

Thermal 1/1.7 Exposure Head

Thermal Head Firmware Version 1.96 Notes

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Revision History

Revision	Date	Author	Comments
A	7/13/04	Amber Strocel	Initial draft.

creo

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1. SCOPE AND INTRODUCTION (PLEASE READ)

This document describes the important changes to the Thermal Head firmware that come with version 1.96.

Note: This document outlines the firmware changes when upgrading from Thermal Head firmware version 1.23 or later only.

- Load this version of head firmware only as part of the controlled release package or patch, available on the TechPlanet CDs. This head firmware was rigorously qualified against certain versions of MPE and MCE firmware for each output device.
- To access all the features of version 1.96 Thermal Head firmware in the MPE or MCE, you must have specific versions of the thermal modules. Refer to the table below:

	Minimum thermal module version
MPE	4.29 or later
MCE	2.15 or later

  Some new functionality, such as configuring the focus learn sequence, will be unavailable with older thermal modules.
- To make the upgrade simpler, there are scripts that automatically back up the head NVS and load the code. The appendices in this document provide a guide for backing up and restoring NVS parameters, and a revised procedure for loading Thermal Head Firmware.

Formatting conventions:

- MPE commands are in the font `Courier` and are preceded by >>. Exceptions to this rule are commands contained in an explanation of a new feature where commands are in **bold**.
- MCE commands are in the font `Courier` and are preceded by MCE>>. Exceptions to this rule are commands contained in an explanation of a new feature where commands are in **bold**.
- All nvs parameters are in *italics.*
- All script names are <u>underlined</u>.

Note: Unless otherwise specified, Trendsetter refers to any Creo output device.

2. LASER SAFETY PRACTICES

To use this document you (the FSE) **must** have attended a Thermal introductory course given either by the service-training department, the product specialist, or the engineering support team. You must be familiar with the safety precautions required when working with a Thermal Trendsetter.

DANGER! Never operate the Thermal Trendsetter 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

- Manually Loading Thermal 1\1.7 Head Firmware, available at: **TechPlanet** > **Output** > **Heads** > **Thermal 1/17** > **Procedures** (http://techplanet.creo.com/output/heads/thermal/content/docs/Manual_Head_Firmware_Load.pdf)
- Controlled Releases site, available at **TechPlanet** > **Output** > **All CTP Devices** > **Control/settings** (http://techplanet.creo.com/output/computer_to_plate/all_ctp/nav/control-set.htm)
- CTP Firmware and controlled releases, available at **TechPlanet** > **Output** > **All CTP Devices** > **Firmware** (http://techplanet.creo.com/output/computer_to_plate/all_ctp/nav/control-set.htm)
- Thermal 1/1.7 Upgrade Script, available at: **TechPlanet** > **Output** > **Heads** > **Thermal 1/17** > **Downloads** > **Firmware Releases** (http://techplanet.creo.com/firmware/CTP/Head/Thermal/versions.htm)
- Service Shell, available at: **TechPlanet** > **Output** > **Service Tools** > **Service Shell** (http://techplanet.creo.com/output/service_tools/service_shell/nav/v2-x/index.htm)
- Splot, available at: **TechPlanet** > **Output** > **Service Tools** > **Splot** (http://techplanet.creo.com/output/service_tools/splot/nav/index.htm)
- TEH 1/1.7 Head Firmware Summary, available at: **TechPlanet** > **Output** > **Heads** > **Thermal 1/17** > **Reference** > **Release Notes** (http://techplanet.creo.com/output/heads/thermal/content/docs/719-00017A-A-PR01.pdf)

4. PRELIMINARY CHECKLIST (COMPLETE BEFORE YOU BEGIN)

1. ☐ On MPE devices, if you're upgrading from firmware version 1.32 or earlier, generate baseline plots "plot 1" and "inchgrid.ps" before performing the upgrade. Comparing the plots generated before and after the upgrade will help you resolve any geometric correction or image quality issues.

Note: On MCE devices that are being updgraded from firmware version 1.74 or earlier, the head will not function when it's first installed on the device (the MCE requires head firmware version 1.80 or later to access the head properly). By upgrading the head firmware, you will be able to bring the head to full functionality.

