Thermal 2 Exposure Head

Thermal 2 Firmware Version 1.01f Release Notes

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Revision	Date	Author	Comments
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1. SCOPE AND INTRODUCTION (PLEASE READ)

This document provides specific information applicable to Thermal 2 firmware version 1.01f 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 (INCLUDING WEB-SITE ADDRESSES)

- http://techplanet.creo.com/output/heads/thermal_2/nav/index.htm
- http://techplanet.creo.com/output/heads/thermal_2/content/docs/firm_release.htm
- http://techplanet.creo.com/output/heads/thermal_2/nav/control-set.htm
- http://techplanet.creo.com/output/heads/thermal_2/nav/troubles.htm

4. COMMON TERMS

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 CreoScitex. 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 CreoScitex. 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 CreoScitex.
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.

5. 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 1.01f (th2h101f.hex and / or th2h101f.bin).
5. ☐ Ensure the following applications are <u>not</u> running:
   - Allegro
   - Print Console
   - Prinergy

6. 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**

   See “Appendix D : Backing Up and Restoring NVS Parameters” for further information.
3. Save the baseline NVS parameters on the exposure head using the following monitor command:

   TH2 > **prm save**

   See “Appendix D : Backing Up and Restoring NVS Parameters” for further information.
4. 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.
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 th2h101f.hex
Navigate to th2h101f.hex	

   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.
6. If the terminal program is Service Shell, initiate the firmware download to the exposure head using the following terminal commands:

Service Shell

At the command prompt, enter "download <path>\th2h101f.bin"

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

7. **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.

7. 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

   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	

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.

2. If the terminal program is Service Shell, initiate the firmware download to the exposure head using the following terminal commands:

   Service Shell

   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.
3. 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.
4. Verify that there are no differences between the readable versions of the NVS parameters generated in section 6 step #4 and section 7 step #3.

8. ADDITIONAL FUNCTIONALITY

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

8.1. Modify the Settling Time for the Beam-Balance Shutter (No PR)

The settling time for the beam-balance shutter has been increased from 25 milliseconds to 50 milliseconds. As a result, the firmware will not attempt to acquire samples from the beam-balance shutter sensor until the beam-balance shutter has been closed for a minimum of 50 milliseconds. Testing has shown that the worst case settling time can exceed 25 milliseconds.

9. BUG FIXES

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

9.1. Correct the Hardware State of the Beam-Balance Shutter (No PR)

The hardware state of the beam-balance shutter may become "confused" during initialization resulting in the beam-balance shutter being "stuck" open. The firmware will correct the hardware state by opening and then closing the beam-balance shutter. As a result, a hardware pulse will always be generated ensuring that the beam-balance shutter is closed. The hardware pulse will not be sufficient to actually move the beam-balance shutter, but the hardware state will be corrected.

9.2. Fix Bugs while Calculating the Stroke Profile (Version B Board Sets Only) (No PR)

While calculating the stroke profile, Xilinx bugs cause errors selecting pixel pairs which corrupts the stroke profile. As a result, the beam balance is corrupted and may fail. Note that this problem only affects version B board sets.

9.3. Focus Rejects the Warning Range for the Voltages (No PR)

The firmware monitors the voltage state of various voltage levels (+5 volts, +3.3 volts, etc) and determines if the voltage state is an alarm, warning or normal state. The focus will no longer prevent imaging if the voltage state is a warning state.

9.4. Adjust the Warning and Alarm Ranges for the Voltages (No PR)

The firmware monitors the voltage state of various voltage levels (+5 volts, +3.3 volts, etc) and determines if the voltage state is an alarm, warning or normal state. Previously, the alarm state existed when the voltage level varied by more than 5% from the nominal level. Since exposure head production only checks the voltage levels to ensure they are within 5%, this resulted in warnings with marginal voltage levels (and when combined with the previous problem, would prevent imaging). Now, the normal state exists when the voltage level varies by less than 5% from the nominal level.

