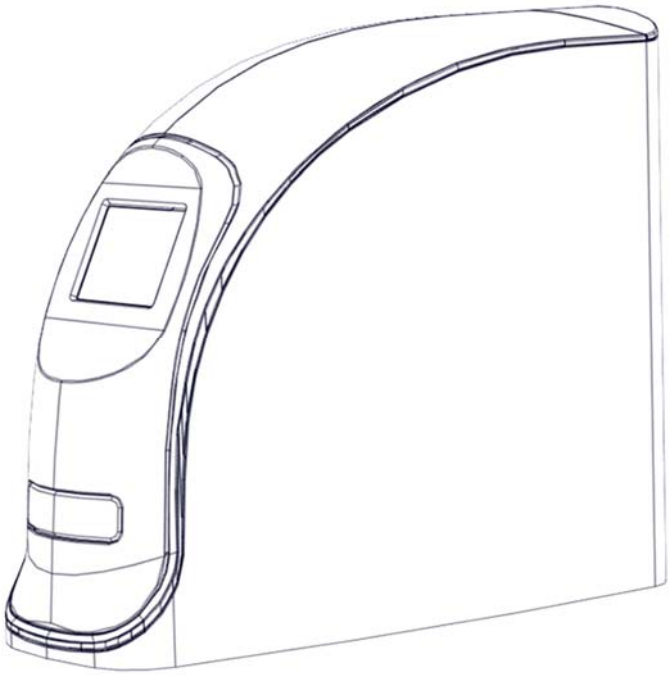
FireCR dental

Service Manual

Hardware revisions **AH** and later.



FireCR dental

FireCR Dental Computed Radiography Reader

Doc No.: TM-821-EN
Rev: 1 Sep 2016
Part No.: CR-FPM-11-021-EN

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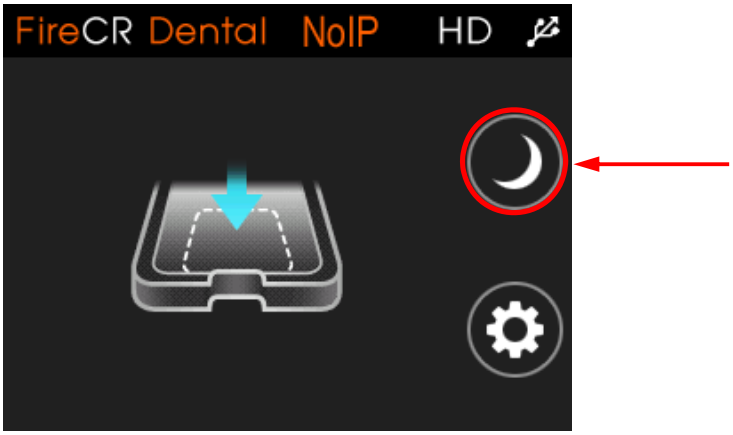
This manual covers replacement of hardware for revision **AH** and later.
The hardware revision of the unit can be identified using the serial number on the back of the unit.
The centre part of the serial number contains two decimals, and 4 alphanumerical characters, the last two identifies the hardware revision.
Please ensure these are AH or later e. g. FR-11-00DH**AH**-XXXXXX, on some units the serial has been changed to a UDI, the hardware revision for these can be verified like shown in the following example: (1)08809466040214(11)160502(10)FR1100**AH**(21)XXXXXX.

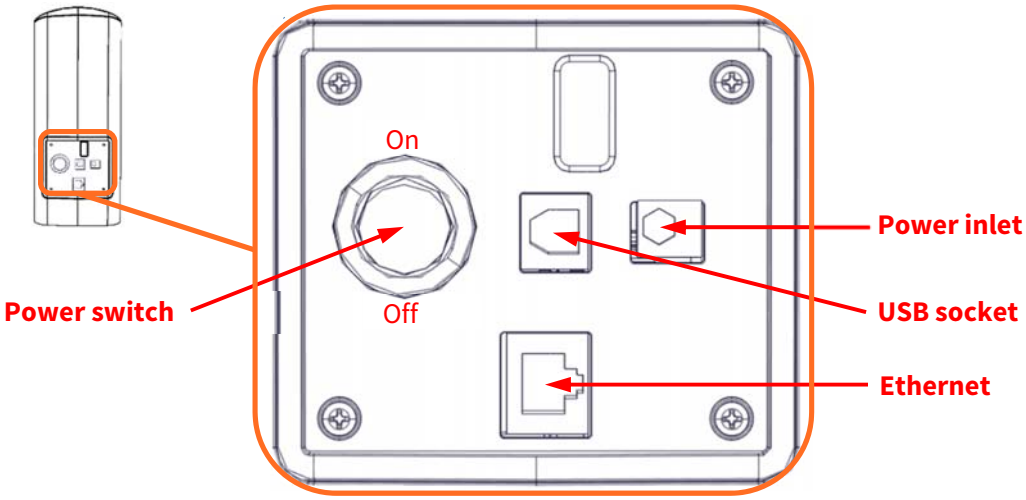
Parts removal/replacement

Disassembly

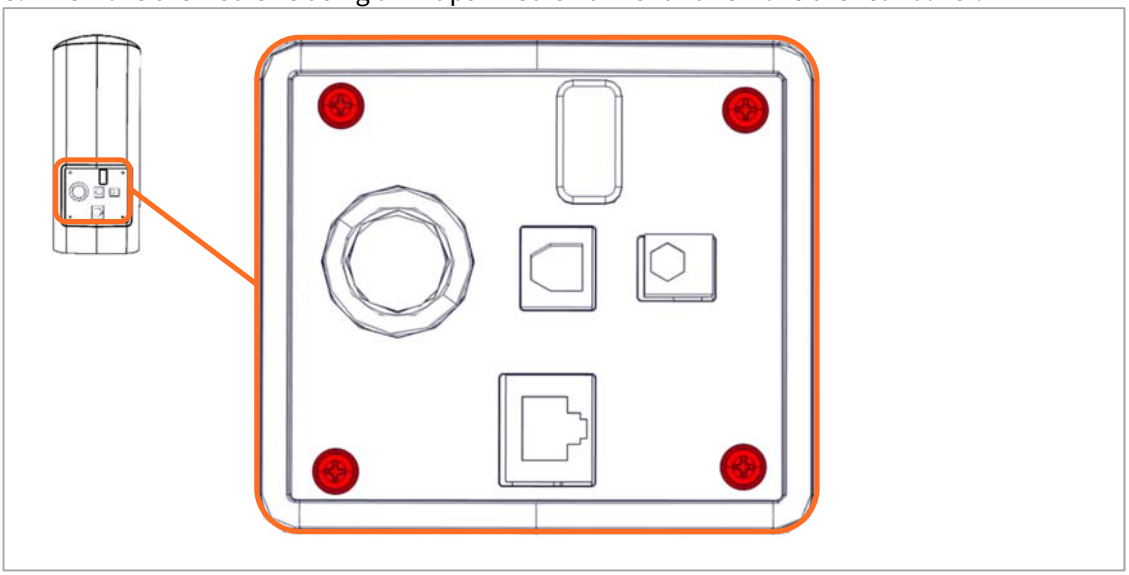
1. Set the reader into “sleep mode” by pressing on the half-moon symbol on the display.



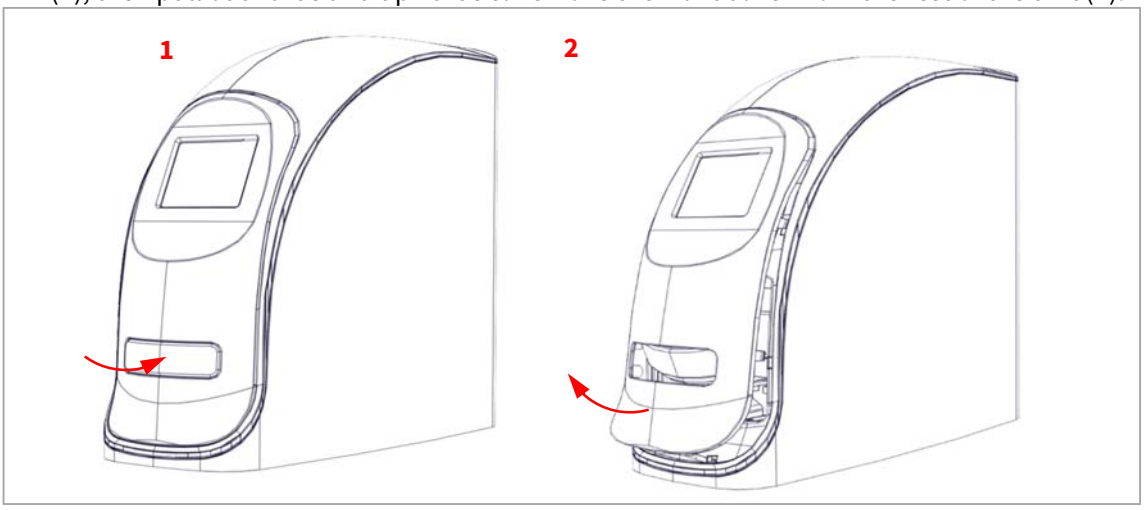
2. Switch off the reader on the back and disconnect all cables.



3. Remove the 4 screws using a Philips #2 screwdriver and remove the rear cover.

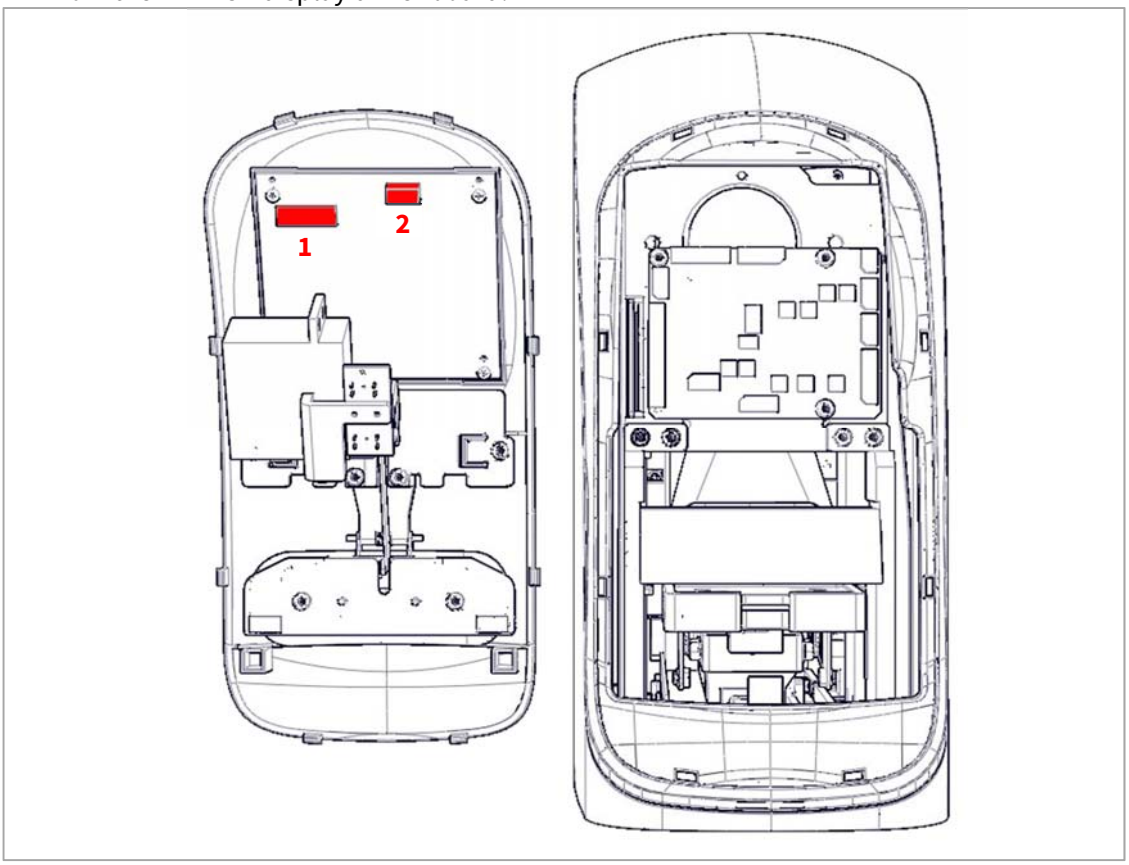


4. Push the door inwards and upwards to gain a decent handhold on the inside of the front cover (**1**), then pull outwards and upwards to remove the front cover from the rest of the unit (**2**).

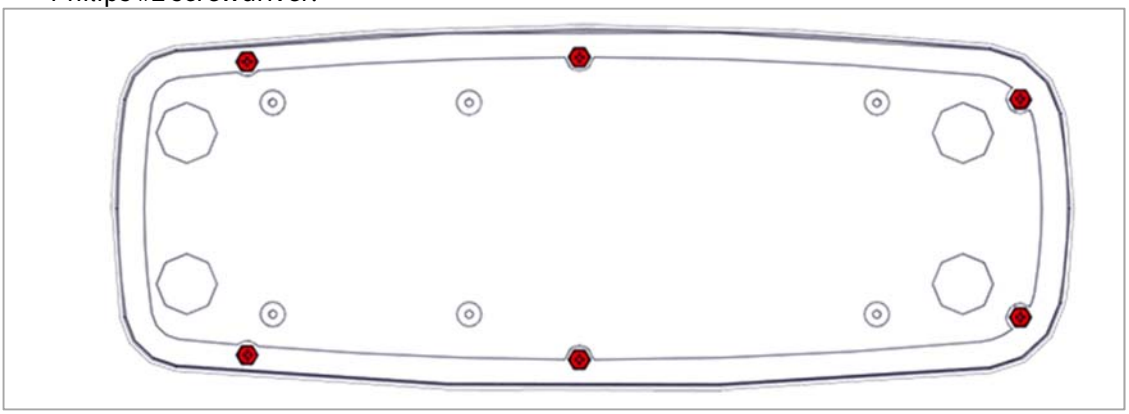


5. Turn the front cover over to gain access to the cables.

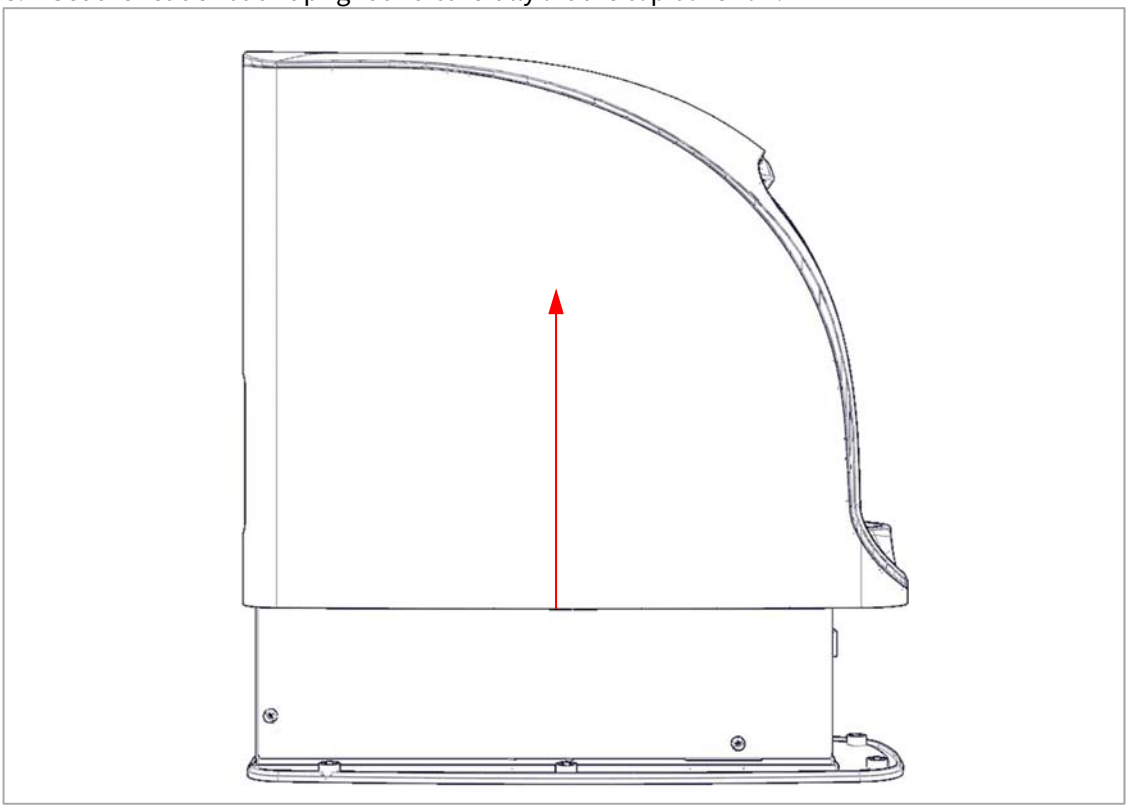
6. Tip the lock of the ribbon cable and disconnect the ribbon cable (**1**) and motor power cable (**2**) from the TFT LCD display driver board.



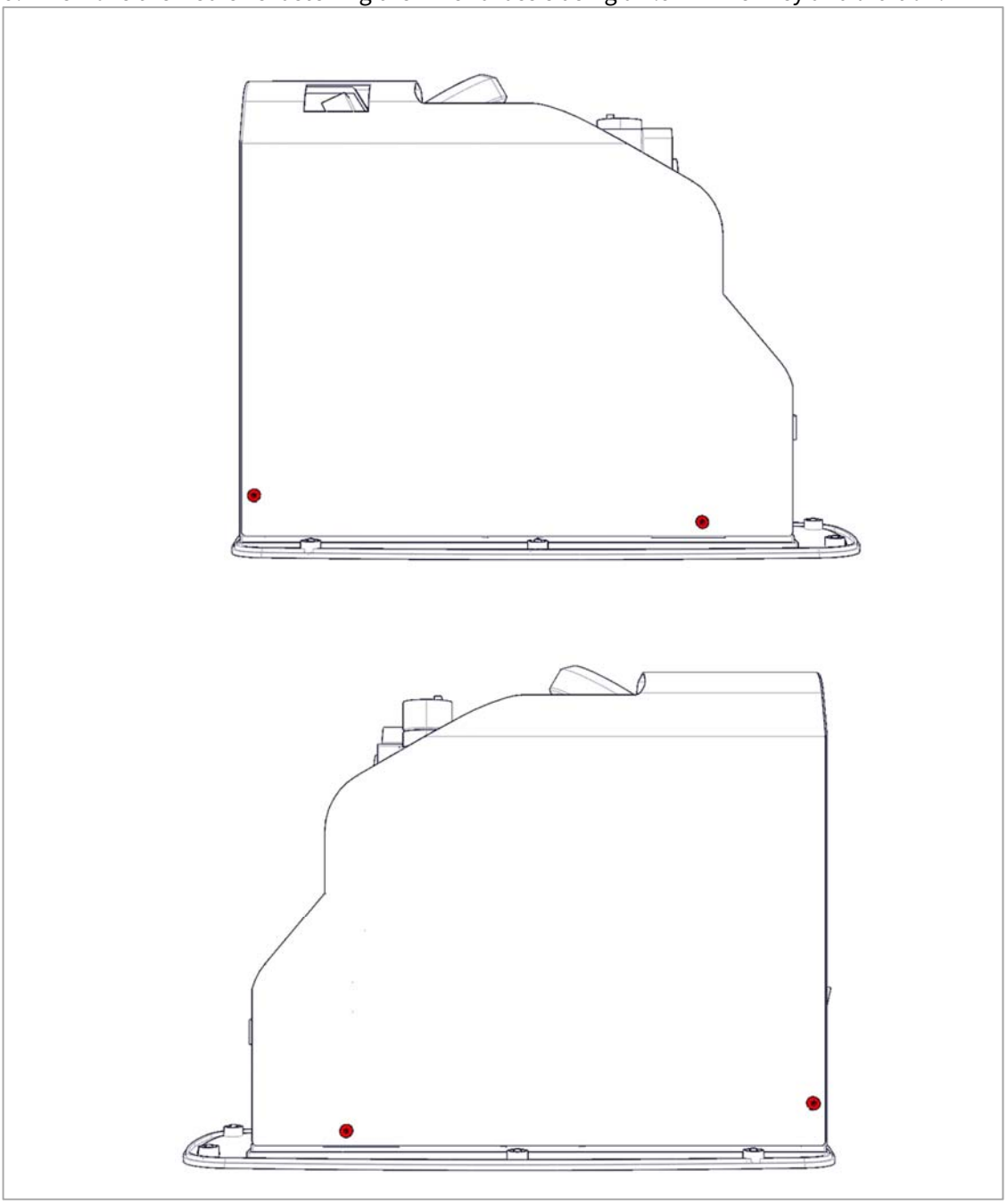
7. Put the reader on the side being careful not to damage it, and remove the 6 screws using a Philips #2 screwdriver.



8. Set the reader back upright and carefully lift the top cover off.



9. Remove the 4 screws fastening the inner chassis using a 2.5 mm hex key and lift it off.



Replacing the door assembly

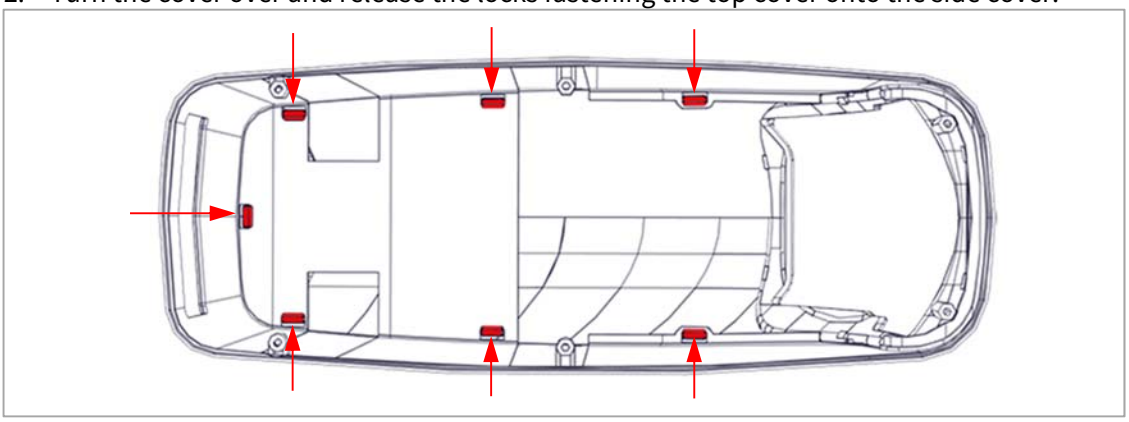
1. Follow step 1, 2, 4, 5 and 6 of **Disassembly**.
2. Replace the door assembly and install in reverse order.
3. Calibrate the LCD as described in the **LCD calibration** section.

Replacing the covers assembly

1. Follow step 1 through 9 of **Disassembly**.
2. Replace the covers and install in reverse order.

Replacing the top cover

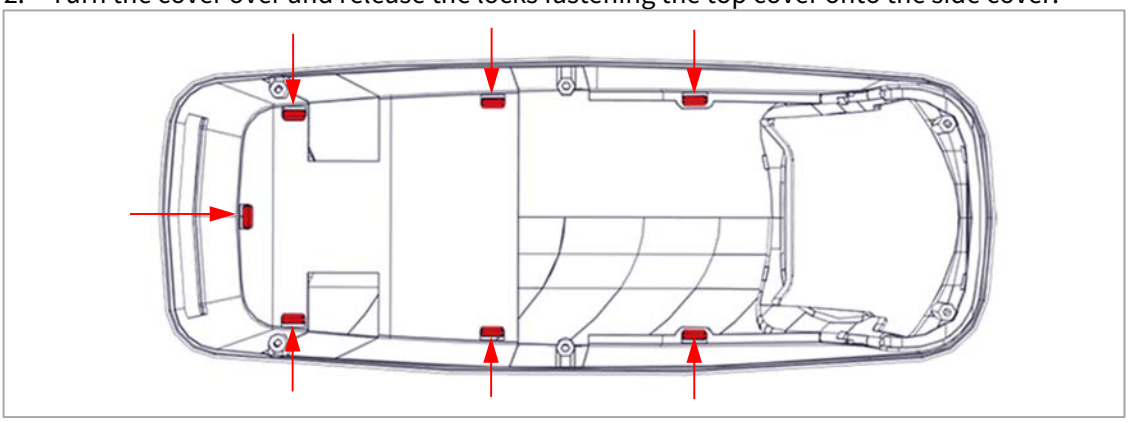
1. Follow step 1 through 8 of **Disassembly**.
2. Turn the cover over and release the locks fastening the top cover onto the side cover.



3. Replace the top cover and install in reverse order.

Replacing the side cover

1. Follow step 1 through 8 of **Disassembly**.
2. Turn the cover over and release the locks fastening the top cover onto the side cover.



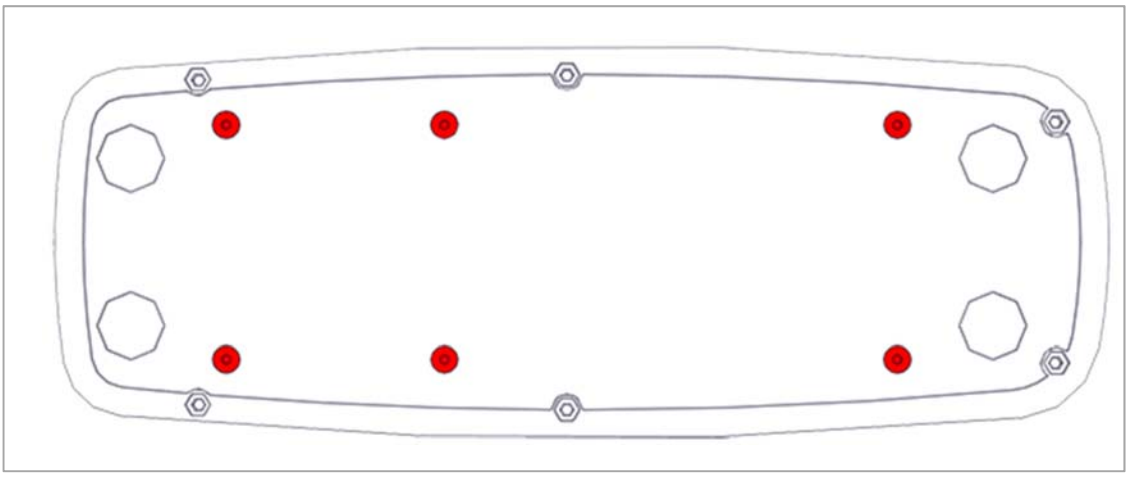
3. Replace the side cover and install in reverse order.
4. Fasten the serial number sticker on the back of the cover.

Replacing the inner cover

1. Follow step 1 through 9 of **Disassembly**.
2. Replace the inner cover and install in reverse order.

Replacing the bottom cover

1. Follow step 1 through 8 of **Disassembly**.
2. Put the scanner onto its side and remove the 6 screws using a 2.5mm hex key and remove the bottom cover.



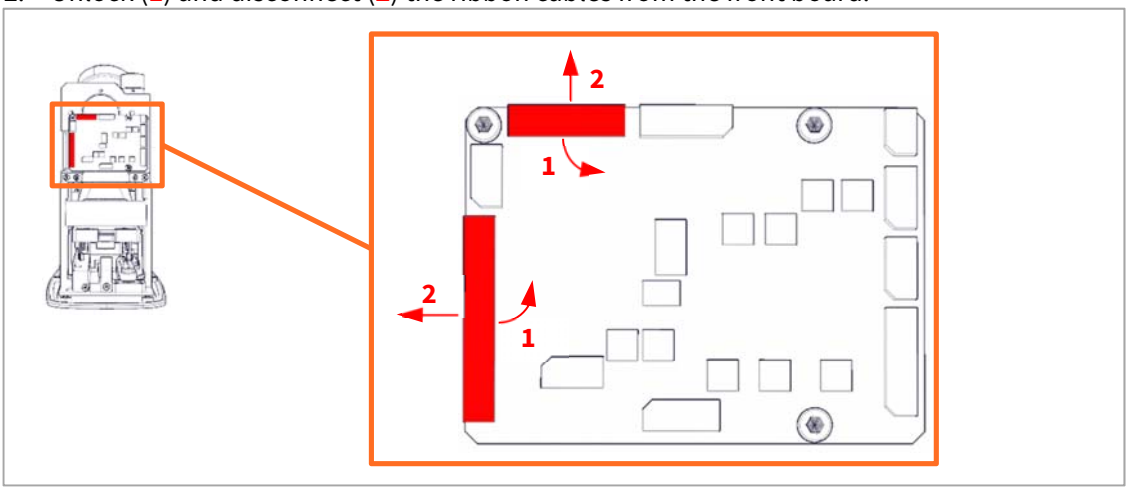
3. Replace the bottom cover and install in reverse order.

