

Thermal 2 Exposure Head

Thermal 2 Firmware Version 1.02 Release Notes

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Revision History

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1. HOW TO USE THIS DOCUMENT

This document provides specific information applicable to Thermal 2 firmware version 1.02 and general information applicable to Thermal 2 exposure heads installed on CTP machines. Note that this document will not provide specific information about any CTP machines.

The formatting conventions used in this document are as follows:

- All references to monitor commands are in **bold**. Note that monitor commands intended for the exposure head may be preceeded by the "TH2 >" prompt and monitor commands intended for the CTP machine may be preceeded by the ">>" prompt.
- All references to NVS parameters are in *italics*.
- All references to scripts are underlined.

2. LASER SAFETY PRACTICES

To use this document, the user **must** have attended an exposure head introductory course given either by the service-training department, the product specialist or the engineering support team and is therefore familiar with the safety precautions when working with a CTP machine.

DANGER: Never operate the CTP machine with the write laser beam on and a door open. Do not use the service bypass jigs to bypass the door interlocks.

3. RELATED DOCUMENTS AND WEBSITES

- Thermal 2 TechPlanet site: http://techplanet.creo.com/output/heads/thermal_2/nav/index.htm
- Thermal 2 Firmware site on TechPlanet: http://techplanet.creo.com/firmware/CTP/Head/Thermal2/versions.htm
- Thermal 2 Control-Settings page: http://techplanet.creo.com/output/heads/thermal_2/nav/control-set.htm
- Thermal 2 Troubleshooting: http://techplanet.creo.com/output/heads/thermal_2/nav/troubles.htm

4. PRELIMINARY CHECKLIST (COMPLETE BEFORE YOU BEGIN!)

Before beginning the upgrade of the exposure head firmware, complete the following preliminary checklist:

☐	1. Verify the state of the CTP machine. If the CTP machine isn't functioning correctly before upgrading the exposure head firmware, it is unlikely that the CTP machine will function correctly after upgrading the exposure head firmware.
☐	2. Verify the hardware version of the exposure head using the following monitor commands: >> **redirect pass** >> **th2 "ver"** If the "Control board" is less than 2, a hardware upgrade of the exposure head is required before the exposure head firmware can be upgraded.
☐	3. Determine if an upgrade of the CTP machine is required. Note that an upgrade of the CTP machine is <u>not</u> required to upgrade the exposure head firmware. However, an upgrade of the CTP machine may be required to take advantage of the new functionality of the exposure head.
☐	4. Ensure the following files are available: • Thermal 2 firmware version 1.02 (th2fmw102.hex and/or th2fmw102.bin).
☐	5. Ensure the following applications are <u>not</u> running: • Allegro • Print Console • Prinergy

5. UPGRADE PROCEDURE

Perform the firmware upgrade of the exposure head using the following procedure:

1. Generate baseline plots "plot 1" and "inchgrid.ps" on the CTP machine. A comparison of plots generated before and after the upgrade will aid in resolving any issues regarding image quality, geometric correction and geometric positioning of the exposure head.
2. Verify the baseline NVS parameters on the exposure head using the following monitor commands:
   >> **redirect enable** wait for "Redirect Mode=Enable"
   TH2 > **prm diff**
3. Save the baseline NVS parameters on the exposure head using the following monitor command:
   TH2 > **prm save**

4. Save a readable version of the NVS parameters on the exposure head using the monitor command:
   TH2 > **prm dump**

   Note: See Appendix D : Backing Up and Restoring NVS Parameters for further information.
5. If the terminal program is Splot or Procomm Plus, download the serial bootloader from the CTP machine to the exposure head using the following monitor commands:

TH2 > **redirect disable**	wait for "Redirect Mode=Disable"
>> **set head type 3**	no wait required, ignore any errors
>> **head program**	wait for "exposure head coming online (programming mode)", may require sixty seconds
>> **head boot**	wait for "EH Boot command (3) Complete", requires two minutes
>> **fload head code**	wait for "Begin ASCII transfer now ...", requires fifteen seconds

   Initiate the firmware download to the exposure head using the following terminal commands:

Splot	**Procomm Plus**
Select "Term", "Upload File"	Select "Data", "Send File"
Select "Text Files" as file type	Navigate to th2fmw102.hex
Navigate to th2fmw102.hex	

6. Load the exposure head firmware using the following monitor command:
   >> **head end**

   See Appendix A : Terminal Program Setup, Appendix C : Downloading Firmware and the CTP machine documentation for further information.
7. If the terminal program is Service Shell, initiate the firmware download to the exposure head using the following terminal commands: at the command prompt, enter "download <path>\th2fmw102.bin"

   See Appendix A : Terminal Program Setup, Appendix C : Downloading Firmware and the CTP machine documentation for further information.

Note: The exposure head will automatically upgrade the NVS parameters when the firmware initializes for the first time.

8. Generate plots "plot 1" and "inchgrid.ps". The quality of the "plot 1" and the geometric correction and geometric positioning of the "inchgrid.ps" should be unaffected.
9. After verifying the state of the CTP machine, save the baseline NVS parameters on the exposure head using the monitor command:
   TH2 > **prm save**

   See Appendix D : Backing Up and Restoring NVS Parameters for further information.

6. DOWNGRADE PROCEDURE

It is never recommended to downgrade exposure head firmware. Newer versions of exposure head firmware include new algorithms, improved algorithms, bug fixes and support for newer versions of hardware.

Note that the original firmware version of the exposure head should be treated as the minimum firmware version for that exposure head. Exposure heads shipped from the factory have been integrated with specific versions of exposure head firmware. The firmware will ensure that all algorithms and NVS parameters are upgraded appropriately but the firmware cannot ensure that all algorithms and NVS parameters are downgraded appropriately.

