, select the meter pair where the audio burst is located and set the threshold level (-9dBs by default) to detect when the audio burst reaches its highest level (ie the centre of the audio burst).

Set the Pos value to 1 to ensure the audio burst is captured.
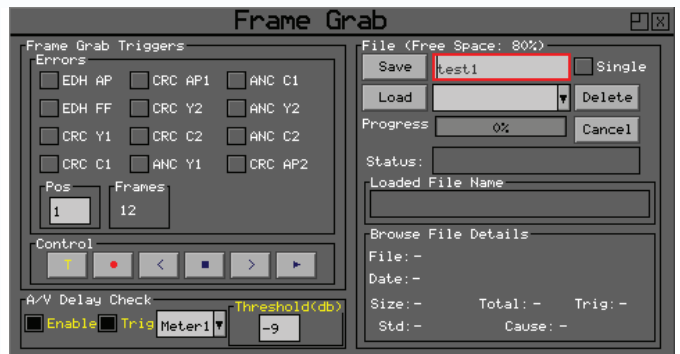
Start the Frame Grab buffer by pressing the red record button.

This should automatically trigger the Frame Grab on the peak level of the AV Delay Audio tone (in this example on Meter 1 which is set to G1P1 of the SDI input). During this process the display will show "Buffering", "Recording" then "Captured".

Once the Capture has occurred, step backwards to the frame with the peak audio level using the < button.

With the "Cursor" check box enabled, place the yellow vertical AV Check Cursor on the edge of the clapper board (red/black edge).

The approximate number frames advance/delay will be displayed.

Note that the AV Check value will be less accurate with large AV Delay offsets. To get more accurate results add or subtract delay using the AV Delay generator.