

Thermal CTP

Thermal Troubleshooting Procedures 3.1

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1. SCOPE

This document describes how to diagnose some problems which may occur with a thermal head. Various problems are described, including hardware failures of various sensors, servos, or components, and nvs parameter configuration problems. If the problem can be fixed directly, a solution is presented, otherwise, the problem should be escalated (through the Response Center) for instructions (please be prepared to provide all details of your diagnosis work, log files, operational context, etc.)

Before following any of the procedures in this document, it is important to first conclusively establish that the problem truly is head related. In some cases, this localization is trivial (for example, the laser will not turn on because of "DTD laser diode over voltage error"), but for many other "microbanding" related problems, the distinction between head and system problems is not clear. In these cases, consult the *Thermal Exposure Head Microbanding Troubleshooting Procedures* to confirm that the rest of the system (preheat oven, processor, etc.) is working properly. Follow those procedures as completely as possible before attempting any of the procedures in this document.

The procedures described in this document are applicable to all Thermal CTP output devices (Trendsetters, Platesetters, and VLFs). However, they do assume that the device uses the following firmware versions (**`list version`**):

- Thermal software version 2.06
- Thermal Head firmware version 1.10 to 1.15.

These procedures may require modifications for machines using different firmware versions.

2. FIRST THINGS TO DO

When trying to troubleshoot a thermal head problem, it is important to acquire a good overall picture of the problems affecting the head and a complete record of the head's configuration BEFORE jumping into diagnosis of specific problems. Try to collect all the information below, regardless of the exact nature of the error/failure. For more information, refer to *1.x Thermal Exposure Head Preventative Maintenance*, 719-00011A, on TechPlanet: http://techplanet.creo.com/output/heads/thermal/nav/maint.htm#pm

2.1 Establishing the Operational Context

- How long has this head been installed on the machine. Was it shipped from the factory with the machine, or was the head installed during a field upgrade?
- What, if any, changes were made recently to the machine (for example, firmware, media, processor, chemistry, plate batch, etc.). Especially note any changes which were coincident with the appearance of the problem/failure.
- What media does the customer use, and what sizes?
- Does the problem occur on all media and plate sizes?
- Is the problem intermittent or continuous?

- Did the problem appear suddenly or gradually?
- In what way is the head behaving abnormally (what are the symptoms)?
- Check the head positioning. Don't think about it, just do it!
- **Follow the procedure in Appendix A of *Thermal Exposure Head Microbanding Troubleshooting Procedures*, 77-0034, to record the present configuration of the machine. Record the results in a log file.** The resulting information will help to localize the problem.

3. USING THIS DOCUMENT

This document is not organized as a series of steps which should be followed in sequence. It is organized into functional sections which are grouped by symptom, head component, or head subsystem (for example, one section describes autofocus problems and another describes EH-PHI cable errors), on a case-by-case basis. After establishing the operational context of the machine and the symptoms of the failure, go through the sections which appear related to the problem. This approach should help in isolating the cause of the failure.

4. CHECKING HEAD POSITIONING

The distance between the drum and a thermal head is adjusted during head installation. Improper head positioning can result in a variety of problems:

1. microbanding
2. autofocus oscillations, or the "snakeskin" artifact visible on processed media
3. incorrect magnification or a swath stitching problem
4. "focus error" at the start of or during plotting

Use the following procedure to verify that the head is positioned correctly on the carriage:

Assumptions:

- optical distance sensor works (for example, **`head install on`** results are meaningful)
- autofocus actuator works
- shutter works
- drum and carriage work
- all doors on the device are closed and no safety interlocks have been tripped

1. Initialize the head parameters and the optical distance sensor:

   ```
   >> reset head
   ```

   ```
   >> focus init
   ```

   Generally, the sum_offset is less than 100. If not, refer to Section 7 to investigate before continuing.

2. Load some unexposed media on the drum (**`mload`** *length*, **`mload bay X`**, or **`pick/load`**, etc., as appropriate for the device in use).

3. Check that the plate thickness **`thk`** accurately describes the plate on the drum (for example, 0.012" plates are 305 microns thick).

   `>> set state plate_loc d thk`

4. Confirm that the active media (Kodak IR, for example) and surface depth are appropriate for the media loaded on the drum:

   `>> mode` (let M = current media number)

   `>> set media M sd` (query sd and adjust if necessary)

   `>> mode media M`

   `>> focus init`

5. Position the drum and carriage so that focus laser hits near the media center (the carriage and drum positions may have to be adjusted for different size engines).

