

TABLE OF CONTENTS

TABLE OF CONTENTS	1
Description	2
1- Introduction	2
1-1 Tools Required	2
2- Eddy Current Compensation Procedure	5
2-1 Introduction	5
2-2 Grafidy Setup	6
2-2-1 Grafidy Hardware Setup Procedure	6
2-3 Scan Prescription.....	11
2-4 Modifying CVs.....	12
2-5 Prescan and Data Collection	12
2-6 Data Analysis and Processing.....	14
3- System Restoration	20
4- Saving/Restoring Existing Coefficient Files	21
4-1 Saving the Files	21
4-2 Backing up the Files	21
4-2-1 From the Service Desktop	21
4-2-2 From a C-Shell on the Service Desktop	21
4-3 Restore the Files	21
4-3-1 From a C-Shell on the Service Desktop	21
4-3-2 From the Service Desktop	21
5- Grafidy Tool Functional Checks/ Maintenance	22
5-1 Functional Check of Grafidy Hardware	22
5-2 Grafidy Coil Checks	23
APPENDIX A - gGRAFIDY DATA SHEETS	25
revision history	27

DESCRIPTION

This procedure on eddy current compensation applies only to Signa “Base” (SR20) systems. This includes systems with a double-bay 8645 Gradient Cabinet (no GRAM's in the system) or a system with SGD Base single bay cabinet.

1- INTRODUCTION

The SR20 Signa Horizon gradient configuration includes an 8645 Gradient Amplifier Cabinet with two power modules per axis (no GRAM cabinet in this system) or an SGD Base cabinet (AN8280G-TK) with a single amplifier per axis. There are no tuning boards nor Grafidy boards on either system. The actual eddy current compensation procedure is similar to what was run on Release 5.4 systems; however, there are no potentiometer adjustments, and the gradient coil cannot be mechanically adjusted. Eddy current compensation is performed in the Systems Cabinet on the IPG and the Exciter.

Eddy current compensation for Signa Horizon is now performed for linear long time constants, and B₀ time constants. The PSD for eddy current compensation is called *grafidy*. The analysis tool is found under Cal/Checks on the Service Desktop, and is called Grafidy. B₀ compensation is also called *FRESBECC* (Frequency Shift B₀ Eddy Current Compensation). FRESBECC is an automated digital method of adjusting B₀ for all three axes. No mechanical adjustments for B₀ are required with the new epoxy-filled gradient coil for the Signa Horizon product line.

After you select the correct Grafidy kit for the system, prepare the scan prescription and hardware to gather the data necessary for the Grafidy analysis tool. The Grafidy analysis tool calculates new compensation parameters for linear long time constant eddy currents and B₀ time constant eddy currents. The linear eddy current parameters are used by IPG-WARP to pre-emphasize the digital profile data that will be converted to an analog input signal, and played out by the Power Modules. The B₀ eddy current parameters are used by IPG-WARP, and are routed to the exciter to be played out as a frequency-shifted RF pulse. The system then automatically adjusts for these predictable eddy currents.

1-1 Tools Required

There are several Grafidy kit variations in the field. The contents of each is itemized in the following tables.

TABLE 1-1
GRAFIDY KIT 46-271417G1 – 1.5T

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Base Plate	46-271410G1	1
2	Coil, 1.5T	46-271411G1	1
3	Coil, 1.5T	46-271411G2	1
4	Collar	46-271456P1	1
5	Spacer	46-271457P1	2
6	Pin Diode Switch	46-271476G1	1
7	Pin Diode Drive	46-271472G1	1
8	Cable, BNC, 8 ft.	46-251920G22	1
9	Cable, BNC, 50 ft.	46-251920G23	1
10	Cable, BNC, 90 ft.	46-251920G24	1

TABLE 1-2
GRAFIDY KIT 46-307164G1 – 1.5T

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Coil, 1.5T	46-271411G1	1
2	Coil, 1.5T	46-271411G2	1
3	Collar	46-271456P1	1
4	Spacer	46-271457P1	2
5	Pin Diode Switch	46-288240G1	1
6	Pin Diode Drive	46-271472G1	1
7	Cable, BNC, 8 ft.	46-282803G15	1
8	Cable, BNC, 30 ft.	46-282803G14	4
9	Cable, Female SMB to BNC	46-301549P5	1
10	Adapter, BNC Coupling	46-282886P1	3
11	Quick Disconnect (Extremity/Linear Adapter), 1.5T	46-282468G3	1

TABLE 1-3
GRAFIDY KIT 46-307164G2 – 0.5T, 1.5T

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Coil, 1.5T	46-271411G1	1
2	Coil, 1.5T	46-271411G2	1
3	Collar	46-271456P1	1
4	Spacer	46-271457P1	2
5	Pin Diode Switch	46-288240G1	1
6	Pin Diode Drive	46-271472G1	1
7	Cable, BNC, 8 ft.	46-282803G15	1
8	Cable, BNC, 30 ft.	46-282803G14	4
9	Cable, Female SMB to BNC	46-301549P5	1
10	Coil, 0.5T	46-307804G1	2
11	Service Tool Adapter, 0.5T	46-317222G2	1
12	Adapter, BNC Coupling	46-282886P1	3
13	Quick Disconnect (Extremity/Linear Adapter), 1.5T	46-282468G3	1

TABLE 1-4
GRAFIDY KIT 46-307164G3 – 0.5T, 1.0T, 1.5T

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Coil, 1.5T	46-271411G1	1
2	Coil, 1.5T	46-271411G2	1
3	Collar	46-271456P1	1
4	Spacer	46-271457P1	2
5	Pin Diode Switch	46-288240G1	1
6	Pin Diode Drive	46-271472G1	1
7	Cable, BNC, 8 ft.	46-282803G15	1
8	Cable, BNC, 30 ft.	46-282803G14	4
9	Cable, Female SMB to BNC	46-301549P5	1
10	Coil, 0.5T	46-307804G1	2
11	Service Tool Adapter, 0.5T	46-317222G2	1
12	Adapter, BNC Coupling	46-282886P1	3
13	Coil, 1.0T	46-307804G2	2
14	Quick Disconnect (Extremity/Linear Adapter), 1.5T	46-282468G3	1

TABLE 1-5
GRAFIDY KIT 46-307164G4 – 1.0T, 1.5T

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Coil, 1.5T	46-271411G1	1
2	Coil, 1.5T	46-271411G2	1
3	Coil, 1.0T	46-307804G2	2
4	Collar	46-271456P1	1
5	Spacer	46-271457P1	2
6	Pin Diode Switch	46-288240G1	1
7	Pin Diode Drive	46-271472G1	1
8	Cable, BNC, 8 ft.	46-282803G15	1
9	Cable, BNC, 30 ft.	46-282803G14	4
10	Cable, Female SMB to BNC	46-301549P5	1
11	Adapter, BNC Coupling	46-282886P1	3
12	Quick Disconnect (Extremity/Linear Adapter), 1.5T	46-282468G3	1
13	Quick Disconnect (Extremity/Linear Adapter), 0.5T/1.0T	46-317222G2	1

TABLE 1-6
GRAFIDY KIT 46-307164G6 – 1.0T

ITEM	DESCRIPTION	PART NUMBER	QUANTITY
1	Coil, 1.0T	46-307804G2	2
2	Collar	46-271456P1	1
3	Spacer	46-271457P1	2
4	Pin Diode Switch	46-288240G1	1
5	Pin Diode Drive	46-271472G1	1
6	Cable, BNC, 8 ft.	46-282803G15	1
7	Cable, BNC, 30 ft.	46-282803G14	4
8	Cable, Female SMB to BNC	46-301549P5	1
9	Adapter, BNC Coupling	46-282886P1	3
10	Quick Disconnect (Extremity/Linear Adapter), 0.5T/1.0T	46-317222G2	1

Additional Requirements:

- Grafidy Holder Base Plate, 46-271410G1
- Rotary Attenuator (10db/step), 46-255838P2
- A female BNC to female BNC adapter is required on mobile systems for Grafidy Kits 46-307164G1 through G6.

