Thermal 1.7 Imaging Head

Shutter Sensor Replacement Procedure

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Revision History

Revision	Date	Author	Comments
Draft	Sep 2000	André Blignaut	Initial release
A	Feb 2001	André Blignaut	Updated wiring instructions
B	Mar 2001	André Blignaut	Epoxy replaces silicone
C	May 2001	Maureen Gill	Updated “Calculating the calibration parameters”
D pre-release	2 Dec 2002	Kurt Shelton (K. DeCarle - TW)	Technical review/edits by Kurt in preparation for EOL. Rebranding and edits done by Ken D.
719-00028A-A	23 Jan 2003	Kurt Shelton (K. DeCarle - TW)	Final review by Kurt S. Posted to TechPlanet by KD.
719-00028A-B	08 Mar 2004	Maureen Munroe	Updated procedure and added correct part numbers (Jeff Edgar).
719-00028A-C	27 May 2004	Maureen Munroe	Removed encoder/lens cleaning kit from replacement kit BOM.
719-00028A-D	03 Aug 2004	Maureen Munroe	Added note to return the old shutter to Creo headquarters in Burnaby.
719-00028A-E	24 Dec 2004	Ken DeCarle	Edited as per Doc Group editor’s markup.
719-00028A-E	24 Feb 2005	Ken DeCarle	Minor edit to Section 3 as per Peter Mills.
719-00028A-F	03 Jul 2006	Maureen Munroe	Floppy disk was removed from the kit. Updated the procedure to reflect this. Updated the template.

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1. LASER SAFETY PRACTICES

This document is intended for field service engineers who have attended a thermal imaging head introductory course and are therefore familiar with the safety precautions when working with a device equipped with a thermal imaging head.

- When any interlocked access panel (relied upon for laser safety) is opened, power is automatically removed from both the write laser and the focus laser.
- For 48 volt TEH1.7 heads and for all thermal 2 heads (TH2), turning the service key switch to the LASER HAZARD position re-energizes the focus laser only. This service key position does not enable the write laser.
- For 24 volt TEH 1.0 and 1.7 heads, turning the key switch to the LASER HAZARD position will re-energize both the write laser and the focus laser.



DANGER! Never operate a device with the enclosure open and the write laser on. The write laser *must* be disabled when the enclosure is open. Failure to do so may result in permanent eye damage. The write laser must be disabled in firmware with the command `set head wenable 0`.

2. RELATED DOCUMENTS

- Thermal 1/1.7 Lens Cleaning Procedure: **TechPlanet** > **Output** > **Heads** > **Thermal 1/1.7** > **Procedures** (http://techplanet.creo.com/output/heads/thermal/content/docs/77-0125A-D-PR01.pdf)
- Thermal Exposure Head 1.7 Installation Procedure: **TechPlanet** > **Output** > **Heads**> **Thermal 1/1.7** > **Installation** (http://techplanet.creo.com/output/heads/thermal/content/docs/77-0074A-D-PR01.pdf)
- Thermal Exposure Head 1.7 Installation Procedure: **TechPlanet** > **Output** > **Heads** > **Thermal 1/1.7** > **Installation** (http://techplanet.creo.com/output/heads/thermal/content/docs/77-0038B-B-PR01.pdf)
- Thermal 1.X field scripts: **TechPlanet** > **Output** > **Service Tools** > **Thermal 1/1.7** > **Downloads** (http://techplanet.creo.com/output/heads/thermal/nav/downloads.htm#scripts)

3. REQUIRED TOOLS AND MATERIALS

- Shutter upgrade/replacement kit 05-0165:

Part Number	Item Description	Qty
719-00028A	PROC,SHUTTER SENSOR,CLEAN REPL,TEH	1
10-4738A	BRD,ASSY,SHUTTER CALIBRATION,FIELD,TEH	1
32-4164A	ASSY,EO,SHUTTER/BEAM BALANCE SENSR,FIELD	1
90-1107	TOOL,DOUBLE OPEN END WRNCH,7MM,15-75 DEG	1
90-1111A	TOOL,HEX WRENCH,2.5MM,L56*W7.5MM	1
89-0040	SUPP,BATTERIES,9 VOLT	1
82-1048	ADHESIVE,EPOXY,PUTTY	5