Replacing the rear cover

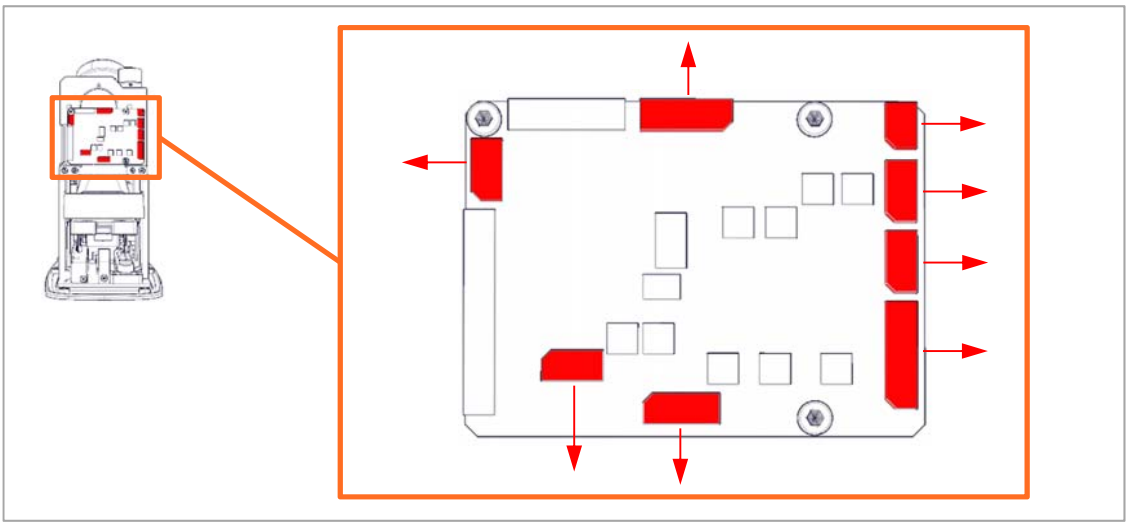
1. Follow step 1 through 3 of **Disassembly**.
2. Replace the rear cover and install in reverse order.

Replacing the front board

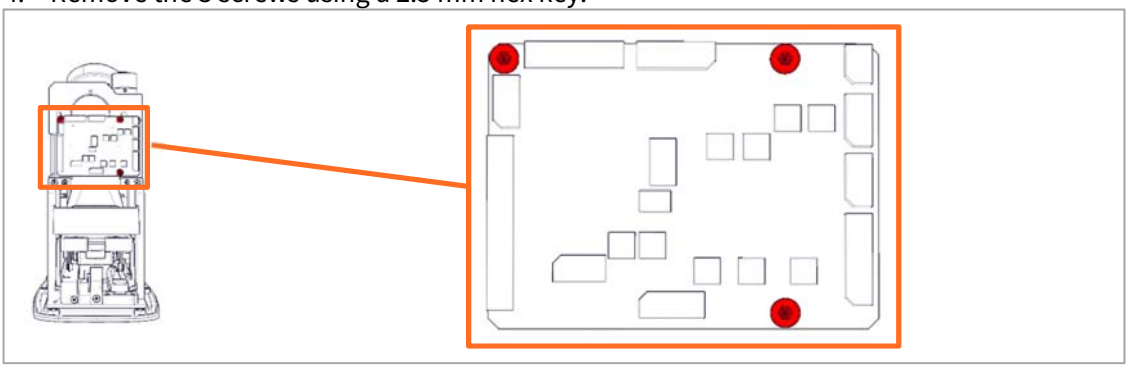
1. Follow step 1 through 9 of **Disassembly**.
2. Unlock (**1**) and disconnect (**2**) the ribbon cables from the front board.



3. Unplug the connectors from the front board.



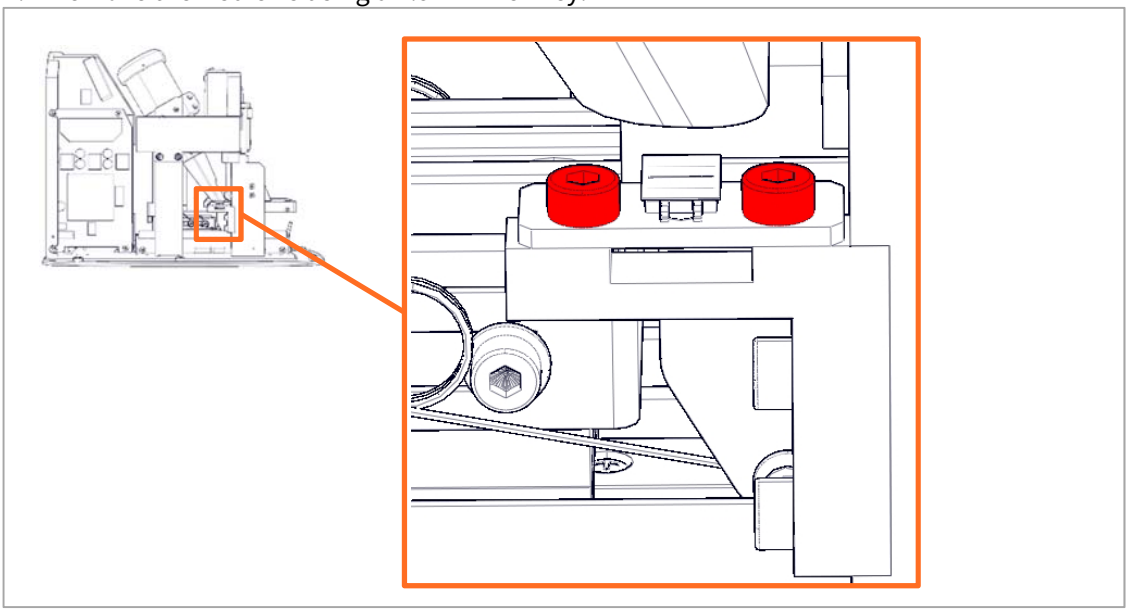
4. Remove the 3 screws using a 2.5 mm hex key.



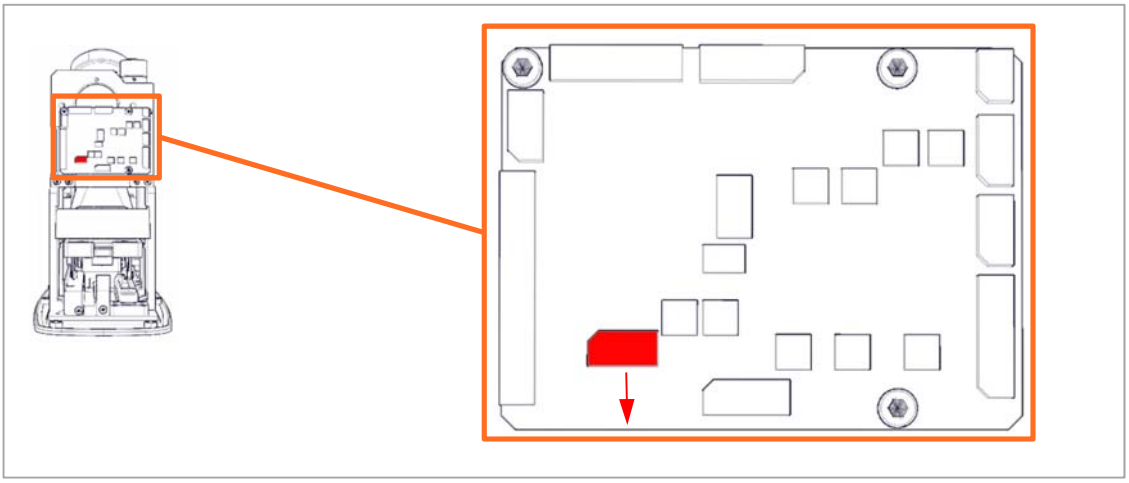
5. Replace the front board and install in reverse order.

Replacing the left PSD sensor

1. Follow step 1 through 9 of **Disassembly**.
2. Remove the 2 screws using a 2.5 mm hex key.



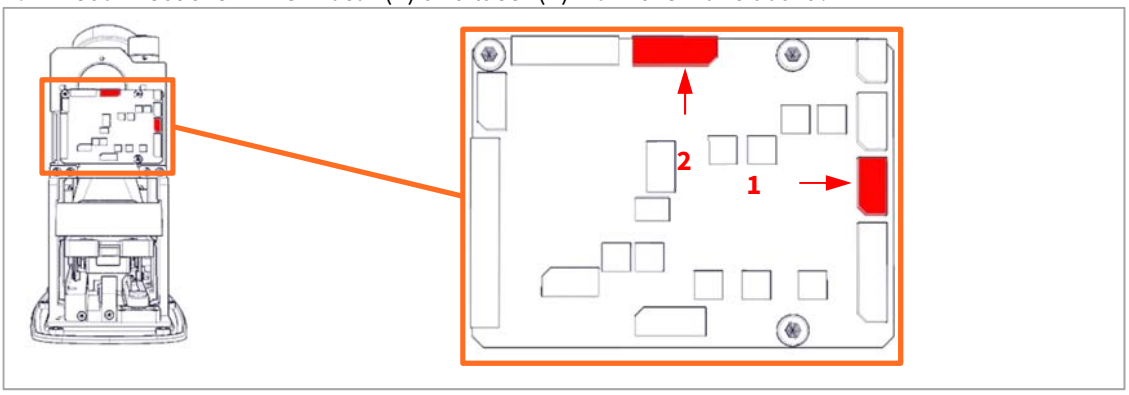
3. Cut the cable tie and disconnect the PSD sensor from the front board PCB.



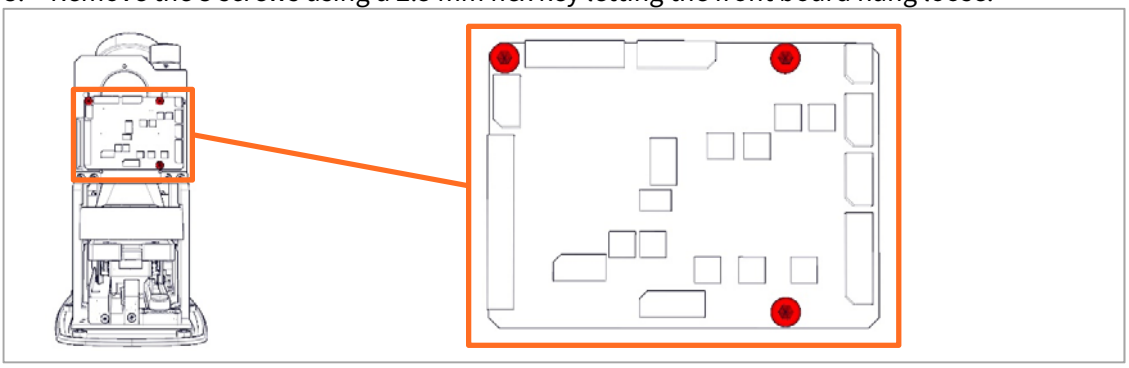
4. Replace the left PSD and install in reverse order.

Replacing the laser module

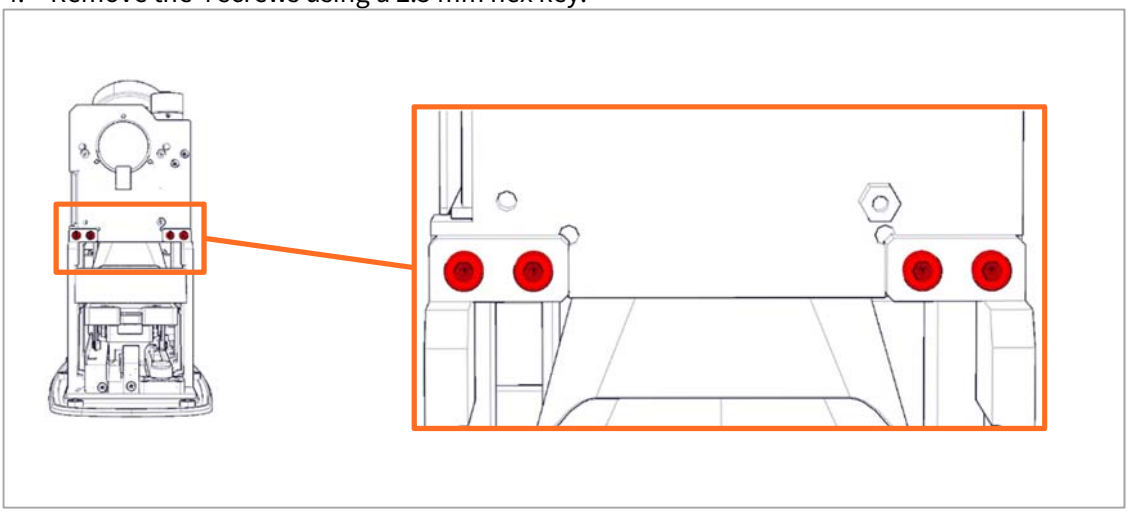
1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect the BLDC motor (1) and laser (2) from the front board.



3. Remove the 3 screws using a 2.5 mm hex key letting the front board hang loose.



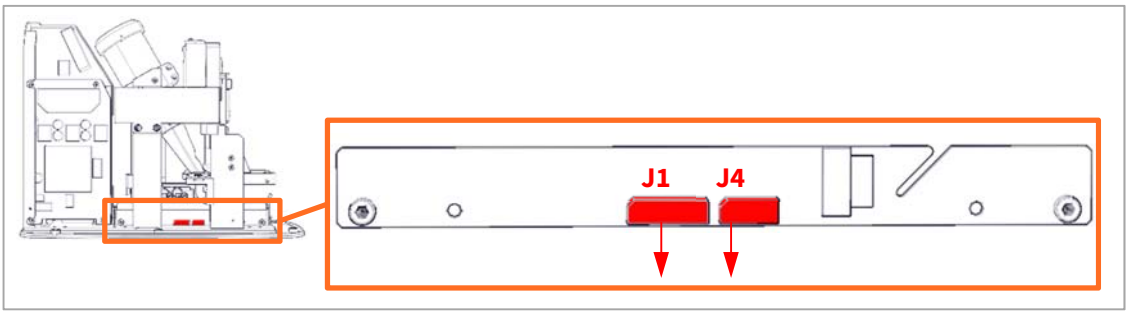
4. Remove the 4 screws using a 2.5 mm hex key.



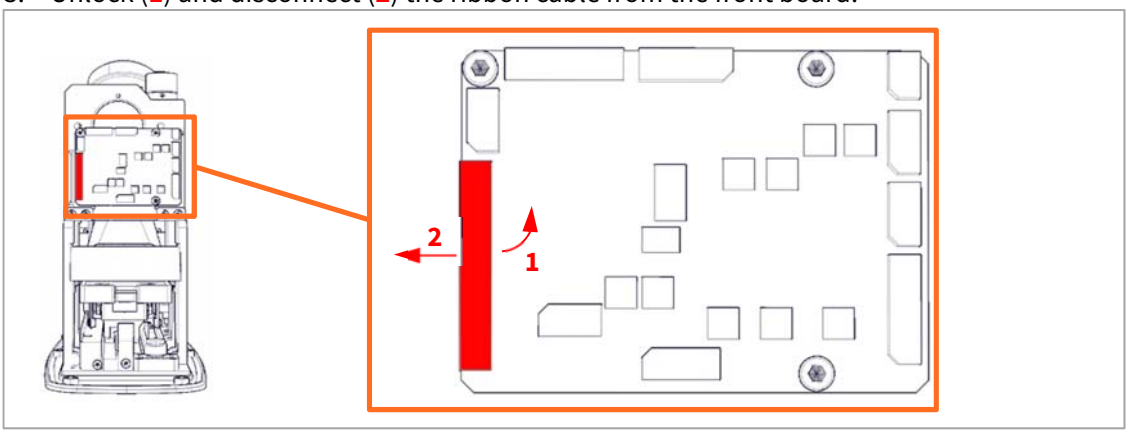
5. Replace the laser module and install in reverse order.

Replacing the optics bracket

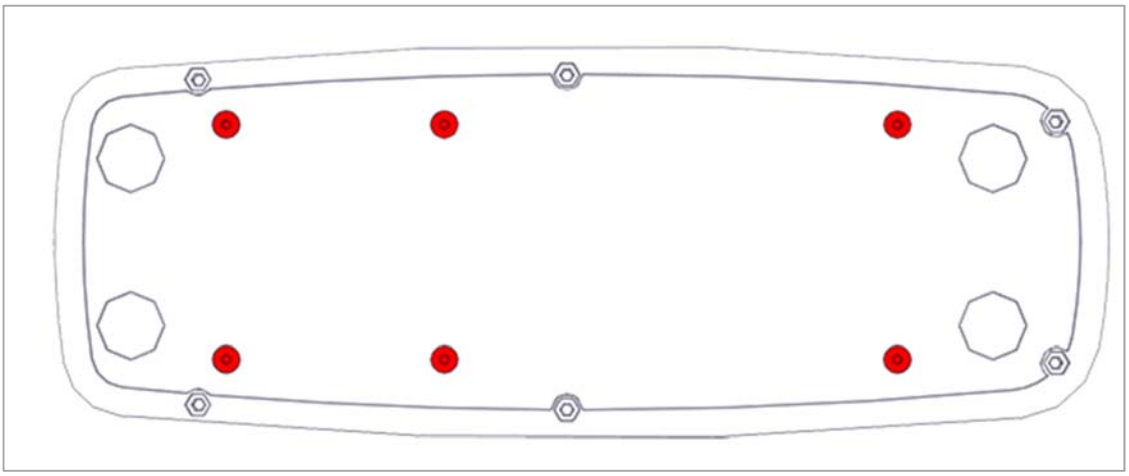
1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect **J1** and **J4** from the bottom board.



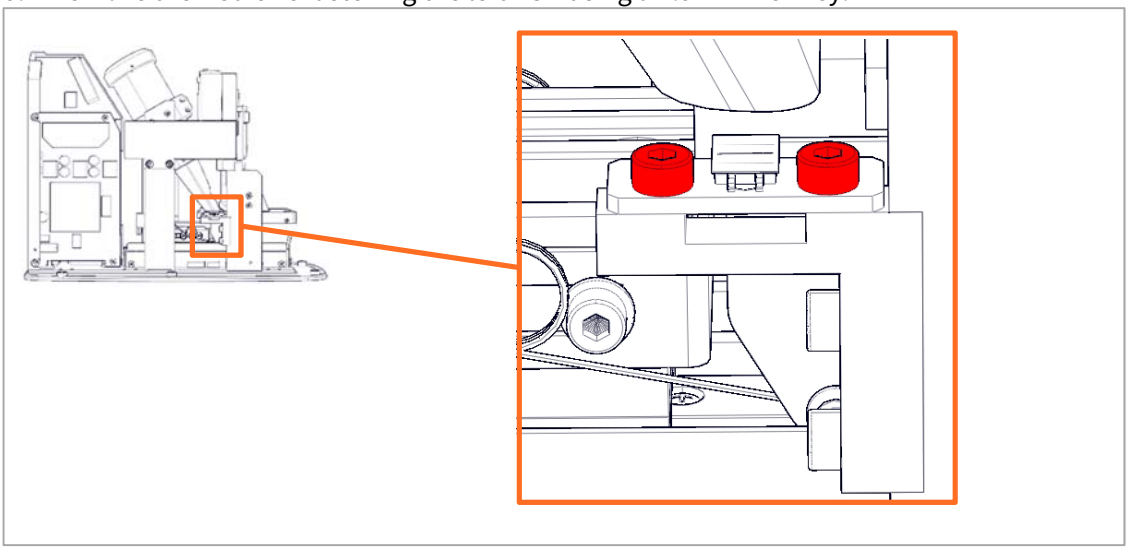
3. Unlock (**1**) and disconnect (**2**) the ribbon cable from the front board.



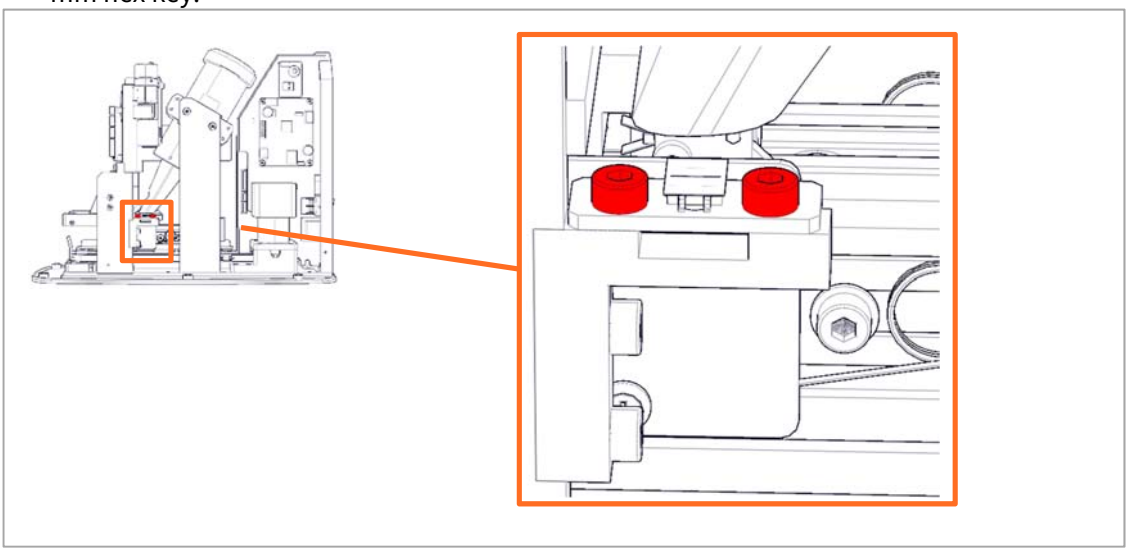
4. Put the scanner onto its side and remove the 6 screws using a 2.5mm hex key and remove the bottom cover.



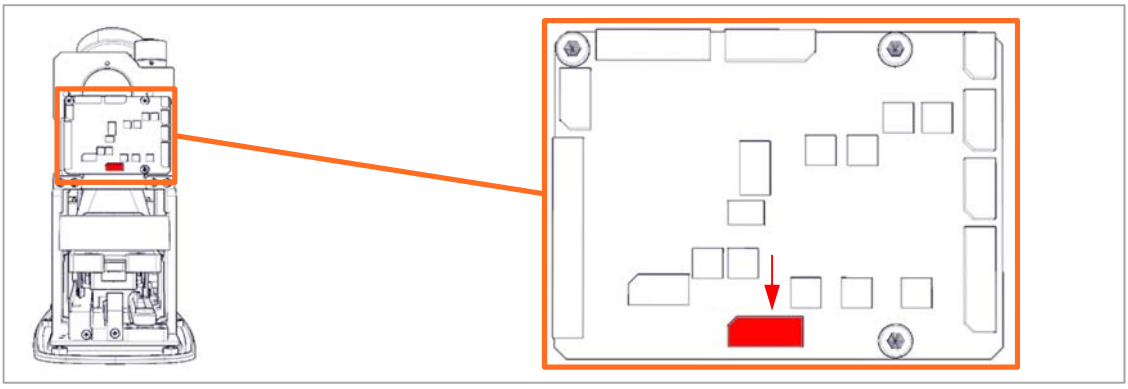
5. Remove the 2 screws fastening the left PSD using a 2.5 mm hex key.



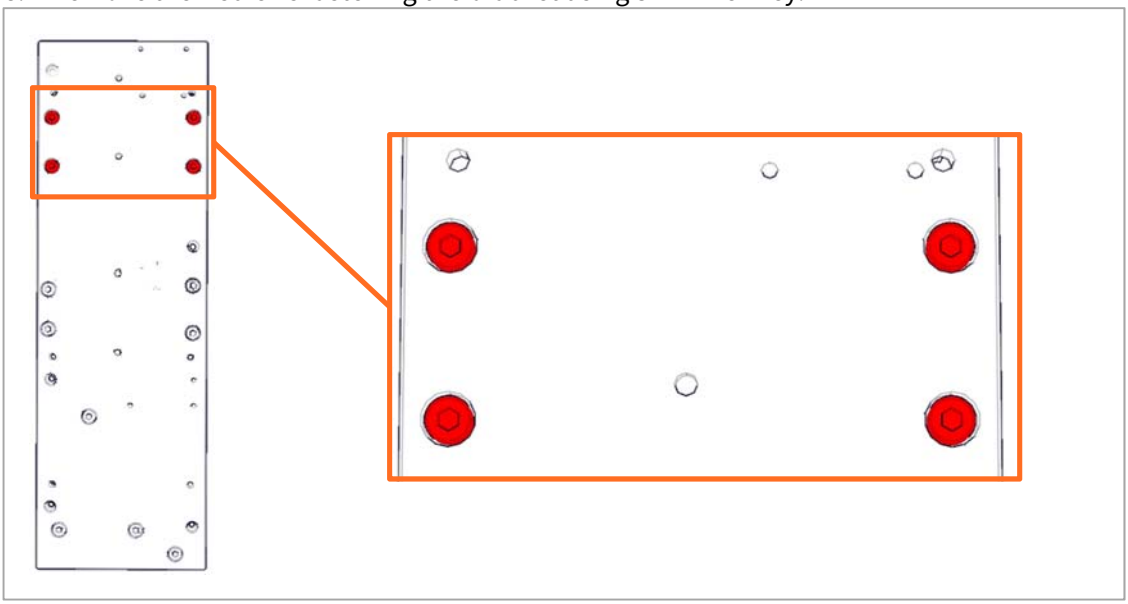
6. Rotate the unit to the other side and remove the 2 screws fastening the right PSD using a 2.5 mm hex key.



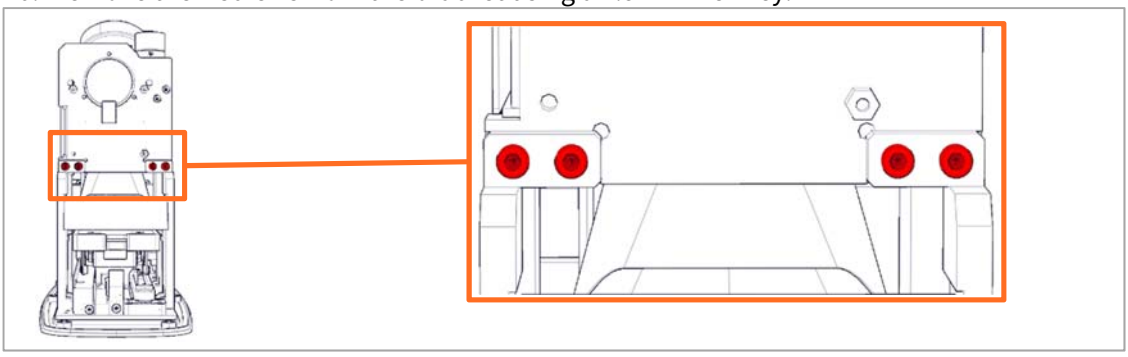
7. Cut the cable tie and disconnect the eraser from the front board.



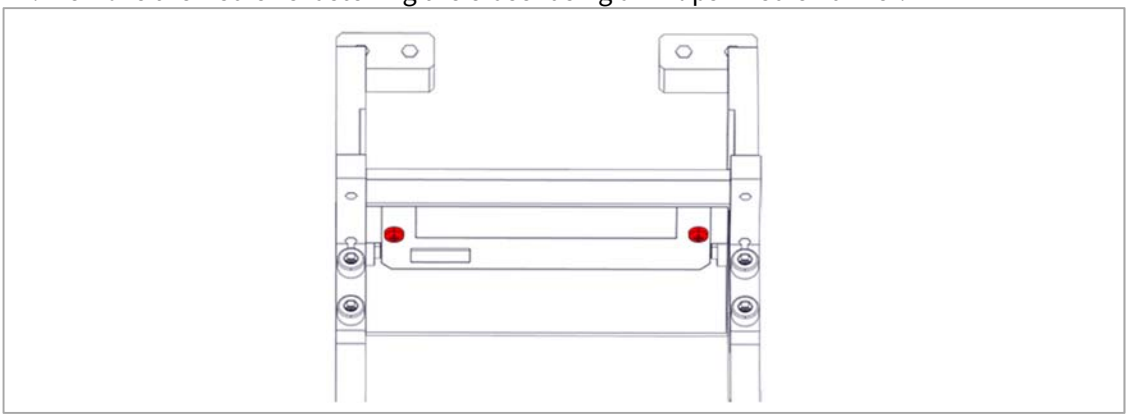
8. Remove the 4 screws fastening the bracket using 3 mm hex key.



