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## 1- OVERVIEW

In this procedure, the strength of the gradient fields are calibrated by modifying the control variables `cfxfull`, `cfyfull`, and `cfzfull`. A separate scan will be taken to calibrate each of the three gradient fields (*x*, *y*, and *z*).

**Note**

Shimming and Grafidy calibrations must be performed prior to this procedure.

## 2- SETUP

### 2-1 Tools Required

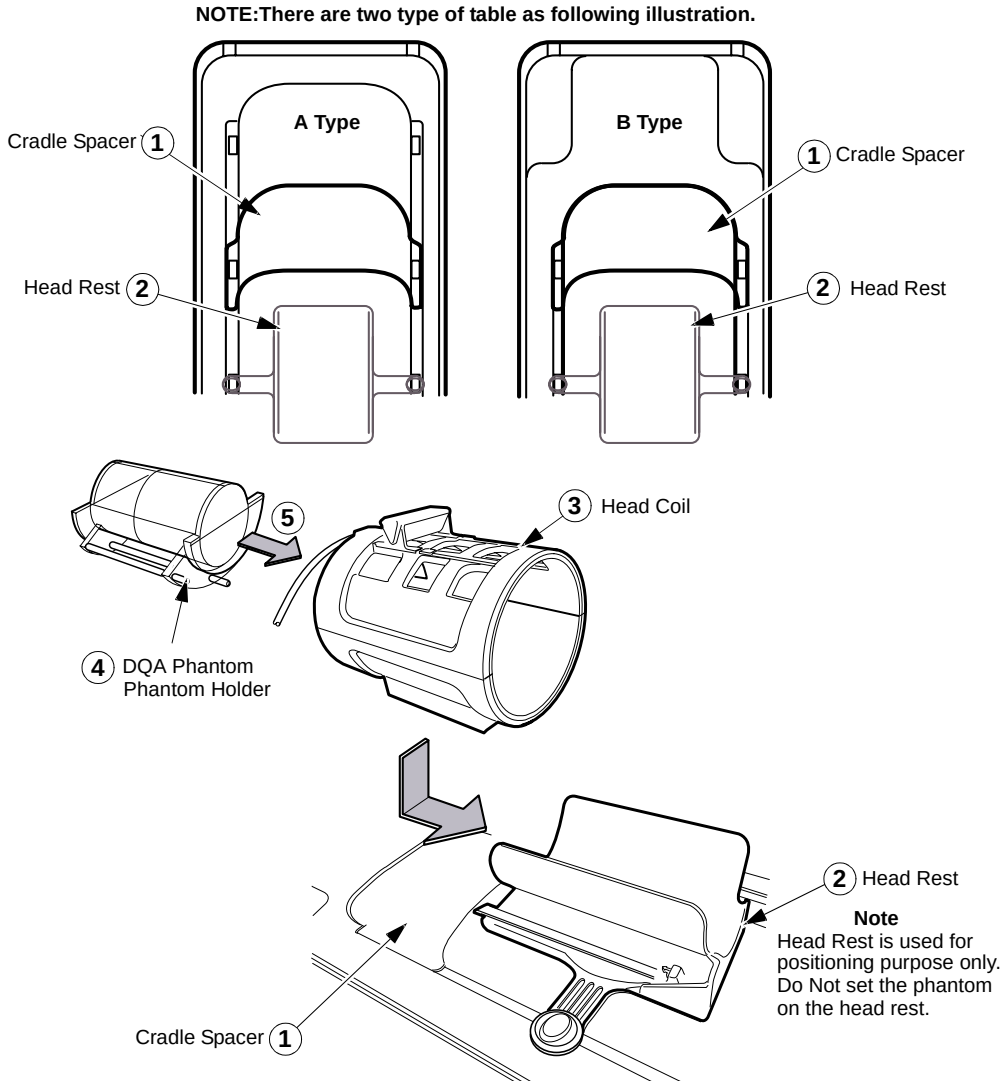
- DQA Phantom

**WARNING!**

**POISON HAZARD! THE PHANTOM CONTAINS NICKEL, A SUSPECT CARCINOGEN. DO NOT INGEST. DISPOSE OF AS A HAZARDOUS WASTE ACCORDING TO STATE AND FEDERAL REGULATIONS.**