   `>> carriage moveto 22000` (appropriate for a 3244 engine)

   `>> drum move 12000 h`

6. Confirm that the **`head.foffset`** parameter is set to the optimum value determined from a recent focus series. If focus series results are not available, use the saved **`foffset`** value or the **`foffset`** value written on the head's label:

   `>> set head foffset` (query setting and adjust if necessary)

7. Check the head position:

   `>> head install on`

8. If the head is positioned correctly then both of the following conditions will be satisfied:

   s ≈ 1000 (between 800 and 1200 is normal)

   The s value indicates the amount of light returning to the optical distance sensor. If s=0 then the shutter is probably closed (enclosure door open?).

   If 0<s<100 and the shutter is fully open, then the head may be badly out of position, or the **`head.fheadcal`** or **`mediaN.sd`** parameters may be wrong.

   If 100<s<3000, then the error value is dubious but probably believable as a rough guide. If the error value is far from 0, then the head is mis-positioned. If the error value is near zero, then the **`fheadcal`** parameter should be adjusted to make s≈1000.

   If 800<s<1200, then the error value is accurate and believable. If "e" < -100 then the head is too *close* to the media, and if "e" > 100, then the head is too *far* from the media. Before reaching a definitive conclusion, it is best to repeat this test at other drum and carriage positions, because the media may have bulges in places.

NOTE: you can measure the "height profile" of the plate by issuing a **`drum spin 5`** command. Now you can see how the s and e values vary around the drum. The changes in s values will allow you to distinguish samples "on the media" from those "on the drum".

Remember, the focus error and e values are calibrated in 1/3 μm units. For example, if the e value changes by 60 units as a media bulge moves in front of the lens, the bulge is 20 microns high. Thus, it is possible to measure the size of media bulges.

9. Turn off the scrolling output:

   `>> head install off`

4.1 Head Skewed on the Carriage

Even if the head is the correct distance from the media as discussed above, the head may be skewed (rotated about a vertical axis, for example) on the carriage if it was not properly installed (if it is not seated properly in the V-groove, for example). As a result, the image plane of the head will not be parallel to the media surface. It then becomes impossible to position the lens such that all 240 pixels are sharply focused. As the lens-to-media separation is varied, first one end of the swath will be sharply focused, then the middle of the swath, and finally the other end of the swath. Even if the *power* of all 240 pixels are perfectly balanced, the pixels that are out of focus will have a larger *spot size* and, consequently, a lower *power density*. Thus, the power density profile of the beam will change dramatically with lens position─first sloped one way, then weak on both edges, then sloped the opposite way. Because it is the power density that determines the localized heating of the media, the unbalanced *power density* profile means that all the pixels will not write the media equally well and imaging artifacts will appear in the plot (even though the power profile is perfect). Worse yet, the visible artifact will change dramatically with lens position. The head installation document contains a diagram illustrating the appearance of this artifact in a focus series.

Although this problem is subtle, its effect is significant and effectively makes it impossible to balance the head to produce consistent artifact-free plots. The following procedure can be used to check for this problem:

1. Plot a focus series plot so that the center band of the plot will have the "best foffset". For example, to plot a seven band focus series centered on the best foffset of +40, start with foffset = +40 - (7-1)/2 * 50 = -110 (where 50 is the desired step size):

   `>> set hdm 1 wpower P` (where P is about 2 Watts below normal)

   `>> set hdp fmsl 7`

   `>> plot 80 focus -110 50`

2. The middle band of the plot should write the best. Carefully scrutinize the "out of focus" bands to estimate the power density profile of each. In particular, compare symmetrical pairs of bands, one on either side of the best foffset value. If the beam profile seems to reverse slope from one side of the best focus to the other, then the head is skewed.

Remember that the head has a depth of focus of approximately 11 μm and the swath consists of 240 pixels, each 11 μm in size. Consequently, an angular skew of 1 part in 240 (1/240 ≅ 4.2 mRad ≅ 0.25 degrees) between the head and the carriage is significant.

To avoid this problem, it is important that the head is seated properly on the carriage when it is installed and clamped. I find it helpful to use one hand to push down on the head directly above the rod and V-groove as the head is being positioned and clamped. Also, if the `head install on` e value changes significantly as the head is clamped, then the head may be skewed. Every time a head is re-clamped, it is important to check for this problem.

5. LINES VISIBLE IN IMAGE

Symptoms: regularly spaced lines appear throughout the image. The lines are spaced one swath width apart and aligned parallel to the swath boundary. They extend from the leading edge clamp to the trailing edge clamp.

The description above applies to a large class of artifacts which can be caused by an assortment of problems. The subsections below identify various characteristics of these problems, which can help to localize and isolate the root cause. The table provides some sample conclusions based on the observations described in the subsections below. The table does not itemize all possible combinations of observations, but does provide some guidelines.

