GE Medical Systems

Technical Publications

Direction 2108264

Revision 1

Signa® Advantage™ 1.5T Knee Phased Array Coil

Operating Documentation

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation “damage in shipment” written on all copies of the freight or express bill before delivery is accepted or “signed for” by a General Electric representative or a hospital receiving agent. Whether noted or concealed, nature, damage MUST be reported to the carrier immediately upon discovery, or in any event, within 14 days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this 14 day period.

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LIST OF EFFECTIVE PAGES

REVISION	DATE	PRIMARY REASON FOR CHANGE
REV 0	10/94	Initial Release
REV 1	11/95	Coil Loss data - 60cm bore

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
Title Page	0						
Damage	-						
A	0						
B	Blank						
i	0						
ii	Blank						
1-1 — 1-3	0						
1-4	Blank						
2-1 — 2-2	1						
3-1 — 3-10	0						
4-1 — 4-4	0						
5-1 — 5-2	0						
Data1	0						
Data2	Blank						
Data3 — Data4	0						
	Blank						
GE Logo Pg.	-						

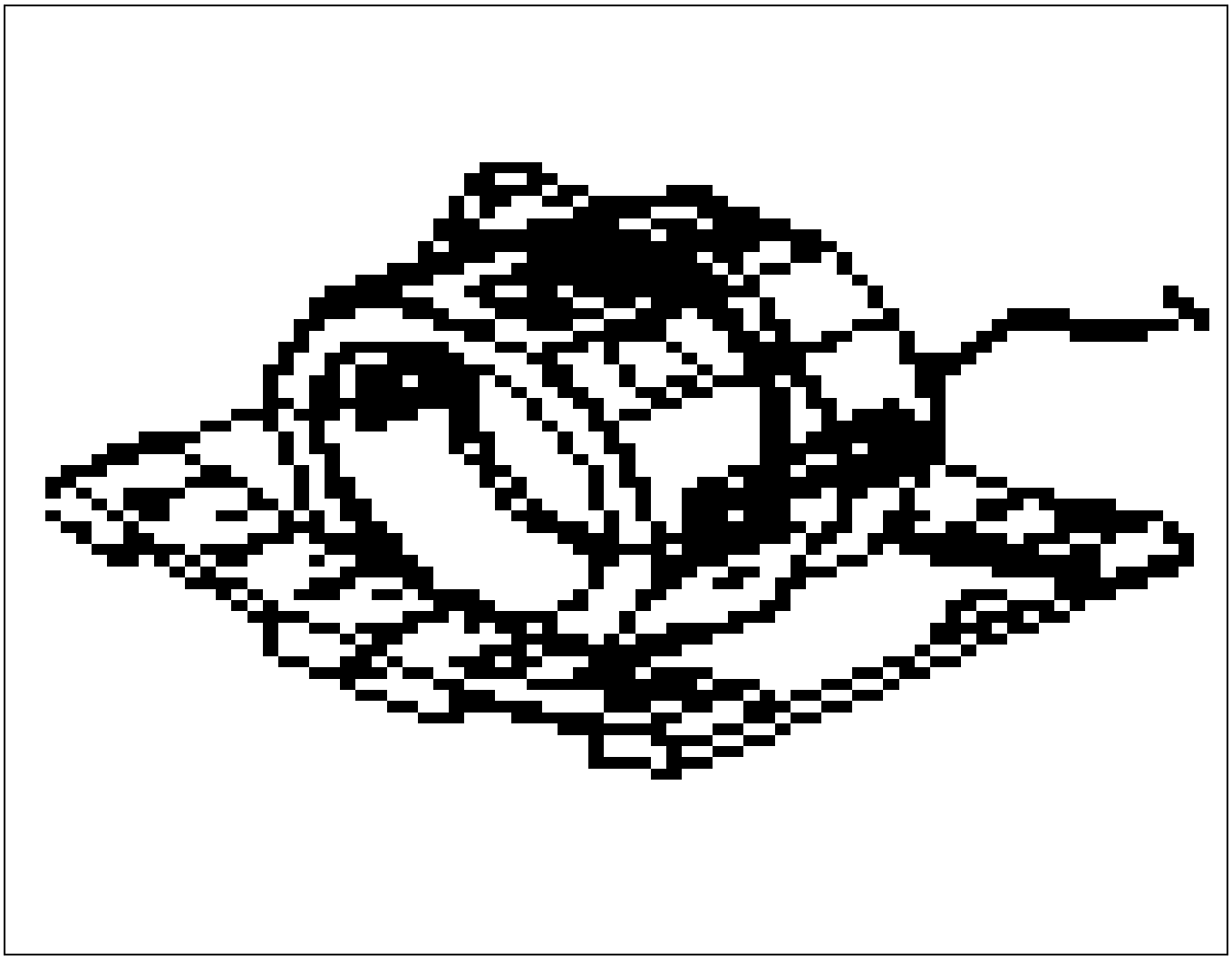
Table of Contents

SECTION 1 - INTRODUCTION

1-1 HOW THE KNEE PHASED ARRAY COIL OPERATES

The Signa Knee Phased Array Coil, see ILLUSTRATION 1-1, is designed for knee imaging on Signa 4.X and 5.X platforms with Phased Array capability. It is a receive-only phased array coil using four receiver channels. Compared with the linear extremity coil, the Signa Knee Phased Array coil provides the benefits of greater signal to noise performance, and larger internal diameter to accept a wider range of patient anatomies.

The coil consists of two eight-conductor low-pass birdcage coil elements, one slightly smaller in diameter than the other. The two quadrature outputs of each coil drive separate receiver channels, for a total of four inputs. Isolation of signal sources for the two outputs from each birdcage is done in the same way as a conventional quadrature birdcage coil. The smaller birdcage coil is then isolated from the larger coil by positioning the overlap of the two birdcages, to cancel the coupling between them. The preamplifier decoupling method used in other Phased Array coils is not possible with the Signa Knee Phased Array Coil because of the multiple elements used.