2. ☐ On MPE devices, type the command:

```
>>list version
```

Record:

current "MPE Firmware version": _____

current “Thermal software version”: _____

current “Head firmware version”: _____

current “PHC hardware version”: _____

The “Thermal software version”, more commonly referred to as the “Thermal module”, is one module of the MPE firmware. For more information on the thermal module and thermal head, refer to the TEH 1/1.7x Head Firmware Summary.

3. ☐ On MCE devices, type the command:

```
>>list version
```

Record:

current “Version”: _____

Type the command:

```
TS>>head version
```

Record:

current “PHC software version”: _____

current “PHC hardware version”: _____

Type the command:

```
TS>>list version version
```

Record:

current “FW EHI Version”: _____

The “FW EHI Version”, is one module of the MCE firmware. For more information on the MCE and thermal head, refer to the TEH 1/1.7x Head Firmware Summary (see the Related Documents section for details).

CAUTION: If the “PHC hardware version” is version 1.00 or earlier, do NOT upgrade Thermal Head firmware. To do so could seriously affect head functionality. A hardware upgrade is required to take full advantage of new Thermal Head functionality.

4. ☐ Ensure that you have a copy of Splot version 2.84 or later, or Service Shell version 2.5 or later. You will need one of these tools to back up the NVS and upgrade the head firmware.

WARNING: If you do not complete step 5, you will likely corrupt the NVS parameters.

5. ☐ It is *mandatory* that the Thermal head firmware *and* the host firmware be kept synchronized. Depending on how old your code is, this may require an incremental upgrade.

Upgrade the host code *first* and then upgrade the head firmware to the next version compatible with the host firmware. Refer to the controlled releases site for a listing of the versions of host and Thermal head code for each Trendsetter model.

If you are installing a new or replacement head, it is *mandatory* that you upgrade the host firmware to a version that is compatible with the replacement head *before* you install the head.

Note: When installing the replacement head, be sure to follow the appropriate procedures for saving the head NVS parameters to the MPE

For MPE-based devices, if the current MPE firmware contains a Thermal module that will *not* support Thermal head firmware version later than 1.34, use the following procedure:

a. Upgrade to a version of MPE code that *does* support Thermal head firmware version later than 1.34.

b. Reboot the device. Ensure that the Trendsetter is functioning correctly.

c. Upgrade to the latest version of MPE firmware for your particular Trendsetter model.

d. Upgrade the Thermal head firmware to version 1.96.

Note: Depending on how old the host version is you may need to do an incremental upgrade. Find out if this is necessary by reading the release notes for all versions of host firmware between the current version and the one you are planning to upgrade to.

If it is still not clear after reading the host firmware release notes which versions it is OK to skip, you should call the Product Specialist for your particular Trendsetter model.

6. ☐ Ensure you have the following files available:

    - Thermal Head firmware version 1.96 (THCV196.EXO)
    - LCA bundle (LCA_BNDL.HEX)

7. ☐ Ensure Allegro™, PrintConsole, or Prinergy® software is not running.

5. UPGRADE PROCEDURE

5.1 Upgrading MPE-Based Devices

The upgrade takes approximately 20 minutes.

To simplify the upgrade process on MPE-based devices, we developed the upgrade script thcv195x.spt. You are strongly encouraged to use the upgrade script, as it performs all necessary backups automatically, providing a simple downgrade path if that becomes necessary.

Note: FirmwareUpgrade.spt can also be used to upgrade head firmware on the MPE platform. This document describes upgrades with thcv195x.spt only. For information on FirmwareUpgrade.spt, right-click on the script name in Service Shell (see the MCE section for a picture), or refer to the d:\ServiceShell\scripts\device folder on your computer.

If you encounter serious problems using the upgrade script, you can manually upgrade the head firmware as a last resort. Refer to *Manually Loading Thermal 1\1.7 Head Firmware* (for download details see Related documents).