Possible Causes of a Line of Exposed or Unexposed Media

Line Spliced or Superimposed into/over the image data	**Line at Swath Boundary**	**Pixels Stuck ON/OFF**	**Pixel Stroke Adjustment Broken**	**Escalate to Thermal Head Engineering Group**	**Conclusion**
spliced into	Yes	None	No	No	Magnification wrong. Check head positioning and overall image size.
Superimposed	Either	Stuck ON	No	Yes	Electronically chop pixels and adjust physical beam blockers if failure is near the edge of the swath
Superimposed	Either	Stuck OFF	No	Yes	Electronically chop pixels if failure is near the edge of the swath
N/A	Either	None	Yes	Yes	LVD board damaged. If it causes microbanding head must be swapped or affected pixels could be chopped if the failure is near the edge

5.1 Lines of Exposed or Unexposed Media?

A line of exposed media can be due to a pixel stuck ON. This is an unusual failure which should show up as a stuck pixel (see Section 5.5.1). A line of unexposed media can be due to some type of contamination in the head (a piece of dust on a lens which blocks the write laser, for example).

5.2 Line Spliced into or Superimposed over the Image?

>> mode (let N=active media and X=mode providing highest resolution)

>> set media N escan 0 (temporary change for this test)

>> mode media N

>> mode X (select the plot mode for highest available resolution)

>> plot 50 50 h (plot #1)

>> set mode X ssca 8000

>> set mode X sssa 6000

>> plot 50 50 (plot #2)

Restore the original **escan, ssca**, and **sssa** setting.

Inspect plot #1 carefully. A line artifact can have two different appearances. First, the line can be spliced into the plot pattern. Imagine cutting a black and white chessboard along a line parallel to the board's edge, spreading the two pieces apart along a direction perpendicular to the cut, and filling the resulting gap with a strip of white or black paper. That is how the plot 50 pattern would appear in this case.

Secondly, a line artifact can be superimposed over top of the plot pattern. Imagine taking a black and white chessboard and painting a white or black line across the board, parallel to the board's edge. That is how the plot 50 pattern would appear in this case.

5.3 Count Pixels

The plot 50 checkerboard pattern is made up of 8x8 pixel squares. By counting the squares in plot #2 in the section above, you can determine exactly how many pixels are visible in the plot. Naturally, the result should be equal to the swidth, but if the line is superimposed over the image, fewer pixels will be visible. Pixels that are missing are presumably stuck ON or OFF (which should show up in the stroke profiles, see Section 5.5.3).

5.4 Line within Swath or at Swath Boundary

Use the following procedure to locate the line in the swath:

>> set media N escan 0 (temporary change for this test).

Select the plot mode (number "X" below) using a resolution equal to the head. resolution (e.g. 2400 dpi plot mode on a 2400 dpi thermal head).

>> mode X

>> set gc ssca 10000

```
>> plot 50 50
```

Restore the original **ssca** and **escan** settings.

By setting ssca to +10000, we purposely introduce a swidth/100 pixel wide gap between successive swaths in the image, which splices a line of unexposed media between successive swaths in the image. Thus we know exactly where each swath begins and ends on the plate and we can determine the location of the problem line within the swath. Notice that if the problem line is a line of unexposed (really weak) pixels on the swath boundary, then only a single line will be visible in the image. Otherwise, you should see two lines. By careful examination with a magnifier you should be able to distinguish between the line we have created and the problem line we are trying to diagnose.

5.5 Stuck Pixels

Individual pixels or pixel pairs can be affected by failures on the LV or LVD board. It is important to distinguish between two different types of failures because they are similar in many aspects but very different in cause and prognosis. Refer to: *Adjusting the Beam Blockers Technical Bulletin*, 719-00025A: http://techplanet.creo.com/output/heads/thermal/nav/proced.htm#calibration

Diagnosing Pixel Problems

The stuck pixel and broken **stroke** adjustment problem can be differentiated as follows:

1. If possible, run the **STROKECAL.SPT SPLOT** script. Otherwise, manually record the output from the following commands:

```
>> shutter close
>> laser on
>> stroke init 33
>> stroke profile
>> stroke init 1
>> stroke profile
>> stroke cal
>> stroke profile
>> stroke
>> laser off
```

2. Extract the data from the log file and graph the three **stroke profiles** on a single graph (it is probably easier to diagnose the problem by looking at a graph than at a table of numbers).

If a pixel is stuck ON or OFF, then a sharp dip should be visible in the **stroke profiles**. **Stroke profile** measures the power of PAIRS of pixels. Thus, if both pixels of a single pair are stuck ON or OFF (in any of the four possible combinations), then **stroke profile** will report a value near 0 for this pixel pair. However, if only one of the two pixels or a pair are stuck ON or OFF, then the power reported by this pair will only be reduced by half. It is possible for pixels to be partially stuck ON or OFF, so the effect can be subtle.