2- EDDY CURRENT COMPENSATION PROCEDURE

2-1 Introduction

It is important that you follow the instructions in this procedure. Before beginning, take a moment to read the procedure from beginning to end to become familiar with the required steps. Refer to section 4- Saving/Restoring Existing Coefficient Files, for backup of the existing eddy current comp system data, prior to initiating a new Grafidy session.

Table 2-1 is a Grafidy scan sequence flow. It is **strongly recommended** that you print this table as a guide to ensure that you complete all calibrations required, in the proper order. The scan order listed in the table starts with long-term and B_0 term time constants, followed by cross term time constants.

Hardware and
Phantom Set-up



Software
Set-up



TABLE 2-1
GRAFIDY SCAN SEQUENCE FLOW

LOCATION	ILLUS. 2-1	THIS TABLE	THIS TABLE	Screen 2-2	Screen 2-3 (B_0) Screen 2-4 (LIN.)	SPEC DATA (Absolute Values) Repeat Scan, Read and Process and Fit for each term/axis until in SPEC.		
						2.5-10 MSEC	10-100 MSEC	100-2000 MSEC
TERM	AXIS SETUP	CV: MODE	CV: AXIS	READ & PROCESS	FIT			
LONG	X	0 (LONG)	0 (X)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
B_0	X	0 (LONG)	0 (X)	B_0	B_0	≤ 0.10%	≤ 0.10%	≤ 0.10%
CROSS	X	0 (LONG)	1 (Y)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
CROSS	X	0 (LONG)	2 (Z)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
B_0 Recheck	X	0 (LONG)	0 (X)	B_0	B_0	≤ 0.10%	≤ 0.10%	≤ 0.10%
LONG	Y	0 (LONG)	1 (Y)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
B_0	Y	0 (LONG)	1 (Y)	B_0	B_0	≤ 0.10%	≤ 0.10%	≤ 0.10%
CROSS	Y	0 (LONG)	0 (X)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
CROSS	Y	0 (LONG)	2 (Z)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
B_0 Recheck	Y	0 (LONG)	1 (Y)	B_0	B_0	≤ 0.10%	≤ 0.10%	≤ 0.10%
LONG	Z	0 (LONG)	2 (Z)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
B_0	Z	0 (LONG)	2 (Z)	B_0	B_0	≤ 0.10%	≤ 0.10%	≤ 0.10%
CROSS	Z	0 (LONG)	0 (X)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
CROSS	Z	0 (LONG)	1 (Y)	LINEAR	LINEAR	≤ 0.09%	≤ 0.030%	≤ 0.018%
B_0 Recheck	Z	0 (LONG)	2 (Z)	B_0	B_0	≤ 0.10%	≤ 0.10%	≤ 0.10%

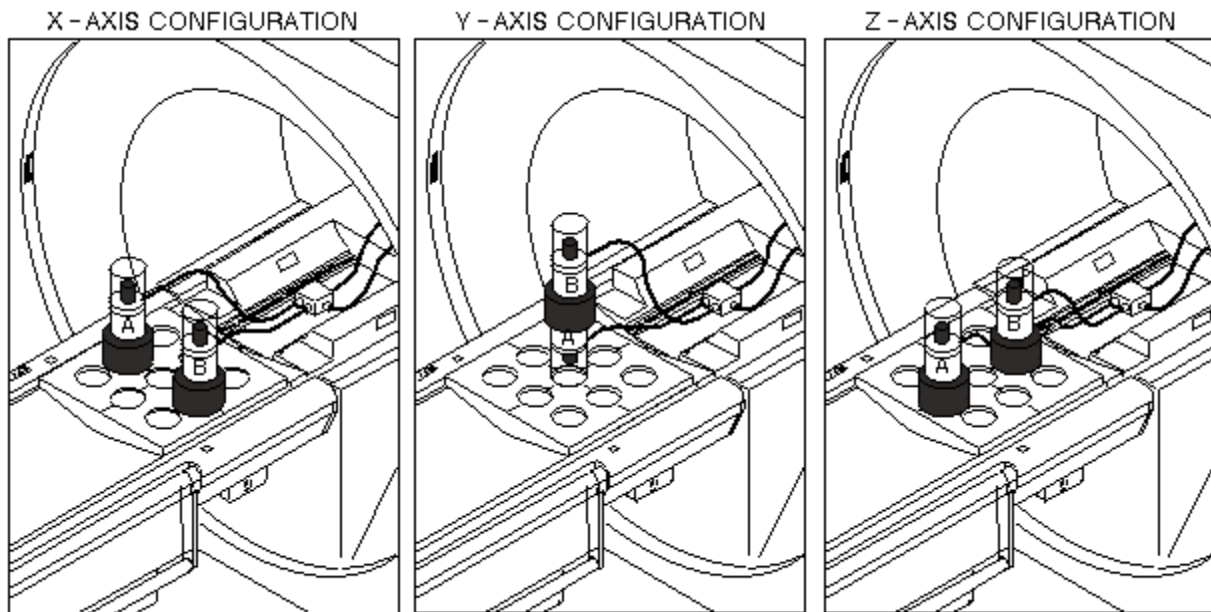
NOTE 1: SELECT [DOWNLOAD] BEFORE PERFORMING EACH SCAN.

NOTE 2: SHORT TIME CONSTANTS ARE COMPENSATED FOR USING DEFAULT VALUES IN THE GRAFIDY CALIBRATION FILES.

2-2 Grafidy Setup

2-2-1 Grafidy Hardware Setup Procedure

1. Set up the Grafidy kit for the first axis to be calibrated using the following instructions.
2. Remove the head coil and head coil holder from the cradle.
3. Select the proper Grafidy coil set for the system to be tested (1.5T or 1.0T).
1. Place the Grafidy holder base plate on the cradle. Configure the Grafidy coil/samples and collars appropriately for the first axis you will perform Grafidy on. See Illustration 2-1.