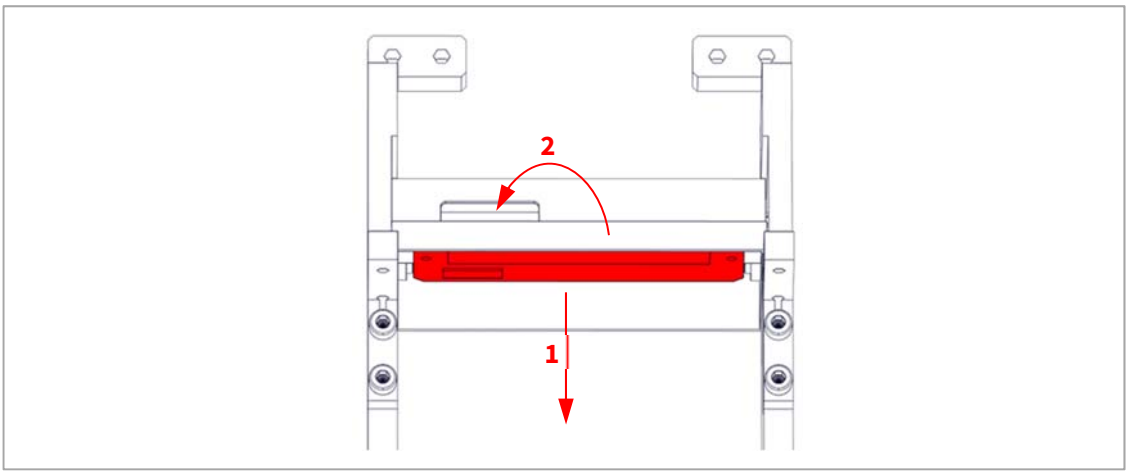
9. Carefully lift the optics assembly out of the unit.
10. Remove the 4 screws from the bracket using a 2.5 mm hex key.



11. Remove the 2 screws fastening the eraser using a Philips #1 screwdriver.



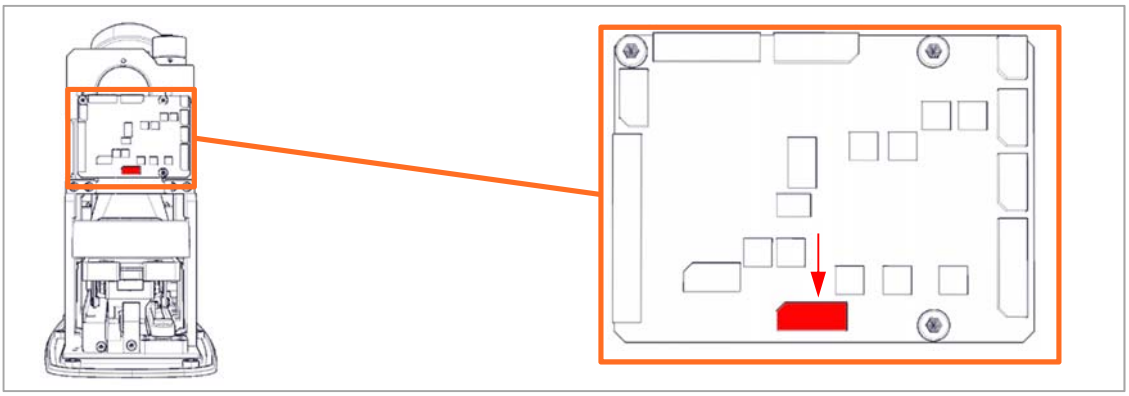
12. Remove the eraser (**1**) while guiding the wires through the eraser cover (**2**).



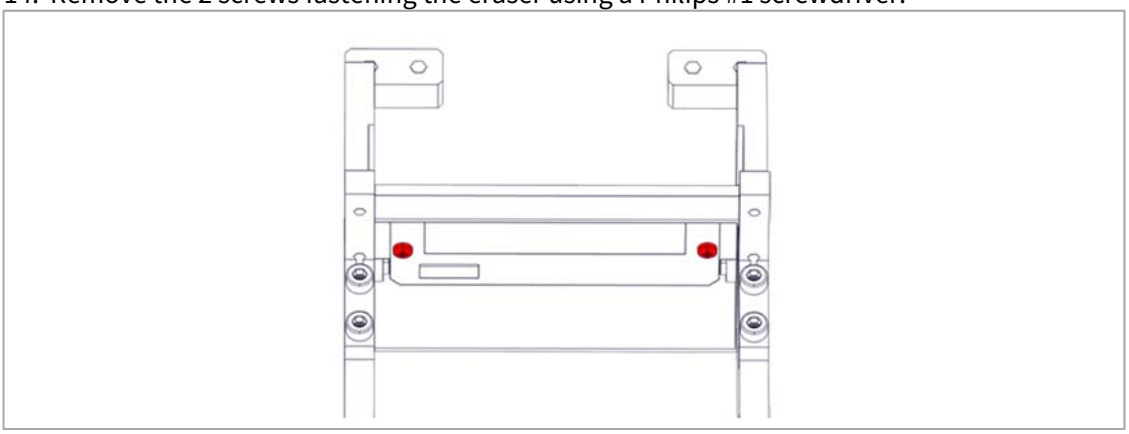
13. Replace the optics bracket and install in reverse order.

Replacing the eraser

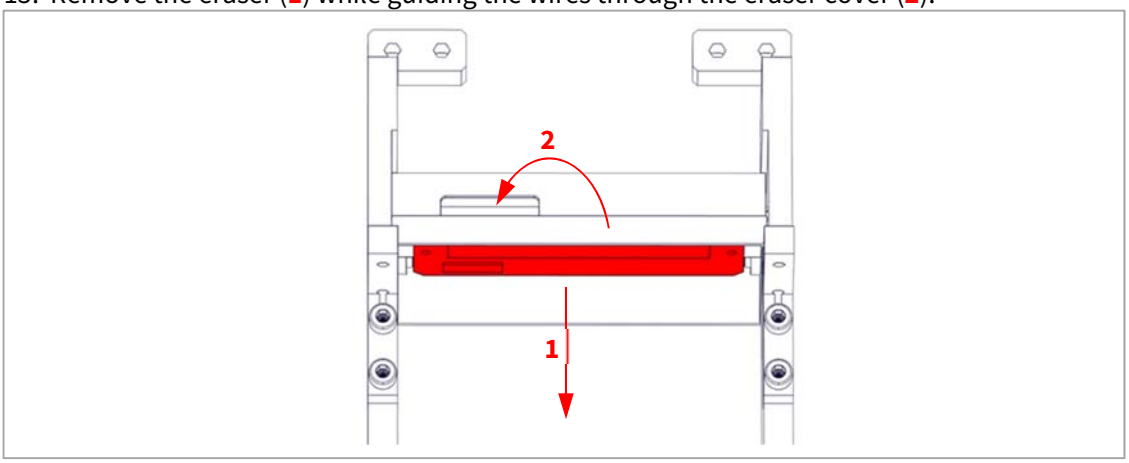
1. Follow step 1 through 9 of **Disassembly**.
2. Cut the cable tie and disconnect the eraser from the front board.



14. Remove the 2 screws fastening the eraser using a Philips #1 screwdriver.



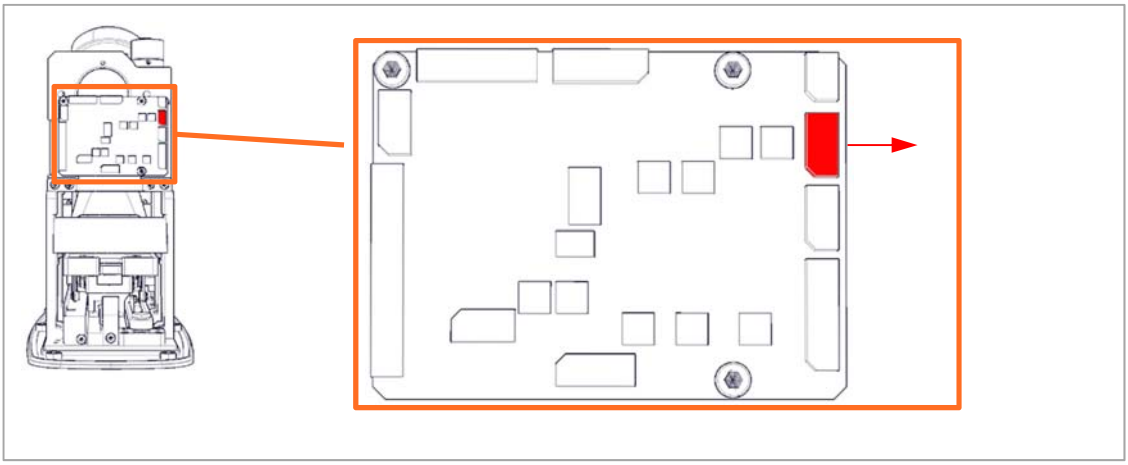
15. Remove the eraser (**1**) while guiding the wires through the eraser cover (**2**).



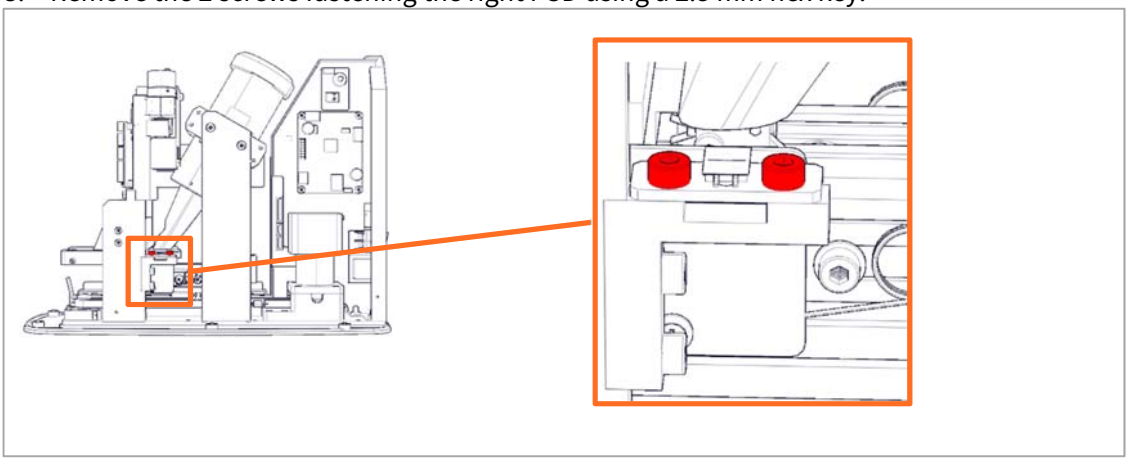
3. Replace the eraser and install in reverse order.

Replacing the right PSD sensor

1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect the PSD sensor from the front board.



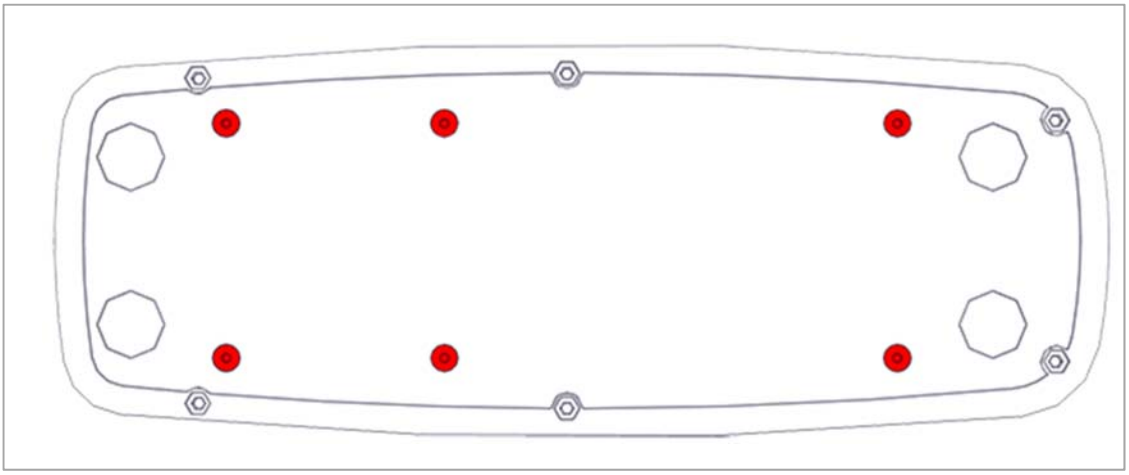
3. Remove the 2 screws fastening the right PSD using a 2.5 mm hex key.



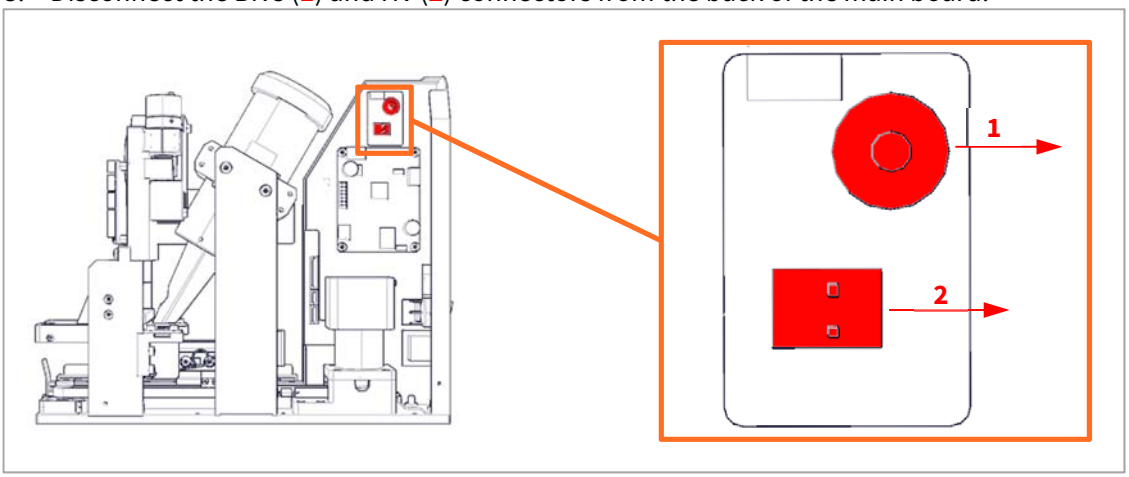
4. Replace the PSD sensor and install in reverse order.

Replacing the PMT assembly

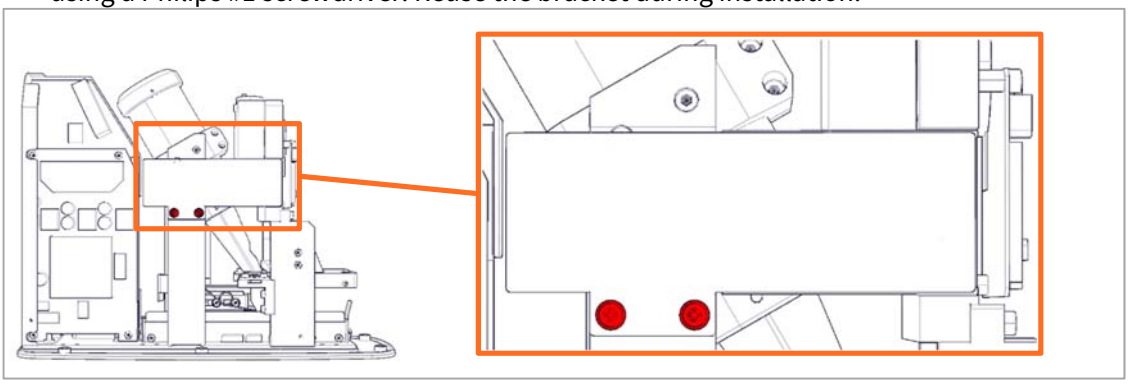
1. Follow step 1 through 9 of **Disassembly**.
2. Put the scanner onto its side and remove the 6 screws using a 2.5mm hex key and remove the bottom cover.



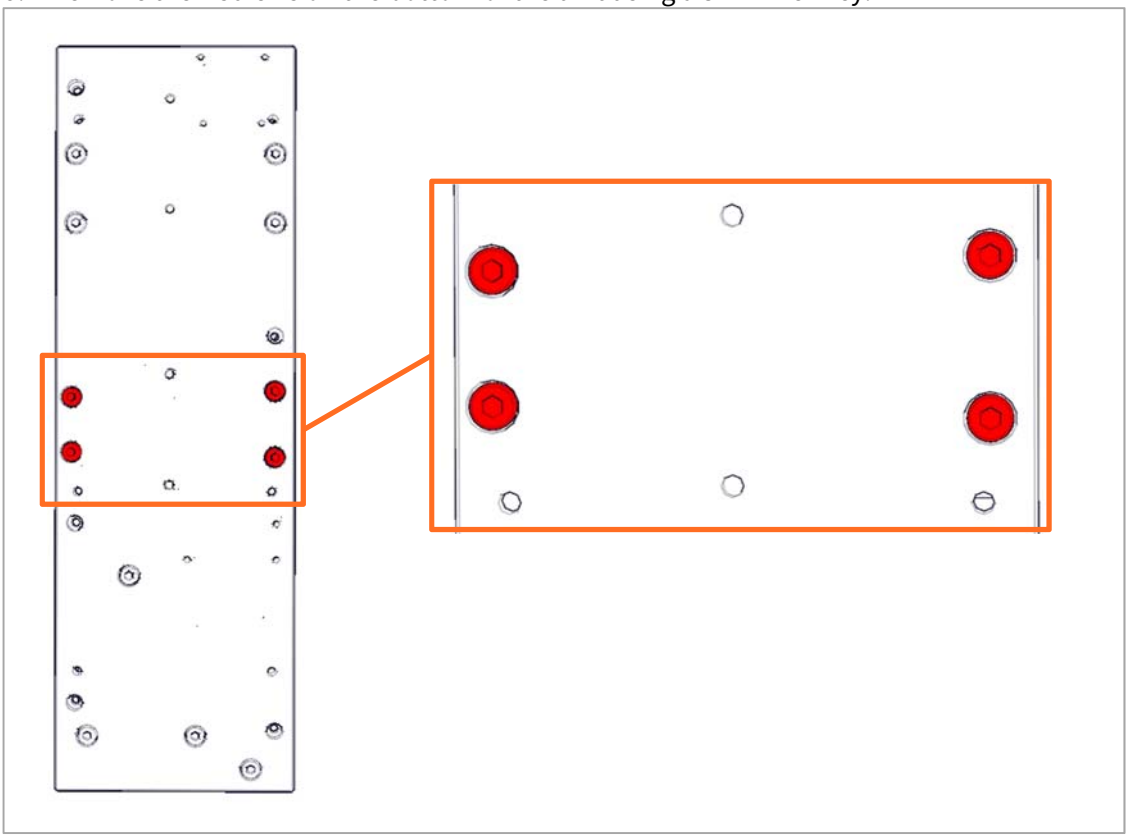
3. Disconnect the BNC (**1**) and HV (**2**) connectors from the back of the main board.



4. Rotate the unit to access the opposite side and remove the 2 screws fastening the bracket using a Philips #1 screwdriver. Reuse the bracket during installation.



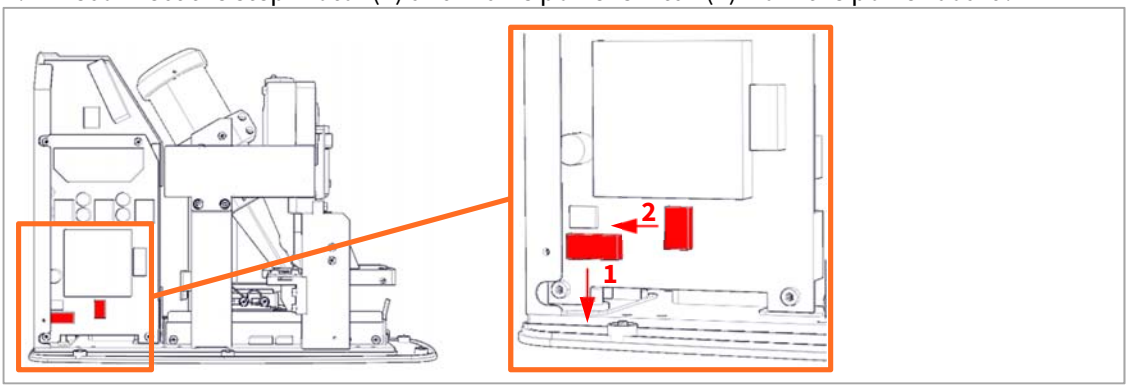
5. Remove the 4 screws on the bottom of the unit using a 3 mm hex key.



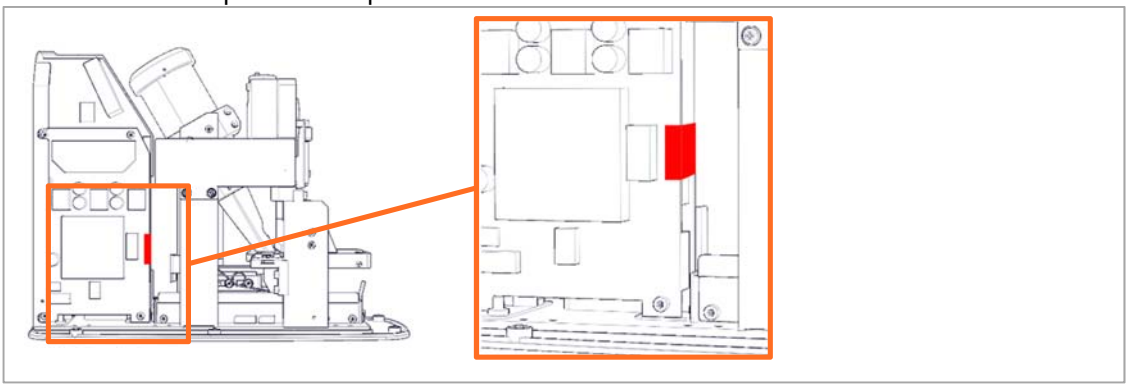
6. Replace the PMT assembly and install in reverse order reusing the metal bracket.
7. Continue onto **PMT gain and ADC offset verification/adjustment**.

Replacing the power board

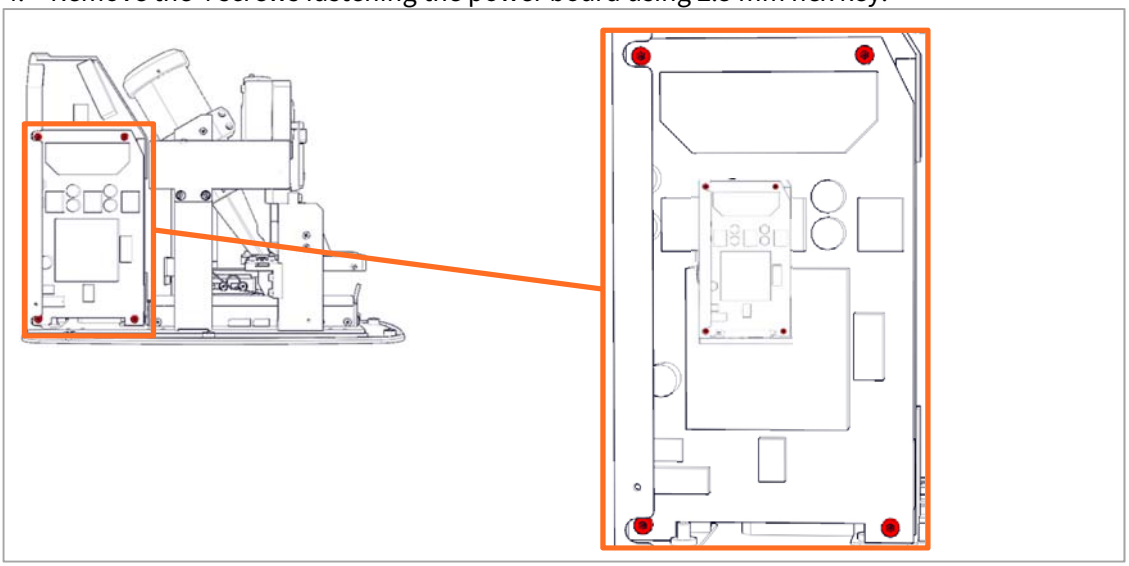
1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect the step motor (1) and mains power switch (2) from the power board.



3. Remove the tape from the power board.



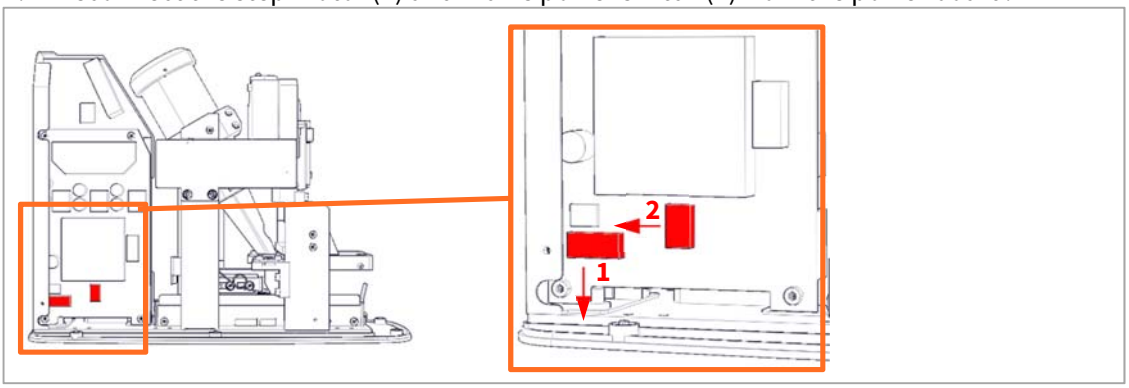
4. Remove the 4 screws fastening the power board using 2.5 mm hex key.



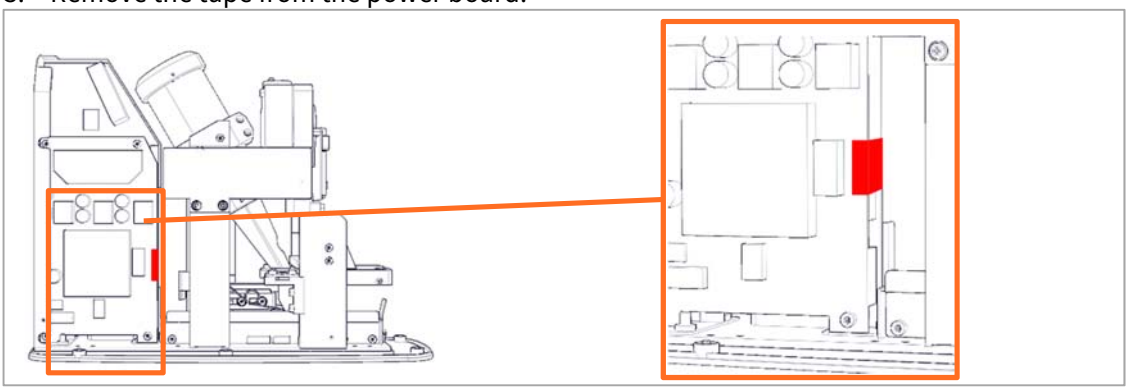
5. Remove the power board by pulling it out of the connector on the main board.
6. Replace the power board and install in reverse order.