If you suspect that a pixel is stuck ON or OFF but it is hard to tell conclusively from the **stroke profile**, you can manually measure the power of individual pixels as follows:

For example, to individually measure the power of pixels 100 through 103, use the following command sequence:

>> shutter close

>> laser on

>> spot 100 1 (turn ON 1 pixel starting with pixel #100)

>> head power pulse (measure power of pixels)

>> spot 101 1 (…turned on with **spot** command)

>> head power pulse

>> spot 102 1

>> head power pulse

>> spot 103 1

>> head power pulse

>> laser off

If the power reading for one pixel is significantly lower than the average power level of its neighbours, then we have strong evidence of a pixel is stuck ON or OFF.

If a pixel pair has a broken stroke adjustment, then the **stroke init 33**, **stroke profile** should look normal, but the power reported in the **stroke init 1** and **stroke cal**, **stroke profiles** for the affected pixel will be nearly the same power as the **stroke init 33**, **stroke profile** (for example, the power of the pixel pair is the same regardless of the **stroke** value setting). This effect is easiest to see if the three **stroke profiles** are plotted together on a single graph (**strokecal.spt** does this automatically).

Furthermore, if a pixel pair has a broken stroke adjustment, then usually the **stroke** value for that pixel pair will be 1. The **stroke cal** algorithm tries to weaken the pixel pair to balance the beam. However, changing the **stroke** value has no affect on the pixel power because of the LVD failure, so the algorithm continues decreasing the **stroke** value until 1 is reached. If a pixel pair exhibits both symptoms, then we have strong evidence of LVD board failure.

6. WRITE LASER DIODE PROBLEMS

The write laser diode can be checked for proper operation as follows:

```
>> shutter close
>> laser off
>> laser
```

1. The write laser diode temperature should be below 20°C, the current should be zero, and the laser power reported should be near 0.0 W. The laser status should be OFF. If it is "disabled", then issue a **`set head wenable 1`** command to enable the laser.

   If the write laser temperature on a 1.0 TEH is reported as 8°C, then the 24 volt supply to the head is disabled. In this case, **`head status dtd`** will indicate "DTD reset asserted." Issue a **`laser off`** command and the MPE will attempt to turn on the 24 V supply. Do not continue until you can get the 24 V supply to turn on. A 1.7x TEH will report a similar error, except it has a 48 volt power supply.

2. Issue a **`head sample bp`** command to query the beam position sensors. With the laser off, both sensors should report values near zero, but values of 30 or 40 are not uncommon due to sensor offsets.

3. Issue a **`head power`** command to query the beam balance sensor. The return value should be near zero with the laser off.

4. Issue a **`head mask`** command. Two error flags may be asserted ("LV 24V or High voltage fault" and "LV 24V not in range"), but no others. Similarly, no error flags should be masked off (for example, no asterisks should be visible). If other flags are asserted, then investigate these problems before continuing.

5. Turn on the laser to a fixed laser current:

   ```
   >> laser current 26
   >> head bp on
   ```

6. Issue a **`laser command`**. The "power" should be similar to the "setpoint power" although they may differ by a few watts. Success here indicates that the laser is ON and laser power is reaching the laser power sensor.

7. If a "DTD board reset asserted" error occurs when trying to turn on the laser, then the 24 volt (1.0 TEH) or 48 volt (1.7x) supply to the head is not enabled. Check the laser safety interlocks (one of them may be open).

8. Issue a **`head sample bp`** command to query the two beam position sensors. Both sensors should report large values, between 300 and 1500. Appropriate values here indicate that the write laser is reaching the beam position sensors located in front of the light valve.

9. Issue a **`spot off`** and `head power` command to query the beam balance sensor for a measurement of the laser power emerging from the head. With **`spot off`**, the output is often 1000 or more. An appropriate reading here indicates that the write laser is passing through the

light valve and final lens to reach the beam balance sensor. Provided the shutter opens, the laser should also reach the media.

10. Issue a **`head power full`** command to turn ON all 240 pixels and query the beam balance sensor for a power measurement. The result is usually between 1000 and 3500. If the sensors reads 0 or 4095, then the head parameter **`hpwrgain`** is set wrong (decrease **`hpwrgain`** if the sensor reads 4095 and increase it if it reads 0).

11. Issue a **`stroke profile`** command. The values reported should be about 500±50, provided an appropriate amount of laser power is reaching the beam balance sensor AND the beam is aligned to the light valve so the light valve can turn the pixels on and off.