## 2-2 Procedure

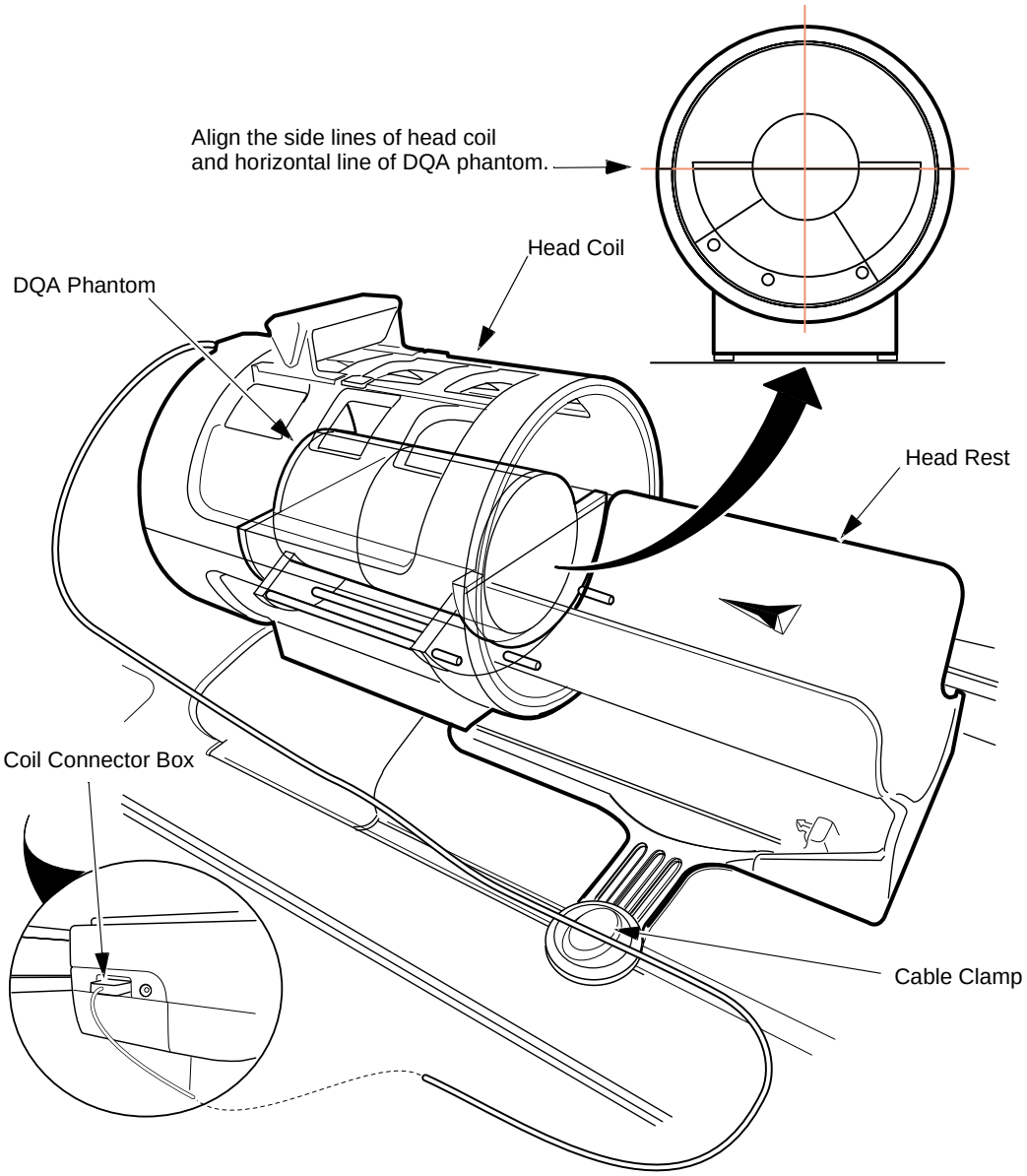
1. Set cradle spacer to cradle.
2. Set head rest onto cradle.
3. Set head coil to head rest. (Head Rest is used for positioning purpose only. Do Not set the phantom on the head coil.)
4. Set DQA phantom to phantom holder.
5. Insert DQA phantom and phantom holder into head coil.