- Scripts: calibrate_amp.spt and calibrate_calculate.spt (available in Service Shell or from the Thermal 1/1.7 Downloads page on TechPlanet)
- Encoder/lens cleaning kit (part number 04-0012B)
- 1.5 mm hex key
- 2.5 mm hex key (modified, included in shutter upgrade/replacement kit)
- 7 mm wrench (75° x 15º, included in shutter upgrade/replacement kit)
- Utility blade
- Jeweler's screwdriver set
- Wire stripper
- Epoxy (included in the shutter upgrade/replacement kit)
- Nail polish or red insulating varnish (GC/Waldom Electronics part number 10-9002)

Note: Do *not* use *Loctite* adhesive *Loctite* adhesive emits gases that will adhere to the shutter sensor and head lens.

4. BOLT MOUNT VS SETSCREW SHUTTER SENSORS

This document describes how to replace the shutter sensor of the thermal exposure head 1.0/1.7. There are two types of shutters:

- *Setscrew mount*: Old style of shutter, mounted to the actuator shaft by one 1.5 mm setscrew
- *Bolt mount*: New style of shutter, mounted to the actuator shaft by two 2.5 mm hex bolts and locknuts

You may encounter variations of these two types of shutters in the field. For example:

- Sensor wires exit from different locations
- Sensor wires are held in place by silicone in different spots
- Sensor wires may have connection plugs and some may not

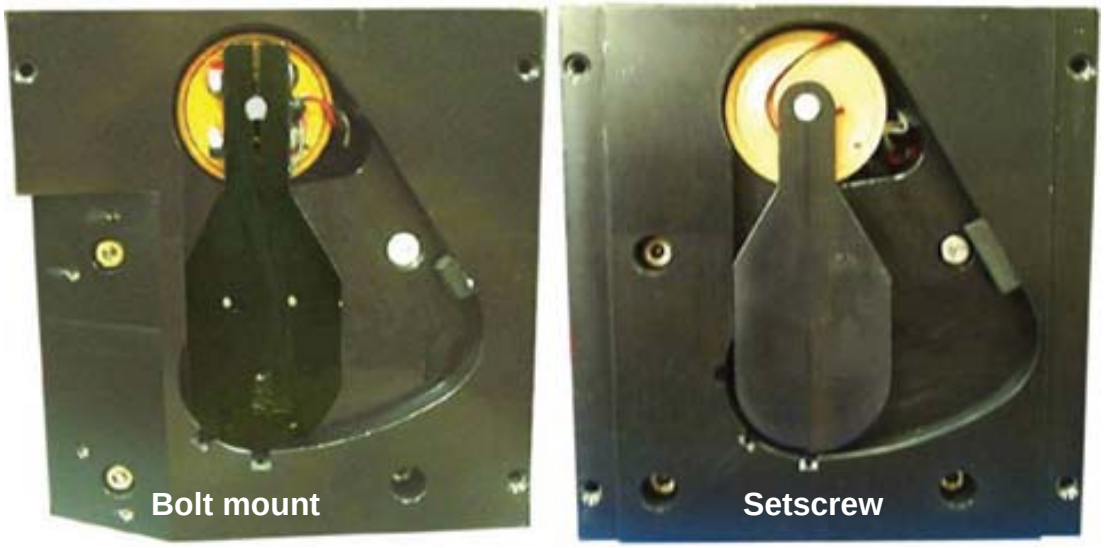


Figure 1: Bolt mount and setscrew shutters

5. WHEN TO REPLACE THE SHUTTER

If you see the following problems, the shutter sensor is defective or the sensor wires have been broken:

- Error message `[17686] HEAD: LV Not enough light for beam balance` appears
- The shutter is stuck
- The focus sum suddenly drops to zero

Note: Before replacing the shutter, ensure that head firmware version 1.62 or later is installed.