7. AUTOFOCUS CONTROL SYSTEM

7.1 "focus error detected at X inches…" what to do?

Issue the following commands to collect more information on the failure:

`>> set sys vb 1`

`>> set head vb 1` (enable diagnostic value display)

`>> plot 80`

If the "focus error" error is generated while the autofocus is learning (before the "ready to begin imaging" message, for example), then investigate the following potential causes for the problem:

- ***Check the head position on the carriage***: see Section 4.
- ***Confirm that focus init is working okay***: see Section 7.
- ***EH/LC-BP cable***: the majority of these errors involve this cable. It runs between the Exposure Head DB-9 connector on the MPE cardcage backplane (J28 Exposure Head PH-BP connector on 17-0730C-A backplane) and a DB-9 connector on the head's PD (J9 on 17-0889B-D). Two signals are carried by this cable from the MPE to the head, to turn the autofocus on and off. This cable does NOT include hardware cable detect. The newer firmware is able to detect a missing cable via a timeout applied to one of the two timing signals (head firmware >= 1.15?), but if there is any doubt, check the cable thoroughly.
- ***Autofocus training off the plate***: If the edge detect is not working correctly, the plate is loaded crooked, or the subscan shift is adjusted incorrectly (the image registration is wrong), then the focus laser might "fall off" the plate as it tries to learn the drum profile at the beginning of the plot. If this is the problem, it should disappear by shifting the image in the subscan direction (for example, **`set mode N sssa 2000`**, 1<=N<=10). This problem could also be caused if edge detect was disabled (edge detect should always be enabled with **`set mode N edge 1`**). Fix the problem by correcting the plate loading or troubleshooting the edge detect. If there is an image registration problem, always check that the edge detect is working properly before adjusting the mainscan and subscan shifts.
- ***Autofocus turning on and off at the wrong time***: confirm that the plate size (**`state bay X msz`**, **`state bay X ssz`**, **`state plate_loc d msz`**, and **`ssz`**), the main scan image size (**`mode X mis`**), and the main scan shift (**`gc.mss, gc.mssa, gc.sss, hdp.mssa, mode X mssa, mode X sssa`**) are all set correctly for the media in use. If not, the autofocus control

system may try to autofocus while the focus laser is off the media (which is probably enough to thoroughly confuse it). ***WARNING***: the main scan and sub-scan shifts are adjusted during final ATP of thermal machines in Vancouver to guarantee that the image is correctly positioned on the plate relative to its edges and they should not be adjusted in the field without careful elimination of the other possible causes of image shift. The only exception to this rule is upgrade or replacement heads installed in the field where, obviously, the head could not go through final ATP with its device because it is already in the field.

- ***Shutter problems***: the shutter may not be opening and closing correctly. See Section 9.

If the focus errors occur while the head is plotting the image (after the "Ready to begin imaging" message, for example), then investigate the following potential problems:

1. ***media profile problems***: the media may not be flat due to drum runout, loading/clamping problems, or kinks/bends/folds/dings in the media. The autofocus has limited ability to compensate for large bumps or bumps with particularly fast features. Each time the autofocus control system samples the focus error, it is compared to the error threshold (**`head.fthresh`**). If the focus error exceeds **`fthresh`** for at least **`head.ferrdur`** sample periods, then the swath is tagged as a "bad swath" and a focus error occurs.

2. ***Noisy or missing timing signals***: corrupted or noisy "imaging" or "newline" signals could corrupt the ability of the autofocus to turn on and off as the drum spins. Check the 9-pin ribbon cable connected to the DB-9 connector on the PD board as described above.

3. ***Shutter problems***: the shutter may not be opening and closing correctly. See Section 9. Proper shutter operation is particularly important during plots which require a retrace since the autofocus must turn off and on as the shutter closes and opens.

4. ***media surface contamination***: Any scratches, gum, or other foreign material on the surface of the plate could conceivably interfere with autofocus operation.

The hard part about fixing focus errors during imaging is identifying which of these events triggers the error. The procedure below may help diagnose the problem:

1. Set **`head.fthresh=0`** to disable error reporting for conditions 1 and 3 above. If the error still occurs with **`fthresh=0`**, then the problem is with the timing signal and the ribbon cable should be inspected. *Restore* **`fthresh`** *to the default value*.

2. If the error does not occur with **`fthresh=0`**, then the problem may be the shutter or the plate loading. Tape the shutter open while being careful not to touch the lens. If the error disappears, then the problem is the shutter. Remove the tape from the shutter.

3. By default, the error is likely the media profile. Inspect the back of the plates for folds, kinks, or bends. Check that the LEC and TEC grip the plates without excessive bulges. Inspect the drum and clamps for foreign material.