**HEAD COIL POSITIONING**
ILLUSTRATION 3-1

6. Align the side lines of head coil and horizontal line of DQA phantom.

7. Connect the coil connector box to table connector port.



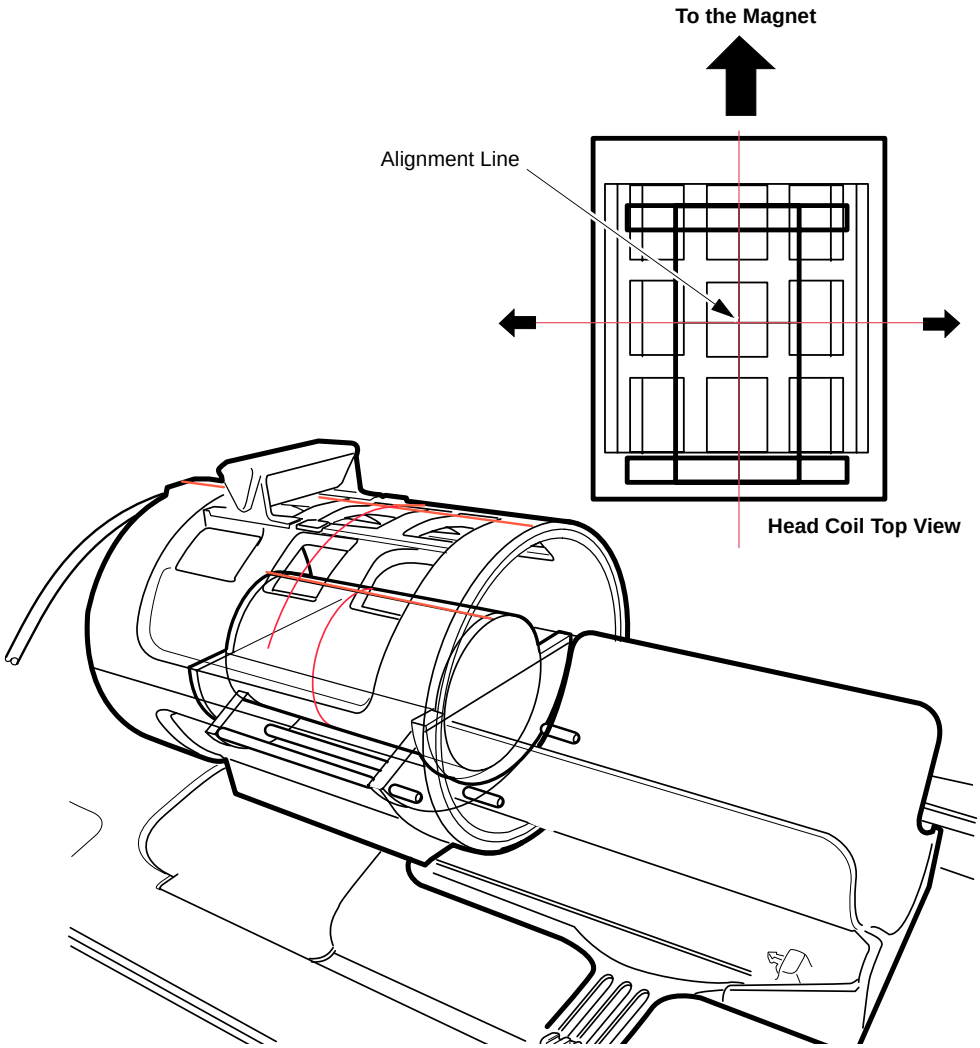

**HEAD COIL POSITIONING**
ILLUSTRATION 3-2

8. Attach the coil cable to cable clamp of head rest.

9. Advance the cradle to the position where the A-light beam hits the center of coil.

10. Align the head coil and DQA phantom center position to laser center.

11. Landmark in the sagital and axial planes.




**HEAD COIL POSITIONING**
ILLUSTRATION 3-2

12. Move the cradle to the scan center.

**Note**

Do not rotate or skew phantom in head coil. This will cause errors in the analysis of Gradient Calibration. Landmark errors can also cause errors in the analysis.

13. Click on **[Autoview]**, just below the Autoview image display screen; your scanned images will display automatically.

## 3- X-GRADIENT SCAN

1. At the Operator Workspace, prepare the system for an Gradcal-*X* scan using the "Service Protocols" procedure located on the service methods CD-ROM, or for the alternate proprietary procedure, see below.

*This alternate proprietary procedure is available for GE use, and to sites with a valid Advanced Service Package Limited License.*

   a. Click on **[New Pt]**, and enter
      Id: **geservice**
      Name: **gradient calibration**
      Weight (Lb.): **111**
      Set Patient Protocols to **Service**.

   b. In the Protocol field, type **o.1.1** (o=Other, 1=dqa, 1=dqa xfield).

   c. **[Save Series]**, then **[Prepare to Scan]**.

2. Click on **[Scan]** (system auto prescans first).

3. Perform Section 6, Gradient Calibration Image Analysis.

## 4- Y-GRADIENT SCAN

1. At the operator workspace, prepare the system for a Gradcal-*Y* scan using the "Service Protocols" procedure located on the service methods CD-ROM, or for the alternate proprietary procedure, see below.