To upgrade the Thermal Head firmware using the upgrade script, Splot version 2.84 or later is required. Alternatively, you can use Service Shell 2.5 or later. For details of where to find Splot, Service Shell, head firmware, and the upgrade script, refer to the Related Documents section.

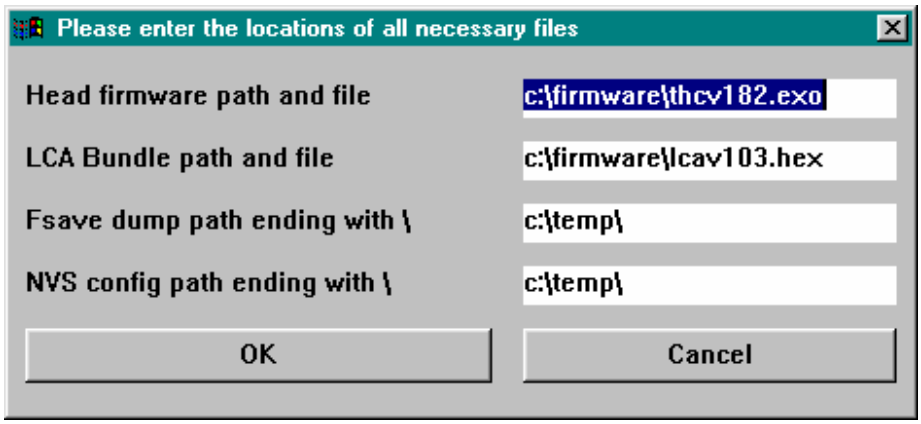
To upgrade the Thermal Head firmware from version 1.32 or earlier:

- perform all the following steps.

To upgrade the Thermal Head firmware from version 1.34 or later:

- perform steps 1 through 4 only.

1. *If any field upgrade is required*, upgrade the MPE firmware *first*, prior to upgrading the head. Upgrade the MPE firmware version to Thermal module 2.36. For more information refer to the controlled release version tables and the TechPlanet Controlled Releases site (these versions are updated frequently).
2. Open Splot or Service Shell, and load the upgrade script, thcv195x.spt.
3. Execute this script: from the **Exec** menu select **Execute**. This script will upgrade the head code to the latest version, provided the current version is 1.23 or later.
4. The upgrade script prompts you to enter filenames and paths, as shown below.



- The **Head firmware path and file** should provide the full name and location of the head firmware file (thcv196.exo), as shown above.
- The **LCA Bundle path and file** should provide the full name and location of the lca bundle file (lca_bndl.hex), as shown above.
- The **Fsave dump path** provides the location that the fsave dump file will be saved to. As shown above, the Fsave dump path must end with the '\' character.

- The **NVS config path** provides the location that the config script will be saved to. As shown above, the NVS config path must end with the '\' character.
- For more information on using the upgrade script, please refer to Appendix C.

Note: The NVS config script is an independent script that can be run in the event of loss or corruption of NVS data. Running the script will take approximately half an hour, and will completely restore the NVS to its state before the upgrade took place.

If NVS corruption occurs, you can either re-load the fsave all data saved in the fsave dump path, or you can run the config script stored in the NVS config path (this restores scorr tables as well as NVS data).

5. Generate plots "plot 1" and "inchgrid.ps" if necessary, and compare with the plots run in section 5, step 1. The quality of the "plot 1" should be unaltered, and check that the geometric correction and positioning of the "inchgrid.ps" are the same as the plot imaged prior to the upgrade.

5.2 Upgrading MCE-Based Devices

The upgrade takes approximately 30 minutes.

To simplify the upgrade process on MCE-based devices, we developed the upgrade script FirmwareUpgrade.spt, for use with Service Shell. You are strongly encouraged to use the upgrade script, as it performs all necessary backups, providing a simple downgrade path if that becomes necessary.

For detailed information on FirmwareUpgrade.spt, right-click on the script name in Service Shell (as below), or refer to the d:\ServiceShell\scripts\device folder on your computer.



If you encounter serious problems using the upgrade script, you can manually upgrade the head firmware using the Service Shell **download <path and filename>** command.