If the "focus error" errors occur at the end of the plot, then most likely the sub-scan size of the plate or the sub-scan shift adjust are incorrect (check the **`media x ssz`**, **`state plate_loc d ssz`**, **`gc ssa`**, **`mode N sssa`**, and **`head sssa`** parameters). When the autofocus nears the end of the plate, it automatically switches into a "hold mode" in which it follows the same profile for the last few swaths on the plate. If the plate size is wrong, the timing of this transition will be incorrect.

Also, make sure that **fthresh** is not too small. Focus learning quits if the summed error is more than this value.

You can also try **fmode 4** a combination of **fmode 0** (learning) and **fmode 3** (real time control).

8. EDGE DETECT PROBLEMS

Refer to the following TechPlanet web page for device-specific information:
http://techplanet.creo.com/output/heads/thermal/nav/troubles.htm

The thermal head uses the autofocus optical distance sensor (specifically, the sum value, or "s") to find the edge of the plate. The plate edge is "found" where the sum value exceeds the "edge detect threshold", which is derived from the head parameters **onthresh** and **offthresh**. The media surface reflectivities, **media N sr,** must be properly configured for consistent and accurate edge detection. Because there is only one edge detect threshold which applies to all media (all **hdm** and **media** configurations), the **media N sr** values must be carefully selected to provide approximately equal sum values for all media in use. This requirement is especially important for multi-media machines because the media reflectivities can vary greatly and the sensor s values will only be equal for all media if the sr values are properly adjusted to compensate for this variation.

Some other nvs parameters are also important for edge detection. The drum parameter **epos** controls the drum position used during edge detect and the carriage parameter **cph** is used with the sub-scan plate size to determine the edge detect starting location. The **mode N edge** parameter enables or disables edge detect and should always be set to 1 to enable edge detect.

Problems with the edge detect can be diagnosed as follows:

1. Are the edge detect problems limited to a single media type or plot mode? Any such correlation is strong evidence for incorrect **media** or **mode** nvs parameter setting(s). Are the plate bays properly configured to select the correct media type for their physical contents?

2. The nvs parameters listed below affect edge detect. Check the machine and confirm that they are reasonable. Compare them to the head's factory nvs settings and fix any unaccountable changes.

NVS Module	Parameter	Relevance for Edge Detect
drum	epos	drum position used during edge detect
mode N	edge	always set to 1 to enable edge detect for customer work
media M	sr	optimized for a head install on "s" value near 1000 on the media, for all media used by the customer
head	onthresh	affects edge detect threshold
head	offthresh	affects edge detect threshold
carriage	cph	affects the starting carriage position for edge detect
state plate_loc d	thk	must accurately describe the media on the drum
state plate_loc d	ssz	affects the starting carriage position for edge detect and must accurately describe the media on the drum
workstation plate sizes	x,y, and thickness	must accurately describe the physical dimensions of the media the customer uses

3. Load a plate onto the drum and set up as follows:

   >> carriage home

   >> reset

   >> laser off

   >> set head wenable 0

   >> nvs save head

   >> focus init

   >> mode (note the active plot mode and media)

   >> set mode X edge 1 (where X is the currently active mode)

4. Open the side panel on the CTP device and disable the safety interlock on the door (always ensure the laser is disabled before doing so). You should be able to see where the autofocus beam is hitting the edge strip, drum, or plate (if the shutter was open).

5. Issue a **plot edge cal** command to move the drum and carriage to where the head would start the edge detect. If the **set state plate_loc d** plate sizes and **carriage cph** parameters are adjusted correctly, then the autofocus beam should hit the middle of the edge strip within 2 mm of the plate edge.

   >> head install on

   >> set head offthresh (query value)

6. The focus laser beam should strike the center of the edge detect strip (adjust the **drum.epos** parameter if the drum position is wrong). The s value streaming on the diagnostic monitor should be roughly equal to the **offthresh** value noted earlier. If the offthresh value is wrong, reinitialize it as follows:

   >> head install off

   >> plot edge cal off

Do NOT adjust the **offthresh** manually using a **set head offthresh** command.

Note: sometimes the MPE outputs an obscure error message ("value out of range error") in response to **plot** or **plot edge cal XXXX** commands. If this happens, check that the media thickness is defined correctly in the **set media X** and **set state plate_loc d** parameters. A similar problem can occur if the workstation media thickness is set to zero.