*This alternate proprietary procedure is available for GE use, and to sites with a valid Advanced Service Package Limited License.*

   a. Click on **[New Series]**, and enter
      Id: **geservice**
      Name: **gradient calibration**
      Weight (Lb.): **111**
      Set Patient Protocols to **Service**.

   b. In the Protocol field, type **o.1.2** (o=Other, 1=dqa, 2=dqa yfield).

   c. **[Save Series]**, then **[Prepare to Scan]** (in RX Manager Window).

2. Click on **[Scan]** (system auto prescans first).

3. Perform Section 6, Gradient Calibration Image Analysis.

## 5- Z-GRADIENT SCAN

1. At the Operator Workspace, prepare the system for a Gradcal-*Z* scan using the "Service Protocols" procedure on the service methods CD-ROM, or for the alternate proprietary procedure, see below.

*This alternate proprietary procedure is available for GE use, and to sites with a valid Advanced Service Package Limited License.*

a. Click on **[New Series]**, and enter
Id: **geservice**
Name: **gradient calibration**
Weight (Lb.): **111**
Set Patient Protocols to **Service**.

b. In the Protocol field, type **o.1.3** (o=Other, 1=dqa, 3=dqa zfield).

c. **[Save Series]**, then **[Prepare to Scan]**.

2. Click on **[Scan]** (the system auto prescans first). If auto prescan fails, use manual prescan to find the RF transmit peak.

3. Perform Section 6, Gradient Calibration Image Analysis.

## 6- GRADIENT CALIBRATION IMAGE ANALYSIS

**Note**

This section describes the procedure for analyzing the x-gradient scan. The procedure for the y-gradient and z-gradient scans is similar.

**Note**

If the Z measurement is not even close to 100mm, there may be a bubble in the phantom causing the incorrect measurement. Open a C shell and type "setftg" to turn off Fast TG, then rescan the z-axis. After completion of gradcal, type "resetftg" to turn Fast TG back on.