To replace the shutter:

1. Prepare the jig.
2. Remove the old shutter.
3. Calibrate the head for the new shutter.
4. Install the new shutter.
5. Calculate the new calibration parameters.

Excluding the time it takes to remove and install the head, this procedure will take approximately 30 minutes.

CAUTION: Always wear an antistatic wrist strap when handling a thermal imaging head.

6. PREPARING THE JIG

1. Unpack the shutter calibration jig (part number 05-0165). Connect the battery and connect the test cable to the jig as shown in Figure 2: Calibration jig assembly.

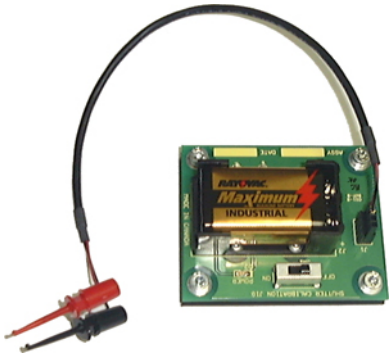


Figure 2: Calibration jig assembly

2. Test the jig by turning on the switch. The ON LED should light. If it does not light:
   - Check the battery.
   - Check the connections.
   - Test the jig using a new 9 volt battery.

7. REMOVING THE OLD SHUTTER SENSOR

CAUTION: Always wear an antistatic wrist strap when handling a thermal imaging head.

1. If the device is fitted with a debris removal system, remove it.
2. Remove the thermal imaging head from the device and place it on a flat antistatic surface (placing the head upside-down works best).
3. If required, use a utility blade to cut the silicone loose from the anodized surface of the shutter. Remove any excess silicone stuck to the wires.

CAUTION: Be careful not to cut the wires or apply any excess force to them.

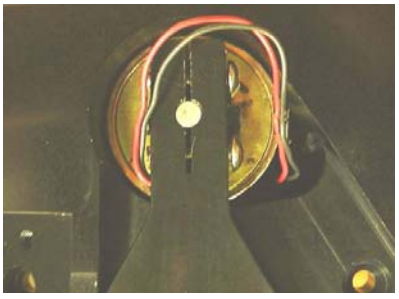


Figure 3: Silicone removed from shutter and wires

4. Using a cotton swab, apply acetone to the red compound that locks the nuts in place. This softens it so you can loosen the nuts.

5. Remove the shutter from the shaft:

   - Bolt mount shutter:

     a) Use the 7 mm wrench to remove the two nuts. Be careful not to pinch or damage the wires.

     b) Use the modified 2.5 mm hex key to loosen the two hex bolts (the bolts are threaded into the shutter). A couple of turns should loosen them enough.

   - Setscrew mount shutter: Use a 1.5 mm hex key to loosen the setscrew.

6. Slide the shutter off the shaft. Let the shutter hang free, but do not apply any force to the wires connected to the shutter sensor.

7. Cut the sensor wires as close to the shutter as possible.

8. Strip the wire ends about 4mm.

CAUTION: When stripping the wires, hold them firmly to prevent any tension on them. Tension on these wires will cause damage on the inside of the head and the head will have to be returned for repairs.

9. Using swabs and acetone from the shutter upgrade/replacement kit, clean the anodized surface that is behind the shutter (see Figure 4: Clean the area indicated).



Figure 4: Clean the area indicated

10. Clean the head lens using the method described in *Thermal 1/1.7 Lens Cleaning Procedure* (see Related Documents on page 1).

11. Return the old shutter to your regional parts depot. Make sure that you include a defective parts form. Mark the package:

    Defective part for investigation
    ATTN: Jeff Edgar
    Kodak Burnaby - Kincaid

8. CALIBRATING THE THERMAL IMAGING HEAD FOR THE NEW SHUTTER

The new shutter included in the shutter upgrade/replacement kit has been measured at the factory. The head must be calibrated to work with the new shutter. The calibration jig included in the shutter upgrade/replacement kit is a current source that simulates a shutter by supplying a fixed current into the head controller board.