If the user still wishes to downgrade exposure head firmware, it is acceptable to downgrade exposure head firmware to the previously installed version. Perform the firmware downgrade of the exposure head using the following procedure:

1. **If the terminal program is Splot or Procomm Plus**, download the serial bootloader from the CTP machine to the exposure head using the following monitor commands:

TH2 > **redirect disable**	wait for "Redirect Mode=Disable"
>> **set head type 3**	no wait required, ignore any errors
>> **head program**	wait for "exposure head coming online (programming mode)", may require sixty seconds
>> **head boot**	wait for "EH Boot command (3) Complete", requires two minutes
>> **fload head code**	wait for "Begin ASCII transfer now ...", requires fifteen seconds

2. Initiate the firmware download to the exposure head using the following terminal commands:

Splot	**Procomm Plus**
Select "Term", "Upload File"	Select "Data", "Send File"
Select "Text Files" as file type	Navigate to the previous version
Navigate to the previous version	

3. Load the exposure head firmware using the following monitor command:
   >> **head end**
   See Appendix A : Terminal Program Setup, Appendix C : Downloading Firmware and the CTP machine documentation for further information.

4. **If the terminal program is Service Shell**, initiate the firmware download to the exposure head using the following terminal commands: at the command prompt, enter "download <path>\<previous file>"

See Appendix A : Terminal Program Setup, Appendix C : Downloading Firmware and the CTP machine documentation for further information.

5. Save a readable version of the NVS parameters on the exposure head using the monitor command:
   TH2 > **prm dump**
   See Appendix D : Backing Up and Restoring NVS Parameters for further information.
6. Verify that there are no differences between the readable versions of the NVS parameters generated in section 5 step #4 and section 6 step #3.

7. ADDITIONAL FUNCTIONALITY

The following additional functionality has been implemented/modified in Thermal 2 firmware version 1.02 (as compared to Thermal 2 firmware version 1.01h).

7.1. Implement the Creo Exposure Head (CEH) Interface (No PR)

The original MPE/Thermal 1.0/1.7x implemented an interface that was specific to Thermal 1.0/1.7x. However the MPE/Thermal 1.0/1.7x interface was undocumented and difficult to maintain.

Initially Thermal 2 provided a Thermal 1.0/1.7x compatible (H1C) interface that simulated a Thermal 1.0/1.7x. Thermal 2 now provides a Creo Exposure Head (CEH) interface that is intended to provide a documented, easily maintainable interface that can be supported by all exposure heads. Note that Thermal 2 will support both the Thermal 1.0/1.7x compatible (H1C) and Creo Exposure Head (CEH) interfaces.

For this reason, the names of the firmware files have been changed from th2***h***xxx.xxx to th2***c***xxx.xxx.

7.2. Implement Support for Additional Focus Startup Sequences (No PR)

When imaging to the plate edge, the plate 'curl' may exceed the auto-focus sub-scan bandwidth. The auto-focus startup sequence is an attempt to compensate for this plate edge curl by extrapolating from the data gathered during the CEH_FOCUS_LEARN ('foc learn 1') and CEH_FOCUS_ADJUST ('foc learn 2') commands to produce the best estimate for profile of the first image swath.

In head firmware versions < 1.02 the start-up sequence was encoded in the CEH_SYSTEM_SWATHS_TO_LEARN parameter. The new startup sequence parameter is intended to decouple these functions. The defined sequences are:

CEH_FOCUS_STARTUP_SEQ0:

This is the default and backward compatible sequence. The auto-focus system will select the appropriate sequence dependant on the CEH_SYSTEM_SWATHS_TO_LEARN parameter.

CEH_SYSTEM_SWATHS_TO_LEARN	Focus Start-up sequence
0	CEH_FOCUS_STARTUP_SEQ1
1	CEH_FOCUS_STARTUP_SEQ2
2	CEH_FOCUS_STARTUP_SEQ3
≥ 3	CEH_FOCUS_STARTUP_SEQ3

CEH_FOCUS_STARTUP_SEQ1:

This sequence uses the contents of the active lens position table. The auto-focus begins actively updating the profile during the first imaging swath.

CEH_FOCUS_STARTUP_SEQ2:

This sequence copies the contents of the initialization table to the active lens position table. The auto-focus begins to actively update the lens position profile during the first imaging swath.

CEH_FOCUS_STARTUP_SEQ3:

This sequence assumes that both the CEH_FOCUS_LEARN, and CEH_FOCUS_ADJUST commands have been executed.

N = CEH_SYSTEM_SWATHS_TO_LEARN

1. The extrapolated backward table, contained in the active table after CEH_FOCUS_LEARN, is used for the first N – 1 imaging swaths.
2. The spiral-interpolated table, copied from the initialization table, is used for imaging swath N.

The auto-focus begins to actively update the lens position profile during imaging swath N.

7.3. Implement Support for Bidirectional Imaging (No PR)

Support for main-scan bi-directional plots has been added to the auto-focus subsystem for use in flat panel imaging systems. This implementation does not work with 1200 DPI heads since the focus is partially blinded in one direction by the wider write swath. Note that only unidirectional carriage plotting is supported.

7.4. Implement Support for Staggered Seams (No PR)

Support for staggered seams, used on Flexo systems, has been added with two new parameters: CEH_SYSTEM_SEAM_OFFSET, and CEH_SYSTEM_SEAM_WIDTH. These parameters allow the location and width (in pixels relative to the start of NEWLINE) of the seam to be defined. The auto-focus subsystem will shift its active region to ignore the area defined by these parameters.

