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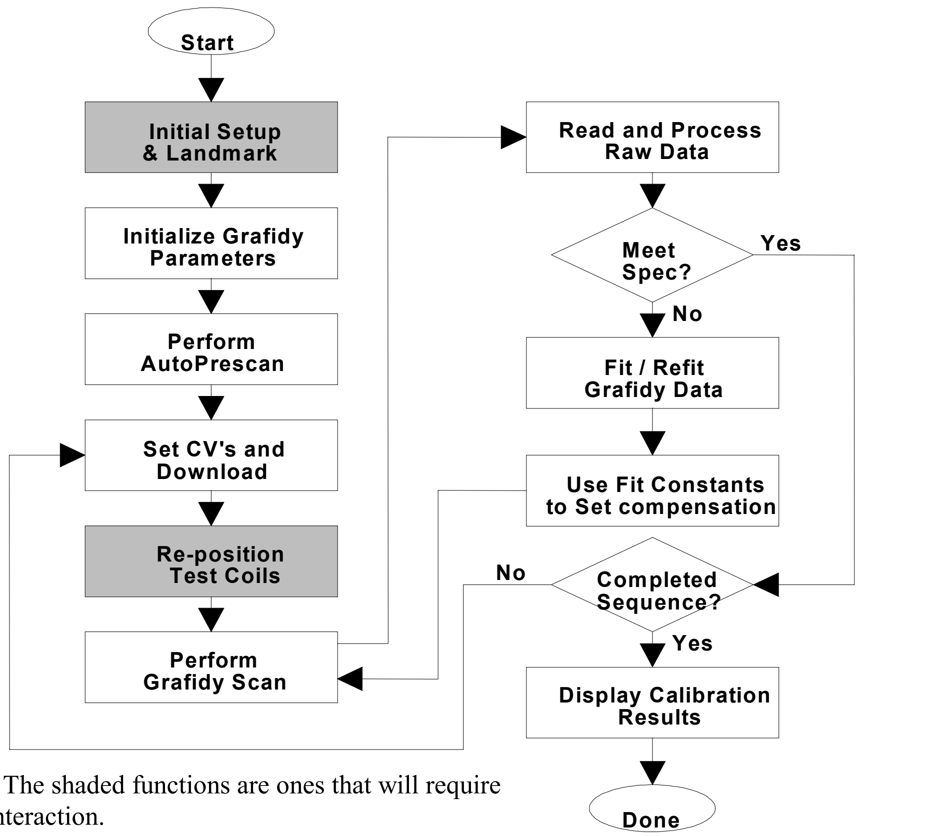
Note
This new tool is not available with Release 8.2 or earlier software.

1- GUIDED GRAFIDY OVERVIEW

Grafidy is a calibration tool which measures and corrects gradient field disturbances caused by eddy currents. Since the gradient field is used to determine signal location in magnetic resonance imaging (MRI), this calibration procedure is critical in achieving undistorted images.

Guided Grafidy creates a user interface for the Grafidy functions which “guides” you through the process and helps prevent common procedural errors. The process flow is also modified to minimize user interaction. The tradeoff for the tool simplicity is tool flexibility. The Guided Grafidy tool will **NOT** support development mode which allows the user flexibility to modify the calibration procedure. The existing Grafidy Tool is still available for those who require flexibility not provided by Guided Grafidy.



Note: The shaded functions are ones that will require user interaction.

GUIDED GRAFIDY PROCESS FLOW CHART
ILLUSTRATION 1-1

The Guided Grafidy tool operates in two modes: “check” and “calibrate”. In the “check” mode, Guided Grafidy will not initialize the grafidy parameters nor perform fit on the raw data. The purpose of this mode is to check whether or not the current system is within calibration specifications. In the “calibrate” mode, Guided Grafidy will not allow parameter initialization for data fit interations, (If parameter initialization is required it can be done with the normal Grafidy program). The purpose of this mode is to calibrate the system so that it comes within system specifications.

Note

If a system is calibrated with one version of the Eddy Compensation tool (Guided Grafidy or ECMT), the same tool must be used for updates or start from beginning with different tool. If a different tool is used to compensate eddy currents the result will be bad plots

2- TOOLS REQUIRED AND PRELIMINARY SETUPS

- Rotary Attenuator (10db/step), 46-255838P5
- Grafidy kit - There are several variations in the field as listed below:

46-271417G1 – 1.5T
46-307164G1 – 1.5T
46-307164G2 – 1.5T
46-307164G3 – 1.0T, 1.5T
46-307164G4 – 1.0T, 1.5T
46-307164G6 – 1.0T

2-1 GRAM DC Offset Adjustment

2-1-1 Adjustments for SGD Systems

Note

Do not touch the Offset pots on the miniGRAM's.

1. Select **[Diagnostics]** from the Service Desktop and select **[Start].**

2. Select **[IPG]**, **[Manual]**, **[Digital DC Offset],** then **[Close]**.

3. Click **[Close]** on the *IPG_* window. Select **[Run Diagnostics]** ←TPS should download and you should observe the words "DC OFFSET" on IPG boards with a display.

4. When one pass of diagnostics are complete (3-4 minutes), exit Diagnostics by closing the *Results* window, then selecting **[Quit]** on the *Diagnostics* window. TPS will download.

5. The calibration values are stored in the */usr/g/caldir/gram_tune.dat.* file.

2-1-2 Adjustments for 8645 / Gram Systems

Perform the GRAM DC Offset Adjustment now (or again), or the return signal may not show up, due to a magnitude offset caused by a DC offset on the output of the GRAM.

1. Remove the head coil and holder from the cradle. Install the Grafidy phantom holder.

2. Landmark on the center line of the Grafidy phantom holder.

3. At keypad on front magnet enclosure, press LANDMARK and MOVE TO SCAN.

4. At the operator work space, prepare the system for a Grafidy scan per scan protocol shown in the *Service Protocols* procedure located on the service methods CD-ROM, or for the alternate proprietary procedure use the following:

Note

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: **grafidy**
   Weight (Lb): **111**
   Set Patient Protocols to **Service**.
b. In the Protocol field, type **o.5.1** (o=Other, 1=series number) to load protocol.
c. **[Save Series]**.

5. Right click on **[Research Operations]** and select **Setup Params** from the Scan Operations list. Enter values listed in Table 2-1.

TABLE 2-1
GRAFIDY SETUP PARAMETERS

SETUP PARAMETERS
R1 = 13
R2 = 14
TG = 0 *(TG must be set to 0.)*
Number of Frames: **4 <Enter>**
WINDOW ONE
Frame: **1 <Enter>**
Frame: **0 <Enter>**
WINDOW TWO
Frame: **3 <Enter>**
Frame: **0 <Enter>**
[Done]

Note

It is necessary to set the grad shim values to zero in order to ensure that there are no additional offsets in the circuit. This ensures an accurate calibration. Remember to restore the grad shim values after this GRAM Tuning procedure is complete.

6. Go to manual prescan. Record grad shim values for *x*, *y*, and *z* axes. If values are not set to 0, set them by moving the slide bar to 0 at this time.

7. Select **[Done]** to exit manual prescan. This is important so that the scanner is ready, but not scanning.

DANGER!!