Note: For the calibration scripts to run, head firmware version 1.62 or later must be installed.

1. Connect the calibration jig to the shutter wires – red clip to the red wire and black clip to the black wire.

CAUTION: Make sure that the two connections do not touch each other.

2. Put the head onto the carriage with the calibration jig connected but *not turned on*. Reconnect the head electrical connectors.

   Note: The head does not need to be correctly fixed to the carriage, but all electrical connectors must be connected to the head.

3. Re-install the access panels so that the device is in a safe state.

WARNING: Always observe the necessary Laser Safety Practices when applying power to the thermal imaging head.

4. Turn on the device.

5. Connect the workstation or your laptop to the device via the serial cable connector. Open Service Shell and select TH1.7X Service.

Note: The scripts are also available from the Thermal 1/1.7 Downloads page on TechPlanet (http://techplanet.creo.com/output/heads/thermal/nav/downloads.htm#scripts)

6. Run the calibration script on the workstation or laptop: Select **calibrate_amp.spt**. Follow the prompts as the script runs.

7. When prompted, turn on the calibration jig:

   a) Remove the appropriate access panel.

   b) Turn on the jig. Make sure that ON LED is illuminated.

   c) Replace the panel after turning the jig on.

8. Once the script is complete, the message **`Script Finished`** appears.

9. Record the values for G, H, I, J, K, and L. They will be used in a later script.

10. Turn off the device and remove the necessary access panels to get access to the calibration jig and head.

11. Disconnect the head electrical connectors from the head and remove the head from the carriage. Place it on a safe, anti-static surface.

12. Turn off the calibration jig and disconnect it from the head.

9. INSTALLING THE NEW SHUTTER

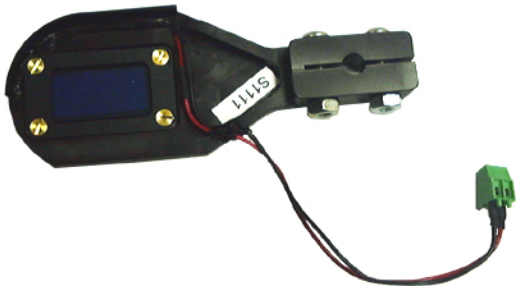


Figure 5: Replacement shutter

The shutter movement can potentially be restricted by:

- The debris removal plate, if the shutter protrudes from the surface of the nosepiece
- The bottom of the recess area in the nosepiece, if the shutter is too far down on the shaft

Ensure that the shutter movement is smooth by following the installation procedure:

1. Unpack the new shutter, including the sheet of calibration values (you will need to refer to this later in the procedure).
2. Place a piece of paper in the recess area to act as a spacer between the shutter and the nosepiece–this will ensure that there is enough clearance between the shutter and the recess area of the nosepiece.
3. Slide the shutter onto the shaft until it is against the paper.
4. Place a straightedge across the surface of the nosepiece and ensure that there is enough clearance between the straightedge and the shutter surface. The thickness of paper is a good gauge.
5. Move the straightedge along the entire length of the shutter to ensure that there is adequate clearance throughout.
6. Tighten the two bolts with the modified hex key. Install and tighten the nuts with the 7 mm wrench.
7. Remove the paper from the recess area and, with the straightedge still across the surface of the nosepiece, move the shutter from the closed position to the open position a few times to ensure that it does not touch the straightedge and that the movement is smooth.
8. Apply nail polish or insulating varnish to the two nuts to lock them against the shutter body.

CAUTION: Do *not* use *Loctite* adhesive. *Loctite* adhesive emits gases that will adhere to the shutter sensor and head lens.

9. Connect the shutter sensor wires from the head to the green connector on the new shutter–red to red and black to black. Use a small jeweler's screwdriver to tighten the connector screws.