Replacing the main board

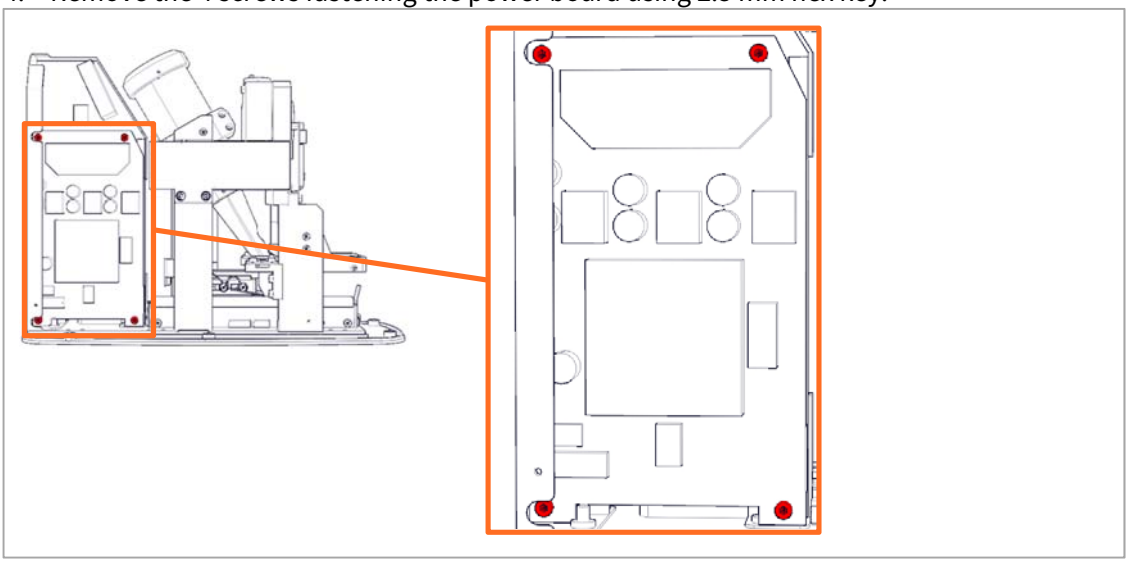
1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect the step motor (**1**) and mains power switch (**2**) from the power board.



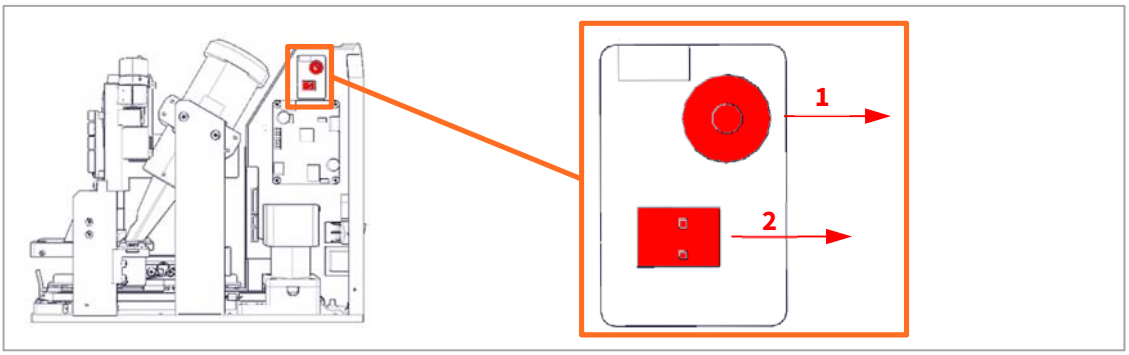
3. Remove the tape from the power board.



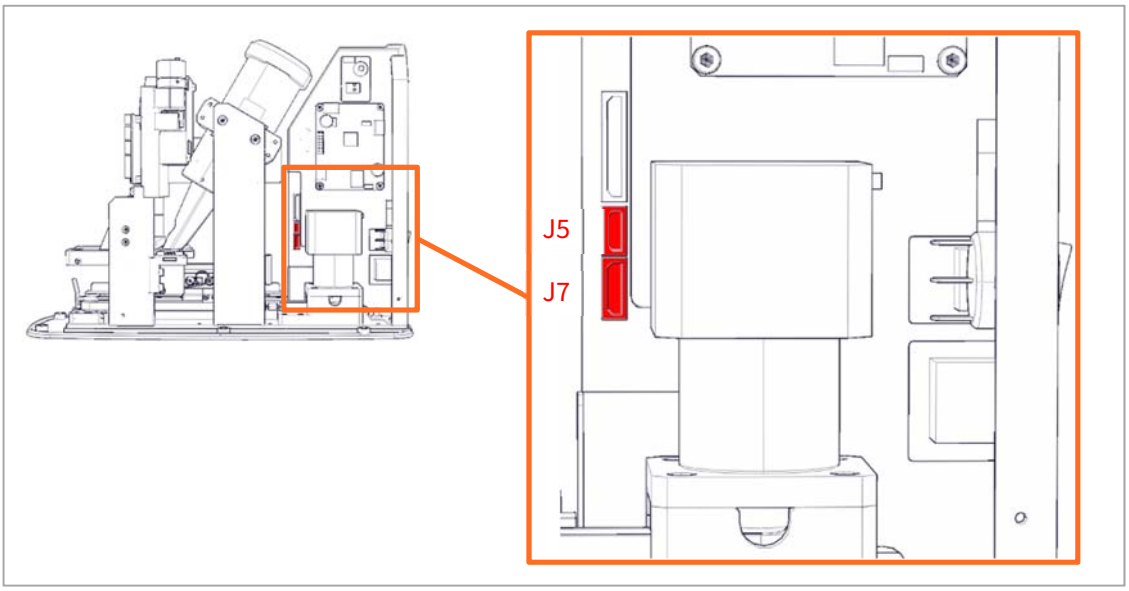
4. Remove the 4 screws fastening the power board using 2.5 mm hex key.



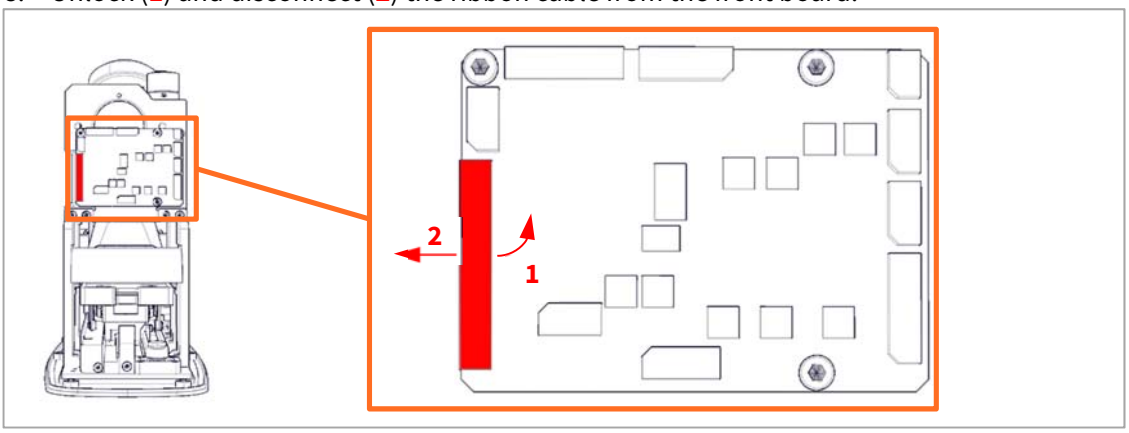
5. Remove the power board by pulling it out of the connector on the main board.
6. Rotate the unit to gain access to the other side and disconnect the BNC (**1**) and HV (**2**) connectors from the back of the main board.



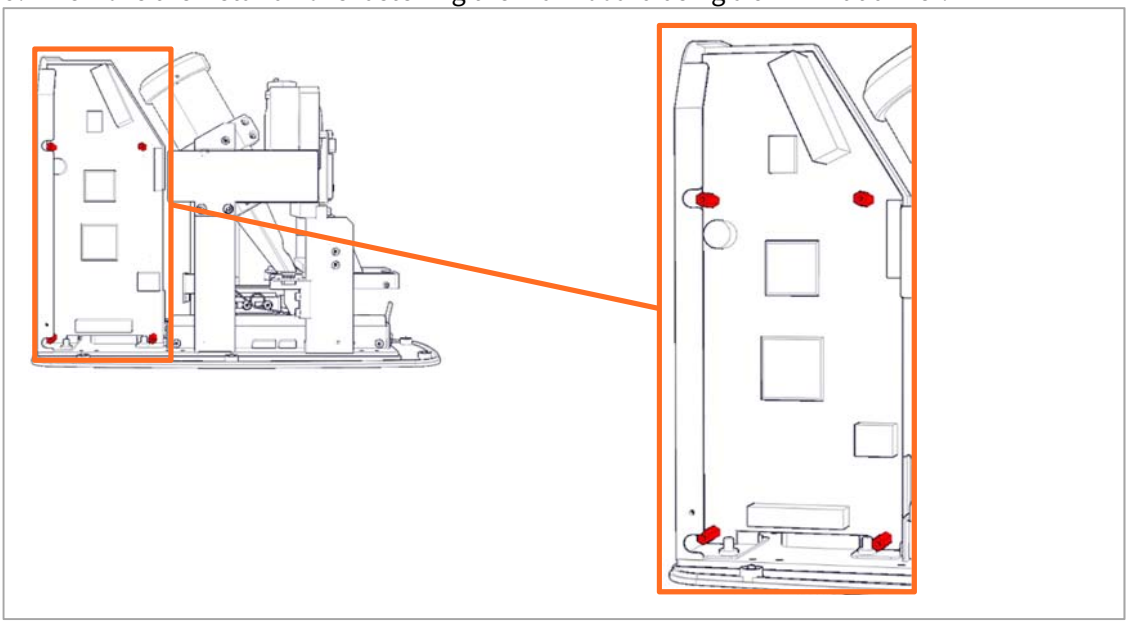
7. Disconnect **J5** and **J7** from the back of the main board.



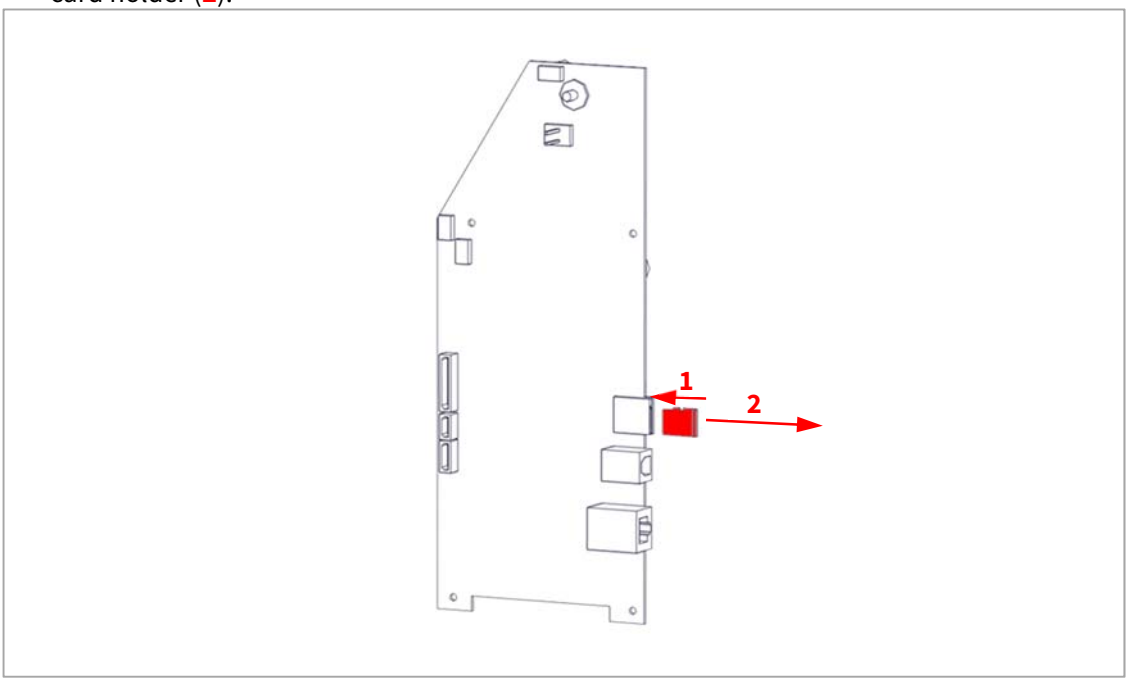
8. Unlock (**1**) and disconnect (**2**) the ribbon cable from the front board.



9. Remove the 4 stanchions fastening the main board using a 5 mm nut driver.



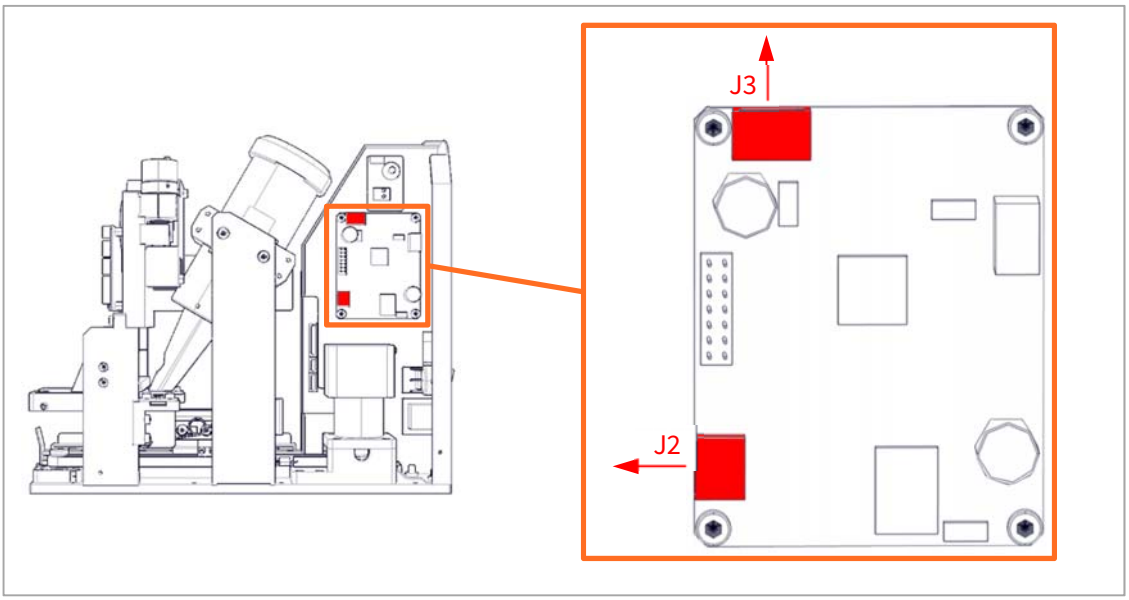
10. Remove the main board from the electronics bracket.
11. Release the SD card by pressing on it (**1**) until you hear a soft click, then pulling it out of the card holder (**2**).



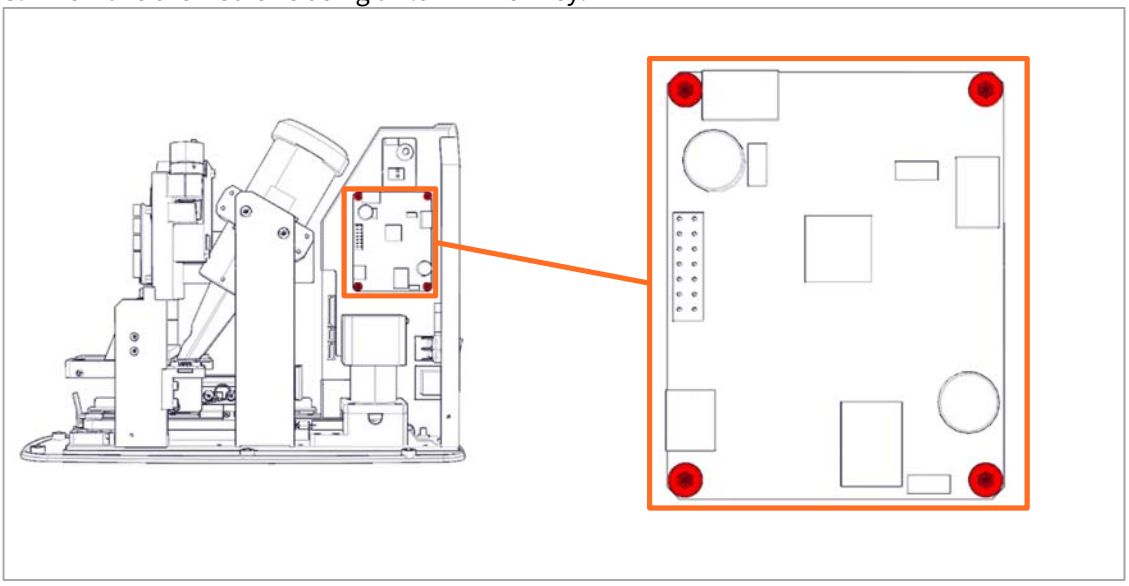
12. Replace the main board and install in reverse order.
13. Update the firmware in the unit as described in the **Updating the firmware after parts replacement** section.

Replacing the BLDC driver board

1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect **J2** and **J3** from the BLDC driver board.



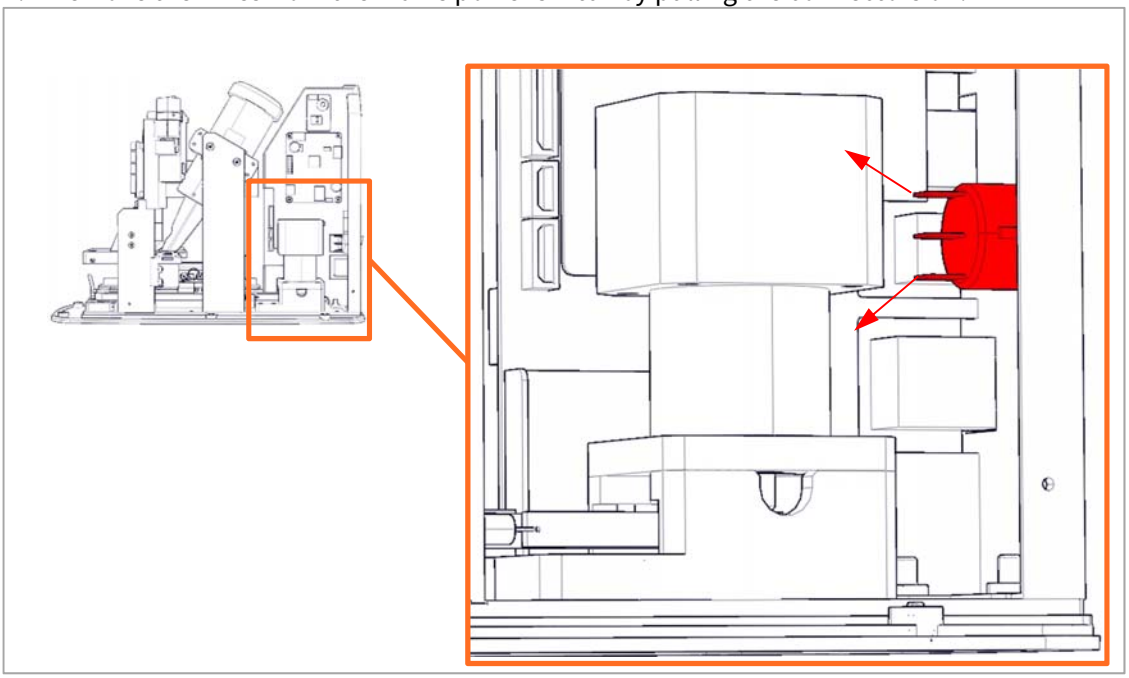
3. Remove the 4 screws using a 2.5 mm hex key.



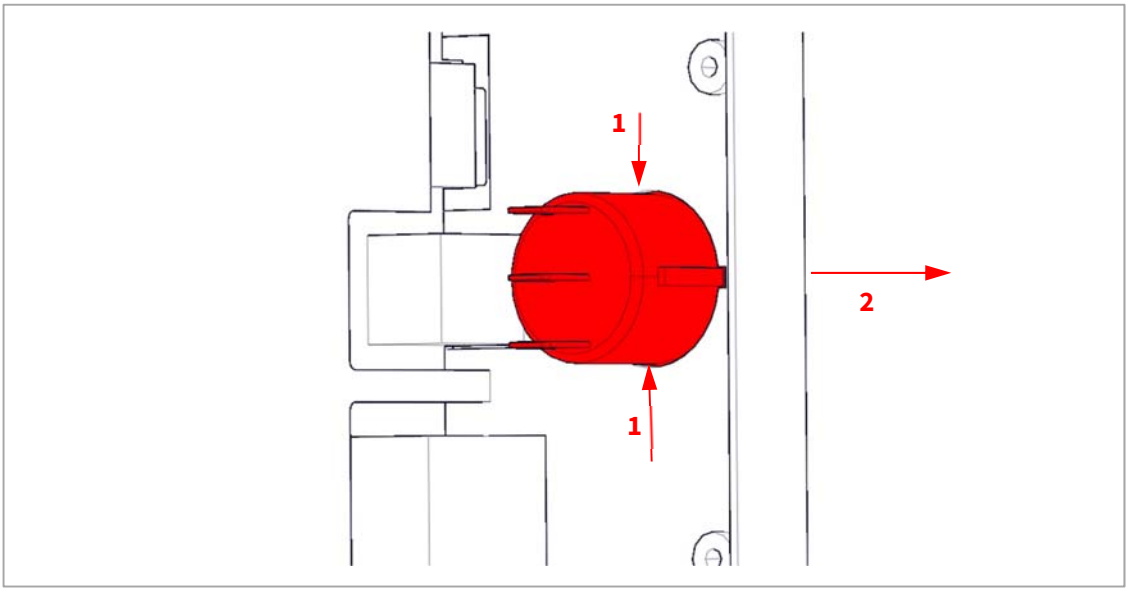
4. Replace the BLDC driver board and ensure the DIP switches are set to 0011 (off-off-on-on) and install in reverse order.

Replacing the mains power switch

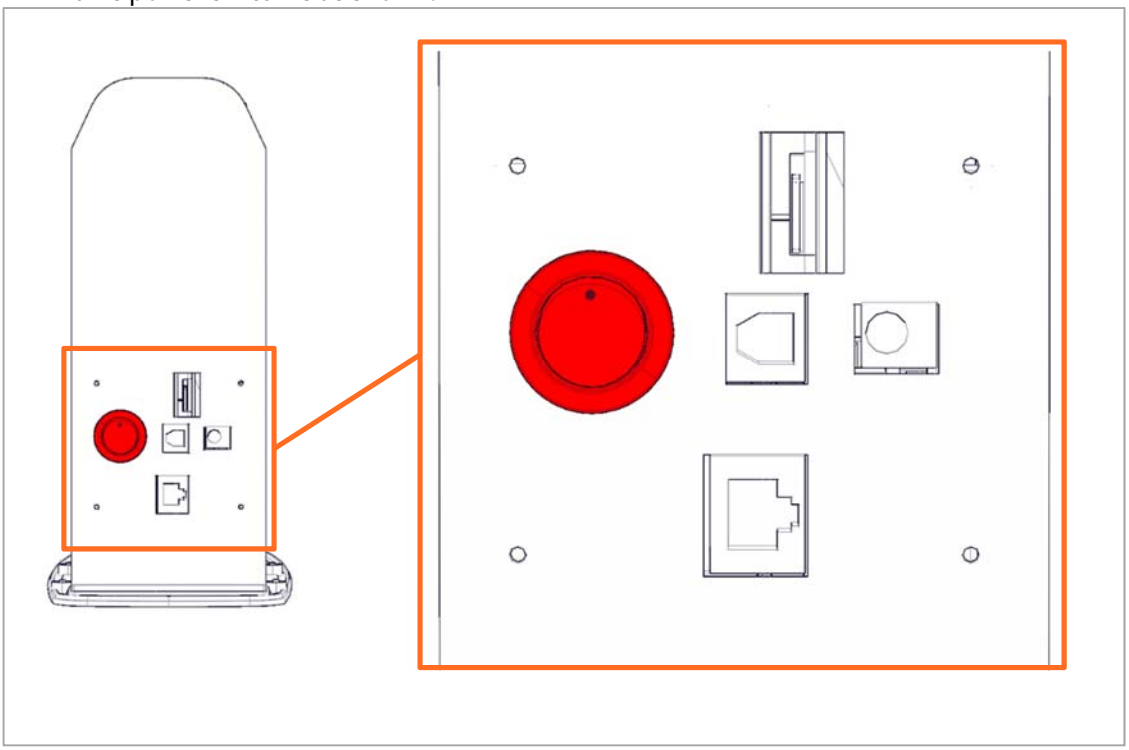
1. Follow step 1 through 9 of **Disassembly**.
2. Remove the wires from the mains power switch by pulling the connectors off.



3. Press the 2 locks inwards and remove the mains power switch out of the rear of the electronics bracket.

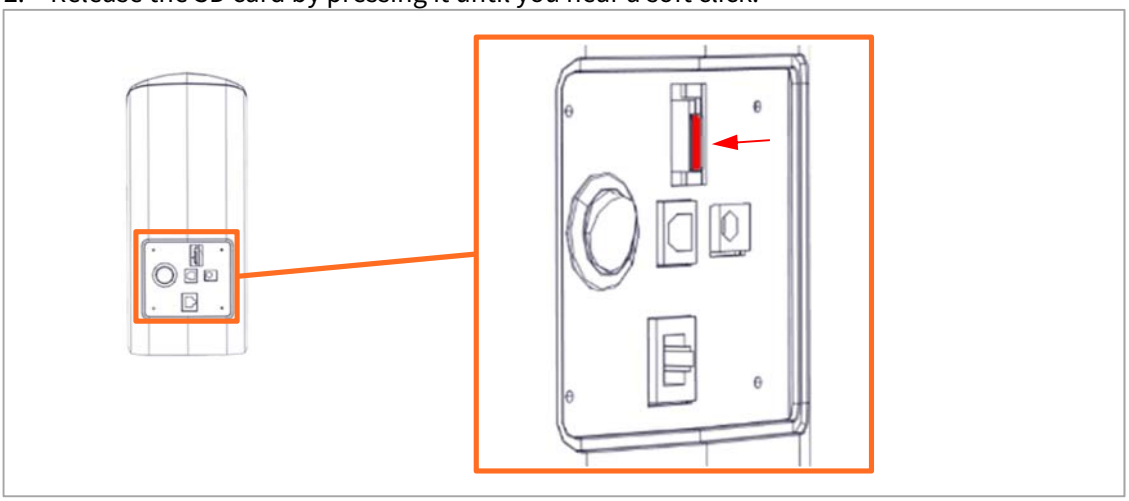


4. Replace the mains power switch and install in reverse order ensuring the orientation of the mains power switch is as shown.