7. Move the carriage so that the focus beam strikes the plate about 1 inch from the edge:

   >> carriage (check the current position)

   >> carriage moveto XXXX (move over a few inches)

   >> set head onthresh (query value)

   >> head install on

8. The s value streaming on the diagnostic monitor should be approximately equal to the **onthresh** value recorded earlier. If there is a discrepancy of more than 10% in the values, issue a **shutter close** command and carefully inspect how the plate is clamped on the drum. Sometimes the corner of the plate under the LEC at the home end of the plate is not clamped

underneath the LEC as it should be. Often when the plate is not held properly, the edge detect fails. If necessary, adjust the onthresh value as follows:

```
>> head install off
>> plot edge cal on
```

Note: Do NOT adjust the **onthresh** parameter directly with **set head onthresh XXXX** commands.

9. If the s, d, and e values are still streaming up the diagnostic monitor:

   ```
   >> head install off
   ```

10. Now that the edge detect is recalibrated, issue a **plot edge cal cph** command to readjust the cph parameter according to where the plate is loaded on the drum. Issue a **plot edge cal** command. The autofocus beam should be within 2 mm of the edge of the plate. If not, then try manually adjusting the **mode X cph** parameters until the **plot edge cal** command brings the autofocus beam within 2 mm of the leading edge clamp.

11. Enable the laser safety interlock on the enclosure doors and close any open doors.

12. If you have adjusted the **onthresh**, **offthresh**, **epos**, or **cph** values in this procedure, then save the new settings:

    ```
    >> set head wenable 1
    >> nvs save head
    >> nvs save carriage
    >> nvs save drum
    ```

13. Issue a **plot edge** command to attempt an edge detect. If it fails, investigate the following potential problems:

    - ***dirty edge detect strip***: the edge strip should be a black anodized strip free of scratches and dust. Clean the strip, or swap it with the one at the away end of the drum if the problem persists.
    - ***autofocus optical distance sensor problems***: test the sensor to ensure it is working properly.
    - ***plate problem***: try using another plate—there could be something wrong with the plate (rough edge, damaged emulsion, etc.).

9. SHUTTER PROBLEMS

Refer to *Thermal Head 1/1.7 Shutter Sensor Cleaning or Replacing Procedure*, 05-0165, and *Thermal Head 1.x Lens Cleaning Instructions*, 77-0125, for more information.

The shutter is used to block the write laser for laser safety and also to hold the beam balance sensor in the write laser beam. There are a few different ways to check whether or not the shutter is working:

1. ***Listen***: Issue a few **shutter open** and **shutter close** commands while listening. The shutter makes some noise when it closes, which you should be able to hear through the door.

2. ***Beam power sensor***: Issue the following commands:

   >> shutter close

   >> laser off

   - Issue a **head power** command and record the value returned.

     >> laser on

     >> spot off

     >> head power

   - Issue a **head power** command. The sensor output should be much greater than previously observed. If the sensor value is the same as when the laser was off, then the shutter may be stuck open. Check the power transistors on the head's PD board as described below.
   - Issue a **shutter open** and **head power** command. The value returned should be the same as that observed previously with the write laser off. If not, the shutter is probably not opening properly.

3. ***Asynchronous plot***: Issue a `plot XX synch` plot after setting up the `sys.asp` and `sys.ast` parameters appropriately. If the shutter is opening and closing properly there should be no imaging artifacts visible in the plot.

   >> set sys asp 1

   >> set sys ast 2

   >> plot 50 synch 100

4. ***Watch the shutter open and close***: It is possible to observe the shutter opening and closing, but to do so it is necessary to disable the laser safety interlocks on the door to the enclosure. Consequently, it is important to disable the write laser first. Issue these commands to set up for the test:

   >> reset head

   >> set head wenable 0

   >> nvs save head

   >> laser off

   >> shutter close

   - Open the side door of the CTP and disable the laser safety interlock once the laser is disabled. Issue **shutter open** and **shutter close** commands and check that the shutter opens an closes correctly. **When finished, enable the hardware laser safety interlock**.

5. ***Shutter reflection interfering with optical sensor***: When the shutter is closed it reflects the autofocus laser back into the head. In some lens positions this reflected light can interfere with the ability of the HC board to detect shutter closures during retrace plots (which can result in "focus errors"). The following procedure can be used to diagnose this problem:

   >> set head flpos -600

   >> set hdp fcp 0

```
>> set hdp fdp 0

>> focus init

>> set head flpos -500

>> focus init (etc.)
```

By continuing in this way, a table of **sum_offset** versus **flpos** can be constructed over the interval -600 < **flpos** < +600. Issue a **reset head** command after the test to restore the original parameter settings. Issue a **set head** command and record the **onthresh** and **offthresh** values. If the following condition is true for any **flpos** settings in the interval, then the head may have this problem:

Sum_offset > offthresh + (onthresh - offthresh ÷ 4)

Contact Burnaby for further instructions if this is the problem.

10. REPLACEMENT AND UPGRADE HEADS

Replacement and upgrade heads present a unique set of circumstances and problems to the field service engineer.