1. From the Service Desktop Manager menu, click **[Cal/Checks],** then **DQA Calibration,** then **[Start]**. Continue as shown:

| Output/Prompts | INPUTS/COMMENTS |
|---|---|
| `**********************************************`<br>`**  Welcome to Automated DQA calibration tool  **`<br>`**********************************************` | |
| `!! Please perform [Phantom Position] test scan !!` | |
| `Press Return when <Proper Phantom Position>`<br>`is obtained .....` | Look at the DQA-III phantom image on the Autoview screen. Be sure it is not skewed more than a few degrees. When the phantom is properly positioned, press **<ENTER>**. |
| `Press Return when the desired scan(s) is`<br>`completed [Y]: .....` | **<ENTER>** |
| `Accessing information from last run number...`<br><br>`Last Exam is:`<br>`  ==================================`<br>`  Exam  number:  50006`<br>`  Series number:  1`<br>`  Series Description:  dqa xfield cal`<br>`  Image  number:  1`<br>`==================================` | |
| `Accept the Default: (Y,N) [Y] : .....` | If the correct image data set is displayed, type **y <ENTER>**. If not, type **n <ENTER>**. |
| *If **n** was entered at the* Accept the Default: *prompt, the following:* | |
| `Please enter image key manually.`<br>`  Enter Exam  Number [50000] : .....`<br>`  Enter Series Number [1] : .....`<br>`  Enter image  Number [1] : .....` | Enter appropriate Exam number.<br>Enter appropriate Series number.<br>Enter appropriate Image number. |
| `Accessing image, please wait ......` | |

## 6- GRADIENT CALIBRATION IMAGE ANALYSIS (continued)

| OUTPUT/PROMPTS | INPUTS/COMMENTS |
|---|---|
| *If the software does not recognize the "Exam Description", the following is displayed:*<br><br>`!!! Unknown Exam Description !!!`<br>`Please enter test mode manually.`<br><br>`Mode 0: Gradient X field Calibration.`<br>`Mode 1: Gradient Z field Calibration.`<br>`Mode 2: Gradient Y field Calibration.`<br>`Mode 3: Isocenter Calibration.`<br><br>`Select test mode: (0..6) [0] : ..................` | Enter **0** for X-Gradient, **1** for Z-Gradient, or **2** for Y-Gradient. |
| `==========================================`<br>`==  dqa xfield cal  analysis in progress  ==`<br>`==========================================`<br><br>*If the scan prescription is incorrect for Gradient Calibration, the following is displayed:*<br><br>`Wrong imaging parameters for Gradient X Field Calibration  <--------------------` | If this is displayed, check to make sure the scan prescription is correct and that the correct image data set was selected. |
| *If Gradient Calibration is OK, the following appears:*<br><br>`**********  Calibration results  **********`<br>`Measured Length:  99.8mm at cfxfull = 28650`<br><br>`X Field Calibration is within 100.0mm +/- 0.5`<br><br>`<<<<<<<  No adjustment required  >>>>>>>`<br>`**********`<br><br>***Note:*** *If the Z measurement is not even close to 100mm, there may be a bubble in the phantom causing the mismeasurement. Open a C shell and type "setftg" to turn off Fast TG, then rescan the z axis. After completion of gradcal, type "resetftg" to turn Fast TG back on.*<br><br>*If Gradient Calibration needs adjustment, the following is displayed:*<br><br>`**********  Calibration results  **********`<br><br>`Desired Length: 100.0mm +/- 0.5mm`<br><br>`Measured Length: 92.4mm at cfxfull = 26472`<br><br>`X Field Calibration adjustment is required.`<br><br>`<<  Try re-scanning with cfxfull set to 28649.  >>`<br>`**********` | |

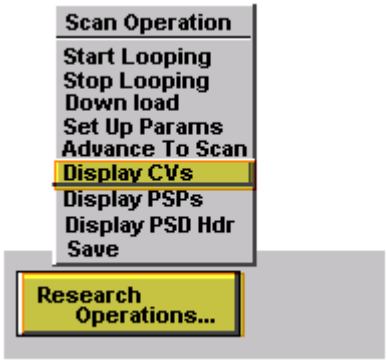
## 6- GRADIENT CALIBRATION IMAGE ANALYSIS (continued)