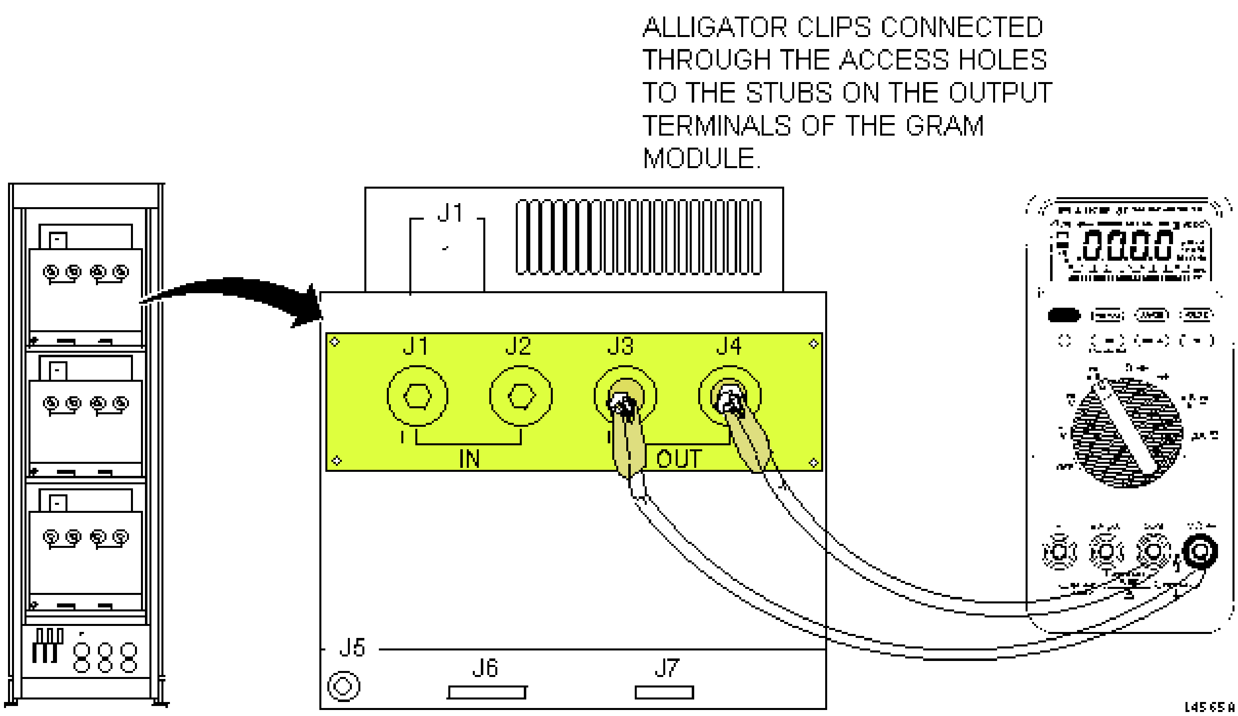
FATAL ELECTRIC SHOCK HAZARD!! GRAM MODULES GENERATE FATAL ELECTRICAL CURRENTS. SCANNING OR PRESCANNING DURING THIS MEASUREMENT MAY CAUSE A FAILURE TO THE GRAM, AND EXPLOSION OF THE VOLTMETER. DO NOT SCAN OR PRESCAN DURING THIS MEASUREMENT AND ADJUSTMENT.

8. At the GRAM Control Board, prepare to perform the GRAM DC Current Offset Adjustment to null any offset currents to zero.

Note

Always use ESD precautions when working on any of the electronic hardware for the protection of the circuit boards.

9. Using voltmeter leads with alligator clips, connect a voltmeter at the rear of the GRAM chassis across J3 (+OUT) and J4 (–OUT). The voltmeter should be set to DC millivolts (see Illustration 2-1).



GRAM CHASSIS – REAR VIEW WITH VOLTMETER ACROSS THE OUTPUT
ILLUSTRATION 2-1

Note

Using longer leads for the voltmeter allows viewing the voltmeter as the adjustment is performed because the potentiometer to be adjusted is on the front of the GRAM Module on the GRAM Control Board.

10. On the GRAM Control Board, locate and adjust R151 (Offset Null), so that the voltmeter reads 0 mVdc ±10 mVdc. R151 is accessible through a hole in the digital tuning board (located between two voltage regulators).

Note

GRAM DC Offset Adjustment must be done with the system in Ready. If the fans in the 8645 Gradient Cabinet slow down while performing the GRAM DC Offset Adjustment, GAP has put the power modules in Standby. Select [Download], and GAP commands the power modules to Ready.

11. If all three axes are to be tuned, repeat steps 7 through 9 for each axis. If one or two axes are to be tuned, repeat steps 7 through 9 for the axis being tuned.
12. Proceed to Section 2-2, LCoil, and Gain Balance if this is the first DC Offset Adjust. Proceed to Section 6, System Restoration if this is the 2nd DC Offset Adjust.

2-2 LCoil and Gain Balance

This adjustment takes about two minutes to run. It automatically updates the system configuration upon completion.

When doing all three axes, no errors should be reported by the system and system configuration will auto update. If a problem is detected on any axis, an error message will be posted by the system and the bad axis configuration will not be updated.

If you don't want to tune all axes, turn off power to the GRAM(s) on those axes. Note: Error messages will be posted by the system for the GRAM(s) that are off, but configuration files will be updated for the GRAM(s) that are still on.

Note

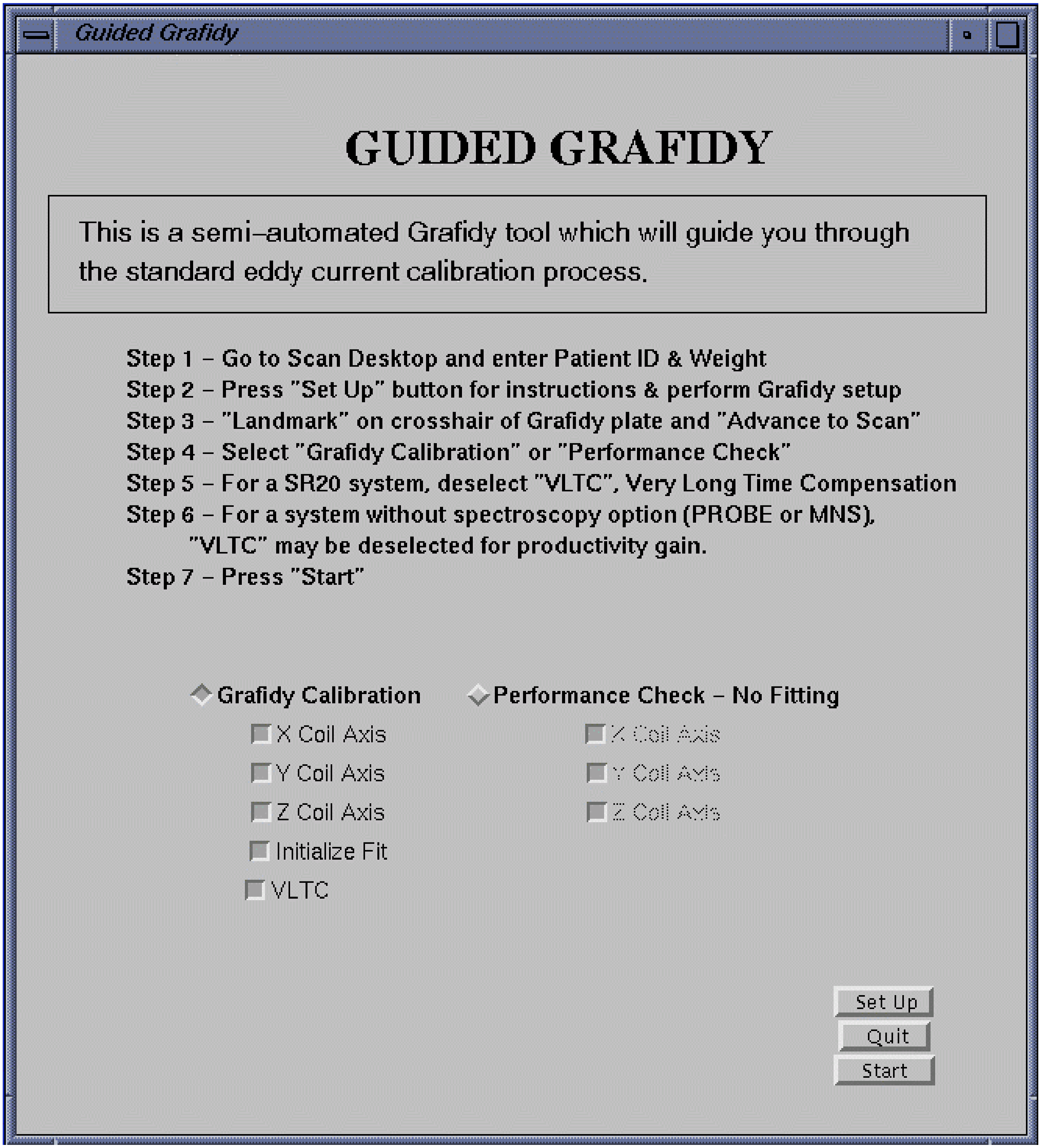
The waveform used to perform the Auto DC Offset procedure is generated locally in the gradient cabinet on the GIP Module. Therefore, it is not necessary to set gradshim currents (which originate from the IPG) to zero before invoking this procedure.

