

Cinema DC2K Half Image Software Implementation

1. Description

The software implementation is a detection solution and does not fix the issue of the half image problem. Because it is not known what causes this half image issue, this detection solution is not guaranteed to correct the problem 100% of the time.

This solution uses the RDRAM current control registers (CCR) to detect an inactive RDRAM. When the RDRAM is functioning normally, these CCR are constantly changing to compensate for voltage and temperature changes in the environment. It is these changes in the CCR that the software uses to determine if the RDRAM is still active.

2. How it works

There are two parts to this implementation.

- 1) Software that runs on each ASIC on all formatters.
- 2) Software that runs on the interface ARM processor.

In the first part, the ASIC reads the RDRAM CCR at a certain interval during a vsync period. If for any reason the RDRAM CCR stop changing for a specified number of repeated times, the software will set a *flag* indicating an inactive RDRAM.

In the second part, the interface ARM processor reads the state of the *flag* for **each** ASIC on all formatters approximately every second and maybe longer if a *flag* bit is set. If the *flag* is set, the rate and repeated threshold are adjusted on **only** the ASIC that the *flag* is set, and then the RDRAM is monitored again for repeated values in the CCR. The rate and repeated threshold are adjustments twice before an initialization on the RDRAM is executed. These adjustments are made incase a certain rate or repeated threshold is

the cause of repeated values in the CCR. If the CCR continue to indicate an inactive RDRAM, the interface ARM processor will send an initialization command **only** to the formatter that has an inactive RDRAM. **The software must initialize both the master and slave RDRAM even if only one or the other has an inactive RDRAM.**

After the initialization is complete, the monitoring continues. If for any reason an RDRAM cannot be successfully recovered after initializing five times, the interface ARM processor will disable the software on **all** the formatters from continuing to monitor the RDRAM's and a message regarding this is logged.

3. System Environment Variable

The implementation is normally disabled and it can be enabled by inserting **ENABLE_RDRAM_HALFIMAGE** into the system.env file. A reset on the projector or by clicking on the Update Page button under the Sys-Status page of the DLP® Cinema Control Program or simply adding or deleting the file from the file-system will enable or disable this function.

Addition environment variables were added to allow configuration of the RDRAM monitoring. Each rate has its repeat pair. All values are in deciaml and located at the end of each environment variable with a space in between.

An attempt is made to reduce a false failure by changing the interval rate and repeat values whenever there is an indication that an RDRAM is inactive. If an RDRAM continues to show inactivity after the two attempts, it is initialized. Setting an interval rate that is very fast may cause artifacts in the image and setting it too large may cause too many repeated values. Therefore, it may require several iterations of different settings to achieve the best results.

RDRAM_HALFIMAGE_READRATE 9

This variable controls the normal running interval rate at which the RDRAM CCR are read. This value has a range of 0 – 127. The interval rate is calculated as: $((\text{This value} * 13) + 50)$ ms. For example: $((9 * 13) + 50) = 167$ ms. The range in milliseconds is 50 – 1701. The default value is 9 if this environment variable is not used. This variable is paired with RDRAM_HALFIMAGE_NORMALREPEAT.

RDRAM_HALFIMAGE_CHANGERATE1 2

This variable controls the interval rate at which the RDRAM CCR are read whenever there is an indicator that an RDRAM is inactive. This is the first attempt to make sure it is not a false failure. On this first attempt, the interval rate is changed to this rate and the RDRAM is monitored again. If the RDRAM continues to indicate inactivity, then the rate is changed a second time using the rate from RDRAM_HALFIMAGE_CHANGERATE2. This rate is calculated the same as RDRAM_HALFIMAGE_READRATE and recommended to be slower or faster than RDRAM_HALFIMAGE_READRATE and RDRAM_HALFIMAGE_CHANGERATE2. The default is 2 if this environment variable is not used. This variable is paired with RDRAM_HALFIMAGE_CHANGEREPEAT1.

RDRAM_HALFIMAGE_CHANGERATE2 11

This variable controls the interval rate at which the RDRAM CCR are read whenever there is an indicator that an RDRAM is inactive. If the first attempt fails, then the interval rate is changed to this rate and the RDRAM is monitored again. This is the second attempt to make sure it is not a false failure. If the RDRAM continues to indicate inactivity, then the RDRAM is initialized and the process starts over. This rate is calculated the same as RDRAM_HALFIMAGE_READRATE and recommended to be slower or faster than RDRAM_HALFIMAGE_READRATE and RDRAM_HALFIMAGE_CHANGERATE1. The default is 11 if this environment variable is not used. This variable is paired with RDRAM_HALFIMAGE_CHANGEREPEAT2.