Note: This feature is only supported on TFX heads.

7.5. Implement a Featureless Edge Detect (No PR)

The Thermal 2 exposure head is now able to do an edge detect at drum locations other than at the edge detect strip. The MPE/ICE/MCE decides whether to do a standard edge detect or to do a featureless edge detect. Please note that the NVS parameter *foc edgespotwidth* needs to be set correctly to ensure that the detected edge positions are accurate. See section 9.2 for a description of the NVS parameter *foc edgespotwidth*.

7.6. Add support for P22/P33 Imaging (No PR)

Creo has added entry-level products for some product lines. The original Thermal 2 exposure head is capable of performing higher quality imaging known as P22 imaging. A new Thermal 2 exposure head is only capable of performing lower quality imaging known as P33 imaging.

Note: The exposure head will not be able to turn the write laser on if a P33 imaging head is installed on a P22 imaging product.

7.7. Eliminate the Minimum Image Size Restriction (PR #428)

The auto-focus subsystem will now accept images which result in the total number of focus samples during the image being smaller than the that required for normal focus operation. In this case the auto-focus will hold the lens position constant during the imaging portion of the swath. At the end of each swath the held lens position is updated, to minimize focus error, based on the available samples.

7.8. Improve the Hotlink Test (PR #530)

During the hotlink test, an interrupt is generated by the hardware for each block of hotlink symbols. The firmware will maintain interrupt counters that can be used to determine if the hotlink test is active. A future enhancement may further improve the test to periodically display the number of symbols received on the hotlink.

7.9. Include the Focus Difference with the Head Install Information (PR #550)

During head installation, Thermal 2 will format and display a head install string that must be consistent across all projects. If desired, each project can display a project specific string that may include the focus difference.

7.10. Support for the TEC Current has been Eliminated (PR #711)

Due to required hardware changes, the TEC current will no longer be available from the WLP. The monitor command ldd info will now display "LDD: TEC Current=0.0 Amps (Not Available)" if the WLP does not support the TEC current.

7.11. Support the Write Laser Disabled State (No PR)

If the NVS parameters have disabled the write laser, the write laser state and returned errors will indicate that the write laser is disabled. As a result, the MPE/ICE/MCE monitor command laser will display "Disabled" if the NVS parameters have disabled the write laser. The MPE/ICE/MCE NVS parameter *head wenable* and the Thermal 2 NVS parameter *sys laserenable* can be used to disable the write laser.

7.12. Read the Average-Lens Position during the Focus Learn (No PR)

The average lens-position of the focus learn can be used to determine if multiple plates have been loaded. For backwards-compatibility with Thermal 1.0/1.7x, Thermal 2 would cache the average-lens position immediately after the focus learn to be read by the MPE/ICE/MCE. However it is more efficient to allow the MPE/ICE/MCE to read the average -lens position during the focus learn.

7.13. Display the Transfer Buffer Usage for the Data Logger (No PR)

To aid in diagnosing overruns of the data logger, the transfer buffer usage is displayed after the acquisition of sample data is complete.

7.14. Turn on the System Fans (No PR)

During initialization, turn on the system fans.

8. BUG FIXES

The following bug fixes have been implemented/modified in Thermal 2 firmware version 1.02 (as compared to Thermal 2 firmware version 1.01h).

8.1. Fix Problems Disabling Head Install (PR #552)

There were occasional problems disabling head install. Typically the display of the install string on the MPE/ICE/MCE would be disabled but the install LED's would continue to function. The firmware bug causing the head install to only be partially disabled was corrected.

8.2. Fix Problems with Monitor Redirection (PR #553)

Several problems with monitor redirection were investigated.

The only problem with missing characters is due to Splot. For efficiency, Thermal 2 will send as many characters as possible instead of sending complete lines in each packet. However, Splot discards all spaces at the end of each packet. The result is that displayed lines can be missing spaces. No other evidence of missing characters was found.

- On Thermal 2, if garbage characters are received while enabling monitor redirection, the partial monitor command of corrupt characters resulted in partial command lines and various error messages. To prevent this problem, any monitor command in progress is aborted while enabling monitor redirection. See section 8.5 for the main cause of garbage characters on the serial port.

- On Thermal 2, if the redirection buffer is full while disabling monitor redirection, the exposure head could crash. To prevent this problem, handling of the redirection buffer was modified to verify the state of monitor redirection.

- On the MPE, the monitor redirection state was incorrectly handled. As a result, the MPE could appear to hang.

- On the MPE, passthrough mode will interleave lines from the MPE and Thermal 2. For efficiency, Thermal 2 will send as many characters as possible instead of sending complete lines in each packet. As a result, the MPE can be "locked out" of using the monitor to enter the next command line. The MPE was fixed to correctly interleave lines from the MPE and Thermal 2.

8.3. Fix the monitor command ldd mode calibrate <setpoint> (PR #674)

During testing, it was noticed the successive exectutions of the monitor command ldd mode calibrate <setpoint> would eventually cause the firmware to crash. The monitor command ldd mode calibrate <setpoint> was fixed to handle successive executions of the monitor command.

8.4. Focus and the Data Logger Cause the Firmware to Crash (PR #677)

Focus and the data logger require significant resources to execute and can combine to prevent other tasks from executing. As a result, the firmware can either hang or crash as other tasks are prevented from executing. The priorities of tasks and interrupts have been adjusted to ensure that other tasks and interrupts can execute.

Note: A side effect is that the data logger has a tendency to overrun. Future patches may attempt to address this problem.