Auto LCoil Adjustment Procedure (All Configurations)

1. Select **[Diagnostics]** from the Service Desktop Manager.
2. Click **[Start]**.
3. Select **[Board Level Tests - IPG]**.
4. Click **[Manual]**.
5. Select **[LCoil Adjust]**. Close the *Manual* and *IPG* windows.
6. Select **[Run Diags]**.
7. Exit diags when diagnostics have completed by closing the *Results* window and clicking on **[Quit]** in the *Diagnostics* window .

3- GUIDED GRAFIDY HARDWARE SETUP

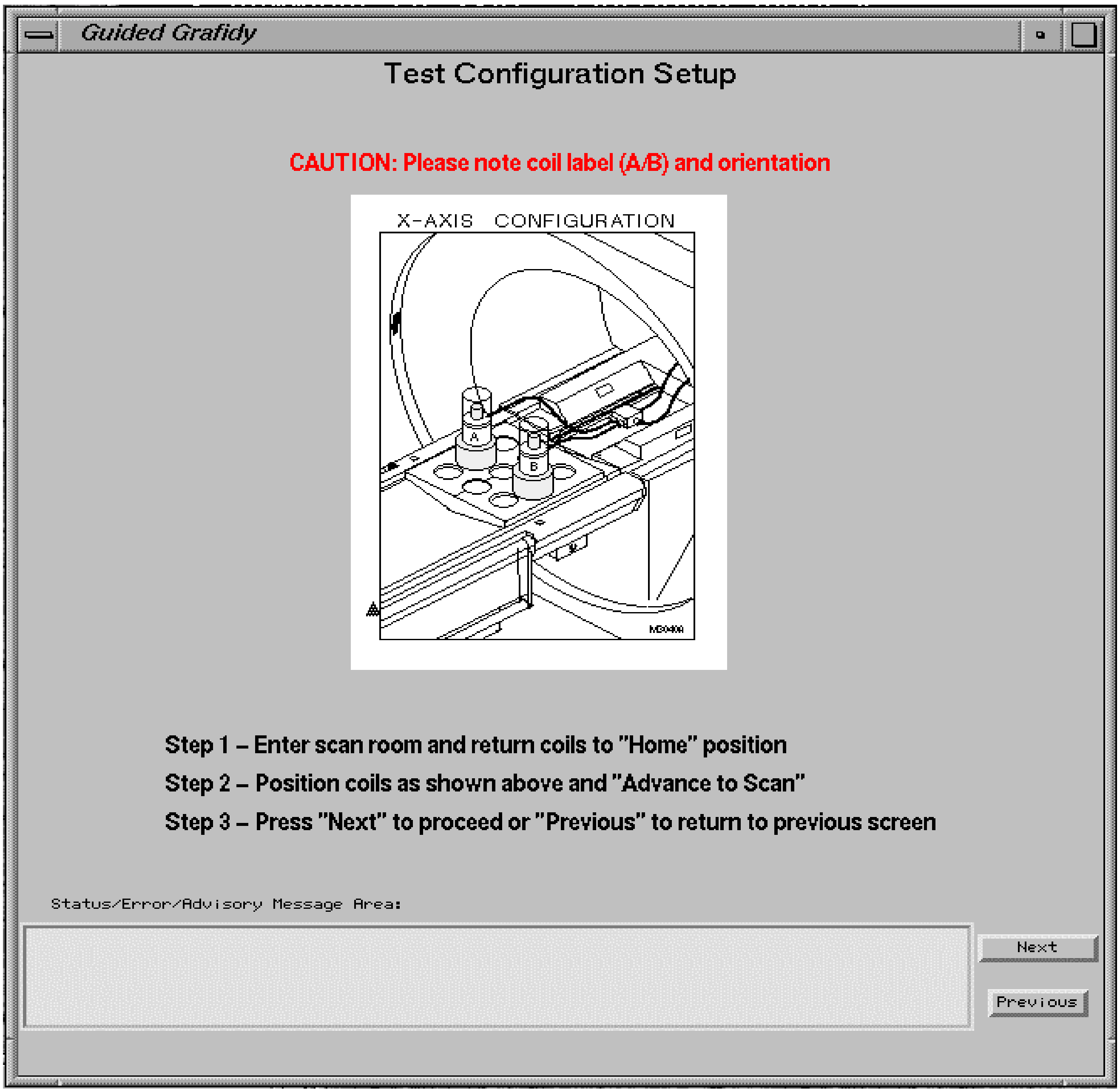
1. On the Service Desktop, select **[Cal/Checks]**, **[Guided Grafidy]**, then **[Start]**. The “Start-Up” window will appear on the screen; see Illustration 3-1.



GUIDED GRAFIDY START-UP WINDOW
ILLUSTRATION 3-1

2. Select between "Parameter Check" or "Calibration". The "Parameter Check" mode will check if the current fit parameters are within system specifications. The "Calibration" mode (default) is used to perform the eddy current compensation and create new Grafidy calibration files. The default is all axes and Initialize Fit Parameters. If you deselect "Initialize Fit Parameters", Guided Grafidy will use the present calibration values as the starting point.

3. Select **[Start]**, The "Configuration Window" is displayed. See Illustration 3-2. This window displays the individual axis for setup every time sample repositioning is required for "Parameter Check" or "Calibration".



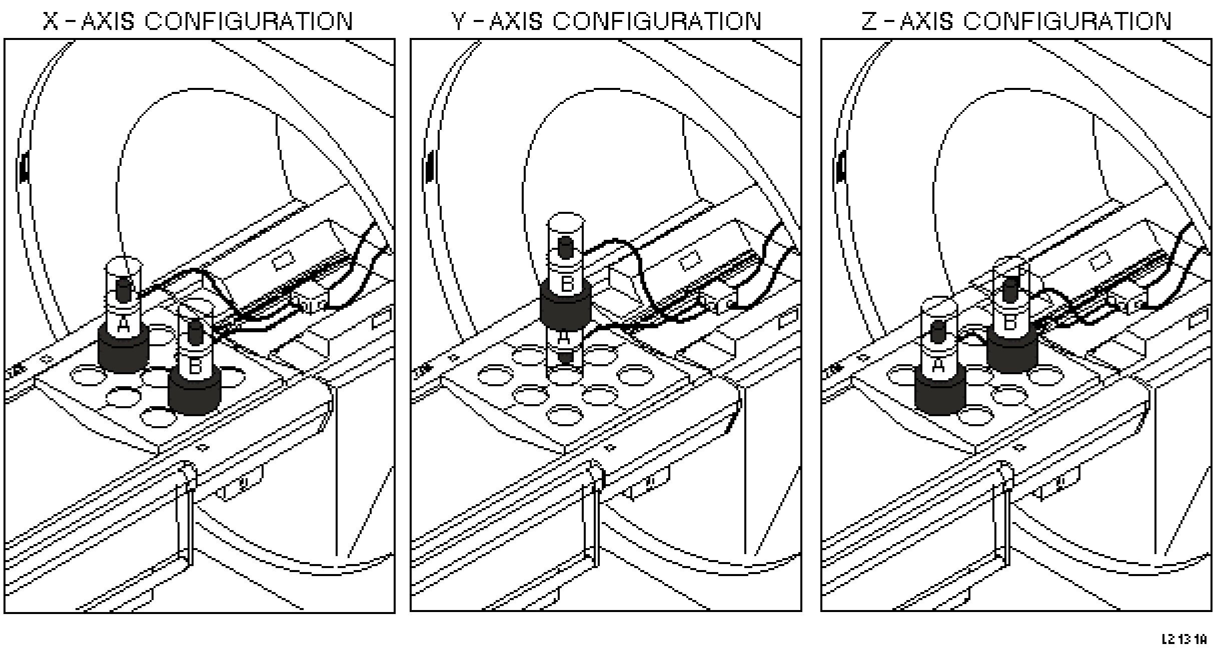
GRAFIDY PHANTOM CONFIGURATIONS
ILLUSTRATION 3-2