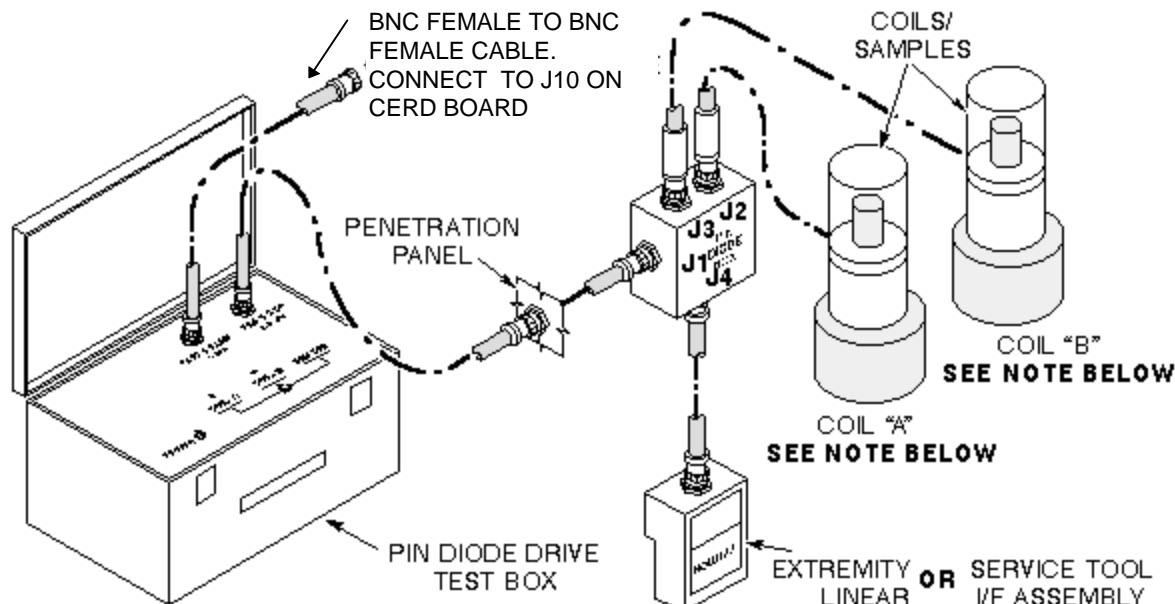


GRAFIDY PHANTOM CONFIGURATIONS
ILLUSTRATION 2-1

L2 13 14

Note

In the X and Z configurations, the coil/sample is placed with the sample at the top. In the Y configuration, the upper 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.

L2.132B 9

GRAFIDY EQUIPMENT SET-UP
ILLUSTRATION 2-2

Refer to Illustration 2-2 for the following steps.

5. Plug the Extremity/Linear Adapter (for 1.0T Systems, use Service Tool I/F Assy. Supplied with Grafidy kit) into quad head coil Carriage Assembly. Connect a 2-ft. coaxial cable from Extremity/Linear Adapter BNC to J4 on Pin Diode Box.
6. Landmark on the center-line of the Grafidy coil base plate (not the coils).
7. At keypad on front magnet enclosure, press LANDMARK and MOVE TO SCAN.

Note

References to "long" coaxial cable indicate whatever length is necessary for you to do the job. Some Grafidy kits come supplied with a 90-ft cable; others are supplied with three 30-ft cables. You may have a special length cable for your site(s). Use the length that best suits your needs.

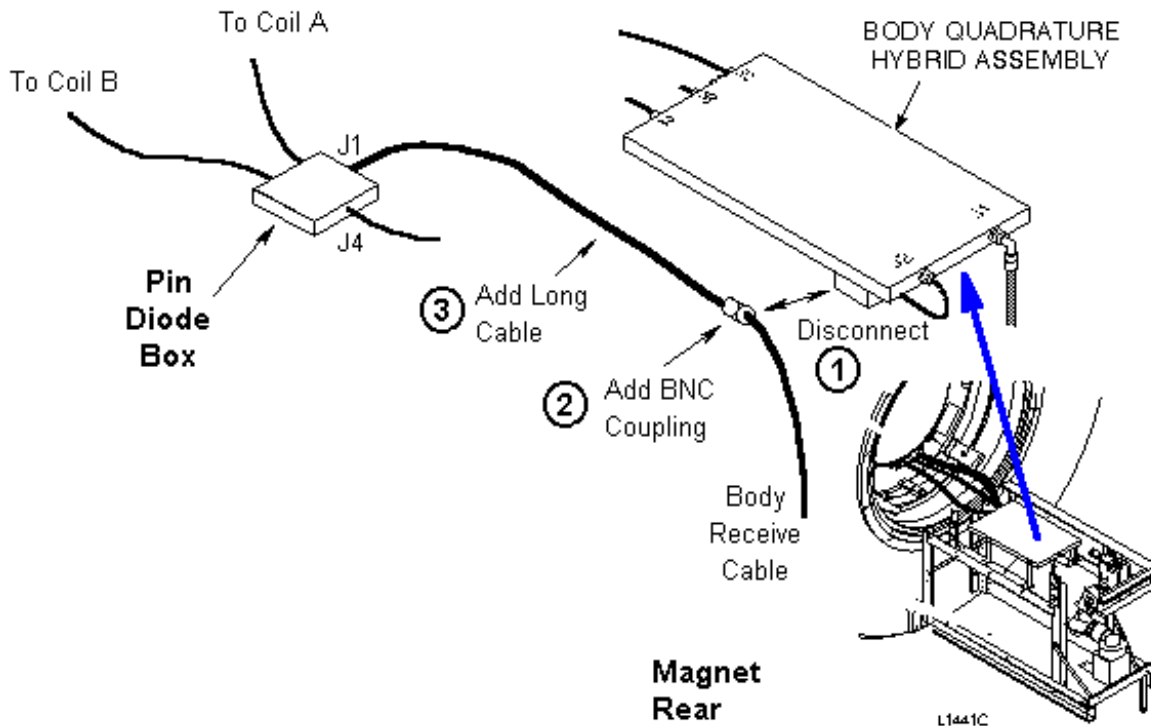


PERSONAL SHOCK POSSIBILITY! THE PIN DIODE DRIVE TEST BOX SENDS 60-VOLT SIGNALS TO THE PIN DIODE BOX. VERIFY THAT THE POWER SWITCH FOR THE PIN DIODE DRIVE BOX IS IN THE OFF (DOWN) POSITION BEFORE CONNECTING CABLES.

Note

An alternate method for Steps 8 and 9 is provided here, if any difficulty is encountered with the primary method provided in the main procedure.

8. Disconnect run #262 Body Receive cable (this signal is not needed for this procedure), from the Body Quadrature Hybrid Splitter at the rear of the magnet. Place a BNC coupling (not provided) on the cable end. See Illustration 2-3.



PIN DIODE DRIVE HOOKUP - MAGNET END
ILLUSTRATION 2-3

(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.

9. 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.