1. *If any field upgrade is required*, upgrade the MCE firmware *first*, prior to upgrading the head. For more information refer to the controlled release version tables and the TechPlanet Controlled Releases site (these versions are updated frequently).
2. In Service Shell, load FirmwareUpgrade.spt, found under the 'Device' tab.
3. Execute this script. This script will upgrade the head code to the latest version, provided the current version is 1.23 or later.

Note: The MCE does not provide automated NVS upgrade functionality like the MPE does. Therefore, it is preferable to use the upgrade script. However, if you do upgrade firmware

manually, you must update the head parameters by running mce_th1_upgrade_195.spt immediately after the upgrade.

6. NVS CHANGES

The following table outlines which NVS parameters changed in this release. The upgrade script automatically implements all of these changes, and no special action is required by the user.

You must have thermal module 4.29 or later for all of these changes to be visible.

NVS Parameter	Comment	Description	See Section
set head *fextfwd*	added	Head parameter *r0* replaced with *fextfwd.*	8.1
set hdp *config*	added	HDP parameter *r1* replaced with *config.*	8.3
set head *maskflt*	added	Head parameter *r4* replaced with *maskflt*	8.4

7. BUG FIXES

- Fix the code to determine where *swidth* and *soffset* are located. In V1.93, certain functions, including automatic stroke cal on the MPE and the **head nvs** command, could cause the head to lose track of the *swidth* and *soffset* locations. This means that while the head should have been referring the HDM parameter block to read these values, it was actually referring to the head parameter block. The result, in certain cases, is banding or failure of **stroke cal**. Upgrading to V1.96 will solve the problem.
- Fix the artifacts on proofing media. In V1.93, plots on proofing media had dark spots in the margins, which frequently burned through to the carrier. More details of the problem and the fix are found in section 8.2, below.

8. NEW FUNCTIONALITY

8.1 Make Focus Learn Sequences Configurable

At the start of every image, the head firmware executes the focus learn sequence. This sequence constructs the best possible focus profile for the start of image, ensuring that we have good image quality all across the plate.

In previous versions of firmware, only one focus learn sequence existed in the TH1.x head. We added a new focus learn sequence in firmware V1.96. By selecting the original or new focus learn sequence, you can ensure optimal focus performance on your platform.

Detailed testing has shown that for most platforms, there will be no difference in focus quality between the original and new focus learn routines. However, to avoid any change in head operation, we recommend that you use the original focus learn sequence. The upgrade tools will set up the head to use the original sequence. If you are setting up the head manually, type:

```
>> set head fextfwd 1
```

If you have MPE firmware that does not contain the *fextfwd* parameter, type:

```
>> mask range
>> set head r0 1
```

In specific cases, we may wish to use new learn sequence. To use the new learn sequence, type:

```
>> set head fextfwd 0
```

If you have MPE firmware that does not contain the *fextfwd* parameter, type:

```
>> mask range
>> set head r0 0
```

8.2 Change Offset Measurement

During the commands **head power off** and **head power sum**, we measure the shutter sensor's offset level. To determine offset, we ensure that there is no laser power on the shutter sensor, and measure the raw power level. This number represents the zero-light level on the shutter sensor, which we can then use to determine the actual laser light falling on the sensor.

In the past, we measured the offset by powering down the laser before taking the measurement. This is non-optimal because the beam-pointing system reacts quite slowly, resulting in slow response time and occasional beam-pointing errors.

In V1.93 we changed the sequence to briefly open the shutter and measure the light at the shutter sensor. This was functionally equivalent, but much faster and not prone to beam-pointing errors. However, in some cases this resulted in leakage light on proofing media, and damage to the carrier.

In V1.96, we have changed the sequence to measure the offset when the head is not in use, and the laser is off. This will result in an accurate offset measurement, without affecting the head operation.

8.3 Add Parameter to Track Head Configuration

When you're servicing a head remotely, you often have unresolved questions. For example, you may wonder what the stroke width was when the head was shipped. Currently, it is difficult or impossible to determine exactly what type of head you're working with. In order to make the process easier, we created the *hdp.config* parameter to track that data.