Using instructions 4 through 16 and Illustrations 3-2, 3-3 and 3-4, set up the Grafidy Kit for the first axis to be calibrated or checked.

4. Remove the head coil and holder from the cradle.

5. Select the proper coil for the system to be tested (1.5T or 1.0T).

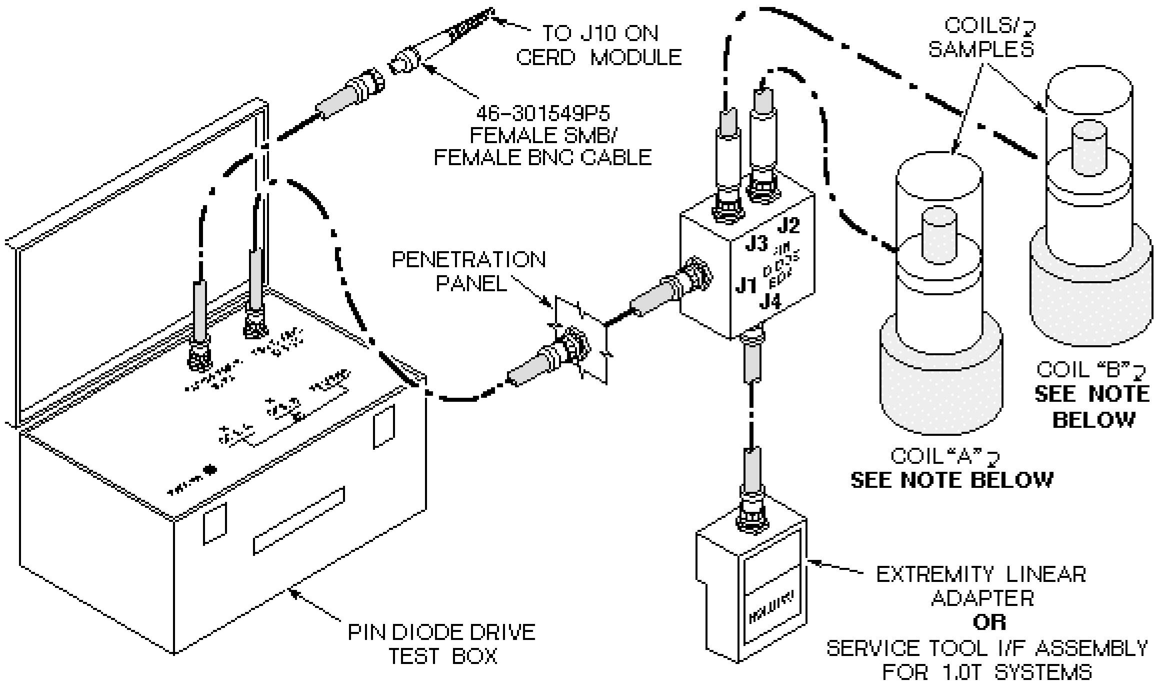
6. Place the phantom holder on the cradle. Configure the Grafidy coil/samples and collars appropriately for the first axis on which you will perform Grafidy. Landmark and move samples to scan position. See Illustration 3-3.



GRAFIDY PHANTOM CONFIGURATIONS
ILLUSTRATION 3-3

Note

In the x and z configurations, the coil/sample is placed with the sample at the top. In the y configuration, the top coil/sample is placed with the sample on top, while the lower coil/sample is inverted so that the sample is on the bottom. Also in the y configuration, no collars are used beneath the bottom sample.



NOTE: OLDER GRAFIDY COILS (WHICH ARE LABELED "A" AND "B") ARE POLARIZED AND MUST BE CONNECTED AS SHOWN. NEWER GRAFIDY COILS (WHICH ARE NOT LABELED) ARE NOT POLARIZED AND CAN BE CONNECTED TO EITHER J2 OR J3.

GRAFIDY KIT SETUP
ILLUSTRATION 3-4

7. Plug the Extremity/Linear Adapter **(for 1.0T systems, use Service Tool I/F Assm. supplied with Grafidy kit)** into Quad Head Coil Carriage Assembly. Connect 2-ft coaxial cable from Extremity/Linear Adapter BNC to J4 on pin diode box.

Note

There are multiple lengths of cables used for this portion of this procedure. The short cable is the 2-ft cable, the medium length cable is either a 5-ft or an 8-ft cable, and the long cable is any cable length that will accommodate the long cable runs, the 90-ft cable, a combination of 30-ft cables, or a custom cable that you may have created.

8. Connect cable as follows, depending on type of system:

   a. **1.5T systems and fixed site 1.0T systems:** Connect the long coaxial cable from J1 on pin diode box to a SERVICE coaxial feed-through on the Penetration Panel (exam room side). Cable must be routed through the bore of the magnet, exiting at the rear.

Note

It is not necessary to use a 90-ft cable. This length is supplied in most Grafidy kits. Other kits are supplied with three 30-ft cables. Use the length of cable that best suits your particular site.

   b. **For mobile systems:** Disconnect cable at J8 of Penetration Panel (this is the body receive line, which is not needed for this procedure). Connect the long coaxial cable from J1 on Pin Diode Box to J8 on Penetration Panel.

CAUTION

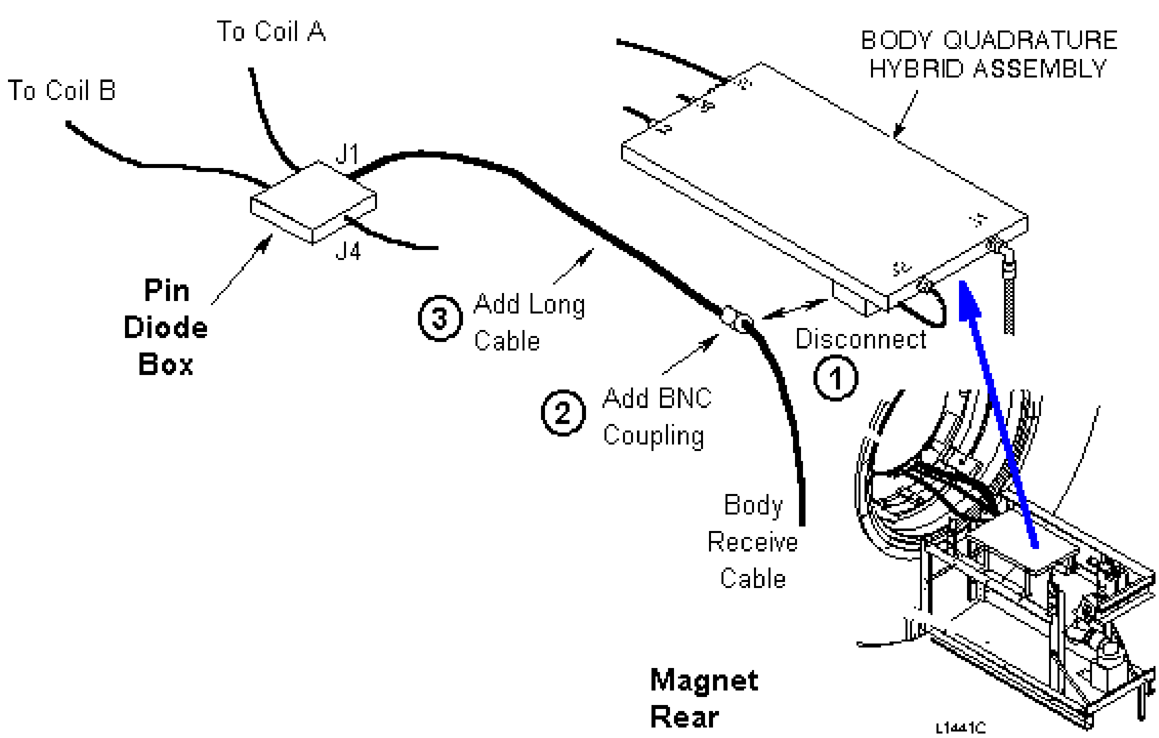
Equipment damage possibility. Do not run the coaxial cable under the RF door. The RF door can cut the outer cable jacket, exposing the braided shield, and grounding it to the RF door. These two grounds are not at the same potential and will adversely affect your calibration.