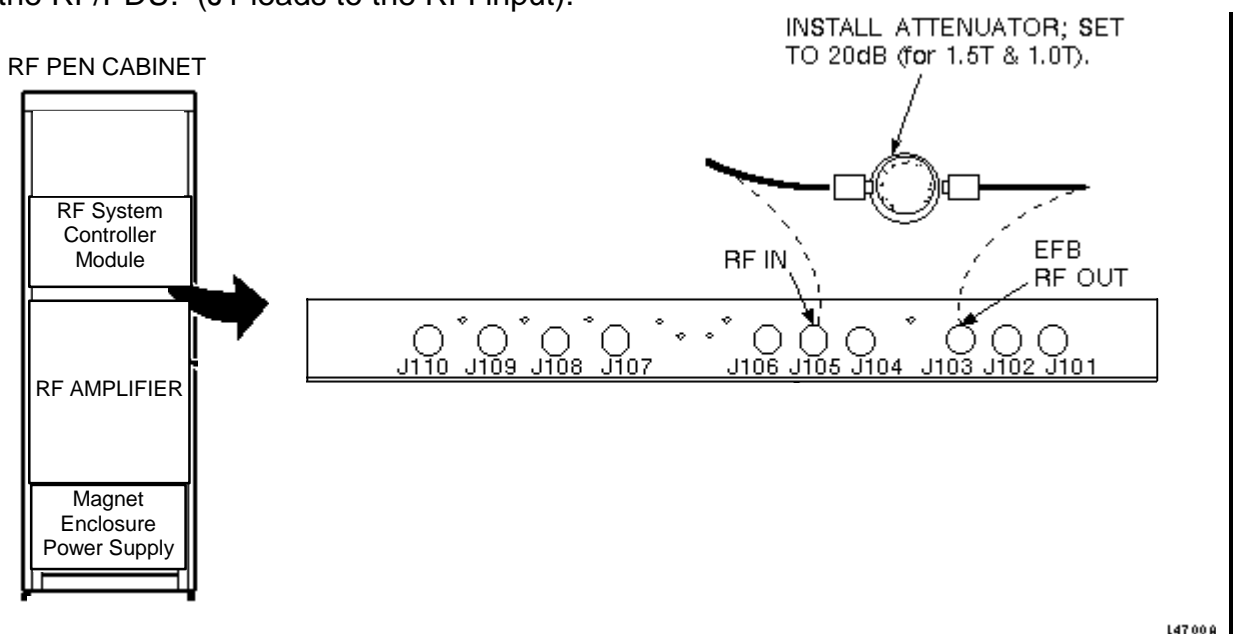
10. Verify that the switch on the Pin Diode Drive Test Box is in the Remote position.
11. Connect a BNC cable from the TRIGGER INPUT (called PATCH PANEL INPUT on some older boxes) connector on the Pin Diode Drive Test Box to J10 (DAB Out 6) on the CERD Board.

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

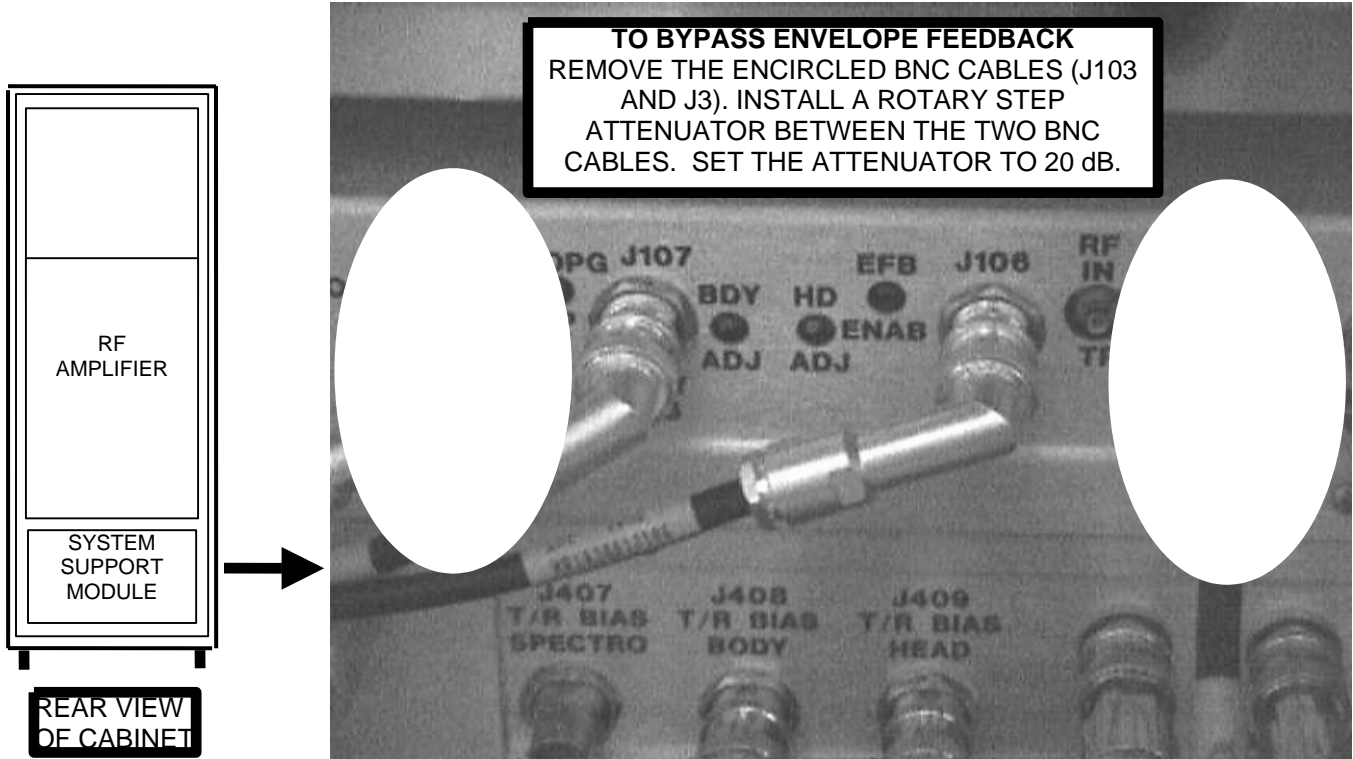
- 14. **RF/PEN 1 and RF/PEN II:** Install an attenuator to bypass envelope feedback circuitry at the RF amplifier. Disconnect BNC from EFB RF Out, and disconnect BNC from RF In. Add a rotary step attenuator (set to 20dB) in-line between the two BNCs, as shown for the RF PEN Cabinet in Illustration 2-4A or the RF PEN II Cabinet in Illustration 2-4B.
- 15. **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 2-4A

L47 00 A





RF PEN II: SYSTEM SUPPORT MODULE--RF ATTENUATOR HOOKUPS (J3 AND J103)
ILLUSTRATION 2-4B

2-3 Scan Prescription

1. Select **Grafidy** in the MR Tools list under **[Cal/Checks]** and click on **[Start]**. Follow the Grafidy Analysis tool directions in Screen 2-1.

SCREEN 2-1
INITIATING THE GRAFIDY ANALYSIS TOOL

OUTPUTS/PROMPTS	INPUTS/COMMENTS
<p>GRAFIDY - Eddy Current Analysis</p> <p>1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status</p> <p>S or Q - Exit to Tools Menu</p>	
<p>Enter Choice: (0..4) [1] :</p>	<p>3 <Enter></p>
<p>Enter axis to clear (0=x,1=y,2=z,3=All): (0..3) [0]:</p>	<p>3 <Enter> (If one or two axes are to be done, select the correct axis.)</p>
<p>Initialize B0 parameters ? (Y,N) [N] :.....</p>	<p>Y <Enter></p>
<p>(Note - Initializing B0 and Linear Long TC This is the first and only time B0 and Linear Long TC parameters are initialized. Once per axis!! Initialize B0 and Linear Long Time Constant Parameters now.)</p>	
<p>Initialize linear long time constants parameters? (Y,N) [N]:.....</p>	<p>Y <Enter></p>
<p>Initialize linear short time constants parameters? (Y,N) [N]:.....</p>	<p>Y <Enter></p>
<p>GRAFIDY - Eddy Current Analysis</p> <p>1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status S or Q - Exit to Tools Menu</p>	
<p>Enter Choice: (0..4) [1].....</p>	<p>(No more entries for now.)</p>

2. At the operator work space, prepare the system for a Grafidy scan using the scan protocol shown in the *Service Protocols* procedure located on the service methods CD-ROM, or for the alternate proprietary procedure, use Table 2-2.