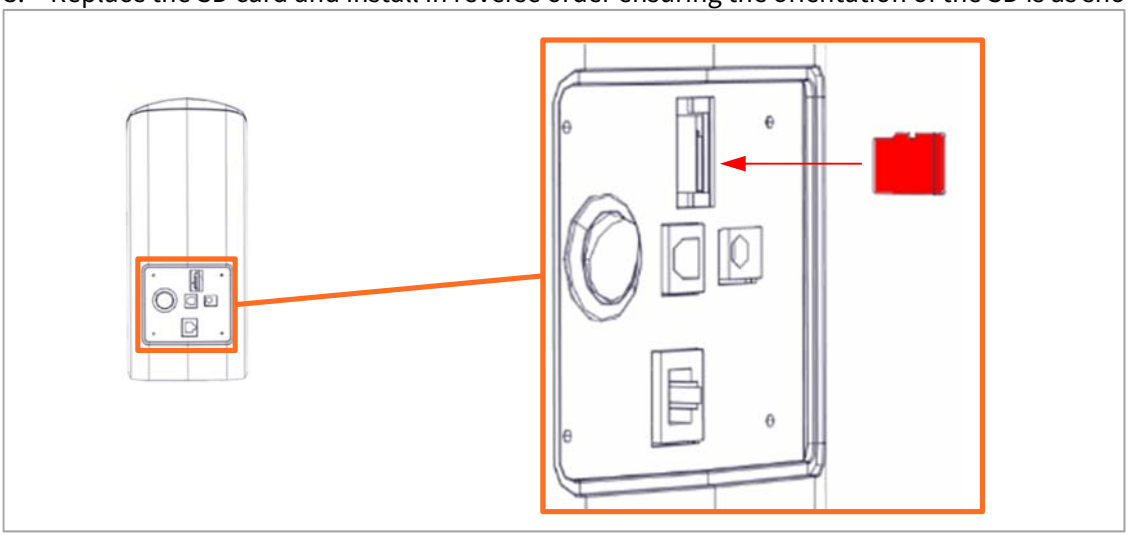


Replacing the SD memory card

1. Follow step 1 through 3 of **Disassembly**.
2. Release the SD card by pressing it until you hear a soft click.



3. Replace the SD card and install in reverse order ensuring the orientation of the SD is as shown.

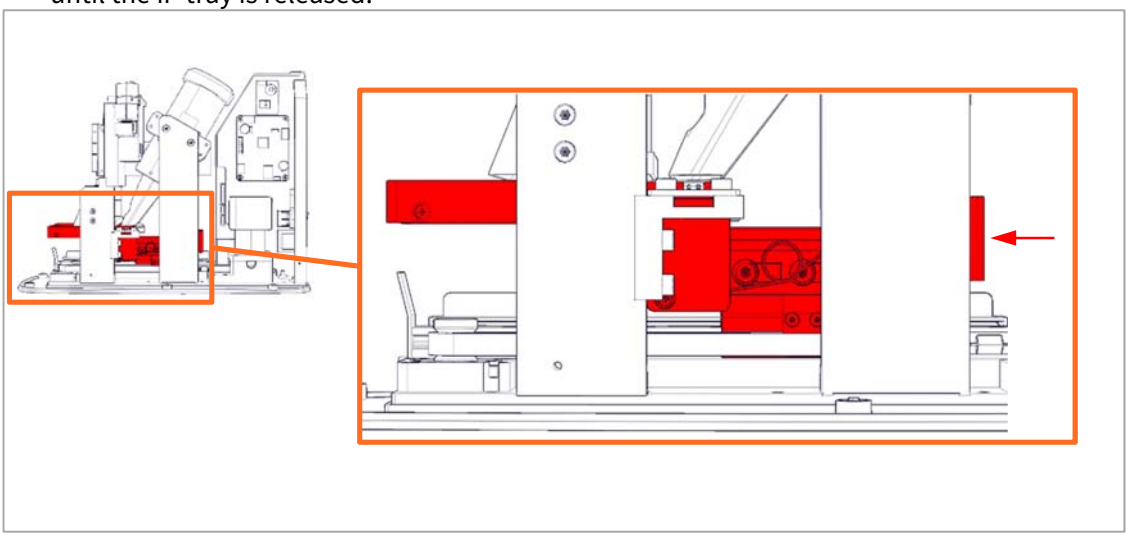


4. Update the firmware in the unit as described in **the Updating the firmware after parts replacement** section.
5. Continue onto **PMT gain and ADC offset adjustment**.
6. Continue onto **Scanner calibration**.

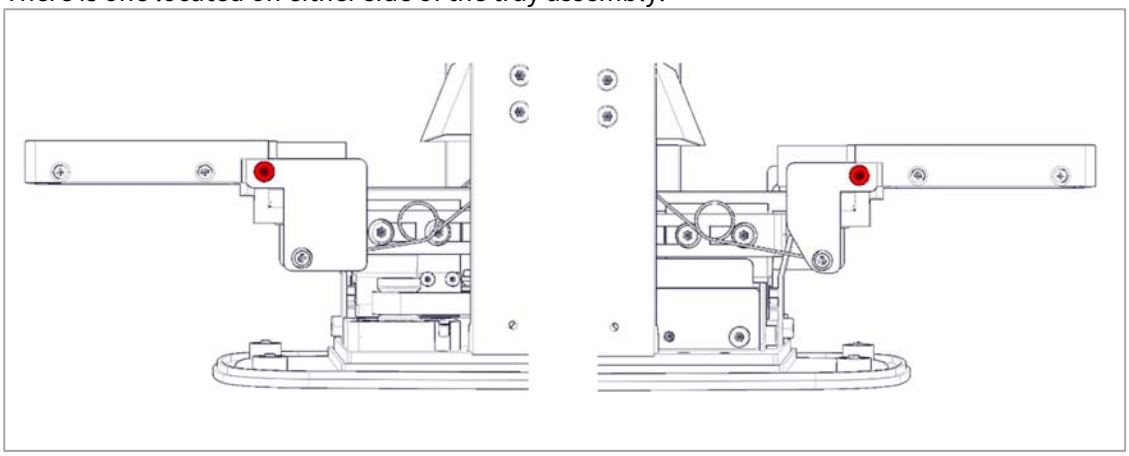
Replacing the RFID board

Illustrations are shown for the torsion spring tray assembly; however, the procedure is the same for a piano wire tray assembly.

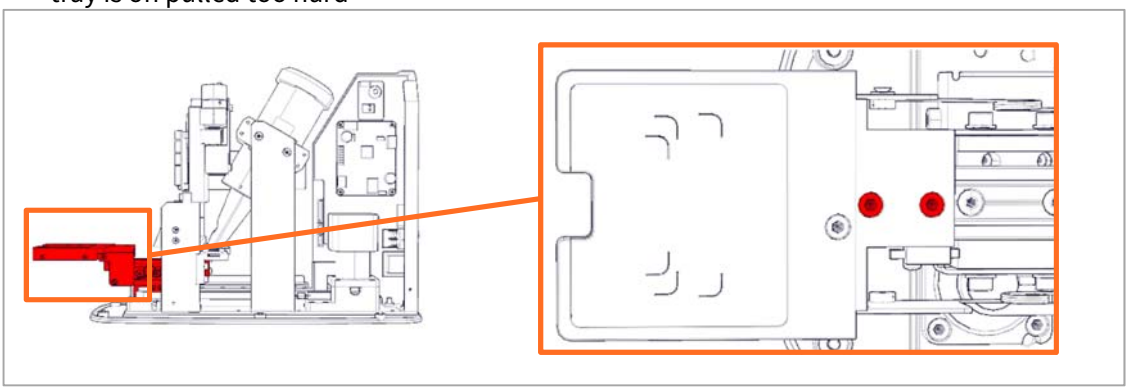
1. Follow step 1 through 9 of **Disassembly**.
2. Move the tray assembly to the front of the unit by bushing on the back of the tray assembly until the IP tray is released.



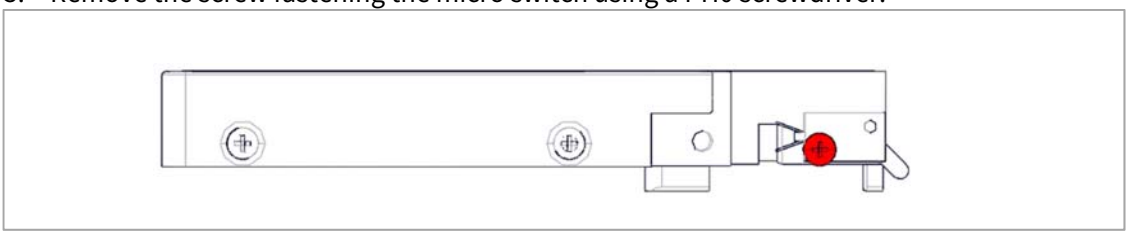
3. Remove the screws fastening the spring brackets to the tray using a 2.5 mm hex key. There is one located on either side of the tray assembly.



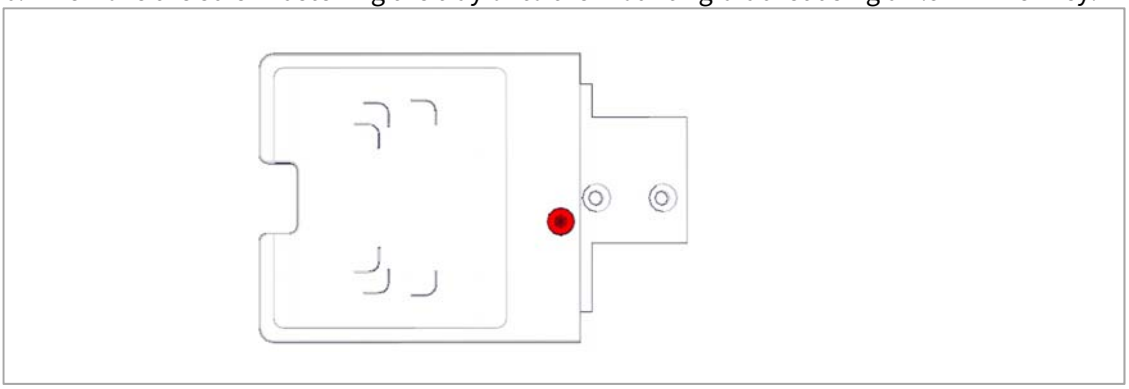
4. Remove the 2 screws fastening the tray using a 2.5 mm hex key and carefully lift the tray out. Note that the flexible FFC cable is fastened with an adhesive and may be disconnected if the tray is on pulled too hard



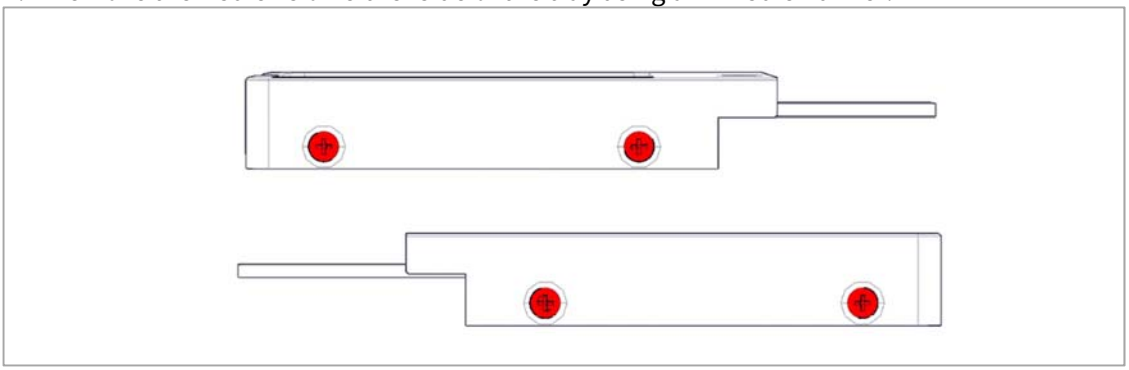
5. Remove the screw fastening the micro switch using a PH0 screwdriver.



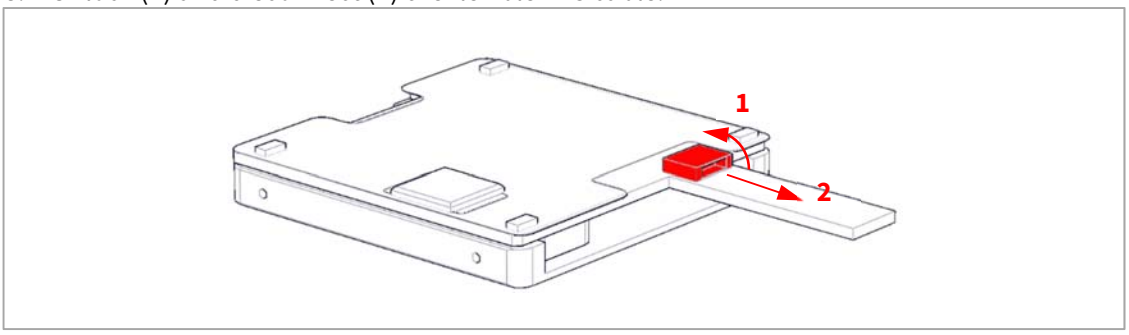
6. Remove the screw fastening the tray onto the mounting bracket using a 2.5 mm hex key.



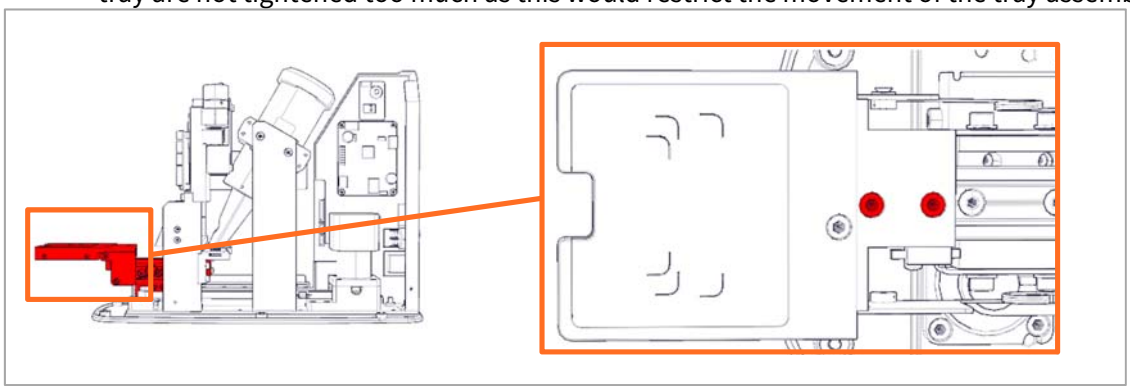
7. Remove the 2 screws on either side of the tray using a PH1 screwdriver.



8. Unlock (**1**) and disconnect (**2**) the flexible FFC cable.



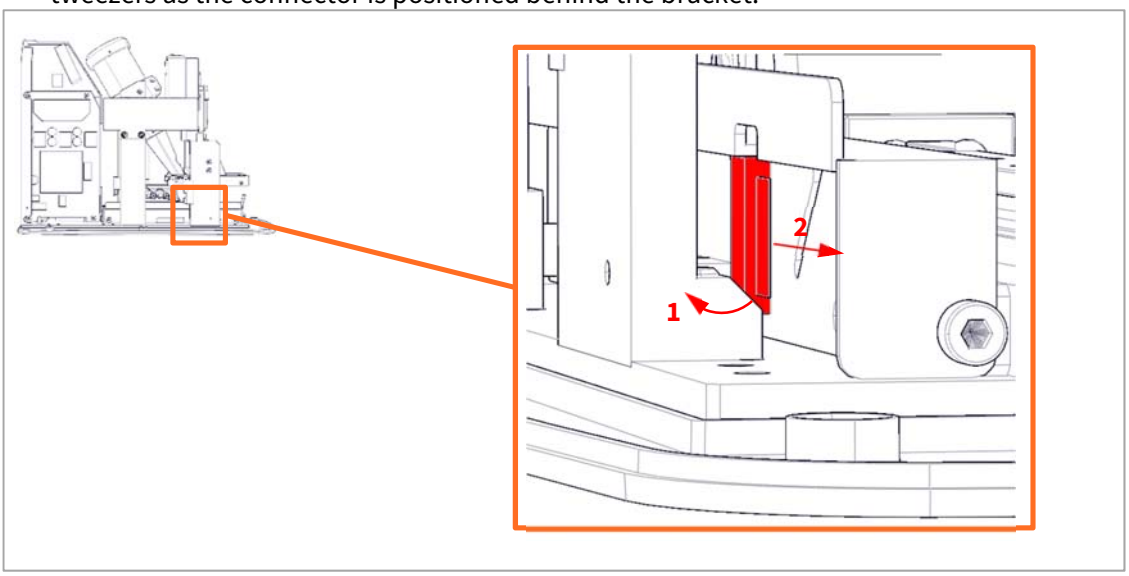
9. Replace the RFID board and install in reverse order taking care that the 2 screws fastening the tray are not tightened too much as this would restrict the movement of the tray assembly.



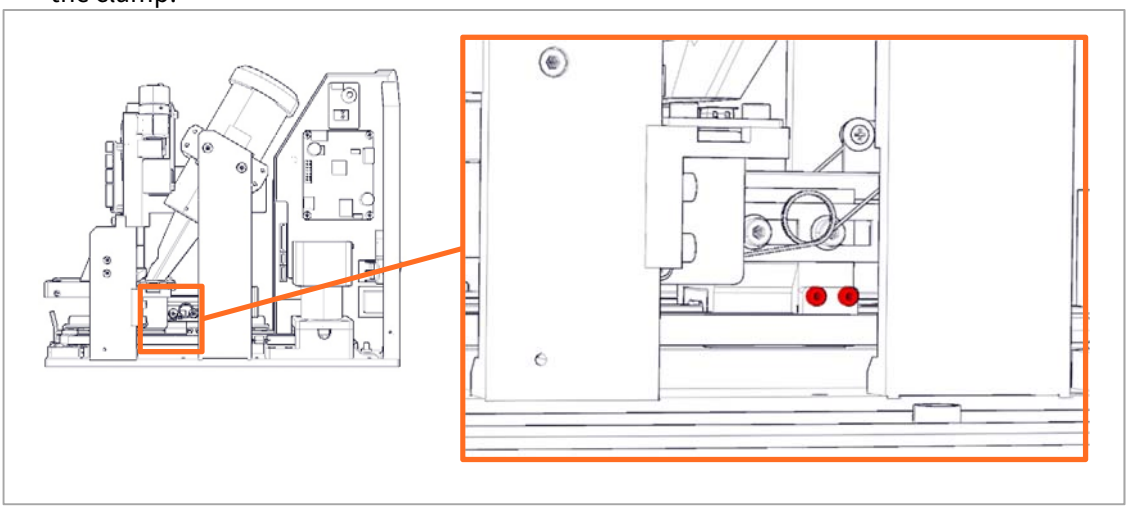
Replacing the tray assembly

Illustrations are shown for the torsion spring tray assembly; however, the procedure is the same for a piano wire tray assembly.

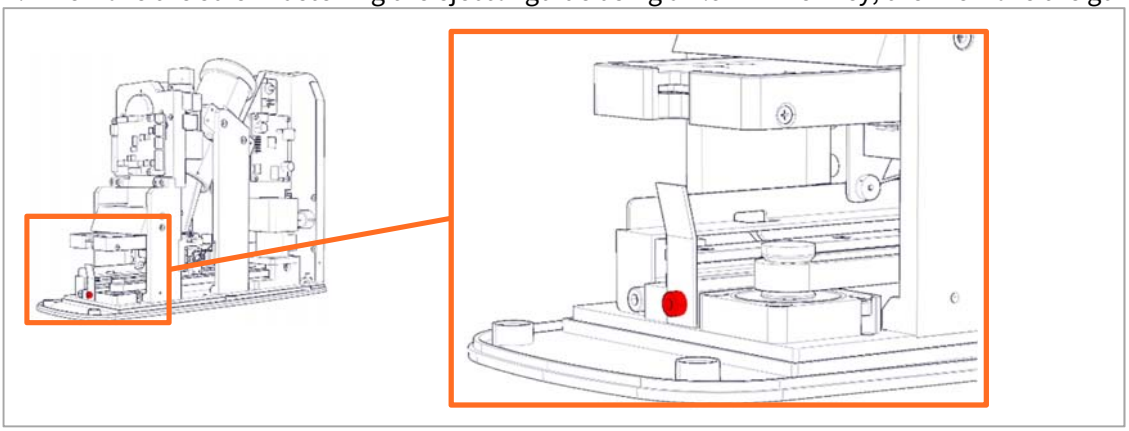
1. Follow step 1 through 9 of **Disassembly**.
2. Unlock (**1**) and disconnect (**2**) the flexible FFC cable from the bottom board using a pair of tweezers as the connector is positioned behind the bracket.



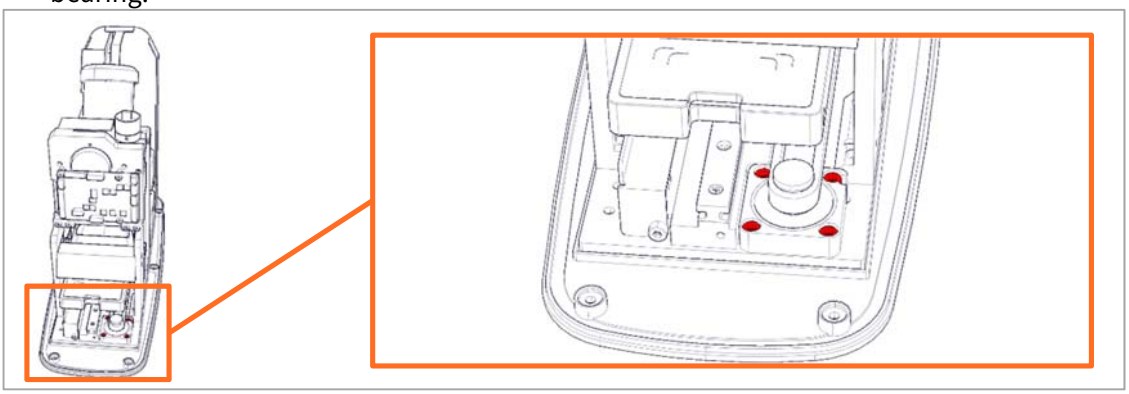
3. Rotate the unit to gain access to the other side and move the tray assembly to the shown position and remove the 2 screws fastening the clamp using a 1.5 mm hex key. Then remove the clamp.



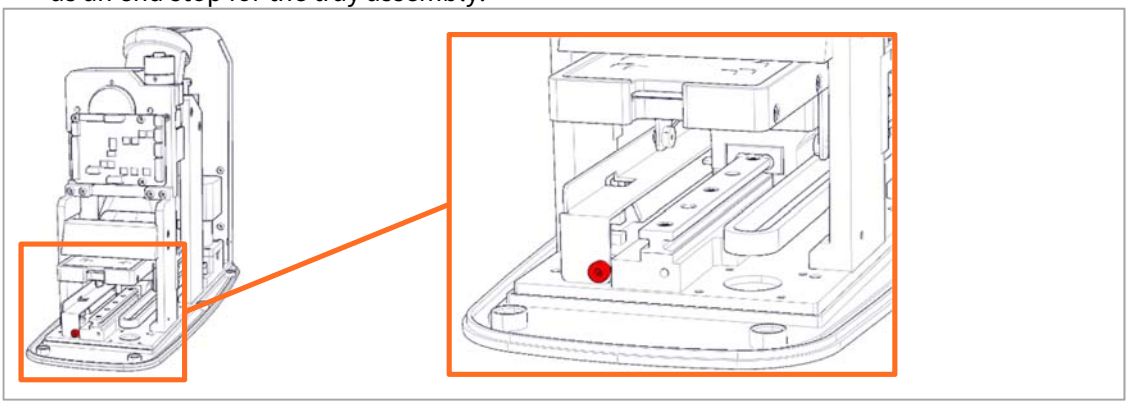
4. Remove the screw fastening the ejector guide using a 2.5 mm hex key, then remove the guide.



5. Remove the 4 screws on the bearing for the drive belt using a 2.5 mm hex key and remove the bearing.



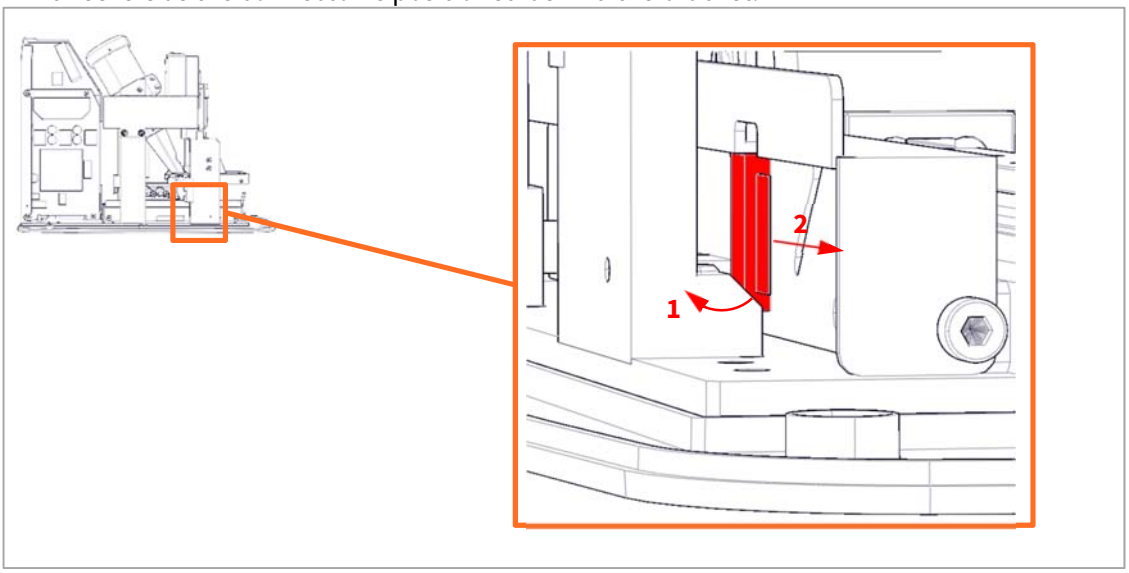
6. Remove the screw for the bottom board PCB frame using a 2.5 mm hex key as the frame acts as an end stop for the tray assembly.



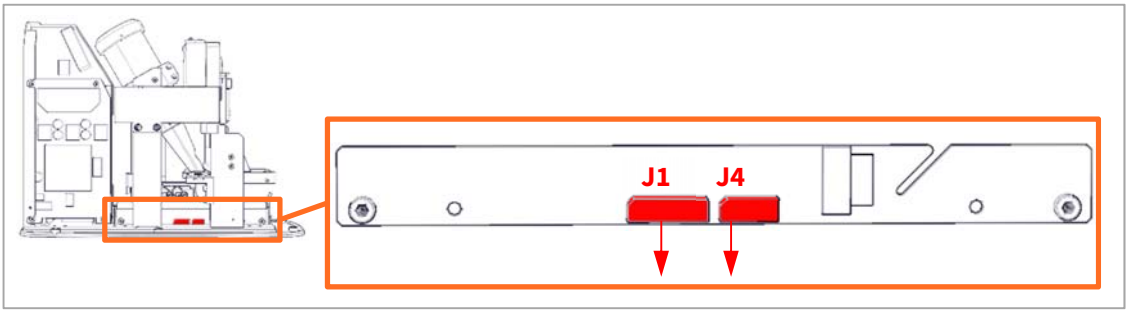
7. Lift the frame out of the way and slide the tray assembly off the rail, bear in mind the ribbon cable is fastened with an adhesive.
8. Replace the tray assembly and install in reverse order noting the orientation of the flexible FFC cable.

Replacing the bottom board

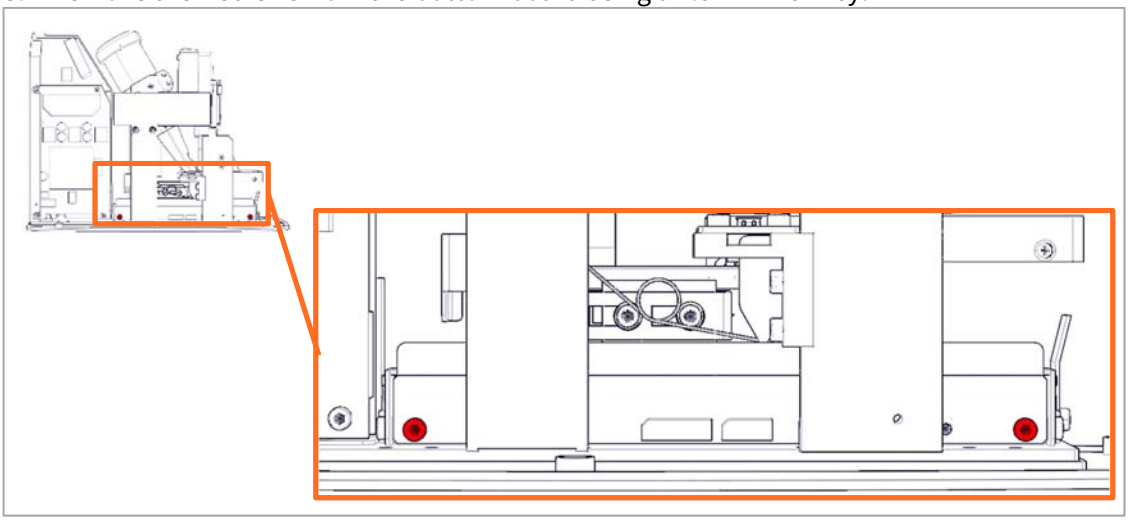
1. Follow step 1 through 9 of **Disassembly**.
2. Unlock (**1**) and disconnect (**2**) the flexible FFC cable from the bottom board using a pair of tweezers as the connector is positioned behind the bracket.