RDRAM_HALFIMAGE_NORMALREPEAT 6

This variable is the number of repeated CCR values that are allowed before the *flag* is set and indicates the RDRAM is inactive. The default is 6 if this environment variable is not used. This variable is paired with RDRAM_HALFIMAGE_READRATE.

RDRAM_HALFIMAGE_CHANGEREPEAT1 9

This variable is the number of repeated CCR values that are allowed before the *flag* is set and indicates the RDRAM is inactive. The default is 9 if this environment variable is not used. This variable is paired with RDRAM_HALFIMAGE_CHANGERATE1.

RDRAM_HALFIMAGE_CHANGEREPEAT2 5

This variable is the number of repeated CCR values that are allowed before the *flag* is set and indicates the RDRAM is inactive. The default is 5 if this environment variable is not used. This variable is paired with RDRAM_HALFIMAGE_CHANGERATE2.

Whenever the RDRAM CCR is enabled, all environment variables are printed out in the log message as follows:

SysEnv: RHIV 9 2 11 6 9 5

The order from left to right is:

RDRAM_HALFIMAGE_READRATE
RDRAM_HALFIMAGE_CHANGERATE1
RDRAM_HALFIMAGE_CHANGERATE2
RDRAM_HALFIMAGE_NORMALREPEAT
RDRAM_HALFIMAGE_CHANGEREPEAT1
RDRAM_HALFIMAGE_CHANGEREPEAT2

Below is an example of a system.env file:

```
ENABLE_RDRAM_HALFIMAGE
RDRAM_HALFIMAGE_READRATE 9
RDRAM_HALFIMAGE_CHANGERATE1 2
RDRAM_HALFIMAGE_CHANGERATE2 11
RDRAM_HALFIMAGE_NORMALREPEAT 6
RDRAM_HALFIMAGE_CHANGEREPEAT1 9
RDRAM_HALFIMAGE_CHANGEREPEAT2 5
```

NOTE: It is recommended to enable this feature when the projector is running in its normal operation and not when it is to be reset, upgraded, or any system configuration is to be done.

4. Log Messages

There are various messages that are logged when the implementation is running. They can be used to diagnose any issues that may occur during the detection process. Below is a list of a few messages descriptions.

SM0 – Slave Master ASIC on formatter 0



SM1 – Slave Master ASIC on formatter 1

SM2 – Slave Master ASIC on formatter 2

SM means Slave and Master on same formatter.

Formatter 0, 1, 2 is the formatter's I2C address i.e. 0x34, 0x36, or 0x38 and depends on how each is configured.

SM0 10 – 11

In the above example pair of two digits, the slave is the left digit and the master is the right digit.

The first pair of digits on left is the *flag* bits indicating which RDRAM is inactive.

01 – Master RDRAM is inactive. In this case the output will be 1.

10 – Slave RDRAM is inactive

11 – Both Slave and Master RDRAM are inactive

The second pair of digits on right indicates the RDRAM monitoring is enabled and should always be “11” when the implementation is enabled.

An Example of log messages:

2009DEC03 11:23:28 RDRAM Monitor re-enabled on formatter

2009DEC03 11:23:27 RDRAM on formatter initialized!

2009DEC03 11:23:26 RDRAM Monitor disabled on formatter

2009DEC03 11:23:26 Inactive RDRAM 3-times on same formatter!

2009DEC03 11:23:26 SM2 10 - 11

2009DEC03 11:23:26 Slave 2 - RDRAM inactive

2009DEC03 11:23:24 RDRAM interval changed on formatter.

2009DEC03 11:23:24 SM2 10 - 11

2009DEC03 11:23:24 Slave 2 - RDRAM inactive

2009DEC03 11:23:22 RDRAM interval changed on formatter.

2009DEC03 11:23:22 SM2 10 - 11

2009DEC03 11:23:22 Slave 2 - RDRAM inactive

2009DEC03 11:23:15 RDRAM Monitor re-enabled on formatter
2009DEC03 11:23:14 RDRAM on formatter initialized!
2009DEC03 11:23:13 RDRAM Monitor disabled on formatter
2009DEC03 11:23:13 Inactive RDRAM 3-times on same formatter!
2009DEC03 11:23:13 SM2 1 - 11
2009DEC03 11:23:13 Master 2 - RDRAM inactive
2009DEC03 11:23:12 RDRAM interval changed on formatter.
2009DEC03 11:23:11 SM2 1 - 11
2009DEC03 11:23:11 Master 2 - RDRAM inactive
2009DEC03 11:23:10 RDRAM interval changed on formatter.
2009DEC03 11:23:10 SM2 1 - 11
2009DEC03 11:23:10 Master 2 - RDRAM inactive