If you have thermal module 4.28 or EHI 2.01 or later, read the configuration value by typing:

```
>> set hdp config
```

If you have MPE firmware using an earlier thermal module, read the configuration value by typing:

```
>> set hdp r1
```

The settings for this parameter are:

config Value	Head Type
1	32-4005A 1.0 2400 192 P2 cam lever
2	32-4005B 1.0 2400 192 P2 side latch
3	32-4030A 1.0 3200 192 P2 cam lever
4	32-4030B 1.0 3200 192 P2 side latch
5	32-4089A 1.0 2400 128 P2 cam lever
6	32-4089B 1.0 2400 128 P2 side latch
7	32-4141A 1.7 2400 192 P2
8	32-4182A 1.7 2400 224 P2
9	32-4180A 1.7 2400 224 P3
10	32-4158A 1.7 2400 224 P2S Fuji
11	32-4206A 1.7 2400 224 P2S Imation
12	32-4207A 1.7 2400 224 P2S Euro
13	32-4217C 1.7 2400 224 P2S G2 (Dupont)
14	507-00108A 1.7 2400 224 P3S Imation
15	507-00109A 1.7 2400 224 P3S Dupont
16	507-00110A 1.7 2400 224 P3S Fuji

The naming scheme used to identify head type is as follows:

Part number | THgeneration.diode indicator | Resolution | Channels | Screening criteria and Proofing descriptor | Proofing media

THgeneration: 1, 2, or 3

Diode Indicator: 0 or 7 for historical reason

TH1: 0 = 20W, 7 = 40W

Resolution: 2400, 3200 dpi

Channels: 128, 192, or 224

Screening Criteria: P2 (abbreviation for P22) = SQUAREspot, and P3 (abbreviation for P33) = Performance

Proofing Descriptor: S = Spectrum proofing

Proofing Media: Dupont, Fuji, Imation etc.

8.4 Allow Masking of the Stroke Clock/IMAGING Fault

A small percentage of MPE devices are susceptible to noise on the stroke clock. Because of error checking on the stroke clock and IMAGING signals added in firmware version 1.93, this noise may result in plot failures. The error message in these cases is:

Stroke Clock or Imaging signal fault, check LC-BP cable **or**
Stroke Clock fault (bipolar)

These error messages correspond to error number 17696 on the MPE platform, and error 44996 on the MCE platform.

An error is reported when a stroke clock or IMAGING cycle is incorrect or missing. In most cases, addressing the underlying hardware fault should remove the error condition. Start by replacing the data cables to the head, including the hotlink cable. Also, re-seat all cables and cards in the card cage (for the MPE).

If these measures do not eliminate the error state, then you can try masking the error fault. This will allow a plot to complete, regardless of stroke clock or IMAGING signal problems. If you have thermal module 4.29 or EHI 2.15 or later, mask the error by typing:

```
>> set head maskflt 1
```

If you have MPE firmware using an earlier thermal module, mask the error by typing:

```
>> mask range
>> set head r4 1
```

To re-enable error checking, set *maskflt/r4* back to 0.

WARNING: Image artifacts may or may not appear as a result of faulty stroke clock or IMAGING signals. Image artifacts, when present, are characterized by missing data, or data shifts. In the case of a single faulty stroke clock, there will likely be no visible artifact, whereas there will be increasingly severe artifacts as the number of faulty cycles increases. Noise on the stroke clock will not generally result in a visible artifact, but head signaling faults are present.

If you choose to mask the fault, run several quality-control plots and examine them carefully for visible artifacts. Following masking, closely monitor the site for quality. As of July/04, the device teams have been contacted to create an engineering fix for the signaling issues, and will communicate a plan in the near future.

If any artifacts appear on plate when the error state is masked, then a head replacement may be necessary.

9. KNOWN DEFICIENCIES

Without thermal module version 3.38, the new hms block and all of its parameters will not be visible. If, after upgrading the head firmware, you receive error 17672 or 17673, enter the following commands:

```
>>nvs save hms cal
>>nvs save hms cfg
```

If, after entering the above commands, the error persists, you can safely disregard it. This error will not affect machine functionality or plot quality in any way.