10. Push the green connector and any excess wires into the cavity beside the shutter (see Figure 6: Installing the new shutter), but *take care to leave enough slack so the shutter can open and close freely*. It may be necessary to shorten the wires coming from the head slightly so that the cavity can accommodate them. The cavity may be partially filled with black silicone that was used during the manufacturing process–use a flashlight to inspect how much space is available.

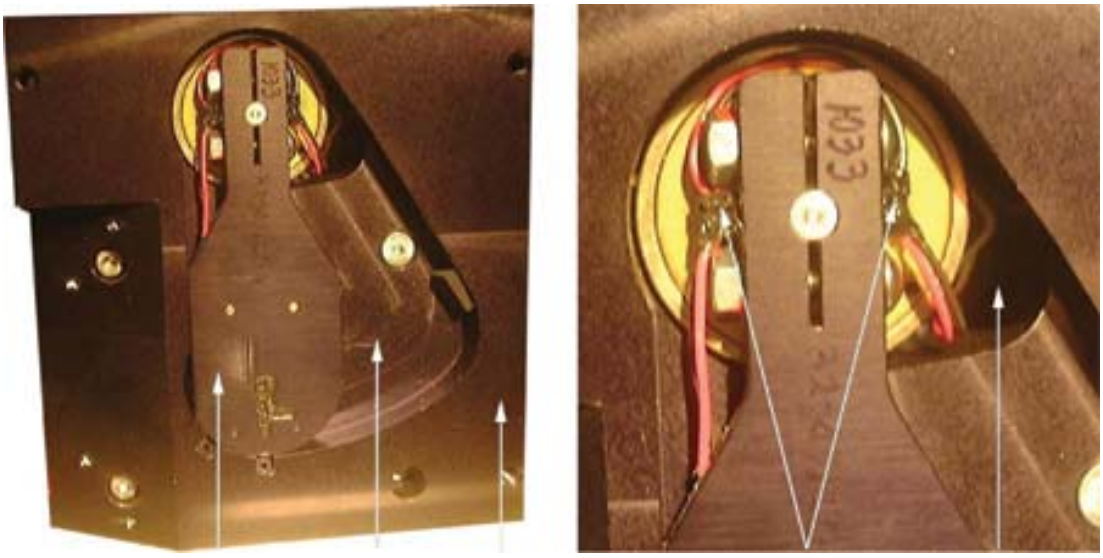


Figure 6: Installing the new shutter

11. Use epoxy (part number 82-1048) to hold the wires in place in the cavity, if needed.

12. Use the epoxy to secure the wires to the shutter to prevent them from interfering with shutter movement (see Figure 6: Installing the new shutter).

Note: After mixing the epoxy, it must be applied within 5 minutes and will harden in 10–15 minutes (mixing and handling instructions are provided in the kit).

13. Reinstall the thermal imaging head into the machine using the correct procedure (see Related Documents on page 1).

14. Reinstall the debris removal system, if applicable.

15. Check that there is adequate clearance between the nozzle plate and the shutter so that the movement of the shutter is not blocked.

10. CALCULATING THE CALIBRATION PARAMETERS

1. Close the access panels and turn on the device.

2. To run the calibration/calculation script on the workstation, open Service Shell and select **calibrate_calculate.spt**.

3. Follow the prompts as the script runs. When prompted for values for A to D, enter the values from the sheet that was included in the kit with the new shutter. When prompted for values G to L, enter the values recorded from the previous script.
4. When the script is complete the message **`Finished`** appears.
5. Check the value of TSTK by typing the command:
   - MPE: `>>set sys TSTK`
   - MCE: `>> set ehi tstk`

   If the value is 0, set it to the correct value of 540 and save using the commands:
   - MPE:
     ```
     >>set sys TSTK 540
     >>nvs save sys
     ```
   - MCE: `>>set ehi tstk 540`
6. Restart the device.
7. Run a `stroke cal` to confirm that the new shutter is working properly. If `stroke cal` will not run, escalate to your regional PSS.