TABLE 2-2
PROPRIETARY GRAFIDY PROTOCOL

Note: This alternate proprietary procedure is available for GE use, and to sites with a valid Advanced

Service Package Limited License.

1. Click on **[New Pt]**, and enter
 Id: **geservice**
 Name: **grafidy**
 Weight (Lb): **111**
 Set Patient Protocols to **Service**.
2. In the Protocol field, type **o.5.1** (o = Other, 1 = series number) to load protocol.
3. **[Save Series]**.

2-4 Modifying CVs

In the next steps, you will change the CV values as indicated.

1. Right mouse click on **[Research Operations]** and select **Display CVs**.
2. Set CV axis = **0 <Enter>** for x, or
1 <Enter> for y, or
2 <Enter> for z
3. Click on **[Accept]**.
4. Under **[Research Operations]** select **Download**.

Note

Be sure that the Grafidy coils are positioned correctly for the axis that is being calibrated. Refer to Illustration 2-1 for coil placement for the X, Y, and Z axis.

2-5 Prescan and Data Collection

1. Right click on **[Research Operations]** and select **Setup Params** from the Scan Operations list. Enter the values listed in Table 2-3.

TABLE 2-3
GRAFIDY SETUP PARAMETERS

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

2. Click on **[Manual Prescan]** and setup Twin Plot mode. See Table 2-4.

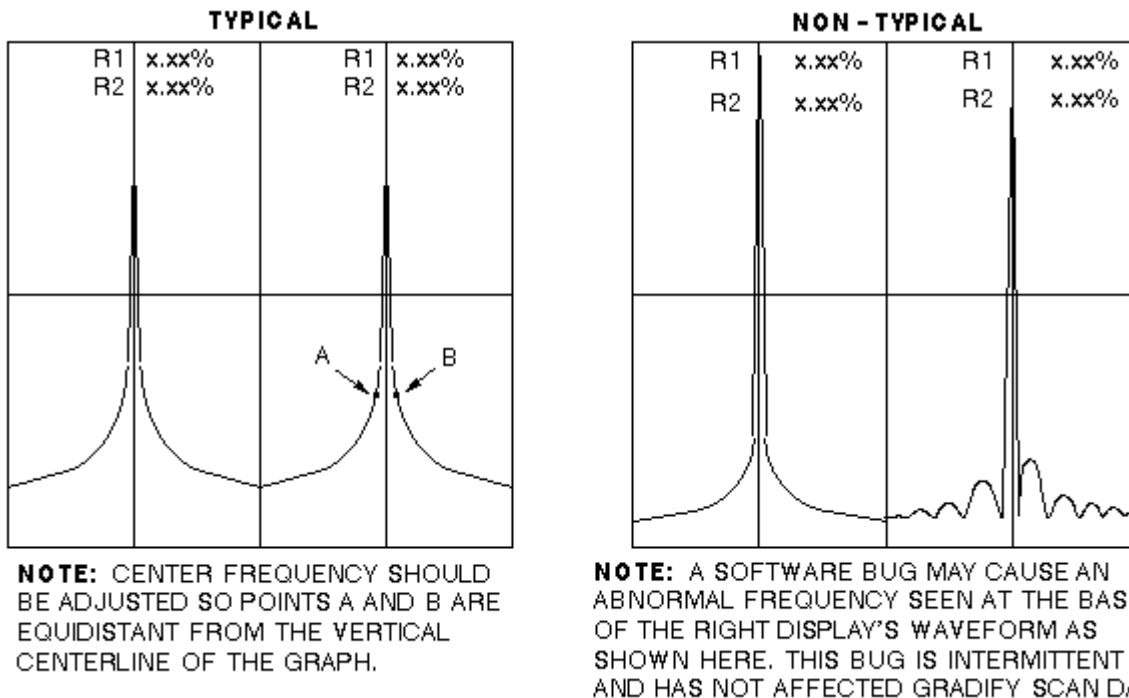
TABLE 2-4
MANUAL PRESCAN

<u>PULL DOWN MENU</u>	[Windows]
	Select: Two Windows

<p><u>WINDOW ONE</u></p> <p style="text-align: right;">Type: P. Spect Plot Gain: 1</p>
<p><u>WINDOW TWO</u></p> <p style="text-align: right;">Type: P. Spect Plot Gain: 1</p>

3. Record the gradshim values for later reference; then, set the gradshim values to 0 for axes x, y, and z.
4. Perform center frequency check. Adjust TG to peak as usual for transmit power.

An example of a typical and an atypical prescan display are shown in Illustration 2-5. Examine the typical example and verify that your display is somewhat similar before continuing. The peaks of the two waveforms need not be exactly equal.



L2 138A

GRAFIDY PRESCAN
ILLUSTRATION 2-5

Note

When the system is scanning, the A and B LEDs on the Pin Diode Drive Box flicker, indicating alternating coil selection. If there is any doubt whether the Grafidy test tools are working correctly, perform the procedure in section 5-1, Functional Check of Grafidy Hardware.

Note

If the Manual Prescan window quits, re-enter [Manual Prescan].