8.5. Handle Streams of Characters from the Serial Port (PR #712)

Due to a hardware problem, a disconnected serial port will generate a constant stream of characters. The handling for the serial port has been modified to detect a disconnected serial port and disable the serial port. Note that the monitor command urt info will display the state of the serial port. See section 8.2 for one of the results of this problem.

8.6. System Monitor Voltage and Temperature Initialization (PR #714)

After holding the exposure head in reset for a period of time, occasionally an over-temperature error would cause the laser to shutdown immediately after startup. In Thermal 2, a system monitor is used to periodically monitor the voltages and temperatures. However the system monitor requires a maximum of 1.5 seconds to initialize before readings from the system monitor are valid. The fix is to ensure the system monitor has 1.5 seconds to initialize before using any readings from the system monitor.

8.7. Data Cable and Stroke Clock Warning Faults (No PR)

The flat panel project would temporarily disable the stroke clock to synchronize the next swath. The stroke clock fault could be disabled and plotting would continue as normal. However, the associated stroke clock warning fault would be displayed on every swath. To fix the problem, if the data cable and/or stroke clock faults are disabled, the associated data cable and/or stroke clock warning faults are discarded.

8.8. Beam-Balance Shutter Initialization (No PR)

Firmware initialization would open the beam-balance shutter and then close the beam-balance shutter. Modify the beam-balance shutter to only close the beam-balance shutter.

9. NVS PARAMETER CHANGES

The following NVS parameters have changed in Thermal 2 firmware version 1.02 (as compared to Thermal 2 firmware version 1.01h):

NVS Parameter	Comment	Description	See Section
bpd kp	modified	The default of the NVS parameter *bpd kp* has been modified.	9.1
bpd ki	modified	The default of the NVS parameter *bpd ki* has been modified.	9.1
bpd kd	modified	The default of the NVS parameter *bpd kd* has been modified.	9.1
foc edgespotwidth	new	The NVS parameter *foc edgespotwidth* is required to accurately determine the edge position for the featureless edge detect.	9.2
h1c brt	modified	The default for the NVS parameter *h1c brt* has been modified.	9.3
ldd wlpsetoint	new	The NVS parameter *ldd wlpsetpoint* implements a configureable setpoint temperature for the write laser.	9.4
lvd strokeoffset	deleted	The NVS parameters *lvd strokeoffset* and *lvd strokewidth* have been replaced by the NVS parameters *med <media index> strokeoffset* and *med <media index> strokewidth*.	9.5
lvd strokewidth	deleted	The NVS parameters *lvd strokeoffset* and *lvd strokewidth* have been replaced by the NVS parameters *med <media index> strokeoffset* and *med <media index> strokewidth*.	9.5
med <media index> strokeoffset	new	The NVS parameters *lvd strokeoffset* and *lvd strokewidth* have been replaced by the NVS parameters *med <media index> strokeoffset* and *med <media*	9.5

		index> strokewidth.	
med <media index> strokewidth	new	The NVS parameters *lvd strokeoffset* and *lvd strokewidth* have been replaced by the NVS parameters *med <media index> strokeoffset* and *med <media index> strokewidth*.	9.5
med <media index> imagemode	new	The NVS parameter *med <media index> imagemode* allows a media to be tuned for specific imaging modes.	9.6
med <media index> rcvrgain	modified	The range of the NVS parameter *med <media index> rcvrgain* has been modified	9.7
sys ignorelaser	new	The NVS parameter *sys ignorelaser* configures the exposure head to ignore write laser commands from the MPE/ICE/MCE.	9.8

9.1. bpd kp, bpd ki, bpd kd (No PR)

The defaults for the NVS parameters *bpd kp*, *bpd ki* and *bpd kd* have been modified to more closely reflect the requirements of Thermal 2.5.

9.2. foc edgespotwidth (No PR)

The NVS parameter *foc edgespotwidth* is required to accurately determine the edge position for the featureless edge detect.

9.3. h1c brt (No PR)

The default for the NVS parameter *h1c brt* has been modified from 20 to 40 seconds to more closely reflect the requirements of the exposure heads.

9.4. ldd wlpsetpoint (No PR)

The NVS parameter *ldd wlpsetpoint* implements a configurable setpoint temperature for the write laser. The setpoint temperature for the write laser was previously hardcoded to 25 degrees Celsius.

9.5. lvd strokeoffset, lvd strokewidth, med <media index> strokeoffset, med <media index> strokewidth (No PR)

The NVS parameters *lvd strokeoffset* and *lvd strokewidth* have been replaced by the NVS parameters *med <media index> strokeoffset* and *med <media index> strokewidth*. For some products, the optimal stroke offset and stroke width is media dependent.

9.6. med <media index> image mode (PR #391)

The NVS parameter *med <media index> imagemode* allows a media to be tuned for specific imaging modes. Note that Thermal 2 does not support narrow mode (narrow mode is an obsolete concept), Thermal 2 only supports wide mode. The NVS parameter *med <media index> imagemode* will allow tuning media for specific imaging modes.

9.7. med <media index> rcvrgain (No PR)

The minimum value for the NVS parameter *med <media index> rcvrgain* has been modified from 0.0 to 1.2. Note that the firmware upgrade will automatically adjust the minimum value as required.

9.8. sys ignorelaser (No PR)

The NVS parameter *sys ignorelaser* configures the exposure head to ignore write laser commands from the MPE/ICE/MCE. This is intended to allow system testing without affecting the actions of the MPE/ICE/MCE. The MPE/ICE/MCE NVS parameter *head wenable* and the Thermal 2 NVS parameter *sys laserenable* will provide similar functionality except that the MPE/ICE/MCE is aware of the configuration.