| OUTPUT/PROMPTS | INPUTS/COMMENTS |
|---|---|
| Press Return when the re-scan is completed [Y]:... | Right click on **[Research Operations]** and **[Display CVs]**. Type **cfxfull<ENTER>**, type the recommended value and **<ENTER>**, then **[Accept]**. Right click **[Research Operations]** and **[Download]**. It is also necessary to rescan. When scan is finished, press **<ENTER>** in the Daily Quality window. |
| ********** Calibration Results ********** | |
| Measured Length: 99.8mm at cfxfull = 28649 | |
| X Field Calibration is within 100.0mm +/- 0.5 | |
| <Old cfxfull = 26472 > -- < New cfxfull = 28649 > | |
| Update cfxfull in Gradientconfig.cfg (Y,N): | Type **y<ENTER>** to update Gradient.cfg file. |
| X Field Calibration updated with calibration number 28733 | |
| ********** | |
| ***Note:*** *The calibration number used to update the Gradient file is not the last "new" value displayed (28649 for example shown). The actual value used (28733 for example shown) is the next one the Gradcal program would have recommended you use (i.e, it saves a better calibration value).* | |
| ********** | |
| Would you like to perform another calibration (Y,N) [Y] : ..... | Type **y** or **n**, as appropriate. |
| ********** | |
| * Thank you for using Automated DQA calibration tool * | |
| ********** | |
| DQA_CAL Exiting! | |
| Press [ENTER] to quit --> ..... | Press **<ENTER>**. |

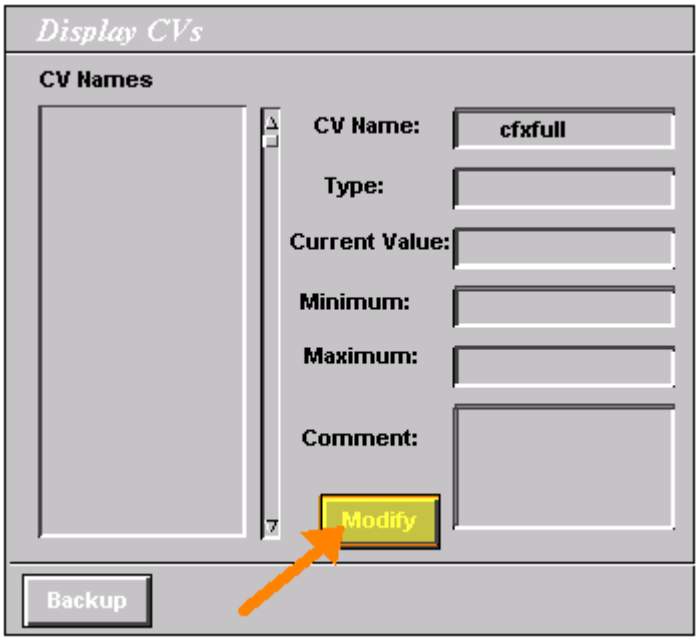
## 6- GRADIENT CALIBRATION IMAGE ANALYSIS (continued)

1. If calibration is required, perform Modify CVs. Then scan again.

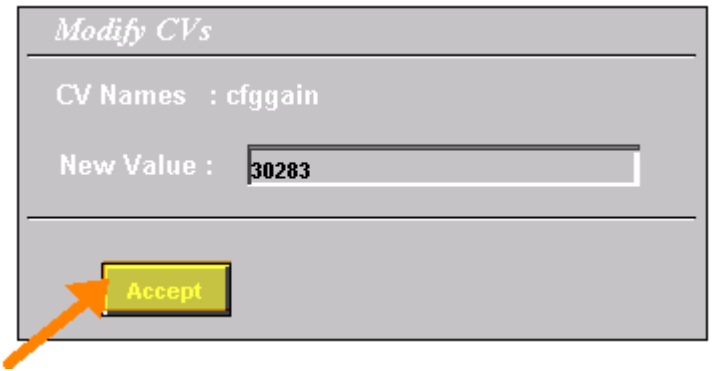
   a. Click [Research Operation] and select [Display CVs].




   b. Input CV name. (X – cfxfull, Y – cfyfull, Z – cfzfull) Then, select [Modify].