10.1 Image location

The location on the media of the imaging pixels and autofocus laser beam relative to the head will vary from head to head. Consequently, if a new head is installed on an engine during an upgrade or field replacement, the image may be shifted on the plate. The image shift parameters (**hdp.sssa**, **mode X.mssa**, **mode X.sssa**, **gc.mssa**, **gc.sss**, **gc.mss**) may have to be adjusted to reposition the image on the plate accurately relative to the edges of the plate. Until this is accomplished, there may be some problems with autofocus training at the beginning of the plot ("focus error", for example).

10.2 Image scaling

It should *not* be necessary to change the mainscan or subscan scaling parameters if a new head is installed on an engine during a field upgrade or field replacement, because the pixel size is adjusted at the factory to ensure that such corrections are not necessary. However, there is coupling between head position on the carriage and the magnification. That is, if the head is mis-positioned on the carriage, then the pixel size will be affected and a magnification problem will be visible on the plate. Consequently, if a magnification artifact is visible on the plate, the head positioning should be checked.

10.3 Head Tilt

The carriage dimensions may vary slightly from engine to engine. Changes in the height of the tilt adjustment pad on the carriage will result in tilt errors in the plot. This should not be a significant problem that affects the plot quality in a significant way, but it some extreme cases it may be necessary to move the head's tilt adjuster slightly to level the swath. The horizontal line (3 on, 3 off) patterns in a plot 1 image are good for checking for tilt errors.

11. EH-PHI CABLE ERROR OR HOTLINK FAULT

The EH-PHI or “hotlink” cable is an RG-58 coaxial cable with SMA connectors on both ends which carries all the imaging data from the PHI board in the MPE cardcage to the LVD board in the head. On the Platesetters, a few cables are connected end-to-end to provide the overall connection:

1. PHI board to "scan amplifier jumper"
2. "scan amplifier jumper" to the head via the cable track
3. cable track cable to the short extension cable on the head
4. extension cable to bulkhead connector on the head (only present on older heads)
5. bulkhead connector to the LVD board (inside the head)

The Trendsetter cabling may be slightly different (they may not have the "scan amplifier jumper").

The "Hotlink" receiver IC on the head's LVD board generates an error signal if it cannot detect valid data (for example, if it detects framing errors or a missing clock signal). Older versions of MPE firmware (Platesetter/ Trendsetter v1.6B or earlier) report this error as a “Hotlink Fault”, while newer versions (Platesetter/ Trendsetter versions newer than 1.6B or all VLF firmware), report it as a “EH-PHI Cable Error”. When this error occurs, it means the imaging data is not getting from the PHI board to the LVD board and the head will NOT be able to plot SCSI or test (TPG) images (or it may plot the images with numerous bit errors in the data). There are four potential sources for the problem:

1. The PHI or FDPE board does not output the data correctly.
2. A bad RF connection in the cables connecting from the PHI or FDPE board to the head.
3. A bad connection on the data cable inside the head.
4. A problem on the LVD board.

Problems 3 and 4 cannot be fixed without returning the head to Creo.

Issuing a **`head mask on 20`** command will stop the MPE from displaying the error message, but it does nothing to fix the underlying problem causing the error condition. The best way to debug and fix the problem is to enable the error reporting with a **`head mask off 20`** command and inspect all coaxial cables from the PHI board to the head to ensure a good connection. The MPE command **`head test lvd X`** (where X is the desired length of the test in seconds) can be used to test the data link. This command reports a pass/fail result. If there is a clear deficiency and the error message goes away when it is fixed, then one can be reasonably confident the problem was fixed. If the error message just goes away for no apparent reason, then the problem is likely a nasty intermittent connection problem (in which case it may be prudent to replace all the "hotlink" coax cables in the machine).

The cables can be inspected as follows:

1. Make sure all connectors are tight, with no sharp bends or kinks in the cable which might indicate a broken conductor. This cable operates at 320 MHz, so it does not take much of a kink, break, or discontinuity in the inner conductor or dielectric material to degrade the connection’s bit error rate.

2. There is a short extension cable permanently connected to the bulkhead connector on many older heads. It can be bypassed by connecting the "hotlink" cable in the cable track directly to the head. If this fixes the problem, then there is likely a break/bad connection in the extension cable. The machine can operate without the extension cable in place PROVIDED there is no mechanical stress on the coaxial cable (the cable track coaxial cable must be long enough to connect to the head with a gentle bend without stressing the connector or cable).

3. If none of the above help, then bypass the coaxial cable in the machine with a long coaxial cable routed outside the machine from the PHI board to the head. If the exterior cable works, then something is wrong with cables in the machine and they must be replaced.