10. REQUIRED ENHANCEMENTS/KNOWN DEFICIENCIES

The next release of Thermal 2 firmware will implement the following required enhancements and/or correct the following known deficiencies in Thermal 2 firmware version 1.02:

1. Changes to prevent firmware from crashing have resulted in frequent overruns of the data logger.
2. The number of symbols received on the hotlink should be periodically displayed on the monitor as positive feedback.
3. A special mode of the write laser will display a configurable pattern of pixels that can be used for alignment purposes.
4. Additional diagnostic functions will be implemented to aid the media service tool.

11. GLOSSARY

CTP	Computer-to-plate.
CTP Machine	Generic term referring to any CTP machine that images media.

Exposure Head	Generic term referring to any exposure head that images on a CTP machine.
Thermal 2, TH2	The Thermal 2 exposure head is a 2nd generation thermal exposure head manufactured by Creo Inc. The TH2 exposure head has a maximum of 240 pixels and can deliver a maximum of approximately 25W.
Tfx	The Tfx exposure head is a 2nd generation thermal exposure head manufactured by Creo Inc. The Tfx exposure head has a maximum of 64 pixels and can deliver a maximum of approximately 64W.
Thermal 1.0/1.7x	The Thermal 1.0/1.7x exposure head is a 1st generation thermal exposure head manufactured by Creo Inc.
Monitor Redirection	The Thermal 2 exposure head implements it's own diagnostic port. Monitor redirection allows the user to access the diagnostic port through the CTP machine.
NVS	Non-volatile storage. Note that non-volatile storage includes battery-backed up RAM, flash, EEPROM, etc.
NVS Parameters	NVS parameters allow the exposure head to permanently save calibration and configuration parameters.

APPENDIX A : TERMINAL PROGRAM SETUP

A terminal program is required to communicate with the CTP machine in order to upgrade firmware, save and/or restore NVS parameters and execute scripts. The terminal program may be run from either DOS (or a DOS window) or it may be used with a "Windows" style interface. It is assumed that the user will run either Splot, Procomm Plus (Version 4.8) or the Service Shell on the system workstation. The user may need to modify the instructions for other terminal programs and/or other PC's.

Splot

If Splot is functioning properly, a terminal prompt should appear when the Enter key is pressed. If the terminal prompt does not appear, execute the following steps to ensure the terminal program is set-up correctly:

Under "Term"
Ensure a checkmark appears in front of "Input Mode". If a checkmark does not appear, click on "Input Mode".

Under "Term" select "Port…"
Ensure that the correct serial port is selected.

Under "Term" select "Port Setting…"
Ensure that the baud rate is 9600, parity is none, data bits are 8 and stop bits is 1.

Procomm Plus (Version 4.8)

If Procomm Plus (Version 4.8) is functioning properly, a terminal prompt should appear when the Enter key is pressed. If the terminal prompt does not appear, execute the following steps to ensure the terminal program is set-up correctly:

Under "Options", "System Options", "Modem Connection..."
Under "Current Modem/Connection" select "direct connect-Comx"
Ensure that the correct serial port is selected.
Under "Modem/Connection Properties"
Ensure that the baud rate is 9600, parity is none, data bits are 8 and stop bits is 1.

Configure the transfer protocol for Procomm Plus (Version 4.8) as follows:

Under "Options", "Data Options", "Transfer Protocol…"
Under "Current Transfer Protocol" select "ASCII"
Under "CR options - upload" select "Don't translate CR"

Under "LF options - upload" select "Don't translate LF"
Under "CR options - download" select "Don't translate CR"
Under "LF options - download" select "Don't translate LF"
Be sure to check the "Use" box and specify "~" for the line pace character
Select "OK"

Service Shell

This section will be completed in the future release notes.

APPENDIX B : MONITOR REDIRECTION

The exposure head includes a diagnostic port used during development and production of the exposure head. The advantages of a diagnostic port are as follows:

- Since all diagnostic routines are implemented within the exposure head, no support for the diagnostic routines is required in the CTP machine.
- Since no support for the diagnostic routines is required in the CTP machine, modification and/or enhancement of the diagnostic routines does not require synchronized upgrades of the CTP machine and the exposure head.
- The exposure head does not require a CTP machine for the majority of development and production.

The disadvantages of a diagnostic port are as follows:

- The exposure head diagnostic routines are not accessible from the CTP machine.
- The diagnostic port of the exposure is not accessible once the exposure head is closed.

To compensate for the disadvantages, monitor redirection will redirect the diagnostic port of the exposure head through the CTP machine to the diagnostic terminal of the CTP machine.

redirect enable

Monitor redirection can be enabled using the following monitor command:

>> **redirect enable**

When monitor redirection is enabled, the diagnostic terminal of the CTP machine will only display diagnostic information from the exposure head and all monitor commands will be handled by the exposure head.

redirect pass

Monitor redirection can be enabled in passthrough mode using the following monitor command:

>> **redirect pass**

When monitor redirection is enabled in passthrough mode, the diagnostic terminal of the CTP machine will display diagnostic information from both the CTP machine and the exposure head and all monitor commands will be handled by the CTP machine (although the CTP machine will passthrough monitor commands intended for the exposure head). Note that enabling verbose information on the CTP machine and/or the exposure head will result in degradation of system performance when monitor redirection is enabled in passthrough mode.

th2 “xxx”

When monitor redirection is enabled in passthrough mode, the CTP machine will handle all monitor commands entered on the diagnostic terminal. However the CTP machine will recognize monitor commands intended for the exposure head using the following monitor command:

>> **th2 “xxx”**

In this example, the CTP machine will passthrough the monitor command xxx to be handled by the exposure head.

redirect disable

Monitor redirection can be disabled using the following monitor command:

>> **redirect disable**

When monitor redirection is disabled, the diagnostic terminal of the CTP machine will only display diagnostic information from the CTP machine and all monitor commands will be handled by the CTP machine.