10. GLOSSARY OF ABBREVIATIONS AND TERMS

MCE	Master Control Electronics
ICE	Imaging Control Electronics
MPE	Master Processor Electronics
Host	Refers to the MCE, ICE, or MPE, as a generic device interface.
CTP	Computer to Plate (this includes Trendsetters and Platesetters)
NVS	Non-Volatile-Storage
PHC	Parallel Head Controller
LVD	Light Valve Driver
LCA	Xilinx configuration file

11. APPENDIX A: TERMINAL PROGRAM SET-UP

You need the Splot terminal utility to run the upgrade script. It is assumed that the terminal program will be run on the system workstation.

Note: If it is run on another PC it may be necessary to change all the hard drive reference letters in the filenames. Any files created on the C: drive of a separate PC (that is, terminal) should be copied over to the workstation's System Drive (S:, D:, or E:).

CAUTION: You must use Splot version 2.84 or later in order for the script to run.

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

1. Under **Term,** ensure that **Input Mode** is checked. If no check-mark appears, select **Input Mode**.

2. Under **Term**, select **Port…** and ensure that the correct input port is selected.

3. Under **Term**, select **Port Settings…** and ensure that the following are selected:

    - baud rate selected is **9600**
    - parity is **none**
    - data bits is **8**
    - stop bits is **1**

12. APPENDIX B: BACKING UP AND RESTORING THE MPE NVS

Before upgrading the firmware of any output device, it is important to backup the current NVS memory in case it becomes necessary to revert to the previously installed version of firmware.

What is NVS RAM?

The NVS RAM in output devices provides the following:

- Storage for device-dependent configuration and calibration parameters that must remain intact between power cycles.
- Storage for state variables that allow a device to resume where it left off if power is cycled during loading or imaging.

Saving individual NVS configuration parameters is a two-step process. A parameter is first *changed* in a volatile RAM copy of the NVS map and then *saved* (that is, copied) to the NVS map itself. State variables are always accessed directly from NVS. Generally, there is no need to change state variables manually since they simply contain a record of where the machine is (or was) during various tasks.

- Whenever firmware is upgraded in an output device, some of the NVS calibration and configuration parameters will typically need to be upgraded as well.

Note: Simply loading new firmware into a machine will *not* upgrade the NVS.

Steps must be taken to ensure that the NVS is properly configured for the new firmware. This process may be partly or wholly accomplished with the **nvs upgrade** command available from the device monitor. In some cases, however, it will be necessary for the installer to make certain upgrade configurations depending on the hardware that is present in the particular machine (plus state variables). The upgrade script will upgrade any necessary NVS parameters.

- The upgrade script will save all the NVS settings and produce a new script that can be used to revert to the current firmware version and settings, if necessary. For manual procedures on how to save and restore NVS, refer to release notes for earlier versions of head code.

Before loading firmware it is assumed that the installer is running Splot version 2.84 or later on the system workstation. It is also assumed that all the necessary program options have been set up as described in Appendix A, *Terminal Program Setup* and that the Allegro™ software is *not* running on the workstation.

13. APPENDIX C: USING THE UPGRADE SCRIPT *THCV195X.SPT*

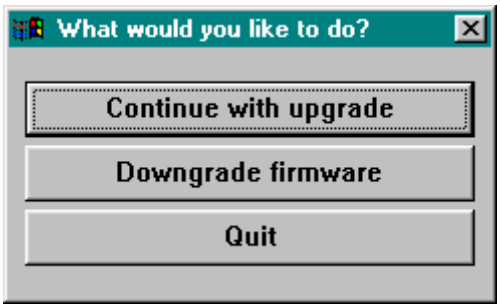
The current upgrade script has a wide range of functionality. Its primary function is still to upgrade the firmware from a previous version to version 1.96. To accomplish this, the script performs the following steps:

1. Read current NVS data, along with stroke and scorr tables, and save to the NVS config script. The upgrade script will automatically generate the file and store it to the user-specified path. The config script will be called ldTHxxxxVyyy.spt, where xxxx will be the head serial number, and yyy will be the head code version before upgrade.
2. Run an **fsave dump**, capturing the data to a file. The upgrade script will automatically generate the file and store it to the user-specified path. The dump file will be called

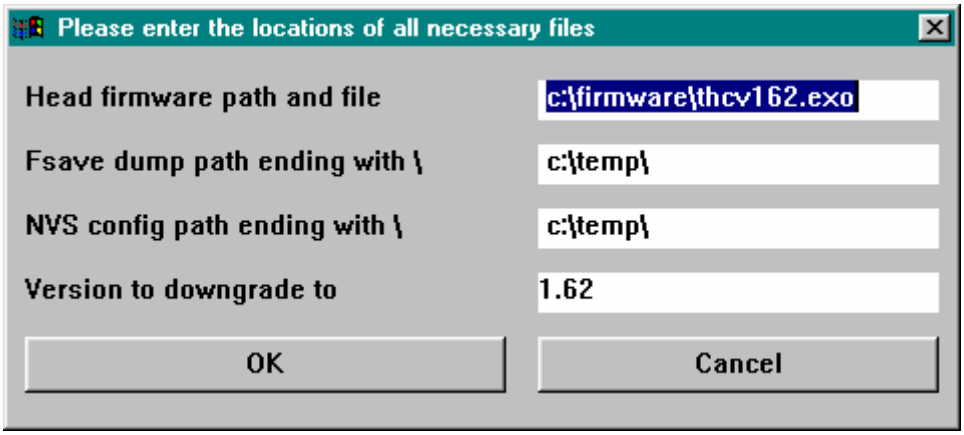
fsTHxxxxVyyy.txt, where xxxx will be the head serial number, and yyy will be the head code version before upgrade.

3. Upload the head firmware from the user-specified file and location.
4. Load the fsave dump data in order to fully restore all NVS parameters and prevent corruption.
5. Save all head NVS parameters.
6. Run the **nvs upgrade head** command in order to ensure that all NVS parameters are properly initialized.
7. Save the head mask.
8. Reset the system.

The script also offers the secondary option of downgrading the firmware. If the current head firmware is already version 1.96 or later, and thcv195x.spt is executed, the following dialog will appear:



By selecting **Continue with upgrade**, the script will proceed to upgrade the firmware in the same way as outlined above. By selecting **Downgrade firmware**, the script will perform a firmware downgrade. The following dialog will appear:



- The **head firmware and path** should provide the location of the firmware version that you wish to downgrade to. As with the firmware upgrade, you must enter the full path and file name.
- The **Fsave dump path** should provide the location of the fsave dump file previously generated during a firmware upgrade. That is, if you previously

upgraded the firmware from version 1.38 to version 1.96, the upgrade script generated a file called fsTHxxxxV138.txt, which the script will search for. As with the firmware upgrade, you must enter the full path name ending with '\'.

- The **NVS config path** should provide the location of the NVS config script previously generated during a firmware upgrade. That is, if you previously upgraded the firmware from version 1.38 to version 1.96, the upgrade script generated a script called ldTHxxxxV138.spt, which the script will search for. As with the firmware upgrade, you must enter the full path name ending with '\'.
- The **Version to downgrade to** should be the same version as the head firmware file. Note that the downgrade will only work if you have previously upgraded from this version number.

In order to accomplish the downgrade, the script performs the following steps:

1. Upload the head firmware from the user-specified file and location.
2. Load the fsave dump data in order to fully restore all NVS parameters and prevent corruption.
3. Save all head NVS parameters.
4. Save the head mask.
5. Reset the system.

14. APPENDIX D: THERMAL HEAD FIRMWARE AND MPE THERMAL MODULES

The following table cross-references the Thermal Head Firmware Version with the MPE Thermal Module required. Information about which versions of head firmware are compatible with device control (MPE or MCE) firmware can be found on the Controlled Releases site (refer to the Related Documents section for details).

Note: Thermal Head Firmware Version entries that are **bold** are the supported releases.