WARNING!

SHOCK HAZARD! THE PIN DIODE DRIVE TEST BOX SENDS 60-VOLT SIGNALS TO THE PIN DIODE BOX. VERIFY THAT THE POWER SWITCH FOR THE PIN DIODE DRIVE BOX IS OFF (DOWN POSITION) BEFORE CONNECTING CABLES.

Note
An alternate method for Steps 9 and 10 is provided here, if any difficulty is encountered with the primary method provided in the main procedure.

9. Disconnect run #262 Body Receive cable (this signal is not needed for this procedure), from the Body Hybrid Splitter at the rear of the magnet, and place a BNC coupling (not provided) on the cable end. See Illustration 3-5.



PIN DIODE DRIVE HOOKUP - MAGNET END
ILLUSTRATION 3-5

(Alternate) Connect the first long coaxial cable from J1 on Pin Diode Box to the BNC coupling on the body receive cable. This cable must be routed through the bore and out the rear of the magnet.

10. On the lower rear panel of the Systems Cabinet, disconnect the existing coaxial cable from J2 (this is the other end of the body receive line run #231T) and place a BNC coupling (not provided) on the cable end.

    (Alternate) Connect a second long cable between the BNC coupling and the PIN DIODE DRIVE connector on the Pin Diode Drive Test Box.

11. Verify that the switch on the Pin Diode Drive Test Box is in the Remote position.

12. Connect BNC-to-BNC cable from the Trigger Input (called *patch panel input* on some older boxes) connector on the Pin Diode Drive Test Box to J10 on the CERD board.

13. Plug in the power cord for the Pin Diode Drive Test Box.

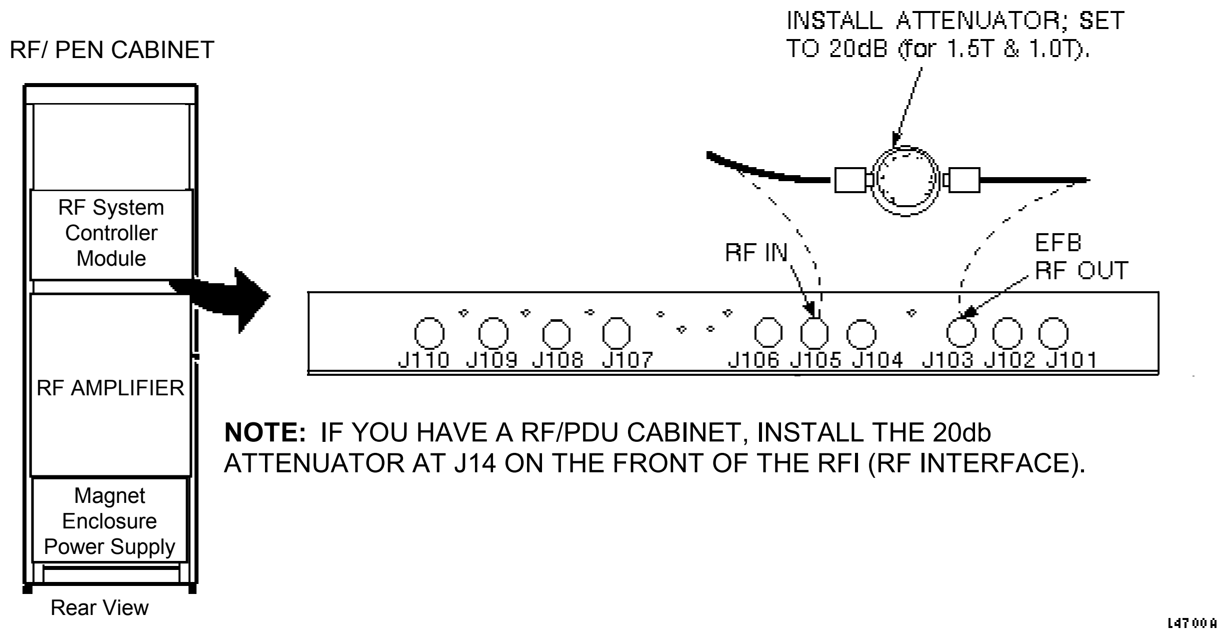
14. Place the power switch for the Pin Diode Drive Test Box in the *on* position (referred to as (1) on the Pin Diode Drive Test Box.

CAUTION

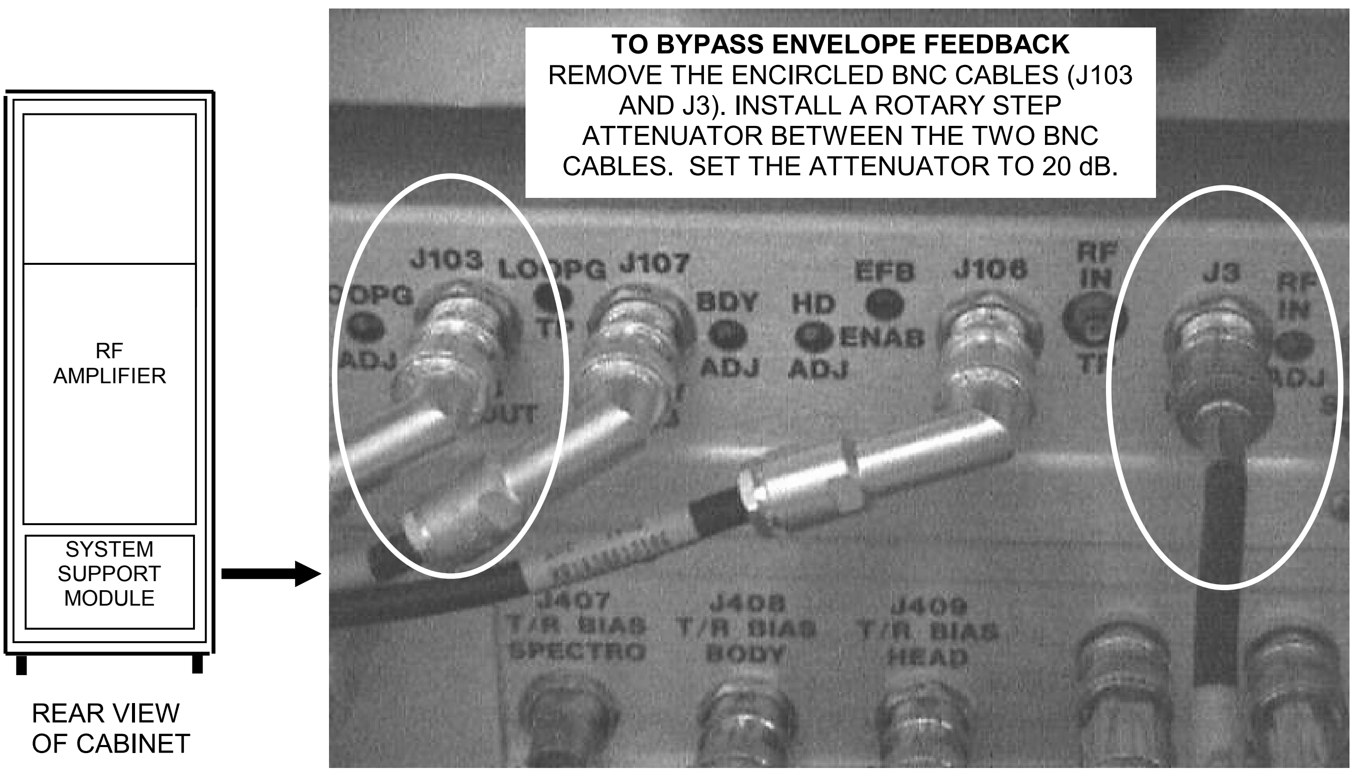
Equipment damage possibility. The coils used in the Grafidy phantoms require low RF power and can be damaged if the appropriate attenuation is not used.