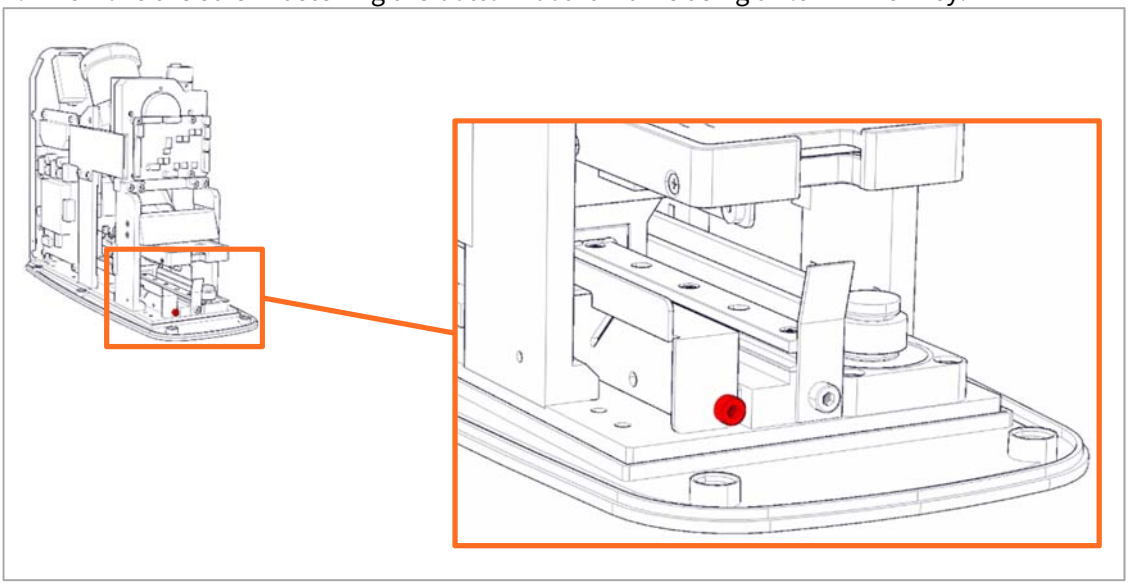
8. Disconnect **J1** and **J4** from the bottom board.



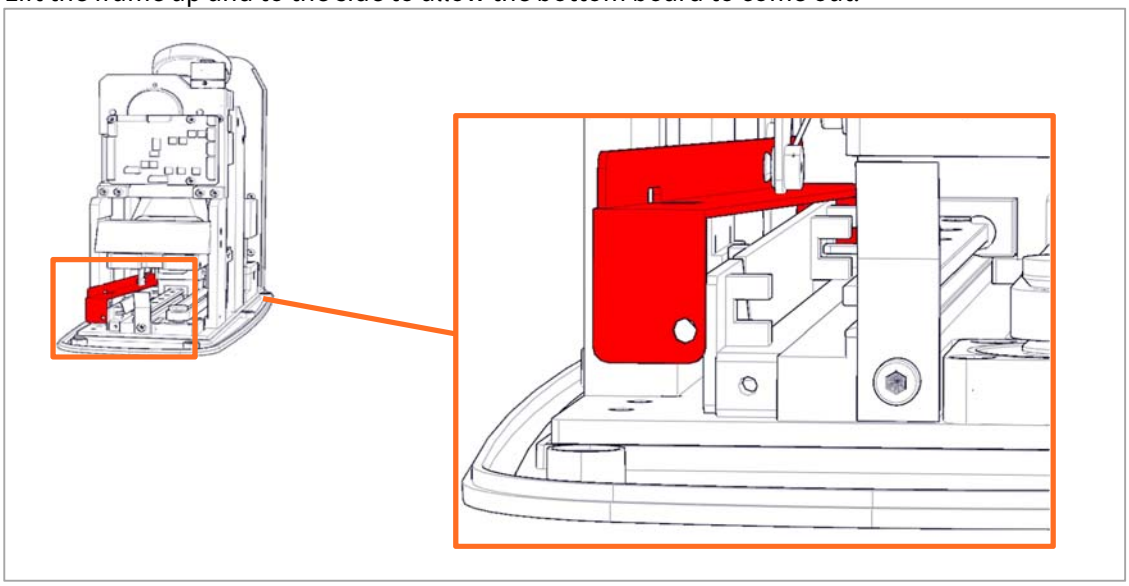
3. Remove the 2 screws from the bottom board using a 2.5 mm hex key.



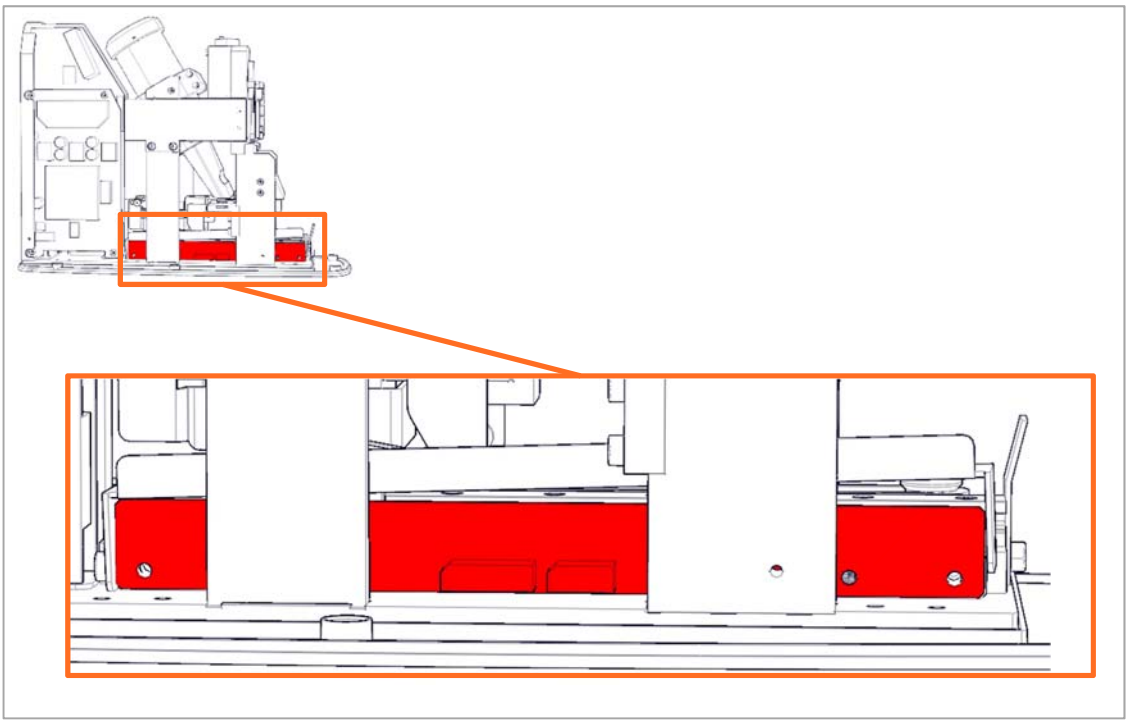
4. Remove the screw fastening the bottom board frame using a 2.5 mm hex key.



5. Lift the frame up and to the side to allow the bottom board to come out.



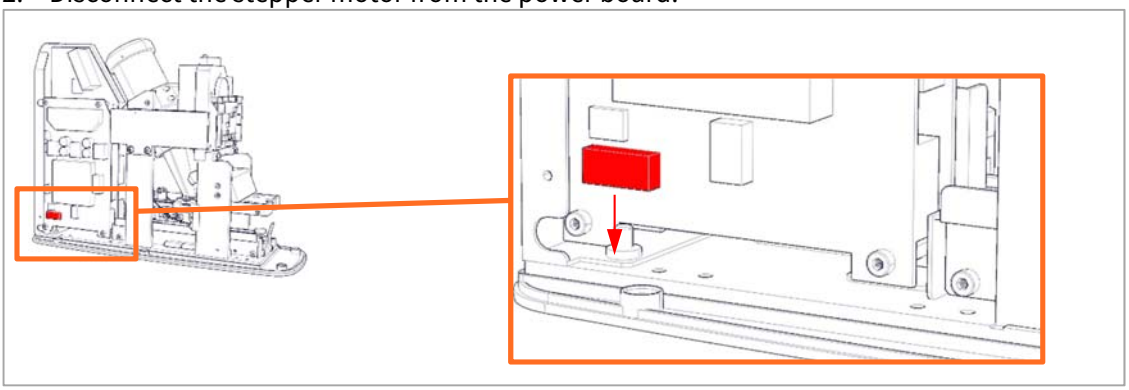
6. Slide the bottom board out.



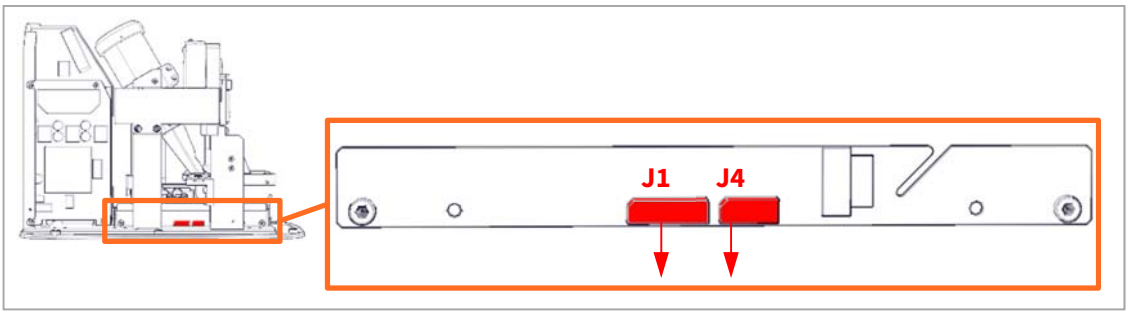
7. Replace the bottom board and install in reverse order.

Replacing the stage base assembly

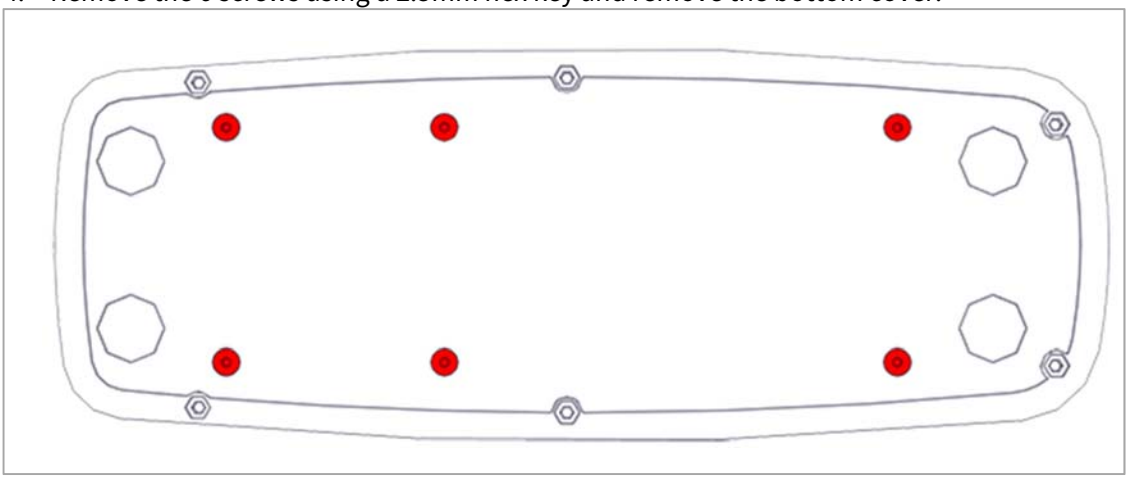
1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect the stepper motor from the power board.



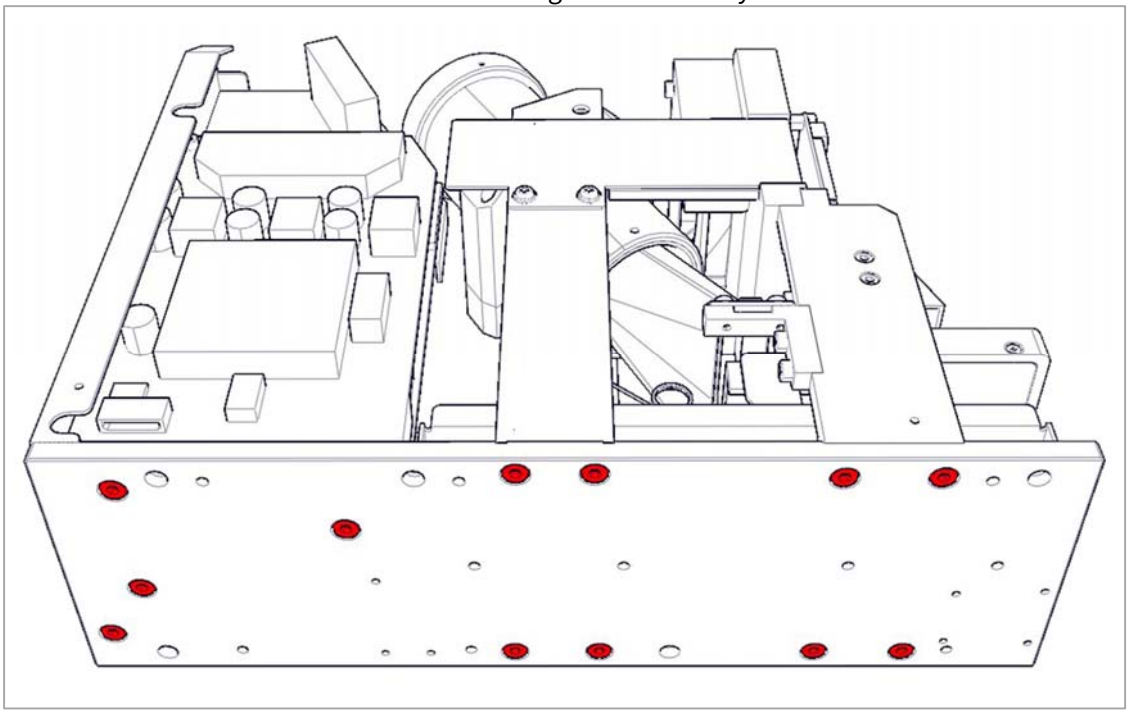
9. Disconnect **J1** and **J4** from the bottom board.



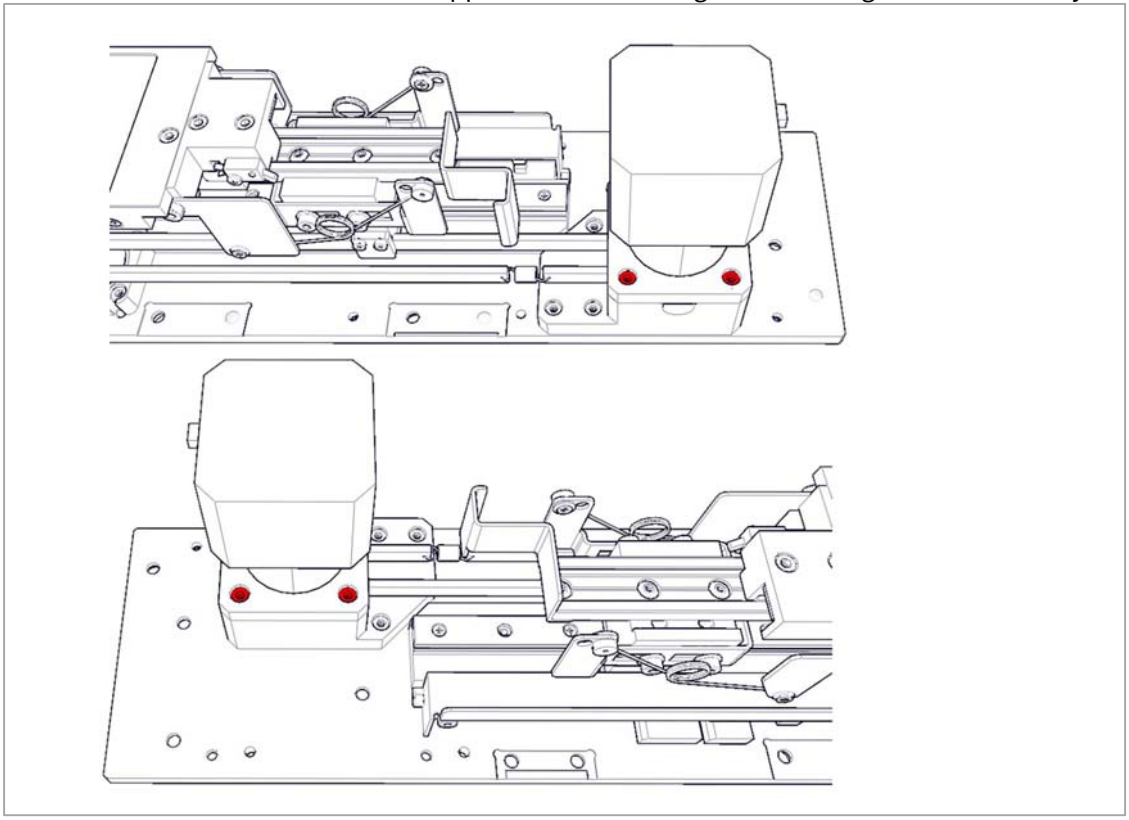
4. Remove the 6 screws using a 2.5mm hex key and remove the bottom cover.



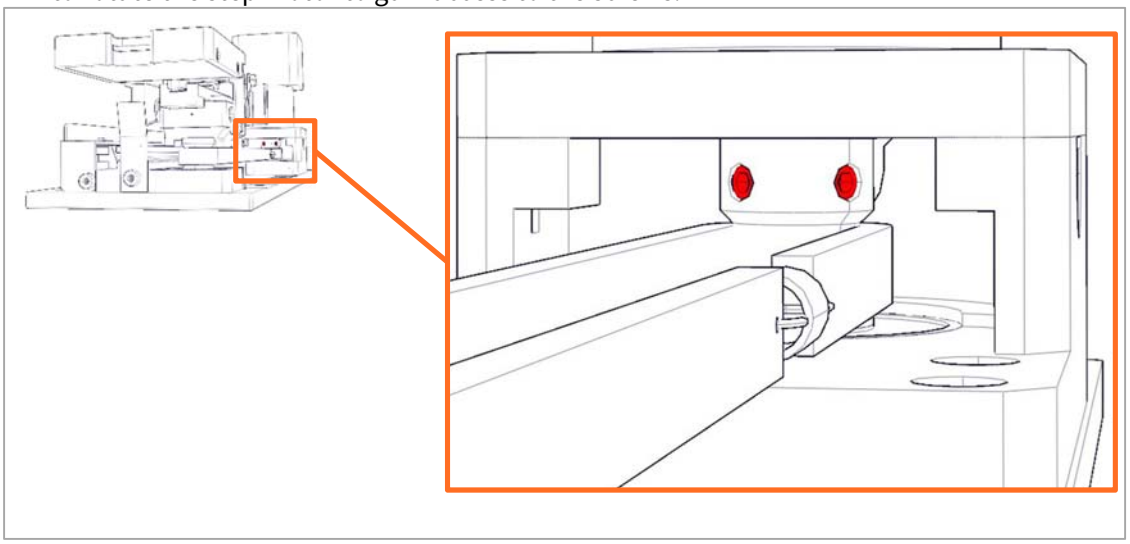
3. Remove the 12 screws on the bottom using a 3 mm hex key.



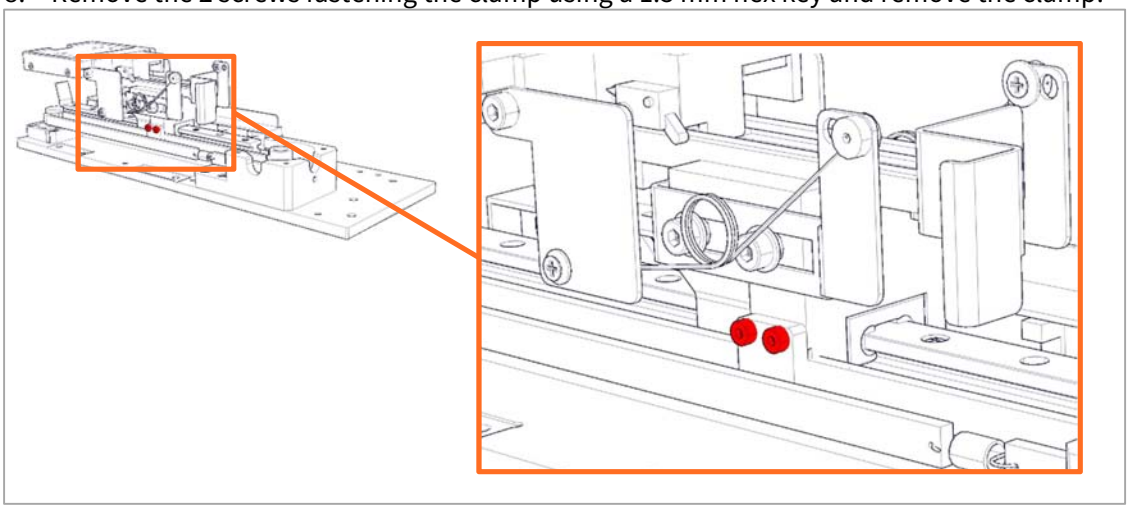
4. Carefully remove the stage base assembly from the remaining assemblies.
5. Remove the 4 screws from the stepper motor mounting bracket using a 2.5 mm hex key.



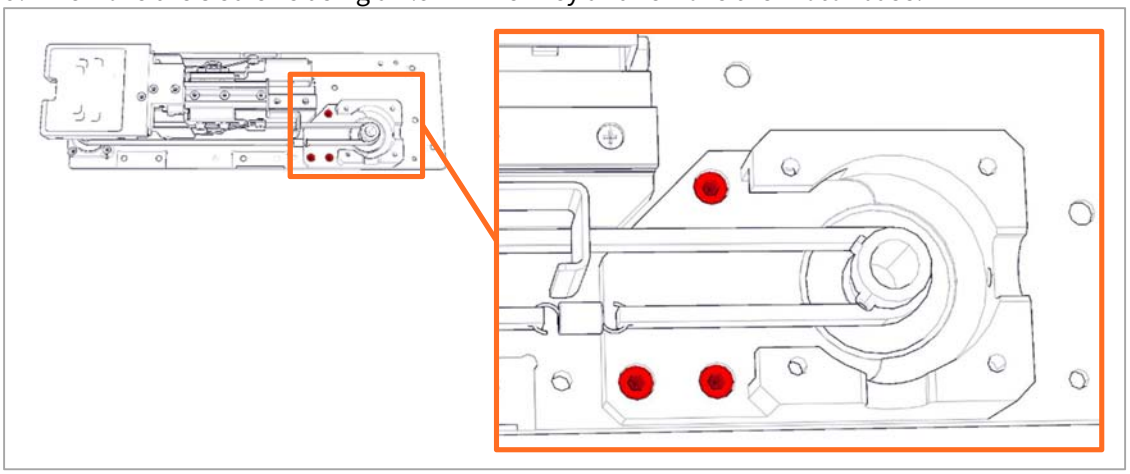
6. Loosen the pivot screws from the stepper motor shaft using a 1.5 mm hex key. You may have to rotate the step motor to gain access to the screws.



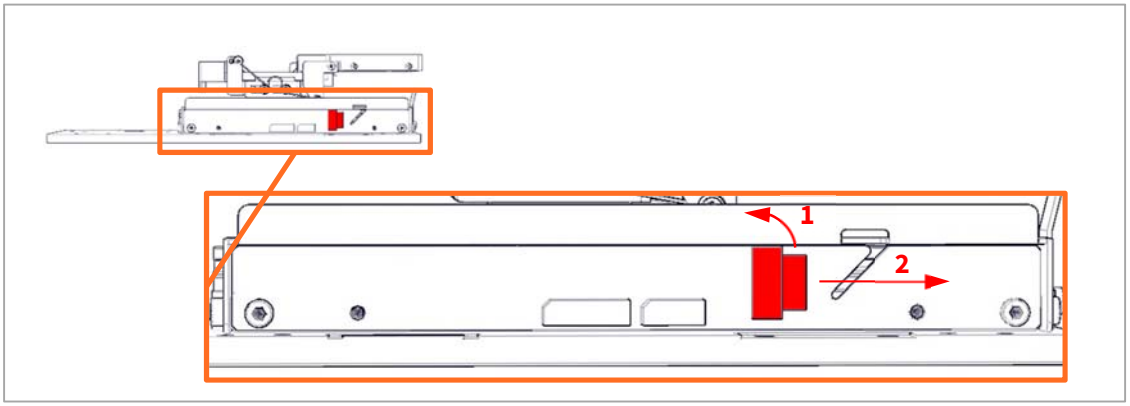
7. Lift the stepper motor up and out of the socket.
8. Remove the 2 screws fastening the clamp using a 1.5 mm hex key and remove the clamp.



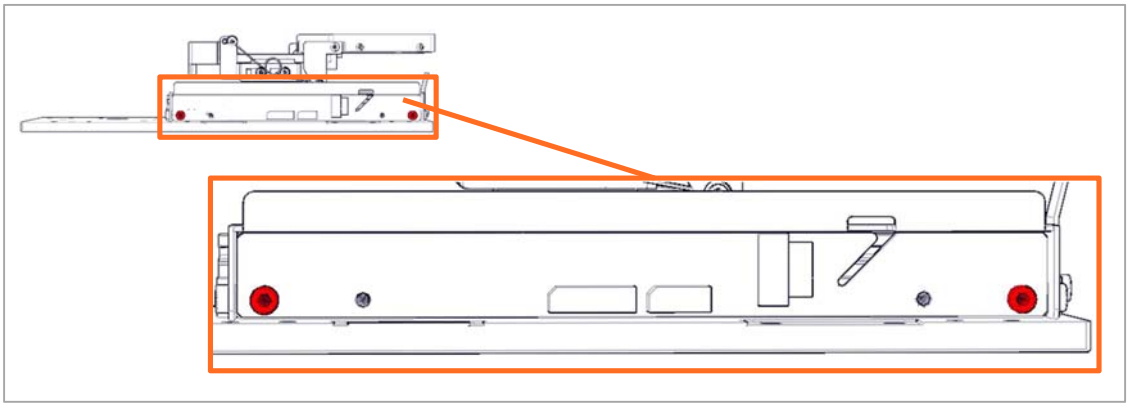
9. Remove the 3 screws using a 2.5 mm hex key and remove the motor base.



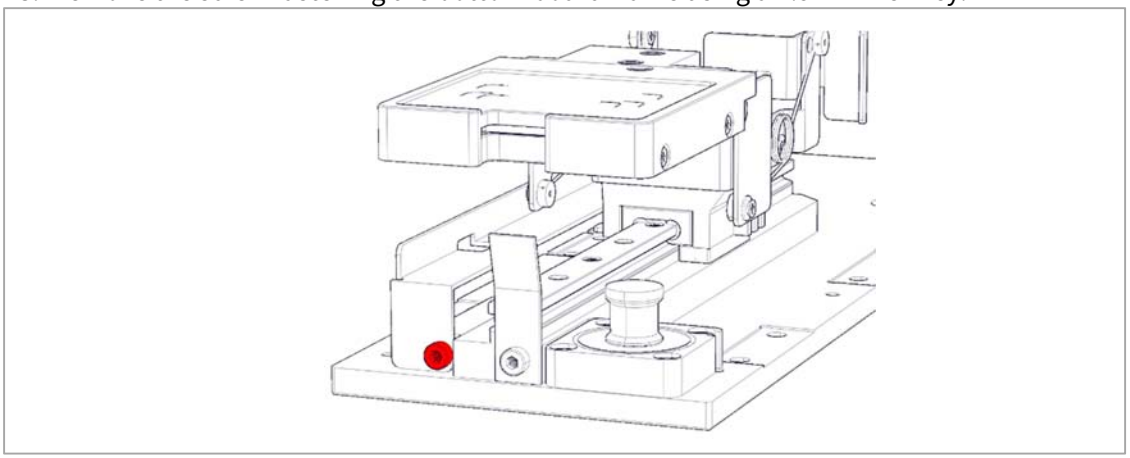
10. Remove the drive belt.
11. Rotate the unit to gain access to the opposite side and unlock (**1**) and disconnect (**2**) the ribbon cable from the bottom board.