5. Click on **[Done]**.
6. Click on **[Scan]**.

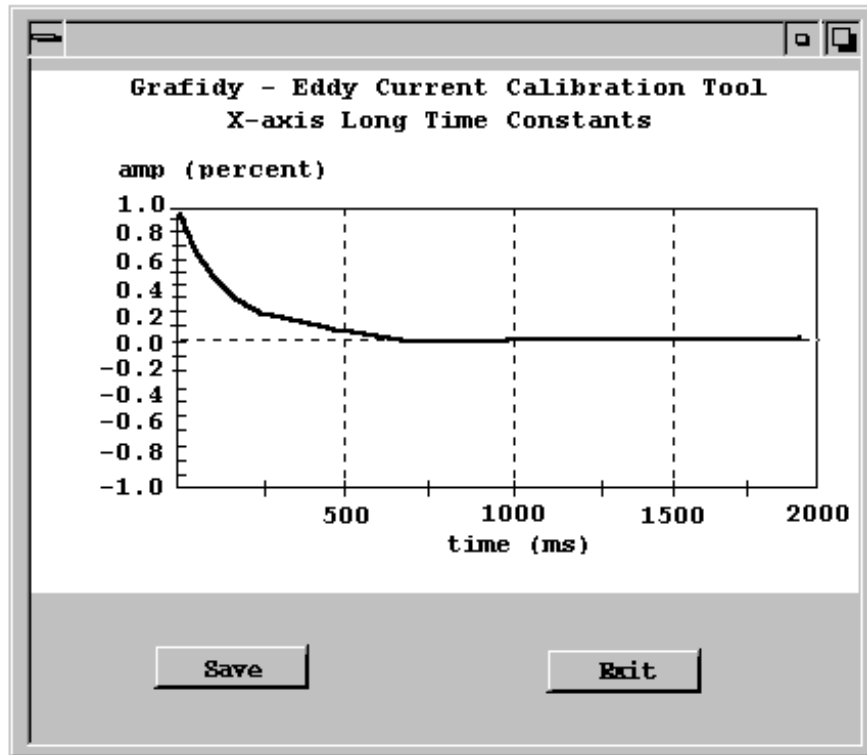
2-6 Data Analysis and Processing

1. Continue on with the Grafidy Analysis and perform a Read and Process Raw Data (see Screen 2-2).

SCREEN 2-2
READ AND PROCESS DATA

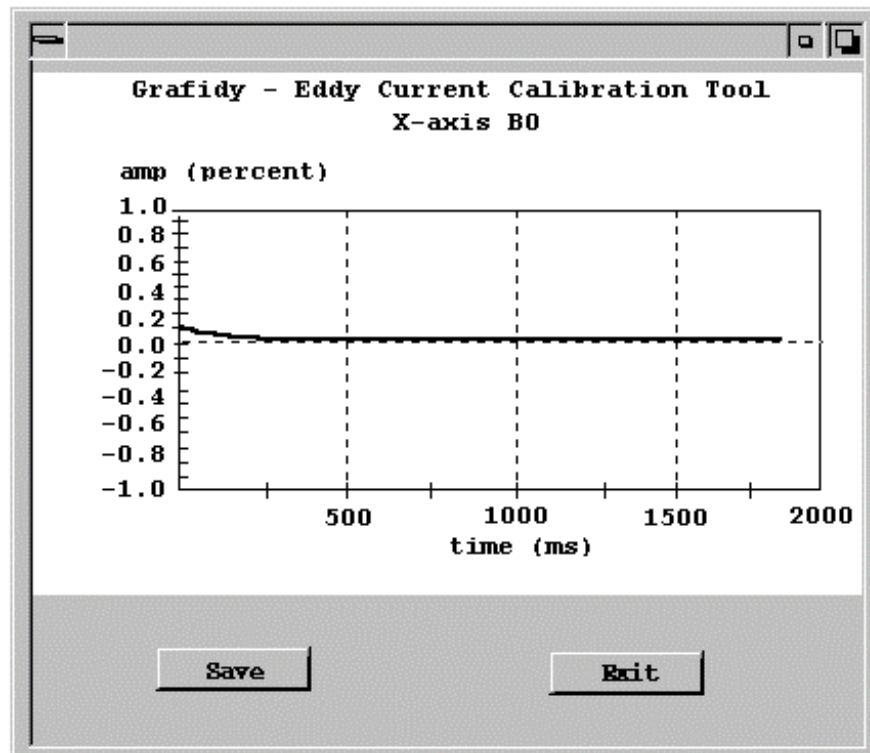
OUTPUT/PROMPTS	INPUTS/COMMENTS
<p>GRAFIDY - Eddy Current Analysis 1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status</p> <p>S or Q - Exit to Tools Menu</p>	
<p>Enter Choice: (0..4) [1] :</p>	<p><Enter> (Read and process raw data.)</p>
<p>Last run number used was : 4608</p>	
<p>Please enter runfile number [4608] :</p>	<p><Enter> (Read/process data from most recent scan.)</p>
<p>Coils Along X-axis: Coil A Position: x.xxxxxx cm Coil B Position: -x.xxxxxx cm</p>	
<p>Linear Eddy Current Performance: Max Deviation:</p>	
<p>2.50ms to 10.00ms/ 10.00ms to 100.00ms/ 100.00ms to 2000.00ms/ x.xxx x.xxx x.xxx <--</p>	<p>(Record Linear Values on Appendix A Data Sheet)</p>
<p>B0 Eddy Current Performance: Max Deviation: 2.50ms to 10.00ms/ 10.00ms to 100.00ms/ 100.00ms to 2000.00ms/ -x.xxx x.xxx x.xxx <--</p>	<p>Linear Long Eddy Current response plot should appear in a pop-up window. See Illustration 2-6.</p>
<p>GRAFIDY - Eddy Current Analysis 1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status</p> <p>S or Q - Exit to Tools Menu</p>	
<p>Enter Choice: (0..4) [3] :</p>	
	<p>If Linear Long & B₀ data are in spec for this axis, stop here and go to Step 5. Otherwise, stop here and go to Step 2.</p>

Note: Axis Reference will reflect the axis being tuned



UNCOMPENSATED LINEAR LONG TIME CONSTANT EDDY CURRENT RESPONSE PLOT
ILLUSTRATION 2-6

Note: Axis Reference will reflect the axis being tuned



B₀ EDDY CURRENT RESPONSE PLOT
ILLUSTRATION 2-7

2. Continue on with the Grafidy Analysis and perform a Fit of the Raw Data for B₀ Raw Data. See Screen 2-3. **Accept new parameters only when out of specification. They will be written to the IPG.**

SCREEN 2-3
FIT B₀ RAW DATA

OUTPUT/PROMPTS	INPUTS/COMMENTS
GRAFIDY - Eddy Current Analysis	
1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status	
S or Q - Exit to Tools Menu	
Enter Choice: (0..4) [1]:	2 <Enter> (Select Fit)
GRAFIDY - Fit Menu	
1 - Fit Linear Data 2 - Fit B ₀ Data	
S or Q - Exit Fit Menu	
Enter Choice: (1..2) [1] :	2 <Enter> (Select B ₀)
Initial Fit: Initial fit in progress..	

B0 Fit Results:	
tau[1]=6.70 ms alpha[1]=-0.61 percent	
tau[2]=43.73 ms alpha[2]=0.12 percent	
tau[3]=278.52 ms alpha[3]=-0.02 percent	
tau[4]=478.05 ms alpha[4]=0.03 percent	
Do you want to plot B0 data? Y,N)[N]:	N <Enter>
Do you want to accept new fit parameters?(Y,N)[N]:..	Y <Enter> (Accept new parameters only when out of specification. They will be written to the IPG.)
GRAFIDY - Eddy Current Analysis	
1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status	
S or Q - Exit to Tools Menu	
Enter Choice: (0..4) [1] :	Stop here and go to step 3.

- Continue with the Grafidy Analysis and perform a Fit of the Raw Data for Linear Long Time Constant Raw Data. See Screen 2-4.

SCREEN 2-4
FIT LINEAR LONG TIME CONSTANT RAW DATA

OUTPUT/PROMPTS	INPUTS/COMMENTS
GRAFIDY - Eddy Current Analysis	
1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status S or Q - Exit to Tools Menu	
Enter Choice: (0..4) [1] :	2 <Enter> Select Fit.
GRAFIDY - Fit Menu	
1 - Fit Linear Data 2 - Fit B0 Data S or Q - Exit Fit Menu	
Enter Choice: (1..2) [1] :	<Enter> (Select Linear Long Time Constant Data)
Initial fit: Initial fit in progress..	