15. **RF/PEN and RF/PEN II:** Install an attenuator to bypass envelope feedback circuitry at the RF amplifier. Disconnect BNC from EFB RF Out, and disconnect BNC from RF In. Add a rotary step attenuator (set to 20dB) in-line between the two BNCs, as shown for the RF PEN Cabinet in Illustration 3-5A or the RF PEN II Cabinet in Illustration 3-5B.

16. **RF/PDU (SRFD)**—Although envelope feedback is not employed on the RF/PDU cabinet, attenuation is still required. Install a rotary step attenuator set to 20dB between J1 on the rear of the System Cabinet (exciter output) and J1 on the fiber optic bracket at the rear of the RF/PDU. (J1 leads to the RFI input).



RF/PEN CABINET: RF SYSTEM CONTROL MODULE WITH EFB BYPASSED
ILLUSTRATION 3-5A



RF PEN II SYSTEM RF ATTENUATOR HOOKUPS J3 AND J103 ON SSM (REAR VIEW)
ILLUSTRATION 3-5B

4- GUIDED GRAFIDY PROCEDURE

1. Select “**Next**” to start Prescan and analysis process.

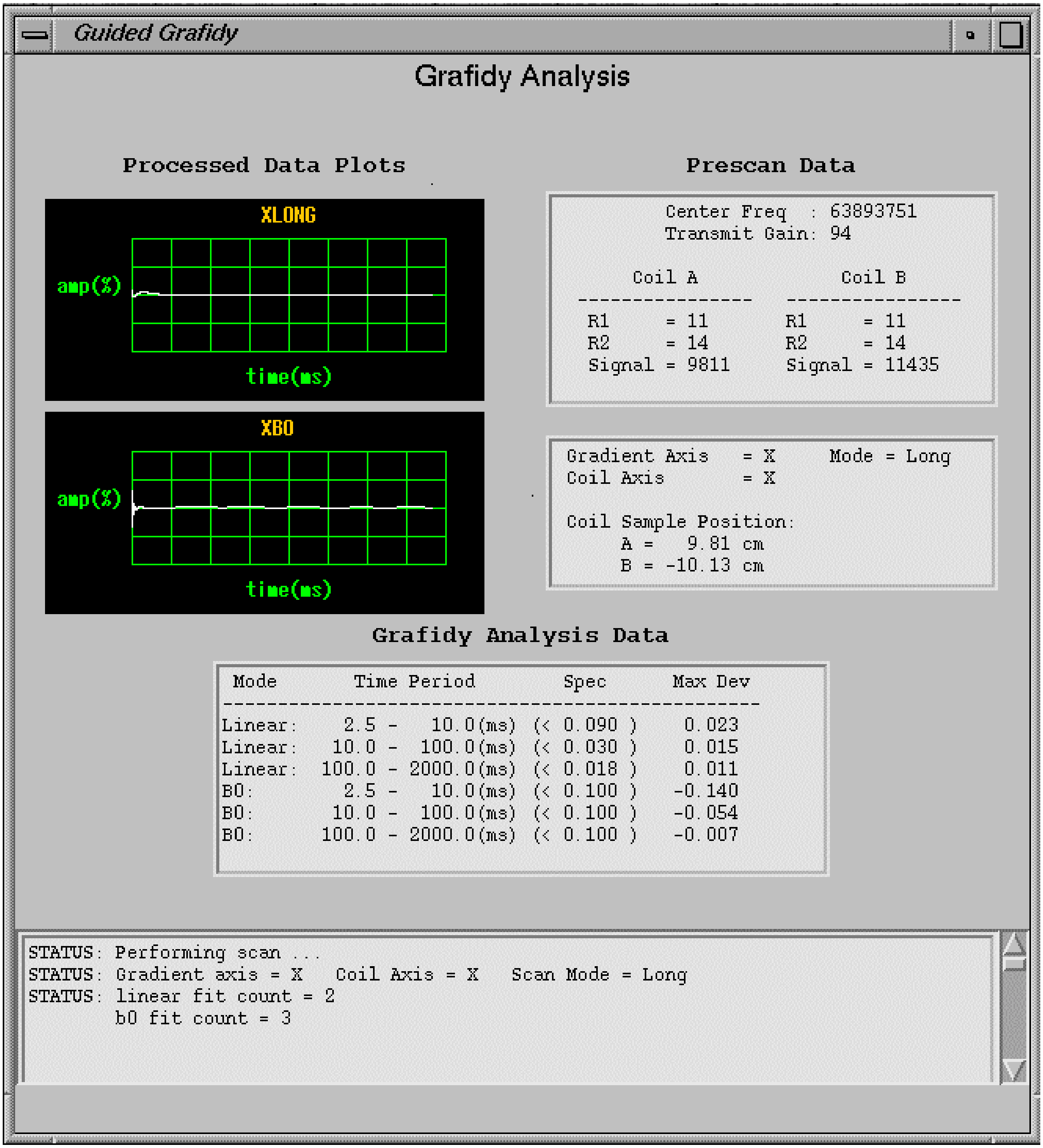
Note

After Prescan, Prescan data will be displayed in the prescan window. Since Prescan is performed only once in the entire check/calibration process, the same Prescan data will be displayed on all subsequent windows.

Note

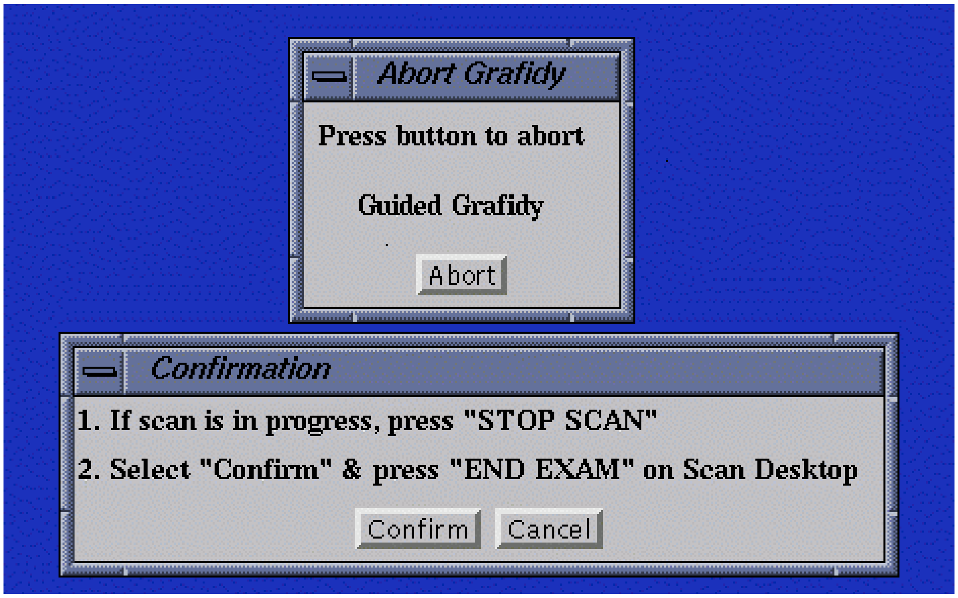
Once the scan and configuration change is completed, you can select the “Previous” or “Next” option with a right mouse click to resume Grafidy operation. The selection of the “Previous” button generates the previous screen. This can be either the “Start-Up” or previous “Analysis” window depending on the current point of the program in the calibration sequence. The selection of the “Next” button automatically initiates the next scan and analysis sequence.