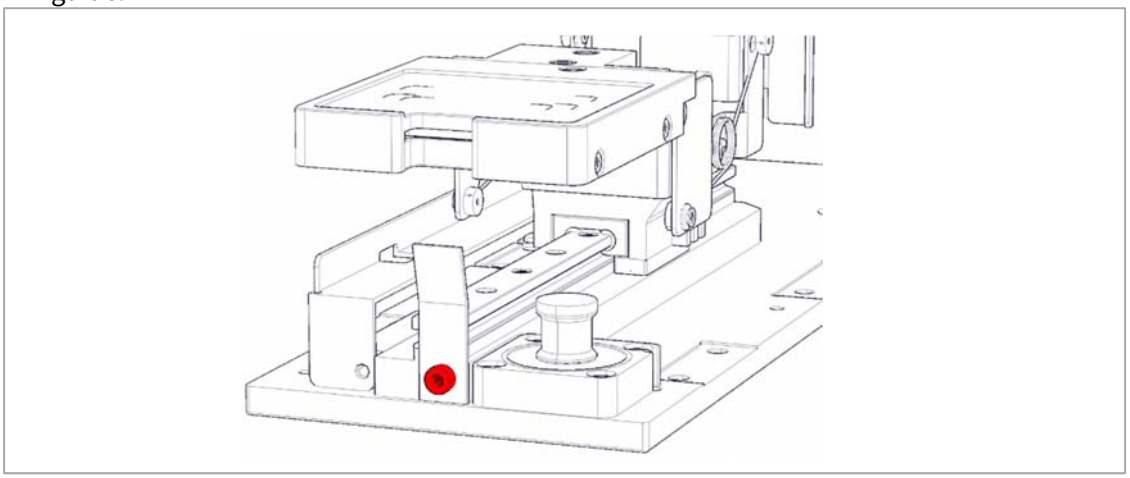
12. Remove the screws from the bottom board using a 2.5 mm hex key and remove the bottom board.



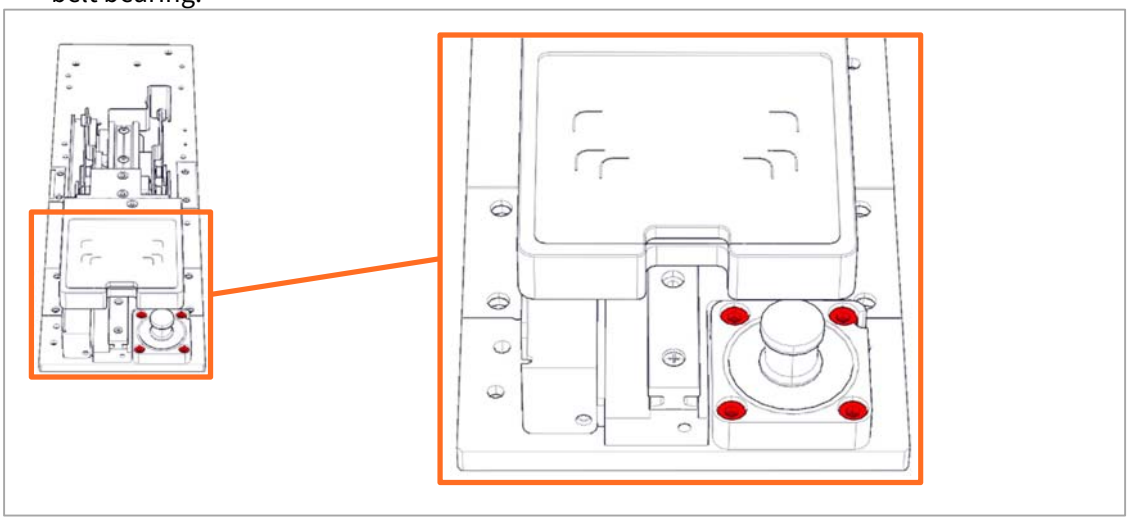
13. Remove the screw fastening the bottom board frame using a 2.5 mm hex key.



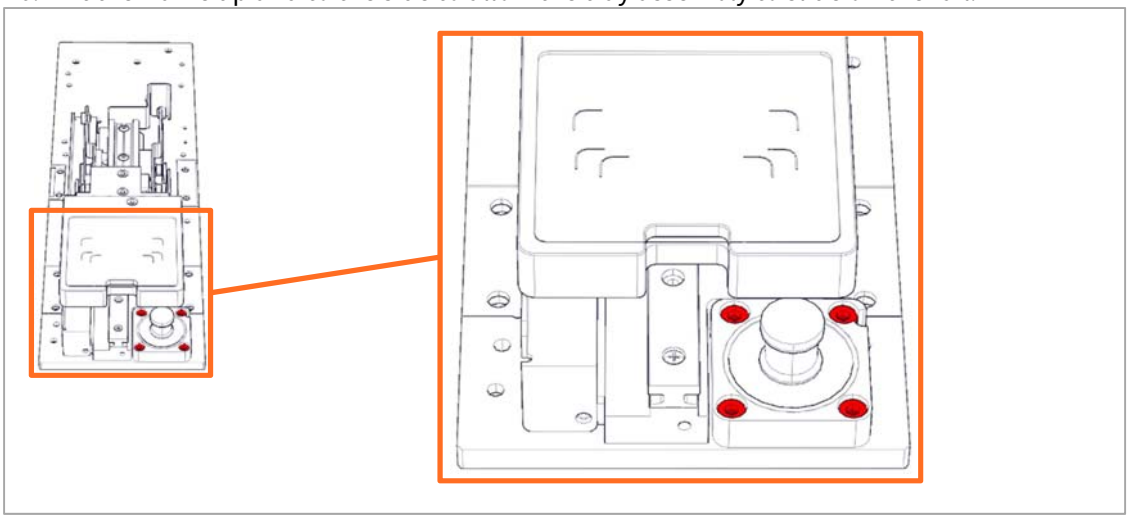
14. Remove the screw from the ejector guide using a 2.5 mm hex key, then remove the ejector guide.



15. Remove the 4 screws from the drive belt bearing using a 2.5 mm hex key and remove the drive belt bearing.



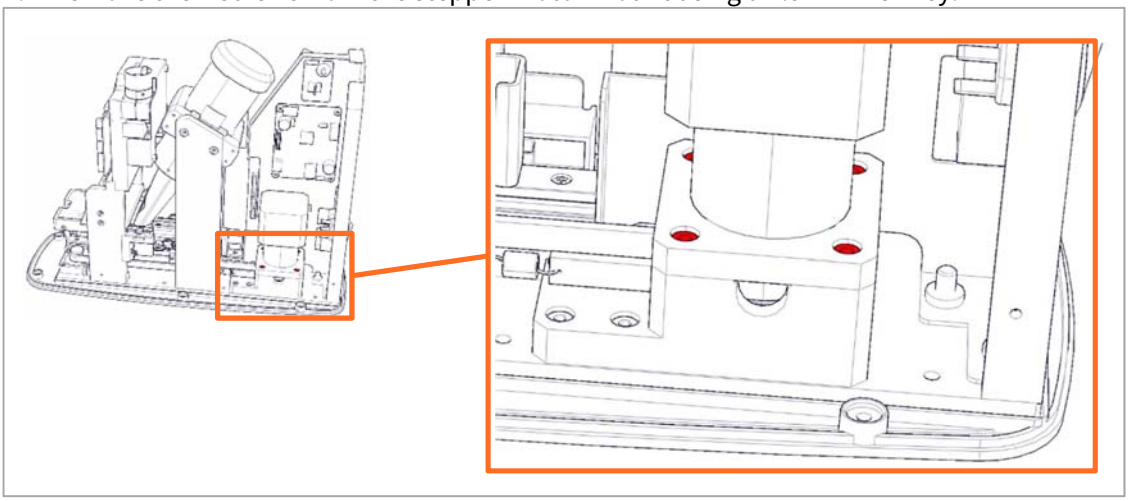
16. Lift the frame up and to the side to allow the tray assembly to slide off the rail.



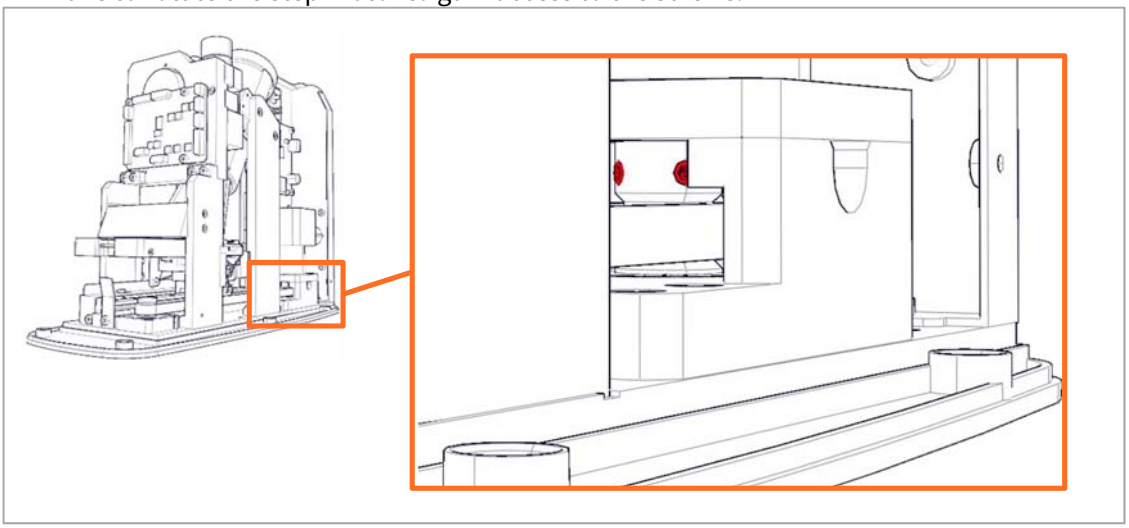
17. Replace the stage base assembly and install in reverse order.

Replacing the drive belt

1. Follow step 1 through 9 of **Disassembly**.
2. Remove the 4 screws from the stepper motor mount using a 2.5 mm hex key.

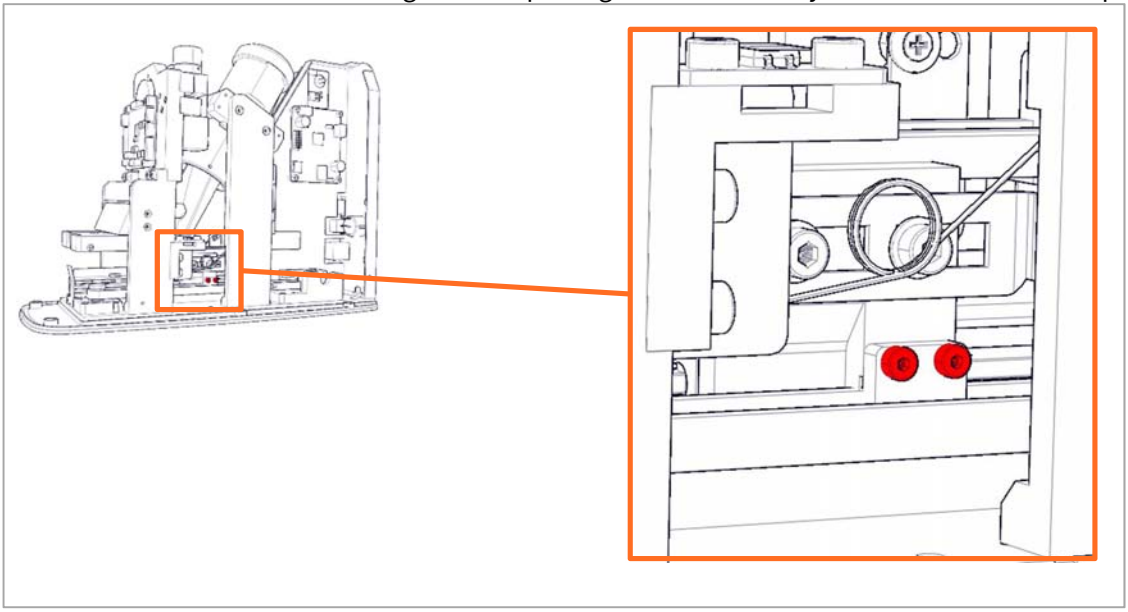


3. Loosen the 2 socket screws from the step motor drive shaft using a 1.5 mm hex key, you may have to rotate the step motor to gain access to the screws.

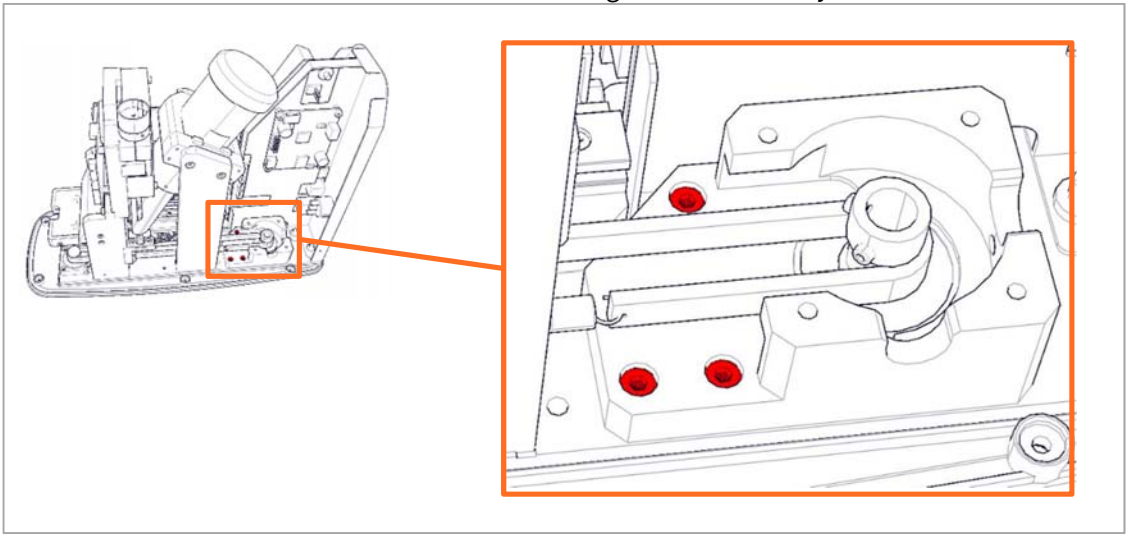


4. Lift the step motor out of the way.

5. Remove the 2 screws fastening the clamp using a 1.5 mm hex key. Then remove the clamp.



6. Remove the 3 screws from the motor base using a 2.5 mm hex key.

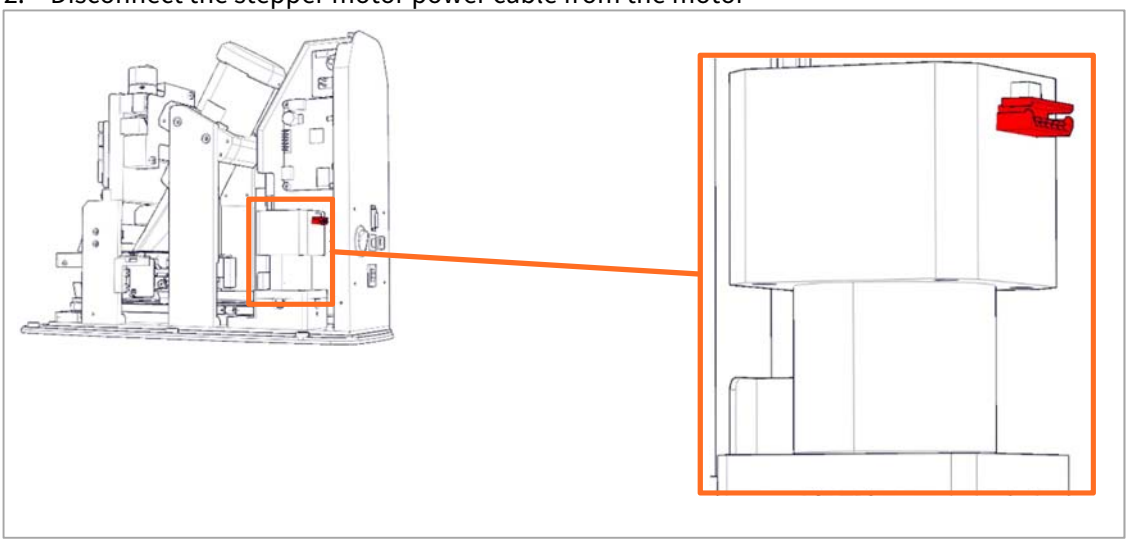


7. Remove and replace the drive belt, install the new drive belt in reverse order.

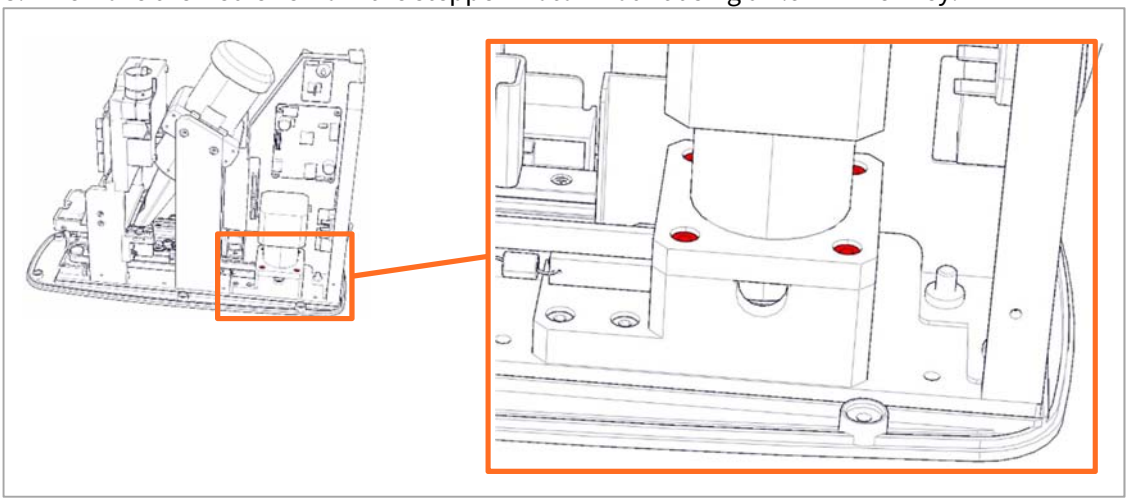
Replacing the stepper motor

This guide shows the replacement of the SAEHAN stepper motor, if the unit has a ws10 mm stepper motor, please follow the steps in the upgrade manual for stepper motor and power board.

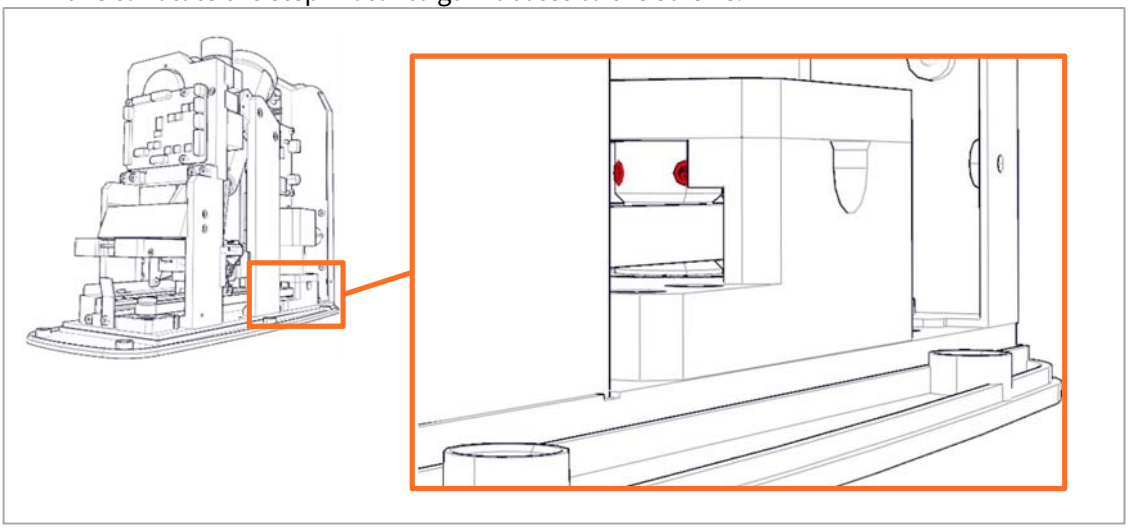
1. Follow step 1 through 9 of **Disassembly**.
2. Disconnect the stepper motor power cable from the motor



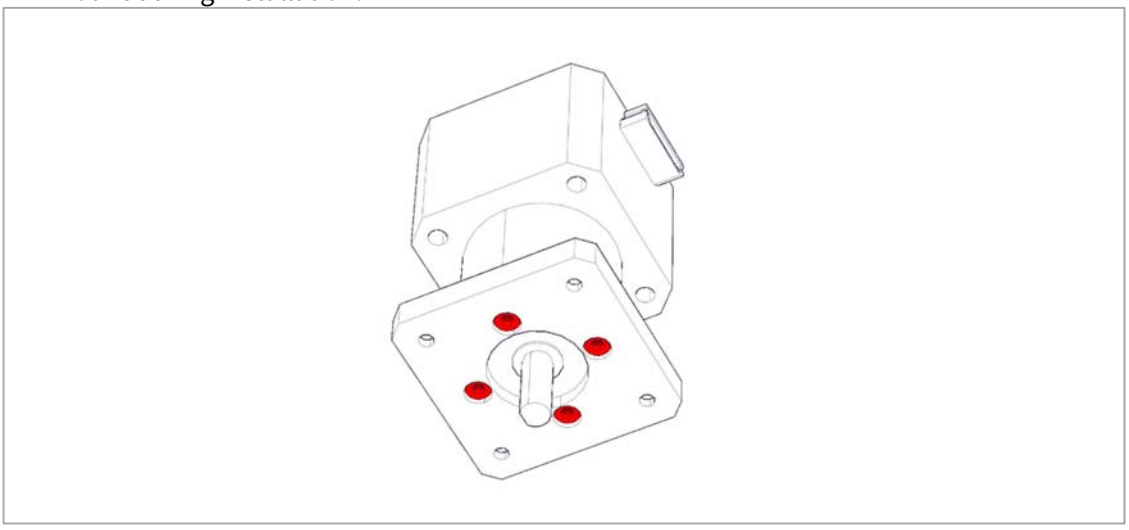
3. Remove the 4 screws from the stepper motor mount using a 2.5 mm hex key.



4. Loosen the 2 socket screws from the step motor drive shaft using a 1.5 mm hex key, you may have to rotate the step motor to gain access to the screws.



5. Lift the stepper motor up.
6. Remove the 4 screws fastening the motor mount to the stepper motor and reuse the motor mount during installation.



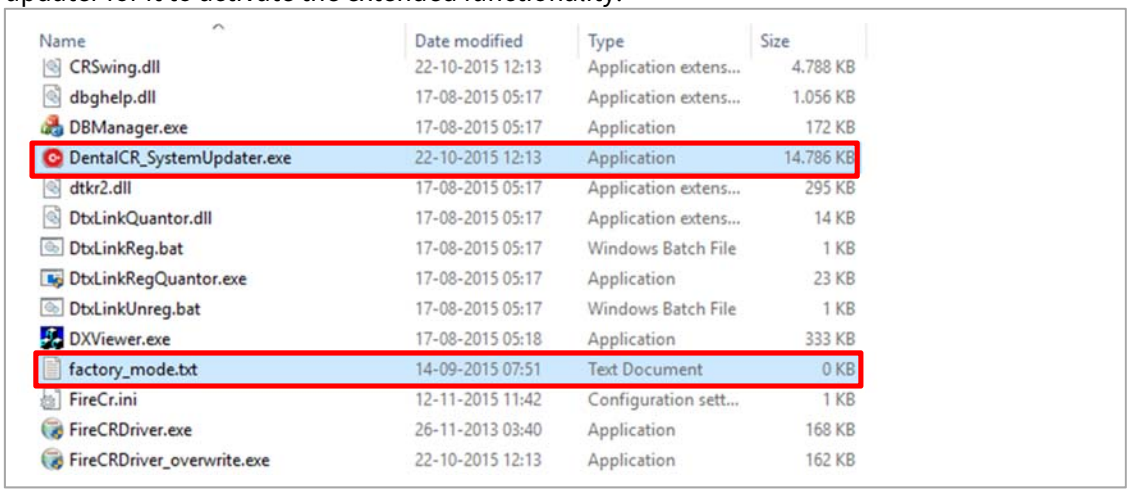
7. Install in reverse order.

Updating the firmware after parts replacement
After parts have been replaced the firmware should be updated to match the version of parts in the unit.

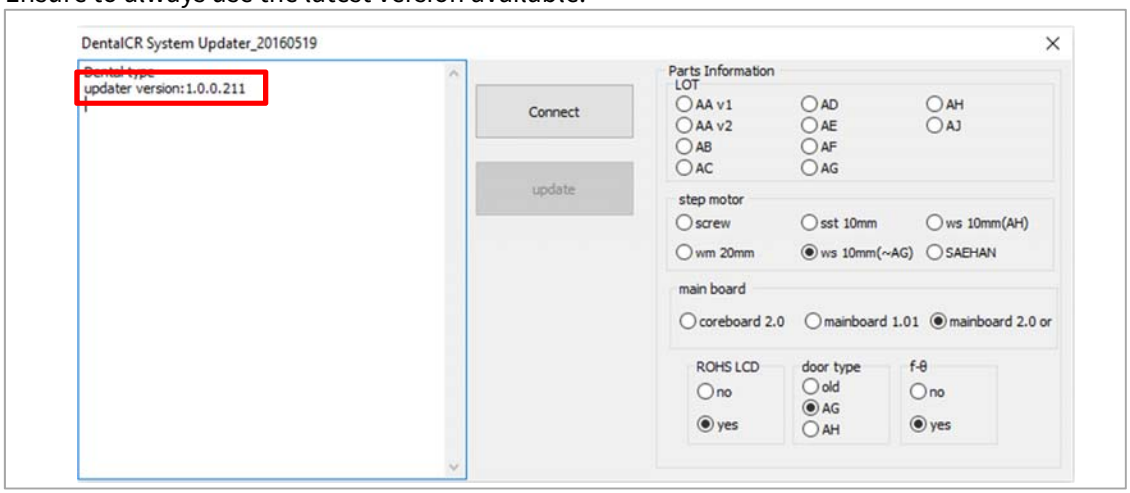
Only one application may communicate with the unit at a time, so in order for the updater to find the unit, please close all other related applications and ensure the ACQ manager is not running in the background by opening the task manager.

If the ACQ manager is running, end the process before running the firmware updater.

To do this you need to set the firmware updater into factory mode. This is done by creating an empty text (.txt) named **factory_mode.txt**. This file should be located in the same folder as the firmware updater for it to activate the extended functionality.



Double click the **DentalCR_SystemUpdater.exe** file to start the firmware update application.
The version of the updater can be seen in the second line in the log window on the right hand side.
Ensure to always use the latest version available.



Press the connect button to read the current data from the unit.
Once data are read and shown, ensure that the correct parts are marked for selection as the unit will not operate correctly if these are wrong.

Once the parts used in the unit has been selected, press the update button to load the information into the unit. The updater requires 5 passes to complete the upload and will then prompt you to switch the unit off and on again to allow the unit to boot with the new firmware and parts information.

Description of parts information
The settings on the right hand side of the firmware updater are present to allow the use of older and newer parts cancelling the need to have multiple stocks of each.

Parts information – Select the base version of the unit being updated depending on the serial number. e.g. an FR11-00EA**AG**-XXXXXX would be an **AG** as a base model.

Step motor – Select the model of step motor currently used in the unit. The standard layout is a follows;
AA – Screw type stepper motor.
AB – wm 20mm stepper motor with a drive belt.
AC – ws 10mm stepper motor with drive belt.
AD – sst 10mm stepper motor with drive belt.
AE – ws 10mm (~AG) stepper motor with drive belt.
AF – ws 10mm (~AG) stepper motor with drive belt.
AG – ws 10mm (~AG) stepper motor with drive belt.
AH – ws 10mm (AH) stepper motor with drive belt.
AJ – SAEHAN stepper motor with drive belt.

Main board – Select the version of main board that is currently installed in the unit.
The version number is printed onto the PCB.

ROHS LCD – Starting from the **AE** model, the LCD was produced in an ROHS approved version, this is identified by the Pb marking on the PCB itself.

Door type – Select the door assembly type that is currently being used in the unit.
The available door assembly types are;

Old –This door type is used on models ranging from **AA** to **AF**.
AG – The standard door assembly type for the **AG** model.
AH – The standard door assembly type for the **AH** and later models.

f-θ – This is the standard laser lens for the **AG** and later models, you can find a small marking on the top of the lens depicting **f-θ** on these.