Thermal Head Firmware Version	MPE Thermal Module	Notes
1.00	1.56	
1.03	1.62, 2.00	
1.05	1.62, 2.00	
1.11	2.06, 2.07, 2.08, 2.09	Beta release of Thermal Head firmware version 1.12.
1.12	2.06, 2.07, 2.08, 2.09	Adds support for more than one media type.
1.13	2.06, 2.07, 2.08, 2.09	Corrects bugs in Thermal Head firmware version 1.12.
1.14	2.06, 2.07, 2.08, 2.09	Corrects bugs in Thermal head firmware version 1.13.
1.15	2.06, 2.07, 2.08, 2.09	Corrects bugs in Thermal Head firmware

		version 1.14.
1.16	2.06[1], 2.07, 2.08, 2.09, 2.10	Adds support for the 10-0892C version of the Thermal Head Controller.
1.17	2.06[2], 2.07, 2.08, 2.09, 2.10	Beta release of Thermal Head firmware version 1.16 that supports 40W Thermal Heads.
1.18	2.06[3], 2.07, 2.08, 2.09, 2.10	Corrects bugs in Thermal Head firmware version 1.16.
1.18b	2.06[4], 2.07, 2.08, 2.09, 2.10	Corrects bugs in Thermal Head firmware version 1.18.
1.19	2.06[5], 2.07, 2.08, 2.09, 2.10	Beta release of Thermal Head firmware version 1.18 that supports 40W Thermal Heads.
1.20	2.23	Beta release of Thermal Head firmware version 1.21.
1.21	2.23	Adds support for Staccato and Bipolar.
1.22	2.23	Corrects bugs in Thermal Head firmware version 1.21.
1.23	2.23	Corrects bugs in Thermal Head firmware version 1.22.
1.24	2.30	Beta release of Thermal Head firmware version 1.30.
1.30	2.30	Adds support for the active chiller and laser standby.
1.31	2.30	Beta release of Thermal Head firmware version 1.34.
1.32	2.30	Corrects bugs in Thermal Head firmware version 1.30.
1.32.6	2.30	Corrects a hardware problem that resulted in the error message “Timeout waiting for LASER OK”.
1.33	2.34	Beta release of Thermal Head firmware version 1.34.
1.34	2.34	Adds support for laser mode 3 and enhanced safety loop handling.
1.35	2.34	Beta release of Thermal Head firmware version 1.36.
1.36	2.34	Corrects bugs in Thermal Head firmware version 1.34.
1.38	2.34	Corrects a hardware problem that resulted in the error message “Timeout waiting for LASER OK”.
1.56	2.34, but later versions preferred	Improved diagnostics, focus and bug fixes
1.62	2.34, but later versions preferred	Bug fixes and added functionality to allow shutter sensor calibration in the field.

[1] Thermal Module 2.06 only supports the 10-0892B version of the Thermal Head Controller.
[2] See footnote 1.
[3] See footnote 1.
[4] See footnote 1.
[5] See footnote 1.

1.73	2.34 but later versions strongly recommended	Improved diagnostics, code optimization, reorganized NVS, added plot statistic storage.
1.74	2.34 but later versions strongly recommended	Fixed head power pulse and stroke profile bugs in version 1.73.
1.80	2.36 but later versions strongly recommended	Support Entry Imaging heads, move media statistics collection to *hms* subsystem.
1.82	2.36 but later versions strongly recommended	This version was replaced by firmware 1.83.
1.83	2.36 but later versions strongly recommended	Support revised P33 Imaging plan.
1.92	2.36 but later versions strongly recommended	This version was replaced by firmware 1.93.
1.93	2.36 but later versions strongly recommended	Add featureless edge detect, optimize media and *scorr* handling for MST, improve diagnostics.
1.95	2.36 but later versions strongly recommended	Fix stroke width handling in 1.93, make focus learn sequence configurable.
1.96	2.36 but later versions strongly recommended	Unreleased firmware patch to mask stroke clock and IMAGING faults, where hardware upgrades are unavailable / insufficient.