APPENDIX C : DOWNLOADING FIRMWARE

Downloading firmware to the exposure head can be accomplished using various algorithms and configurations. Understanding the algorithms and configurations is best accomplished by understanding the exposure head. The exposure head consists of the following:

- The datalink port of the exposure head is used for communicating with the CTP machine.
- The diagnostic port of the exposure head is used during development and production of the exposure head. It is the most efficient method of accessing the exposure head; however the diagnostic port of the exposure head is not accessible when the exposure head is closed.
- The flash in the exposure head is used for permanent storage of the firmware bundle (and NVS parameters, test jig waveforms, etc). The flash is not used during normal operation of the exposure head.

- The RAM in the exposure head is used to execute firmware. During initialization, the firmware bundle is loaded from flash into RAM.
- The bootloader ROM in the exposure head is used to download the serial bootloader stored in the CTP machine to the exposure head. The bootloader ROM and serial bootloader ensure that downloading firmware to the exposure head will succeed even if the flash in the exposure head is corrupt (or erased).
- The reset line from the CTP machine to the exposure head allows the CTP machine to reset the exposure head when required.
- The boot line from the CTP machine to the exposure head allows the CTP machine to select between the two bootstrap methods of the exposure head. The bootloader ROM in the exposure head will either boot from flash or prepare for a serial download from the CTP machine.

Note the following about downloading firmware to the exposure head:

- If the flash is corrupt (or erased), the CTP machine is required to download the serial bootloader stored in the CTP machine to the exposure head. As a result, only the default (and original) method used to download firmware to the exposure head will succeed.
- Once the flash is erased, the user is committed to successfully completing a firmware download. Since the firmware executes from the RAM in the exposure head, the firmware will continue to execute as normal. However if the exposure head is reset or power to the exposure head is cycled, the bootloader ROM in the exposure head will not be able to boot from flash.

Closed Exposure Head, Monitor Redirection Disabled

In a closed head, the datalink port is accessible by the user through the CTP machine. This is the default (and original) method used to download firmware to the exposure head. Note that since the algorithm will download the serial bootloader stored in the CTP machine to the exposure head, this algorithm will succeed even if the exposure head is non-functional.

If using Splot or Procomm Plus, perform the firmware download using an S-record file format and an ASCII protocol to the exposure head as follows:

1. Connect a PC with a terminal program to the diagnostic port of the CTP machine.
2. Configure the terminal program to use the correct serial port, 9600 baud, no parity, eight data bits and one stop bit. The download protocol should be configured for an ASCII download using a '~' character for a pace character.
3. Download the serial bootloader from the CTP machine to the exposure head using the following monitor commands:

TH2 > **redirect disable**	wait for "Redirect Mode=Disable"
>> **set head type 3**	no wait required, ignore any errors
>> **head program**	wait for "exposure head coming online (programming mode)", may require sixty seconds

>> **head boot** wait for "EH Boot command (3) Complete", requires two minutes

Once the serial bootloader has been downloaded to the exposure head, the "closer" install LED on the exposure head will flash once per second (the "closer" install LED is used as a heartbeat).

Warning: **Completion of the next step requires that all remaining steps be completed successfully.** If you abort the firmware download or the firmware download fails, the flash of the exposure head will be corrupt. If the exposure head is reset or power to the exposure head is cycled, the exposure head will not be able to load and execute firmware.

4. Erase the flash on the exposure head using the following monitor command:
   >> **fload head code** wait for "Begin ASCII transfer now ..."
5. Initiate the firmware download to the exposure head using the following terminal commands:

Splot	**Procomm Plus**
Select "Term", "Upload File"	Select "Data", "Send File"
Select "Text Files" as file type	Navigate to th2fmw102.hex
Navigate to th2fmw102.hex	

   While downloading the firmware to the exposure head, the "further" install LED on the exposure head will flash (the "further" install LED is used as a receive indicator). The firmware download typically requires ten to twenty minutes depending on the efficiency of the terminal program, PC and CTP machine.
6. Load the exposure head firmware using the following monitor command:
   >> **head end**

If using Service Shell, perform the firmware download using a binary file format and a binary protocol as follows:

1. Connect a PC with a terminal program to the diagnostic port of the CTP machine.
2. Configure the terminal program to use the correct serial port and 9600 baud. Note that the binary file should be sent "as is"; there should be no additional characters transmitted and no translations of any characters within the binary file.
3. Initiate the firmware download to the exposure head using the following terminal commands: at the command prompt, enter "download <path>\th2fmw102.bin"
4. Once the serial bootloader has been downloaded to the exposure head, the "closer" install LED on the exposure head will flash once per second (the "closer" install LED is used as a heartbeat). While downloading the firmware to the exposure head, the "further" install LED on the exposure head will flash (the "further" install LED is used as a receive indicator). The firmware download typically requires five to ten minutes depending on the efficiency of the terminal program, PC and CTP machine.

Note: Service Shell will automatically perform all of the steps performed manually when using Splot or Procomm Plus.

Closed Exposure Head, Monitor Redirection Enabled

In a closed head, the diagnostic port is not accessible by the user. However, monitor redirection allows you to access the diagnostic port of the exposure head through the CTP machine. A firmware download to the exposure head is not supported using this configuration since this configuration does not provide any additional benefits.