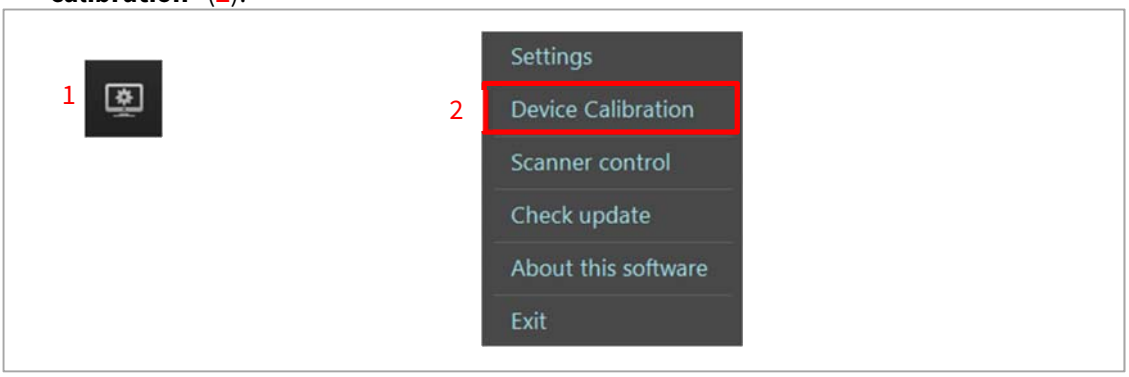
PMT gain and ADC offset verification/adjustment
Whenever parts that have influence on the gain and offset are replaced it is important to verify, and if necessary adjust the PMT gain and ADC offset to ensure that the image quality is not lowered.

To properly verify the PMT gain and ADC offset you will need the following items;

- QuantorDent(Vet) or similar acquisition software installed on a PC.
- Size 4C dental IP.
- Dosimeter to measure absolute dose.
- X-ray generator.

ADC offset verification and adjustment

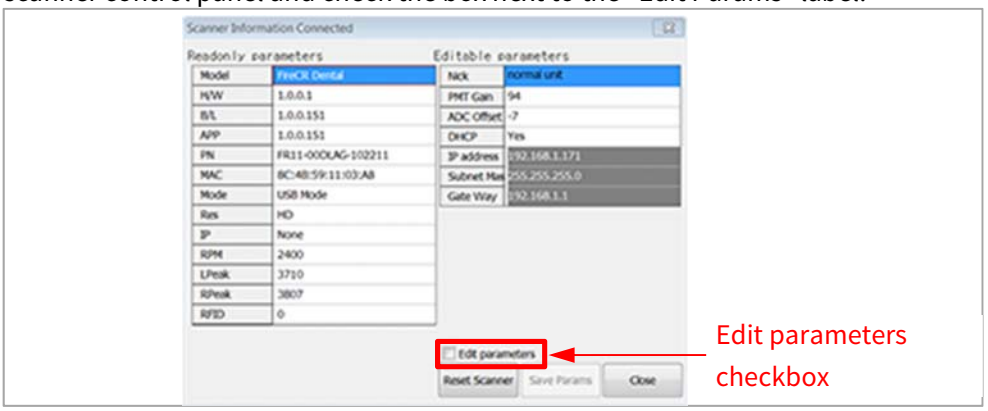
1. Connect the unit to both a PC and power outlet.
2. Switch the unit on.
3. Enter the **calibration menu** as described in the user manual for your software.
4. For Quantor users use the options icon (**1**) in the top right hand corner and select "**Device calibration**" (**2**).



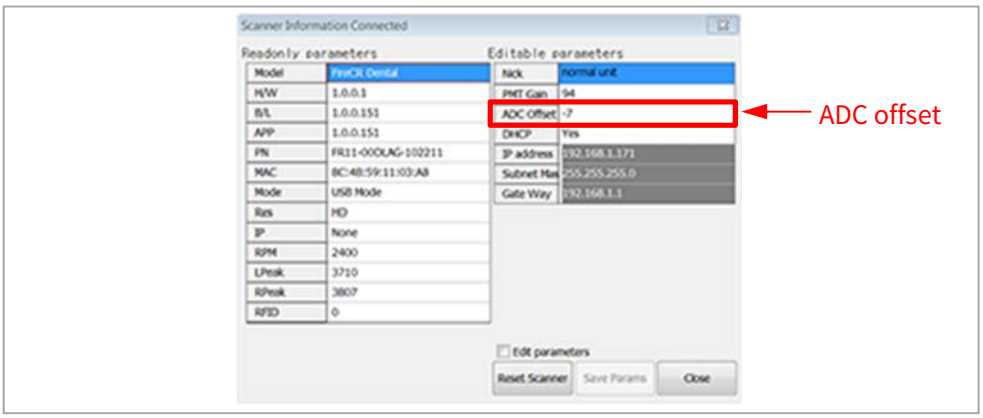
5. Position the size 4C IP on the tray and close it to erase the IP.
6. Remove the IP from the tray and reposition it on the tray.
7. Scan the IP using the blank calibration position.
8. Compare the readout value to the tolerance for the blank calibration.

- If the readout value is within the tolerance for the blank scan calibration, continue to **PMT gain verification and adjustment**.

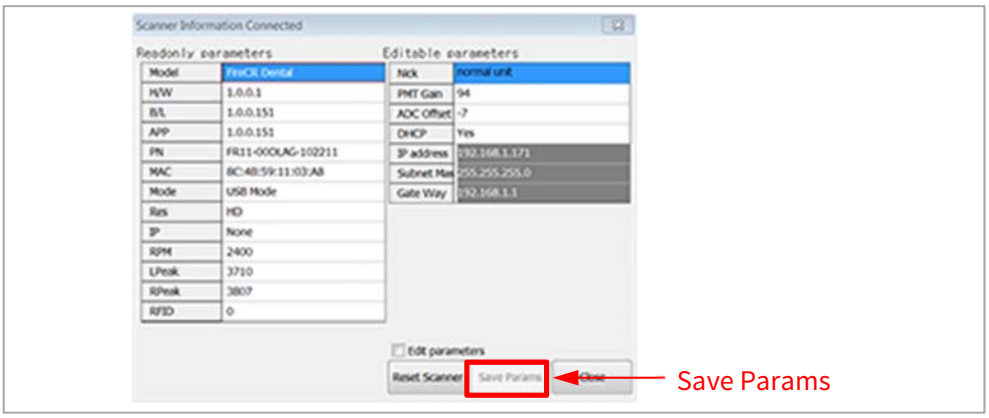
- If the readout value is outside the tolerance for the blank calibration scan, open the scanner control panel and check the box next to the “Edit Params” label.



- Adjust the value next to the label “ADC offset”. Increasing the value will increase the ADC offset level resulting in a lower readout value on the next scan. Decreasing the value will decrease the ADC offset level resulting in a higher readout value on the next scan.



- Once the value has been altered, click on the button labelled “Save Params”.
  A dialogue will appear asking that you switch the unit off, close the software, switch the unit on and reopen the software.

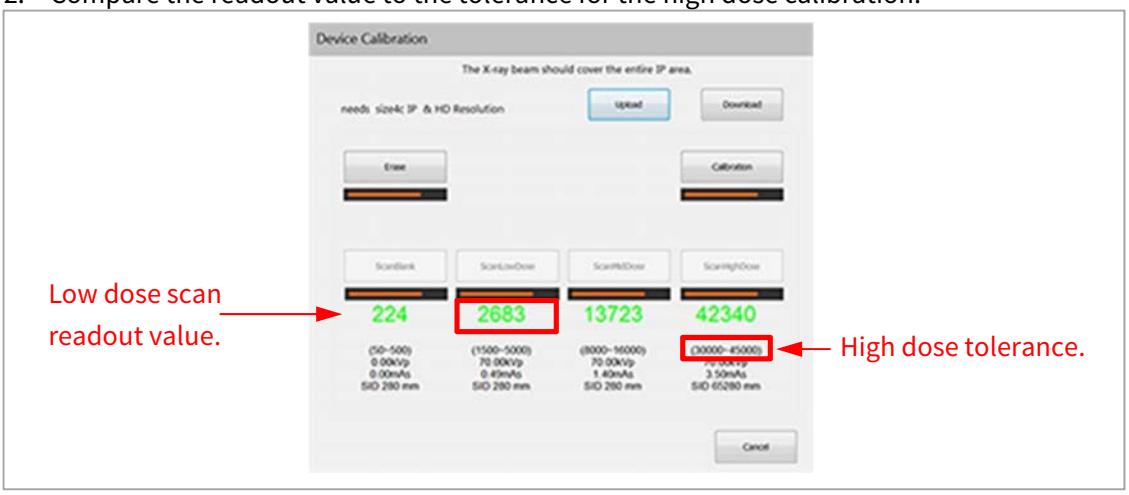


9. Repeat the procedure until the readout value is within the blank scan calibration tolerance, then continue onto **PMT gain verification and adjustment**.

PMT gain verification and adjustment

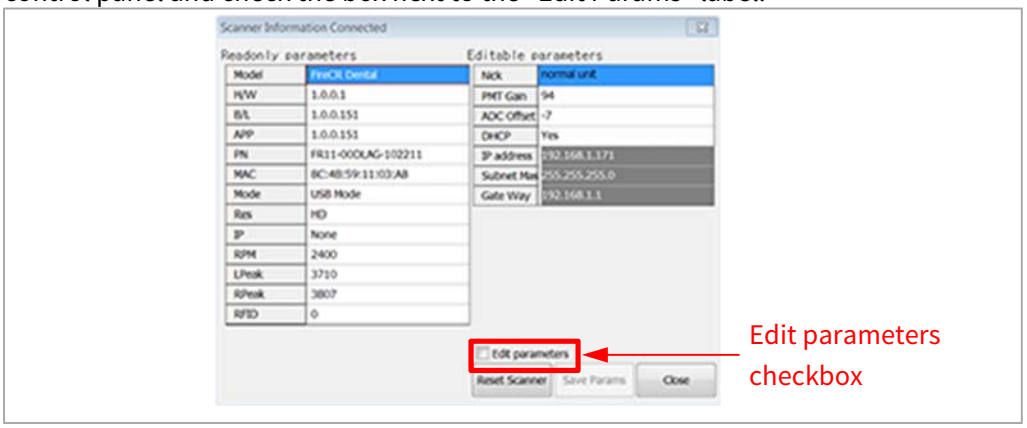
1. Expose the IP with **1100µGy**, position it on the tray and close it to scan on the low scan position.

2. Compare the readout value to the tolerance for the high dose calibration.

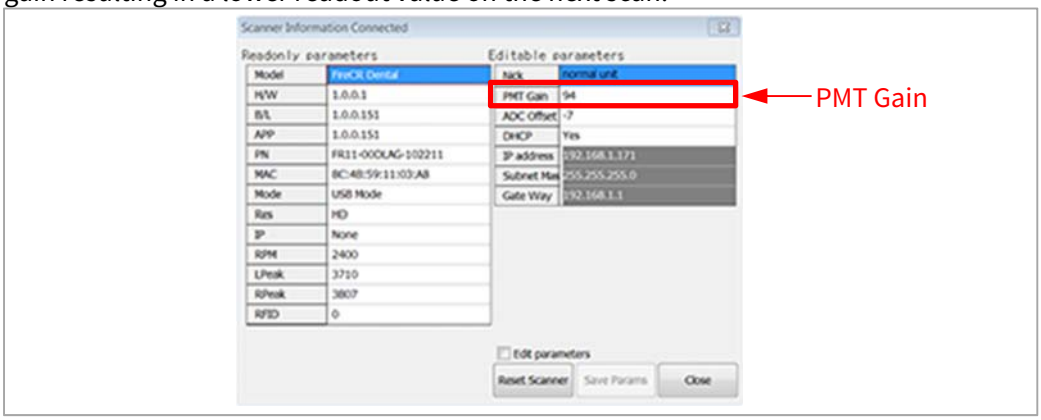


- If the readout value is within the tolerances for the high dose calibration, continue onto **Scanner calibration**.

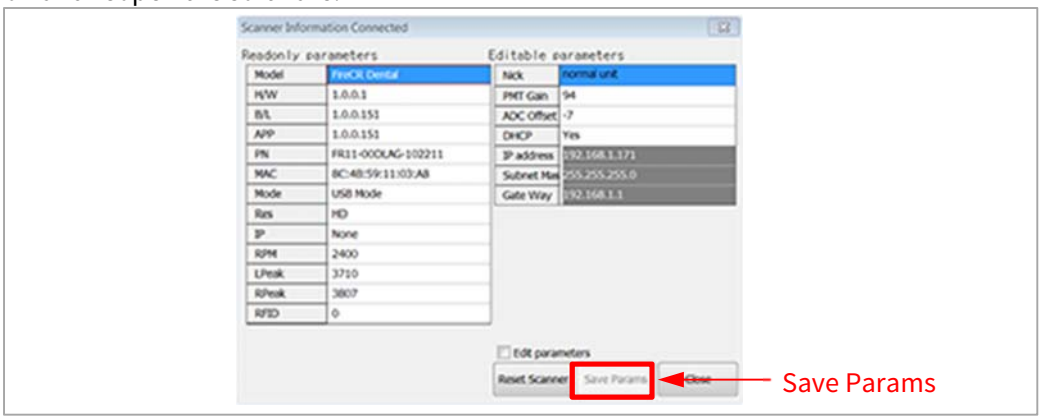
- If the readout value is outside the high dose calibration tolerances, open the scanner control panel and check the box next to the “Edit Params” label.



- Adjust the value next to the label “PMT gain”. Increasing the value will increase the gain resulting in a higher readout value on the next scan. Decreasing the value will lower the gain resulting in a lower readout value on the next scan.



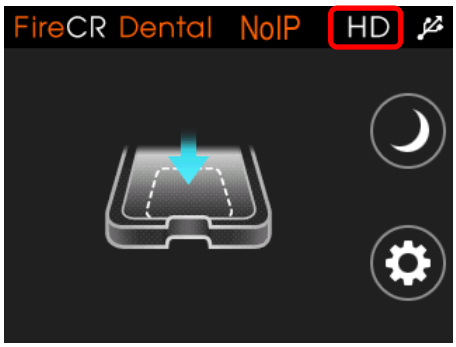
- Once the value has been altered, click on the button labeled “Save Params”.
  A dialog will appear asking you to switch the unit off, close the software, switch the unit on and reopen the software.



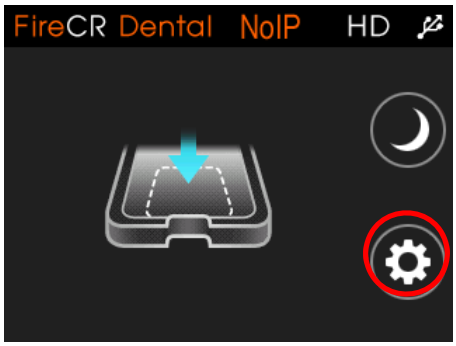
3. Repeat the procedure until the readout value is within the high dose calibration tolerance, then continue onto **Scanner calibration**.

Scanner calibration
To calibrate the FireCR Dental you will need an IP size 4C, a generator and preferably a dosimeter.

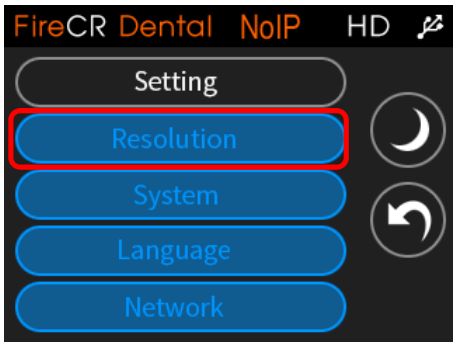
Before calibrating ensure that the unit is scanning with **HD** resolution by looking in the top of the LCD display on the unit.



If the unit is scanning with **SD** resolution, enter the settings menu by pressing on the cog wheel on the LCD display of the unit.

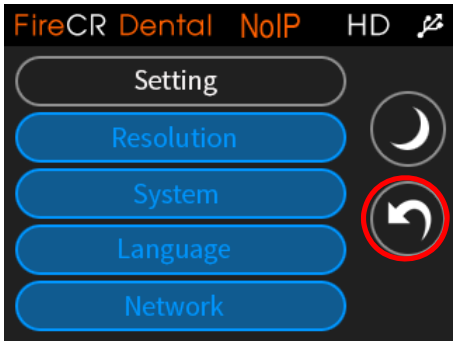


Select the **Resolution** field.

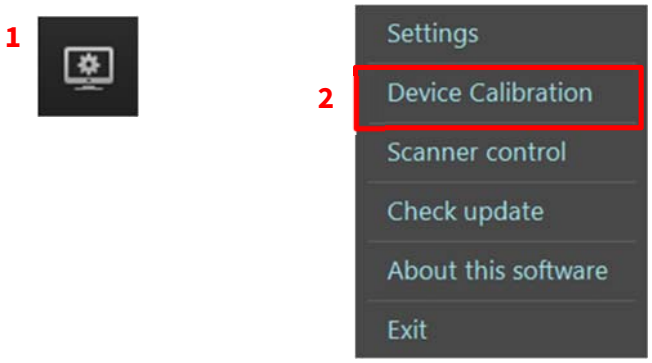


Select **High Resolution** (1) and then use the back button (2) on the LCD display to go back one step.

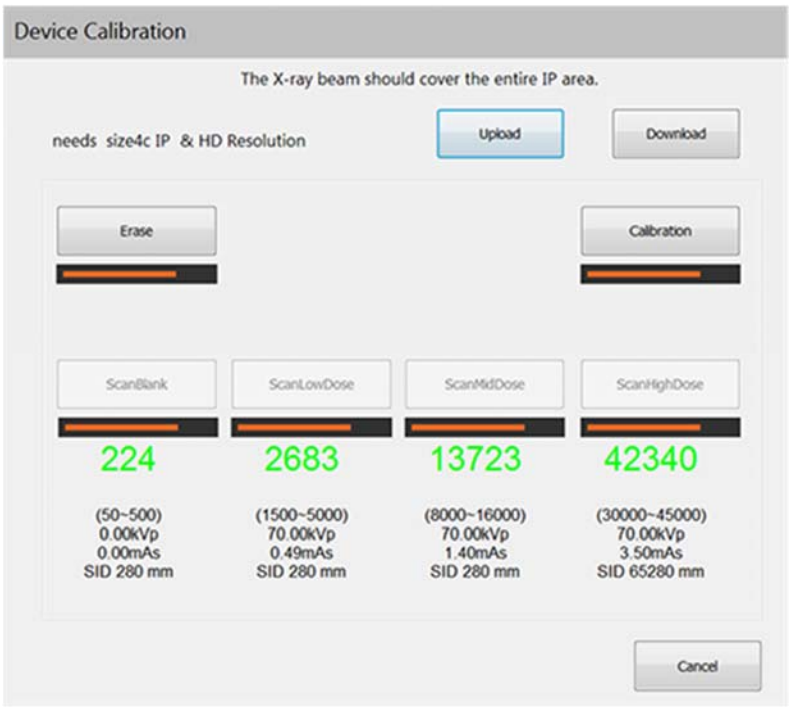
Press the back button again to exit the settings menu.



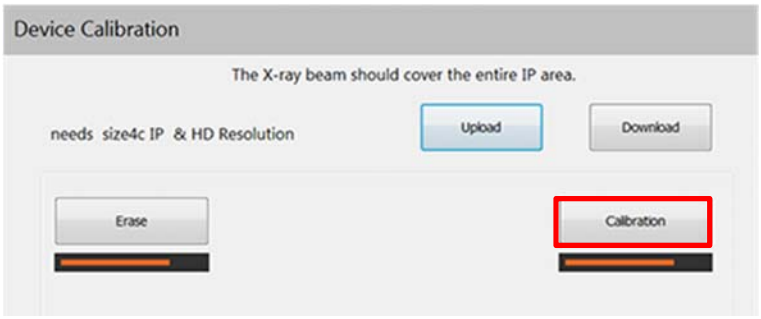
1. Enter the calibration menu as described in the user manual for your software.
   For Quantor users use the options icon (1) in the top right hand corner and select "**Device calibration**" (2).



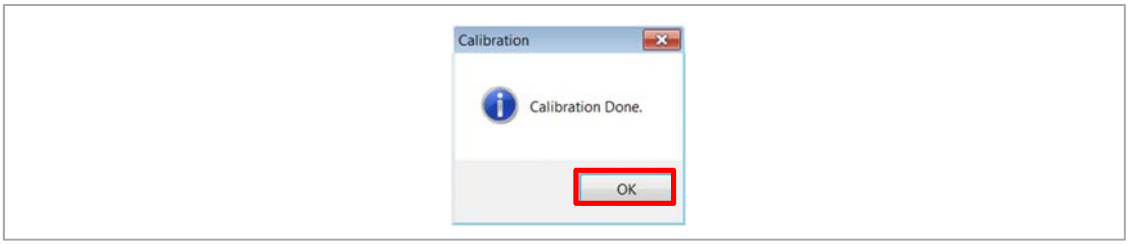
2. Follow the on screen guide to calibrate the unit using the following dose for each step;
    - Blank = 0μGy
    - Low dose = 70μGy
    - Mid dose = 325μGy
    - High dose = 1100μGy



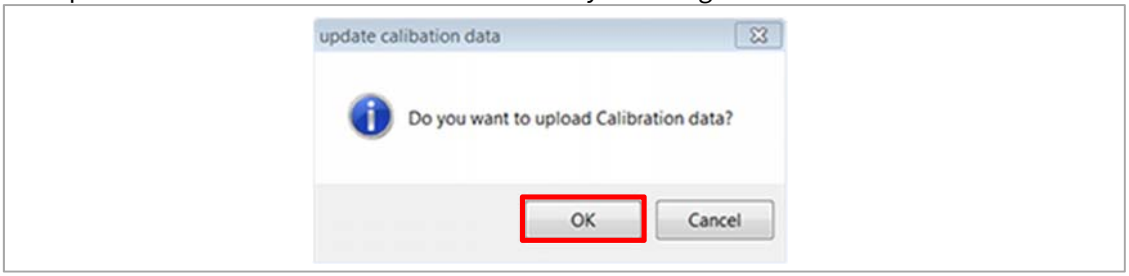
3. Select **Calibration** to complete the calibration.



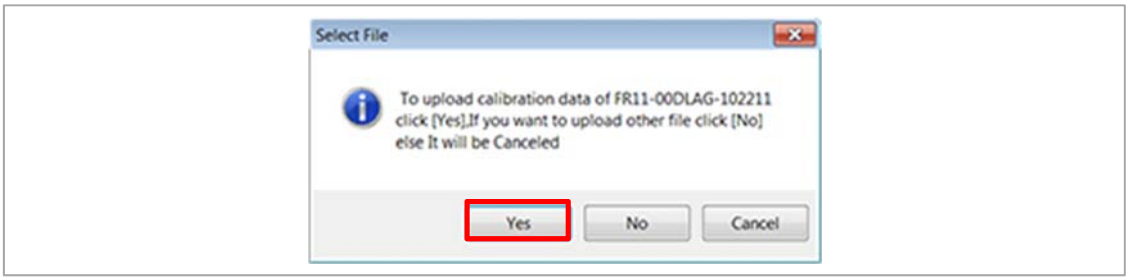
4. When the calibration is done a pop up window will confirm that it was successful. Select **OK** to continue.



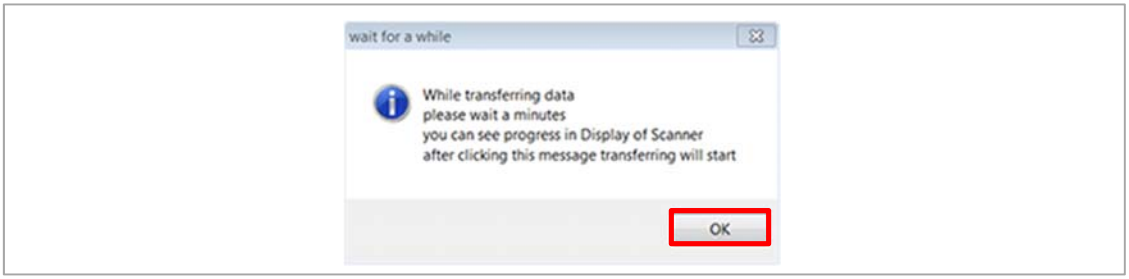
5. Upload the new calibration data to the unit by selecting **OK**.



6. Select **Yes** to use the new calibration.

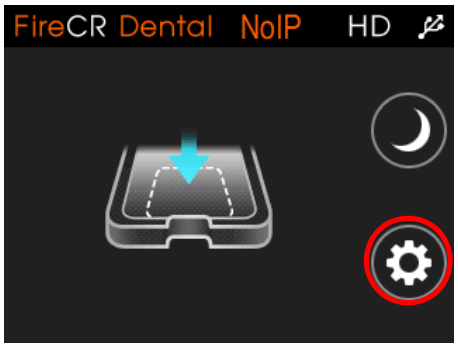


7. Select **OK** to start the transfer.

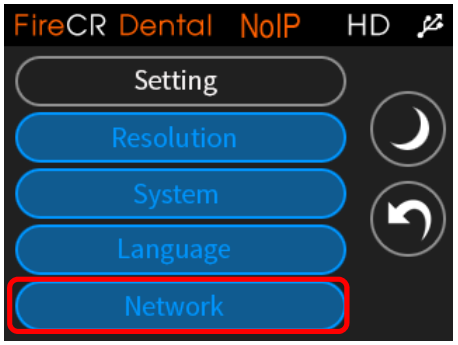


LCD calibration

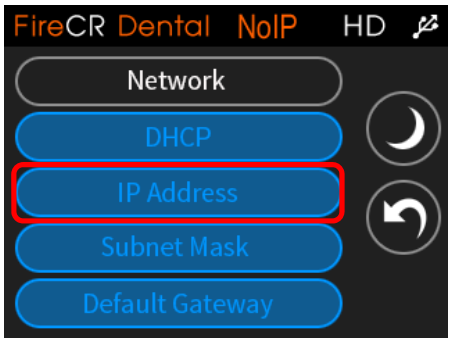
1. Go to the settings menu using the cog wheel on the LCD display of the unit.



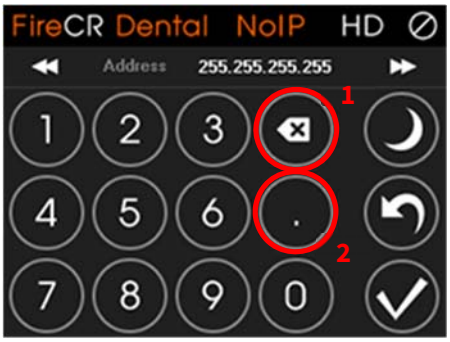
2. Enter the network setting menu.



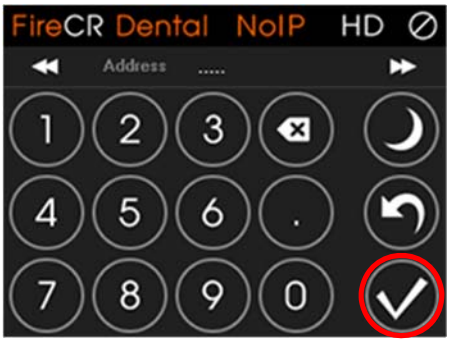
3. Select the IP address field.



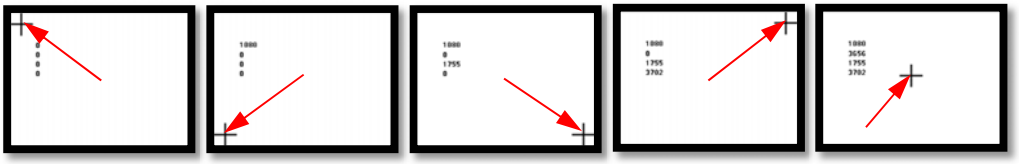
4. Delete the existing IP address using the backspace button (**1**) on the display of the unit and enter 5 dots (**2**). The IP address will be restored automatically when the calibration is finished.



5. Select the check mark on the display of the unit to boot the unit in LCD calibration mode.



6. Press in the center of the 5 crosshairs to calibrate the display.



7. The scanner is now ready for use.

3DISC
IMAGING

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