Long TC Linear Fit Results:	
tau[1]= 3.64 ms alpha[1]=0.37 percent	
tau[2]= 28.83 ms alpha[2]=0.43 percent	
tau[3]= 148.29 ms alpha[3]=0.44 percent	
tau[4]= 785.62 ms alpha[4]=0.69 percent	
Do you want to plot Linear Data? (Y/N) [N]:.....	N <Enter>
Do you want to accept new fit parameters? (Y,N) [N]:	Y <Enter> (Accept new parameters only when out of specification. They will be written to the IPG.)
GRAFIDY - Eddy Current Analysis	
1 - Read and Process Raw Data 2 - Fit 3 - Initialize Parameters 4 - System Status S or Q - Exit to Tools Menu	
Enter Choice: (0..4) [1] :	Stop here and go to step 4.

- Repeat all of section 2-5 and steps 1 through 5 of section 2-6, until this axis is in specification.

5. If another axis is to be calibrated, repeat Section 2-5 for the next axis. If all axes are in specification, continue with step 6.
6. If all axes are in specification, exit the Grafidy Analysis tool by typing **s <Enter>** to exit and to save the calibration values.

3- SYSTEM RESTORATION

Restore normal Signa functioning as follows:

1. Remove in-line attenuator, bypassing Envelope Feedback in the RF cabinet, added at the start of this procedure, and reconnect both BNC connectors to the original locations>
 - **RF/PEN Cabinet** (J103 & J105).
 - **RF/PEN II Cabinet** (J103 & J3).
 - **RF/PDU (SRFD)** (System Cabinet J1 & RF/PDU rear fiber optic bracket J1).
2. Reconnect the Body Receive cable at both ends.
 - System Cabinet (J2).
 - Body Quad Hybrid Assembly.
3. Remove the Grafidy kit from the system.
4. Replace patient comfort module at rear of body coil, if necessary.
5. Restore the grad shim values if they were changed at the beginning of this procedure.
6. Gradient Calibration must be performed following this procedure.
7. If this Grafidy session was not successfully completed, refer to section 4- Saving/Restoring Existing Coefficient Files, for restoring the original system eddy current compensation data.
8. Perform at least one body scan to verify proper system operation.

4- SAVING/RESTORING EXISTING COEFFICIENT FILES

4-1 Saving the Files

This section details how to back up the `ecccoeff.dat` before a pass of Grafidy is performed. This is useful if you are in troubleshooting mode, and want to restore the system to it's original calibration.

The `ecccoeff.dat` file is the coefficient file that is downloaded to the WARP on IPG when TPS Reset is performed, and every time the Grafidy analysis tool is run. This file contains the B0 (zeroth order) coefficients, and the eddy current (first order) coefficients.

4-2 Backing up the Files

It is possible to back up these files in either of two ways: from the Service desktop, and from a C-shell on the Service desktop.

4-2-1 From the Service Desktop

1. Click on **[Install]**.
2. Place a MOD in the appropriate drive.
3. Click on **[Save Info]**.

4-2-2 From a C-Shell on the Service Desktop

1. At the prompt, type: `cd /usr/g/caldir <Enter>`
2. For all systems, type: `cp ecccoeff.dat ecccoeff.bak <Enter>`

4-3 Restore the Files

This file restoration process overwrites the current coefficient data on the system. If you successfully completed a new Grafidy session since file backup, then skip this section.

4-3-1 From a C-Shell on the Service Desktop

1. Ensure that you are in the `/usr/g/caldir` directory.
2. For all systems, type: `cp ecccoeff.bak ecccoeff.dat <Enter>`

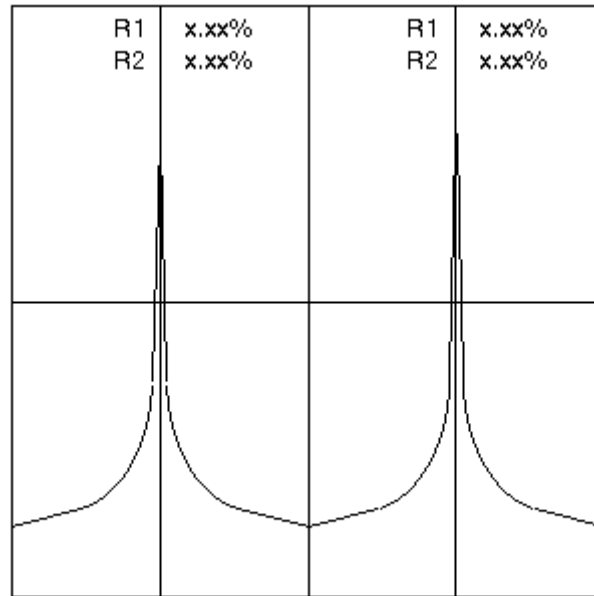
4-3-2 From the Service Desktop

1. Ensure that you are on the Service Desktop.
2. Click on **[Install]**.
3. Click on **[Restore Info]**, and answer the appropriate questions.

5- GRAFIDY TOOL FUNCTIONAL CHECKS/ MAINTENANCE

5-1 Functional Check of Grafidy Hardware

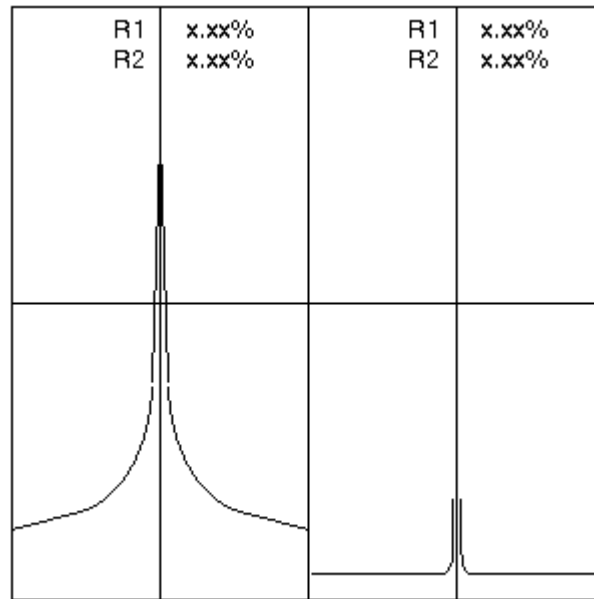
1. Right click on **[Research Operations]** and select **Setup Params** from the Scan Operations list. Enter the values listed in Table 2-2.
2. Click on **[Manual Prescan]** and setup Twin Plot mode. Refer to Table 2-3. Using the Grafidy hardware, verify that the display is similar to the display in Illustration 5-1. If not similar, some things to check include:



L2 14 18

TYPICAL GRAFIDY PRESCAN
ILLUSTRATION 5-1

- Are all cables, including the coil/samples, connected properly per Illustration 2-2?
 - Is the Pin Diode Drive Test Box plugged in to a good power source with the switch in the "1" position?
 - Is an output signal present at J10 on the CERD Module (alternating from 0 volts to 2.5–4.0 volts)?
3. Click on **[Done]**.
 4. Turn off the Pin Diode Drive Test Box.
 5. Disconnect one of the coil/samples from the hardware by removing cable from J3 of the Pin Diode Box.
 6. Place the POWER switch for the Pin Diode Drive Test Box in the 1 position.
 7. Click on **[Manual Prescan]** again and setup Twin Plot mode. See Table 2-3. Verify that one of the signals has been eliminated (see Illustration 5-2). At this point, you can be fairly confident that the Grafidy hardware works. You should note that it is important that only one waveform be eliminated when a coil is disconnected; which one is not important.