Once the scan completes, analysis is performed and displayed in the “Analysis” window. See Illustration 4-1.



GUIDED GRAFIDY ANALYSIS WINDOW
ILLUSTRATION 4-1

At any time, you may exit the Guided Grafidy Tool by clicking on the **[Abort]** button. After aborting, follow the instructions in the Confirmation pop up window. See Illustration 4-2.

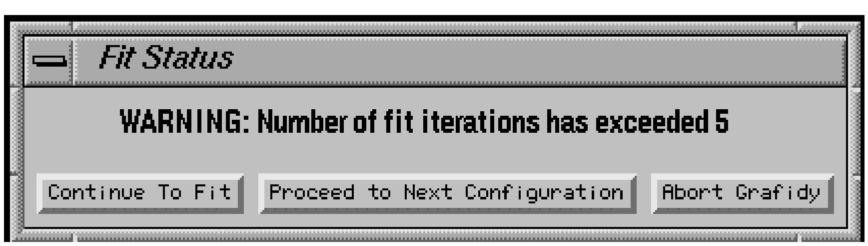


GUIDED GRAFIDY ABORT & CONFIRMATION WINDOWS
ILLUSTRATION 4-2

2a. If performance data meets the system specifications, no further fits are necessary with this configuration and Guided Grafidy will automatically proceed to the next configuration on the same axis (i.e. Long term and B0). **(Record final Grafidy results in data sheet as each configuration completes.)** Once all configurations have been completed on an axis, the program proceeds to the next setup/scan/axis configuration. Select “**Next**” for the “Configuration Window” to appear. Set up the coils per the Configuration Window; see Illustration 3-2 and 3-3. Select “**Next**” to start the scan and analysis process for the next axis being tested. Continue the process in steps 2a and 2b until all data meets system specifications.

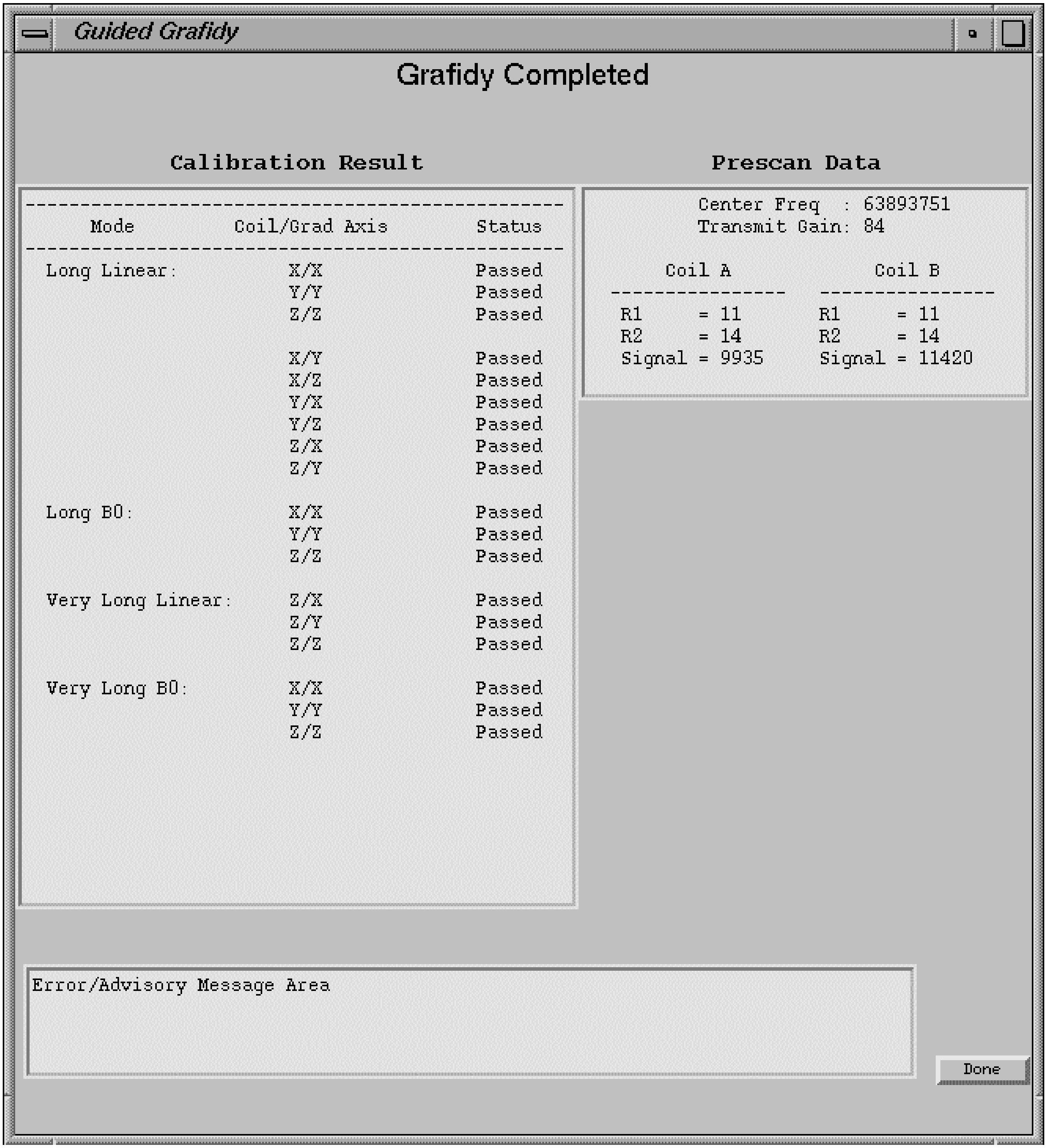
OR

2b. If performance data does NOT meet the system specifications, compensation parameters are calculated and downloaded to the GRAM and WARP. Select “**Next**” to perform a new scan using the new values and to generate another set of performance data. This process will continue until the system specification is met (go to step 2a) or five fit iterations is exceeded. If the number of fit iterations exceeds five, a pop-up window displays this error condition and the operator is given a choice to either abort the calibration or continue with this limitation. See Illustration 4-3. **(Record final Grafidy results in data sheet.)**



GUIDED GRAFIDY FIT ERROR POP UP WINDOW
ILLUSTRATION 4-3

3. After all axes have been calibrated or checked, a “Results” window is displayed. See Illustration 4-4.



GUIDED GRAFIDY RESULTS WINDOW
ILLUSTRATION 4-4

4. The “Results” window for Grafidy calibration indicates whether or not gradient performance meets the system specification for image quality. After examination of these results, you can exit the Guided Grafidy tool by clicking on the “**Done**” button with the right mouse.