9.5. Fix Bugs Clearing the Beam-Pointing Actuator Over-Current State (No PR)

The beam-pointing actuator can be damaged if the beam-pointing actuator limits are exceeded (more than 200 milliamps for more than 30 seconds). To prevent damage to

the beam-pointing actuator, the firmware will shutdown the beam-pointing when the beam-pointing actuator limits are exceeded. Firmware bugs have been fixed that prevented the beam-pointing from being re-enabled after the beam-pointing actuator limits had been exceeded.

9.6. Disable the Data Cable System Fault (Version B Boards Only) (No PR)

Due to hardware problems, the firmware will constantly detect data cable faults. To prevent the display of data cable system faults, the data cable system fault has been disabled. Note that this problem only affects version B board sets.

9.7. Fix Bugs Causing the Beam-Pointing Control Loop to be Disabled (Thermal 2 PR #509)

Due to a silicon bug on the microcontroller, interrupts cannot be reliably disabled by the firmware. Handle the silicon bug in the microcontroller by disabling interrupts in a write-read-verify loop to ensure that interrupts have been disabled. As a result of the "interrupt hole", the beam-pointing control loop could be disabled.

9.8. Modify the Implementation of WLP Burst Data (No PR)

The laser diode setpoint temperature is configurable on recent versions of the WLP board. When requested, the firmware will enable the transmission of configuration information and configure the laser diode setpoint temperature as requested by the user. The problem is that the communication link is noisy and the WLP will interpret noise as configuration information; thus corrupting the laser diode setpoint temperature. The fix is for the firmware to always enable the transmission of configuration information, even if the laser diode setpoint temperature is the default. The laser diode setpoint temperature will still be corrupted occasionally, but will be corrected the next time the configuration information is sent.

10. NVS PARAMETER CHANGES

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

NVS Parameter	Comment	Description	See Section
bpd kp	modified	The default of the NVS parameter	10.1

		bpd kp has been modified.	
bpd ki	modified	The default of the NVS parameter *bpd ki* has been modified.	10.1
bpd kd	modified	The default of the NVS parameter *bpd kd* has been modified.	10.1

10.1. bpd kp, bpd ki, bpd kd

The default values for the beam-pointing PID gains have been modified to reflect typical values in exposure heads.

11. 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 1.01f:

1. Reduce the number of samples collected during the beam-balance to reduce the beam-balance time. Reducing the number of samples by a factor of four will also reduce the beam-balance time by a factor of four (sixteen samples to four samples and approximately eleven seconds to three seconds). Originally, averaging sixteen samples was required to reduce the beam-balance noise.

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).
4. **NOTE**: Completion of the next step requires that all remaining steps be completed successfully. If the user aborts 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.
5. Erase the flash on the exposure head using the following monitor command:

>> **fload head code**	wait for "Begin ASCII transfer now ..."

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 "Text Files" as file type	Navigate to th2h101f.hex
Navigate to th2h101f.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.
7. 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:

   Service Shell

   At the command prompt, enter "download <path>\th2h101f.bin"

   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 that 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 the user 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 the user 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 the user 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.
9. **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.
10. Initiate the firmware download to the exposure head using the following monitor command:
    TH2 > **fload bundle**
11. **NOTE**: Completion of the next step requires that all remaining steps be completed successfully. If the user aborts 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.
12. 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'	

13. 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 ...".
14. 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 th2h101f.bin
Navigate to th2h101f.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 ***".
15. Load the exposure head firmware using the following monitor command:

TH2 > **reset**

Note that 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.
3. **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.
4. Initiate the firmware download to the exposure head using the following monitor command:
   TH2 > **fload bundle**
5. **NOTE**: Completion of the next step requires that all remaining steps be completed successfully. If the user aborts 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.

6. 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’	

7. 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 ...”.
8. 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 th2h101f.bin
Navigate to th2h101f.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 ***”.
9. Load the exposure head firmware using the following monitor command:
   TH2 > **reset**

Note that 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 the user upgrades exposure head firmware, upgrades of the NVS parameters will occur automatically when the firmware is executed for the first time.
- If the user downgrades 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 that 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 6 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