Closed Exposure Head, Break-out Card

In a closed head, the diagnostic port is not accessible by the user. However, a break-out card allows you to swap the datalink and diagnostic ports of the exposure head. Note that since the algorithm will not download the serial bootloader stored in the CTP machine to the exposure head, this algorithm will succeed only if the exposure head is functional. If the flash in the exposure head has been corrupted or has been erased, see the section Closed Exposure Head, Monitor Redirection Disabled.

Swap the datalink and diagnostic ports and perform the firmware download to the exposure head as follows:

1. Turn off the power to the CTP machine and the exposure head.
2. Disconnect the exposure head and connect the break-out card. The break-out card will convert the serial port from RS-485 to RS-232 and hold the reset and boot lines in the appropriate state. This allows you to connect a standard PC to the exposure head.
3. Connect a PC with a terminal program to the datalink port of the exposure head.
4. Configure the terminal program to use the correct serial port, 9600 baud, no parity, eight data bits and one stop bit.
5. Turn on the power to the CTP machine and the exposure head.
6. Wait for the exposure head to initialize (approximately ten seconds, there is no feedback).
7. Send the following sequence of raw bytes to the exposure head (not the string, the hexadecimal values):
   0x10, 0x01, 0x22, 0x00, 0x6E, 0x6F
   The raw bytes form a command packet to request the exposure head swap the datalink and diagnostic ports.
8. Configure the terminal program to use the correct serial port, 115.2K baud, no parity, eight data bits and one stop bit. The download protocol should be configured for a binary download with no pace characters. Note that the binary file should be sent “as is”; there should be no additional characters transmitted and no translations of any characters within the binary file.

Note: If the terminal program drops characters at 115.2K baud, reduce the exposure head baud rate using the following monitor command:

TH2 > monitor baud 57600

After reducing the baud rate of the exposure head, reduce the terminal program baud rate accordingly. Note that the exposure head supports baud rates of 9600, 19200, 38400, 57600 and 115200.

9. Initiate the firmware download to the exposure head using the following monitor command:
   TH2 > **fload bundle**

Warning: Completion of the next step requires that all remaining steps be completed successfully. If you abort the firmware download or the firmware download fails, the flash of the exposure head will be corrupt. If the exposure head is reset or power to the exposure head is cycled, the exposure head will not be able to load and execute firmware.

10. The exposure head will display "Erase flash and load firmware bundle (Y/N)?" to query for confirmation from the user. Confirm the firmware download using the following terminal commands:

Splot	**Procomm Plus**
'y'	'y'
'shift' and 'enter'	

11. The exposure head will display "Erasing the flash ..." and initiates erasing the flash in the exposure head. When the exposure head has erased the flash and is ready to initiate the firmware download (approximately 15 seconds), the exposure head will display "Begin loading the firmware bundle ...".
12. Initiate the firmware download to the exposure head using the following terminal commands:

Splot	**Procomm Plus**
Select "Term", "Upload File"	Select "Data", "Send File"
Select "Binary Files" as file type	Navigate to th2fmw102.bin
Navigate to th2fmw102.bin	

    When the exposure head has completed the firmware download (approximately 45 seconds at a baud rate of 115.2K), the exposure head will display "*** Command Success ***".
13. Load the exposure head firmware using the following monitor command:
    TH2 > **reset**

Note: The Splot scripts getdiagport.spt and upload.spt will perform the required steps.

If using Service Shell, see the section Closed Exposure Head, Monitor Redirection Disabled. Service Shell does not support firmware downloads to the exposure head using the diagnostic port. Service Shell only supports firmware downloads to the exposure head through the host.

Downloading firmware using the break-out card on the datalink port is the quickest method to download firmware to a closed exposure head. Unfortunately, non-standard hardware, non-standard cables and complex sequences are required.

Open Exposure Head

In an open exposure head, the diagnostic port is accessible to the user. Note that since the algorithm will not download the serial bootloader stored in the CTP machine to the

exposure head, this algorithm succeeds only if the exposure head state is valid (the flash must be valid). Note that since the algorithm will not download the serial bootloader stored in the CTP machine to the exposure head, this algorithm will succeed only if the exposure head is functional. If the flash in the exposure head has been corrupted or has been erased, see the section Closed Exposure Head, Monitor Redirection Disabled.

If using Splot or Procomm Plus, perform the firmware download to the exposure head as follows:

1. Connect a PC with a terminal program to the diagnostic port of the exposure head.
2. Configure the terminal program to use the correct serial port, 115.2K baud, no parity, eight data bits and one stop bit. The download protocol should be configured for a binary download with no pace characters. Note that the binary file should be sent "as is"; there should be no additional characters transmitted and no translations of any characters within the binary file.

Note: If the terminal program drops characters at 115.2K baud, reduce the exposure head baud rate using the following monitor command:

TH2 > monitor baud 57600

After reducing the baud rate of the exposure head, reduce the terminal program baud rate accordingly. Note that the exposure head supports baud rates of 9600, 19200, 38400, 57600 and 115200.

3. Initiate the firmware download to the exposure head using the following monitor command:

TH2 > **fload bundle**

Warning: **Completion of the next step requires that all remaining steps be completed successfully.** If you abort the firmware download or the firmware download fails, the flash of the exposure head will be corrupt. If the exposure head is reset or power to the exposure head is cycled, the exposure head will not be able to load and execute firmware.