5. To display Guided Grafidy results (all iterations) for this session:
   a. Open a **[C shell]** on the Service Desktop.
   b. Type **cd /usr/g/caldir <Enter>**
   c. Type **more Grafidy.results <Enter>** *(Displays pass/fail results.)*
   d. Type **more Grafidy.log <Enter>** *(Displays correction values, specs, and fit results.)*

6. Repeat Section 2-1, GRAM DC Offset adjustment. The Grafidy process causes a DC voltage to be applied, so this must now be removed. Check and set DC Offset on each axis after Guided Grafidy has been completed. The DC offset introduced from one axis may cause the sample position of the next axis to be less than desired.

7. Select **[TPS Reset]** after completing the calibrations. (In some cases, other PSDs may fail to download after running Guided Grafidy.)

5- SYSTEM RESTORATION

1. Remove the in-line attenuator (which bypasses Envelope Feedback) in the RF cabinet, added at the start of this procedure, and reconnect the BNC connectors to the original locations. See Illustration 3-5A or 3-5B.

2. Remove the Grafidy Kit from the system.

3. Install appropriate cabinet front covers if removed.

4. Restore the grad shim values if they were changed at the beginning of this procedure.

6- GUIDED GRAFIDY TROUBLESHOOTING

1. Guided Grafidy has convergence problem : **Run Manual Grafidy.**

2. Guided Grafidy did not run one or more of the VALID axes: **Run Manual Grafidy.**

3. Guided Grafidy runs successfully but cal files are out of spec or not updated: **Run Manual Grafidy.**

4. Manual Grafidy does not converge: **Use the following sequence for calibration:**
    - **Long**
    - **VLTC**
    - Check **Long** to see if it is still in spec. If not, calibrate **Long** then check if **VLTC** is in spec. Continue alternating until both **Long** and **VLTC** are in spec.

5. Guided Grafidy and Manual Grafidy plots do not look same: **They are not supposed to look same as they are based on different data sets and use different plot techniques.**

6. ECMT performs better than Guided Grafidy and Manual Grafidy or the performance of these tools are not the same: **ECMT is an entirely new tool and their performances should not be compared. The only important criterion is that the system is in spec after running any of the tools.**

GRAFIDY DATA SHEET (ALL CONFIGURATIONS)

VERY LONG TIME CONSTANTS (Cross-term, Linear, Bo)					
Axis	**Time Interval (M Sec)**	**Run # _______ Max. Deviation**	**Run # _______ Max. Deviation**	**Run # _______ Max. Deviation**	**Specifications**
X (Coil) Bo axis = 0 (X)	2000-200,000				≤ 0.10% (B0)
Y (Coil) Bo axis = 1 (Y)	2000-200,000				≤ 0.10% (B0)
Z (Coil) Bo axis = 2 (Z)	2000-200,000				≤ 0.10% (B0)
Z (Coil) Linear axis = 2 (Z)	2000-200,000				≤ 0.018% (Linear)
Z(Coil) Cross-term axis = 0 (X)	2000-200000				≤ 0.018% (Cross-Term)
Z(Coil) Cross-term axis = 1(y)	2000-200000				≤ 0.018% (Cross-Term)

LINEAR LONG TIME CONSTANTS					
X-axis	**Time Interval (msec)**	**Run# _______ Max. Deviation**	**Run# _______ Max. Deviation**	**Run# _______ Max. Deviation**	**Specifications**
	2.5 - 10.00				≤ 0.09%
	10.00 - 100.00				≤ 0.03%
	100.00 - 2000.00				≤ 0.018%
Y-axis	**Time Interval (msec)**	**Run# _______ Max. Deviation**	**Run# _______ Max. Deviation**	**Run# _______ Max. Deviation**	**Specifications**
	2.5 - 10.00				≤ 0.09%
	10.00 - 100.00				≤ 0.03%
	100.00 - 2000.00				≤ 0.018%
Z-axis	**Time Interval (msec)**	**Run# _______ Max. Deviation**	**Run# _______ Max. Deviation**	**Run# _______ Max. Deviation**	**Specifications**
	2.5 - 10.00				≤ 0.09%
	10.00 - 100.00				≤ 0.03%
	100.00 - 2000.00				≤ 0.018%

GRAFIDY DATA SHEET (ALL CONFIGURATIONS)

LINEAR CROSS-TERM TIME CONSTANTS					
X-axis axis = 1(y)	**Time Interval (msec)**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Specifications**
	2.5 – 10.00				≤ 0.09%
	10.00 – 100.00				≤ 0.03%
	100.00 – 2000.00				≤ 0.018%
X-axis axis = 2(z)	**Time Interval (msec)**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Specifications**
	2.5 – 10.00				≤ 0.09%
	10.00 – 100.00				≤ 0.03%
	100.00 – 2000.00				≤ 0.018%
Y-axis axis = 0(x)	**Time Interval (msec)**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Specifications**
	2.5 – 10.00				≤ 0.09%
	10.00 – 100.00				≤ 0.03%
	100.00 – 2000.00				≤ 0.018%
Y-axis axis = 2(z)	**Time Interval (msec)**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Specifications**
	2.5 – 10.00				≤ 0.09%
	10.00 – 100.00				≤ 0.03%
	100.00 – 2000.00				≤ 0.018%
Z-axis axis = 0(x)	**Time Interval (msec)**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Specifications**
	2.5 – 10.00				≤ 0.09%
	10.00 – 100.00				≤ 0.03%
	100.00 – 2000.00				≤ 0.018%
Z-axis axis = 1(y)	**Time Interval (msec)**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Run# ________ Max. Deviation**	**Specifications**
	2.5 – 10.00				≤ 0.09%
	10.00 – 100.00				≤ 0.03%
	100.00 – 2000.00				≤ 0.018%

GRAFIDY DATA SHEET (ALL CONFIGURATIONS)

B0 TIME CONSTANTS					
X-axis	Time Interval (msec)	Run# ________ Max. Deviation	Run# ________ Max. Deviation	Run# ________ Max. Deviation	Specifications
	2.5 - 10.00				≤ 0.10%
	10.00 - 100.00				≤ 0.10%
	100.00 - 2000.00				≤ 0.10%
Y-axis	Time Interval (msec)	Run# ________ Max. Deviation	Run# ________ Max. Deviation	Run# ________ Max. Deviation	Specifications
	2.5 - 10.00				≤ 0.10%
	10.00 - 100.00				≤ 0.10%
	100.00 - 2000.00				≤ 0.10%
Z-axis	Time Interval (msec)	Run# ________ Max. Deviation	Run# ________ Max. Deviation	Run# ________ Max. Deviation	Specifications
	2.5 - 10.00				≤ 0.10%
	10.00 - 100.00				≤ 0.10%
	100.00 - 2000.00				≤ 0.10%

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	June 12, 1998	B. Schmidt	Initial version for Released CV1 software.
1	Oct. 19, 1998	B. Schmidt	Added Very Long Time Constants. Also updated for program change from Release “CV1” to “8.2.5”; corrected VLTC Bo spec on data sheet.
2	Nov 11, 1998	B. Schmidt	Updated Guided Grafidy screens and added “Abort” Screen.
3	Feb 15, 1999	B. Schmidt, M. Keber	Corrected Illustration #’s and added step 4-5 to obtain Guided Grafidy results. Removed “prerequisite steps” (part of 8.2.5 upgrade procedure). Added step to Reset TPS after Guided Grafidy. Updated heading for correct proprietary wording.
4	March 3, 1999	F. Fiore	Changes to pp. 8,9,11,12, and 14 based on bay validation.
5	Mar. 18, 1999	M. Keber	Corrected page 18 directory info and added Grafidy.results file for viewing results.
6	May 20, 1999	S.M.Atladottir	Updated Procedure References for New GUI
7	July 28, 1999	G. Boerner	Edits to pp. 3, 4, 10 & 15 based on 8.3 bay validation.
8	May 23, 2000	K. Keshena	Added trouble shooting section 6. Added note stating that once calibrations are done with one tool must continue to use the same tool or start over in section 1.