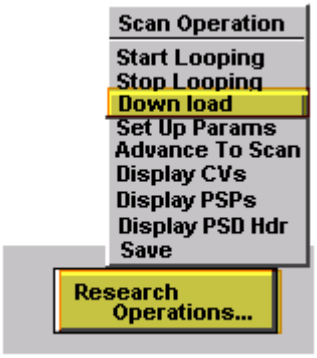

   c. Enter New Value. Then, hit **[Return]** key. After that, click **[Accept]** button.




   d. Click **[Accept]** button for “Display CVs”.

## 6- GRADIENT CALIBRATION IMAGE ANALYSIS (continued)

e. Click [Research Operation] and select [Download].




f. Perform [Scan].

g. Then, hit [Enter] key at the command window.

| OUTPUT/PROMPTS | INPUTS/COMMENTS |
|---|---|
| `Press Return when the re-scan is completed [Y]:...` | **<ENTER>** |
| `********** Calibration Results **********`<br>`Measured Length: 99.8mm at cfxfull = 28649` | |
| `X Field Calibration is within 100.0mm +/- 0.5` | |
| `<Old cfxfull = 26472 > -- < New cfxfull = 28649 >` | |
| `Update cfxfull in Gradientconfig.cfg (Y,N):` | Type **y<ENTER>** to update Gradientconfig.cfg file. |
| `X Field Calibration updated with calibration number 28733`<br>`**********` | |
| ***Note:*** *The calibration number used to update the Gradientconfig file is not the last "new" value displayed (28649 for example shown). The actual value used (28733 for example shown) is the next one the Gradcal program would have recommended you use (i.e, it saves a better calibration value).* | |
| `**********` | |
| `Would you like to perform another calibration (Y,N) [Y] : .....` | Type **y** or **n**, as appropriate. |
| `**********`<br>`* Thank you for using Automated DQA calibration tool *`<br>`**********` | |
| `DQA_CAL Exiting!` | |
| `Press [ENTER] to quit --> .....` | Press **<ENTER>**. |

## 6- GRADIENT CALIBRATION IMAGE ANALYSIS (continued)

2. Record the final gradient calibration results in Appendix A, Gradcal Data Sheet.

3. When **all three** gradient fields have been calibrated, the Signa software must be brought down and back up (reSigna) to activate the changes in the `MRconfig.cfg` file.

   a. Right click on the desktop wallpaper and select **Service Tools** from the root menu, then select [**System Shutdown**]. Wait for Signa logout to complete.

   b. Restart system software by double clicking on the **Signa** icon, then type the password **adw2.0 <Enter>**. Allow initialization to fully complete before any user interaction.

# APPENDIX A - GRADCAL DATA SHEET

| **MEASUREMENT** | **FINAL MEASUREMENT (mm) Spec = 99 to 101** | **FINAL CV VALUE** |
|---|---|---|
| Y GRADIENT | | (cfyfull) |
| Z GRADIENT | | (cfzfull) |
| X GRADIENT | | (cfxfull) |

**CORRECTION FORMULA:**

$$\frac{100\ (\text{Desired Distance})}{\text{Calculated Distance}} \mathbf{X}\ \text{Current Value} = \text{Corrected Value}$$

# REVISION HISTORY

| REV | DATE | AUTHOR | PRIMARY REASONS FOR CHANGE |
|---|---|---|---|
| 0 | Jan. 26, 2001 | Y. Masumo | Initial release |
| 1 | May 15, 2001 | Y. Masumo | Phantom setting is updated |
| 2 | Oct 18, 2001 | Y. Masumo | Page 5: Added the purpose of Head Rest. |
| 3 | Jun 17, 2002 | Y. Masumo | Page 6 and 7: Corrected protocol number. |
| 4 | Aug 22, 2002 | Y. Masumo | Page 10 and Page 12: Mrconfig was changed to Gradient Config. |
| | | | |