L2-1420
PRESCAN MINUS ONE COIL/SAMPLE
ILLUSTRATION 5-2

5-2 Grafidy Coil Checks

5-2-1 1.5T Coil Impedance Check

1. To verify the functionality of the 1.5T Grafidy coil, make an impedance measurement. The pin diode must be forward biased. Use a BNC tee adapter to inject a 10-ma dc current at the point where the impedance meter probe mates with the quarter wavelength cable. A 1000-ohm resistor driven by a 10-volt power supply produces the necessary current with only a small additional load on the desired input impedance. Forward bias the pin diode as described above.
2. Set vector impedance meter at 63.86 mHz and measure the input impedance of the coil.
3. Fine tune the variable trim capacitor, P10, to get nearly 50 ohms at 0° phase. Acceptable values are:
 - Magnitude: 38 to 65 ohms
 - Phase Angle: -15° to 15°

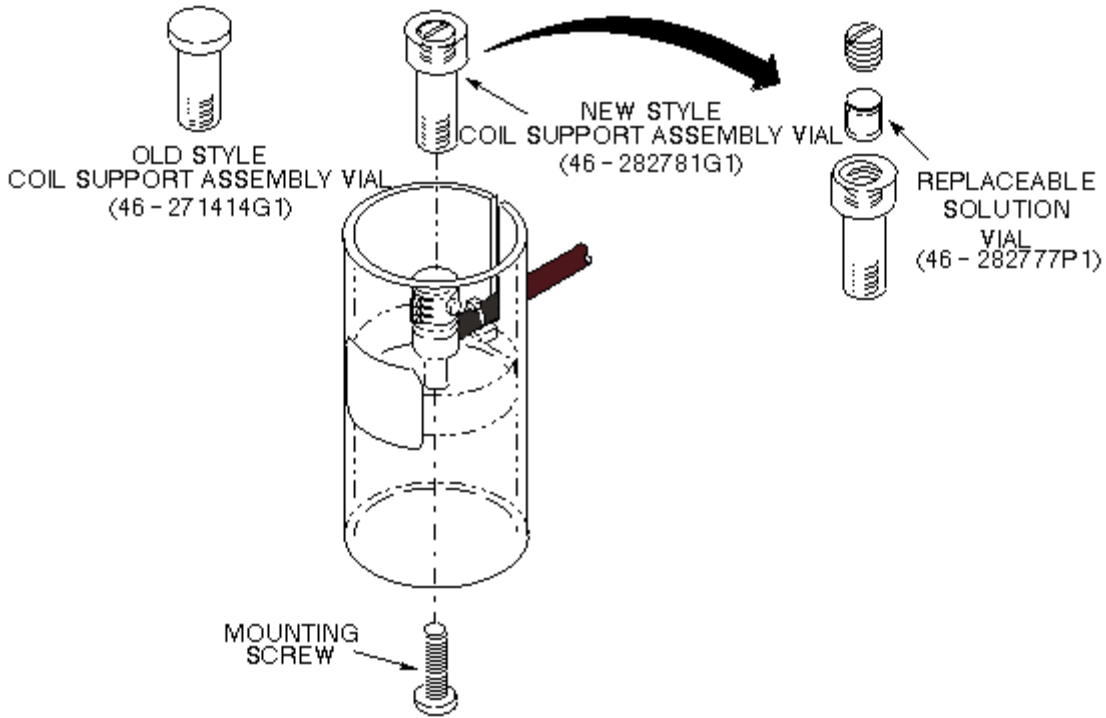
5-2-2 1.0T Coil Impedance Check

Set Grafidy coil assembly on a non-conductive stand at least three feet from any conducting surfaces. Set vector impedance meter at 42.68 mHz (1.0T), and measure the input impedance of the coil. Acceptable values are:

- Magnitude: 38 to 65 ohms
- Phase Angle: -15° to 15°

5-2-3 Solution Vial Replacement

1. The Grafidy coils have replaceable solution vials; see Illustration 5-3 for assembly and part number information. The 1.5T and 1.0T replacement vials are identical.



L2 143A

GRAFIDY COIL/SAMPLE REPLACEMENT
ILLUSTRATION 5-3

APPENDIX A - GRAFIDY DATA SHEETS

LINEAR LONG TIME CONSTANTS <u>X</u> - AXIS DATA			
TIME INTERVAL (msec)	MAX. ABSOLUTE VALUE	ACCEPTANCE SPECIFICATIONS	RAW FILE NUMBER :
2.5 - 10.00		≤ 0.150%	
10.00 - 100.00		≤ 0.030%	
100.00 - 2000.00		≤ 0.018%	
B0 TIME CONSTANTS <u>X</u> - AXIS DATA			
TIME INTERVAL (msec)	MAX. ABSOLUTE VALUE	ACCEPTANCE SPECIFICATIONS	
2.5 - 10.00		≤ 0.1%	
10.00 - 100.00		≤ 0.1%	
100.00 - 2000.00		≤ 0.1%	
LINEAR LONG TIME CONSTANTS <u>Y</u> - AXIS DATA			
TIME INTERVAL (msec)	MAX. ABSOLUTE VALUE	ACCEPTANCE SPECIFICATIONS	RAW FILE NUMBER :
2.5 - 10.00		≤ 0.150%	
10.00 - 100.00		≤ 0.030%	
100.00 - 2000.00		≤ 0.018%	
B0 TIME CONSTANTS <u>Y</u> - AXIS DATA			
TIME INTERVAL (msec)	MAX. ABSOLUTE VALUE	ACCEPTANCE SPECIFICATIONS	
2.5 - 10.00		≤ 0.1%	
10.00 - 100.00		≤ 0.1%	
100.00 - 2000.00		≤ 0.1%	
LINEAR LONG TIME CONSTANTS <u>Z</u> - AXIS DATA			
TIME INTERVAL (msec)	MAX. ABSOLUTE VALUE	ACCEPTANCE SPECIFICATIONS	RAW FILE NUMBER :
2.5 - 10.00		≤ 0.150%	
10.00 - 100.00		≤ 0.030%	
100.00 - 2000.00		≤ 0.018%	
B0 TIME CONSTANTS <u>Z</u> - AXIS DATA			
TIME INTERVAL (msec)	MAX. ABSOLUTE VALUE	ACCEPTANCE SPECIFICATIONS	
2.5 - 10.00		≤ 0.1%	
10.00 - 100.00		≤ 0.1%	
100.00 - 2000.00		≤ 0.1%	
SITE:		NAME:	DATE:

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%

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	Oct 5, 1998	F. Fiore/ M. Keber	Initial version for Release CV1.
1	Nov 9, 1998	M. Keber	Updated for program change from Release "CV1" to "8.2.5". Corrected Sec 2-2-1 file names to delete.
2	Sept. 27, 1999	G. Boerner	Updated per 8.3 bay validation.
3	Feb 06, 2007	Stetz	Corrected 10 db rotor attenuator part number