4. The exposure head will display "Erase flash and load firmware bundle (Y/N)?" to query for confirmation from the user. Confirm the firmware download using the following terminal commands:

Splot	**Procomm Plus**
'y'	'y'
'shift' and 'enter'	

5. The exposure head will display "Erasing the flash ..." and initiates erasing the flash in the exposure head. When the exposure head has erased the flash and is ready to initiate the firmware download (approximately 15 seconds), the exposure head will display "Begin loading the firmware bundle ...".
6. Initiate the firmware download to the exposure head using the following terminal commands:

Splot	**Procomm Plus**
Select "Term", "Upload File"	Select "Data", "Send File"

Select “Binary Files” as file type Navigate to th2fmw102.bin
Navigate to th2fmw102.bin

When the exposure head has completed the firmware download (approximately 45 seconds at a baud rate of 115.2K), the exposure head will display “*** Command Success ***”.

7. Load the exposure head firmware using the following monitor command:
   TH2 > **reset**

Note: The Splot script upload.spt will perform the required steps.

If using Service Shell, see the section Closed Exposure Head, Monitor Redirection Disabled. Service Shell does not support firmware downloads to the exposure head using the diagnostic port. Service Shell only supports firmware downloads to the exposure head through the host.

Downloading firmware using the diagnostic port is the quickest and easiest method to download firmware to an open exposure head. Unfortunately, the diagnostic port is not available once the head is closed for shipping.

APPENDIX D : BACKING UP AND RESTORING NVS PARAMETERS

NVS parameters allow the exposure head to permanently save calibration and configuration parameters. Before upgrading the firmware of exposure head, it is important to backup the NVS parameters in the event it becomes necessary to revert to the previously installed version.

Note the following about NVS parameters in the exposure head:

- The exposure head automatically saves changes to the NVS parameters.
- If you upgrade exposure head firmware, upgrades of the NVS parameters will occur automatically when the firmware is executed for the first time.
- If you downgrade exposure head firmware to the previously installed version, it is not necessary to restore the NVS parameters.

Monitor Commands

prm dump

The NVS parameters can be displayed using the following monitor command:
TH2 > **prm dump**

Note: All NVS parameters are displayed; the only exceptions are NVS parameters that are not accessible using monitor commands and are intended for engineering usage only.

Baseline NVS Parameters

The exposure head implements baseline NVS parameters to allow the user to save a "snapshot" or "baseline" of the NVS parameters. The advantage of baseline NVS parameters is that the user can quickly and easily manipulate and compare NVS parameters without any additional tools. The disadvantage of baseline NVS parameters is that the user is dependent on the exposure head firmware and hardware functioning normally. Thus baseline NVS parameters are a useful tool but do not replace the readable versions or backups of NVS parameters.

For example, if the user encounters problems after upgrading the exposure head firmware, the baseline NVS parameters can be used to determine what, if any, differences there are in the NVS parameters as follows:

- Before upgrading the exposure head firmware, the user saves the baseline NVS parameters (section 5 step #2).
- After the user completes the upgrade of the exposure head firmware, problems are encountered with the CTP machine.
- The user can compare the NVS parameters with the baseline NVS parameters to determine what, if any, changes have been made to the NVS parameters.

prm diff

The NVS parameters can be compared to the baseline NVS parameters using the following monitor command:

TH2 > **prm diff**

The baseline NVS parameters are verified and then the NVS parameter are compared to the baseline NVS parameters. The following differences are displayed:

- Any NVS parameters that differ from the baseline NVS parameters are displayed.
- Any NVS parameters that do not exist in the baseline NVS parameters are displayed.

Note that a small number of NVS parameters that do not exist in the baseline NVS parameters typically results when the exposure head firmware is upgraded. A significant number of NVS parameters that do not exist in the baseline NVS parameters typically results when the baseline NVS parameters have never been saved.

prm save

The NVS parameters can be saved to the baseline NVS parameters using the following monitor command:

TH2 > **prm save**

The NVS parameters are verified, the baseline NVS parameters are erased and then the NVS parameters are saved to the baseline NVS parameters.

prm restore

The NVS parameters can be restored from the baseline NVS parameters using the following monitor command:

TH2 > **prm restore**

The baseline NVS parameters are verified and then the NVS parameters are restored from the baseline NVS parameters. Any NVS parameters that do not exist in the baseline NVS parameters are ignored (presumably the user has done a compare and is aware of the differences).

Splot Scripts

The Splot script nvsdump.spt will dump a readable version of the NVS parameters and the Splot script nvsrestore.spt will restore the readable version of the NVS parameters. Further information about Splot and Splot scripts is beyond the scope of these release notes.

APPENDIX E : CTP MACHINE/EXPOSURE HEAD COMPATIBILITY

Exposure head firmware is backwards compatible. As a result, an upgrade of the CTP machine is *not* required to upgrade the exposure head firmware. However, an upgrade of the CTP machine may be required to take advantage of the new functionality of the exposure head.

Note that CTP machine/exposure head compatibility is no longer a major issue for the following reasons:

- The exposure head includes a diagnostic port used during development and production of the exposure head. Since all diagnostic routines are implemented within the exposure head, no support for the diagnostic routines is required in the CTP machine. The CTP machine only needs to provide a generic implementation of monitor redirection.
- The exposure head defines the errors strings associated with the error codes. The CTP machine only needs to implement a generic algorithm to retrieve the error string associated with the error codes.
- The exposure head defines and manages the NVS parameters required by the exposure head. However, the CTP machine implements the *head*, *hdp* and *hdm* NVS parameters which will vary as required by Thermal 1.0/1.7x.

Thus the only compatibility issue involves the handling of the *head*, *hdp* and *hdm* NVS parameters. The exposure head firmware compatibility with Thermal 1.0/1.7x is defined in the following table:

Thermal 2 Firmware Version	Thermal 1.0/1.7x Firmware Version
0.30x	1.38
0.31x	1.70
1.00x	1.70
1.01x	1.80
1.02x	1.90