KNEE PA COILS
ILLUSTRATION 1-1

Each birdcage consists of eight rods and two end rings. Each resonant birdcage in low-pass mode, is formed by end rings (inductive elements) and rods (capacitive elements). Each rod contains two series capacitors.The signal outputs are obtained from the center of two rods located 90 degrees apart on each birdcage. At the signal output port, a 180 degree balun consisting of two 90 degree Pi sections is used to minimize electric field losses in the coil, and to minimize RF currents on the outside of the output cable shields. Each end ring includes gradient eddy current blocking capacitors. These capacitors have a very low inductance value at the coil operating frequency to minimize the effect on the RF circuit of the coil. At gradient switching frequencies, the capacitors have a very high reactance value to ensure that the circulating eddy currents induced in the end rings from the MR system gradient coils are insignificant.

As this is a receive-only coil, decoupling from the transmit RF field is needed. This is accomplished with a passive decoupling circuit on each rod of each birdcage coil element. The decoupling network consists of a pair of high speed switching diodes in a crossed configuration in series with an inductor. These components are shunted across a series capacitor in each rod. The reactance of the inductor is chosen to parallel resonate the capacitor at the operating frequency of the coil. This places a high impedance in series with each rod at the capacitor location during transmit pulses, decoupling the coil from the transmit RF field. PIN diodes are used at the feedpoints for a similar function. These diodes are biased by the system T/R Driver through the coil output cable.

The coil output is internally connected to a connector mounted on the housing by four lengths of coaxial cable. The external cable includes a plug attached to the coil housing, and a 30 pin Bendix connector to mate with the system Phased Array Coil Port. The length of the cable is selected to cause the electrical length from the coil elements to the zero-phase reference point to be exactly one wavelength at the operating frequency. The Signa Knee Phased Array Coil drives four coil inputs: Ports 3, 4, 5, and 6. These correspond to receiver channels 2, 3, 0, and 1 respectively.

1-2 COMPATIBILITY

The Knee Phased Array Coil is compatible with the following hardware configurations:

- Signa Advantage 1.5T, 1.0T, 0.5T Systems with Phased Array upgrade. (1.5T only)

1-3 RELATED DOCUMENTS

- Direction 15400, Signa Advantage 1.5T, 1.0T, & 0.5T System
- Direction 15404, Signa Advantage 1.5T, 1.0T, & 0.5T Renewal Parts

1-4 ORGANIZATION OF THIS DOCUMENT

This document is divided into the following sections:

Section 1, INTRODUCTION, describes how and where the Knee Phased Array Coil can be used.

Section 2, SET UP AND CALIBRATION, describes installation procedures.

Section 3, FUNCTIONAL CHECKS, describes the normal power-up sequence.

Section 4, REPLACEMENT/MAINTENANCE, describes field maintenance procedures.

Section 5, RENEWAL PARTS, lists field replaceable parts.

SNR Data Table

Coil Return Form

TLT Table

1-5 ENVIRONMENTAL REQUIREMENTS

Operate and store the Knee Phased Array coil in the Magnet Enclosure Room.

SECTION 2 - SET UP AND CALIBRATION

2-1 CHECKING THE SHIPPING LIST

Table 2-1 lists the M1087AA Signa Knee Phased Array Coil parts. Check that all parts have been shipped.

TABLE 2-1
COIL PARTS

QTY.	ITEM	PART NO.
1	Knee Phased Array Coil Assembly	46-320406P1
1	Comfort Pad - Internal	
1	Comfort Pad - Side	
1	Service Manual	2108264
1	Operator Manual	2129471

2-2 INSTALLING THE KNEE PHASED ARRAY COIL

At the terminal, install a new soft key. This key will be used by the operator to select Knee Phased Array imaging. Name the key "**KNEEPA**". Some proprietary software tools key from the coil name. Use the correct coil name to ensure that these tools function.

Refer to the Signa Advantage 1.5T, 1.0T, & 0.5T System Manual for information on installing soft keys (use Coil default values in Table 2-2 and 2-3.

TABLE 2-2
COIL VALUES

SYSTEM	COIL NAME	COIL TYPE	EXTREMITY COIL	CABLE LOSS	COIL LOSS	RECON SCALE FACTOR	XMIT COIL TYPE	XMIT ATTN	MULTI-COIL.
1.5T	KNEEPA	surface	no	1.05	0.313-55cm 1.72-60cm	Head Coil Recon Scale Fctr.x 1.0	Quad	0	YES

TABLE 2-3
PHASED ARRAY VALUES

Multi-Coil NAME	# OF REC.	START REC.	STOP REC.	PORT ENABLE MASK	ERROR ENABLE MASK
KNEEPA	4	0	3	6	6

2-3 FUNCTIONAL CHECKS

1. Perform a Body coil scanner performance verification. Refer to Section 3-1, SIGNA ADVANTAGE 1.5T SCANNER VERIFICATION.

2. Perform a Knee Phased Array Coil performance verification. Refer to Section 3-2, KNEE PHASED ARRAY COIL IMAGING PERFORMANCE VERIFICATION.

3. Perform an SNR Image analysis. Refer to Section 3-3, SNR IMAGE ANALYSIS FOR 4.X SYSTEMS or Section 3-4, SNR IMAGE ANALYSIS FOR 5.X SYSTEMS.

2-4 PERIODIC QUALITY ASSURANCE CHECK

On a periodic basis, such as during planned maintenance, perform the quality assurance check outlined below to ensure that the Knee Phased Array Coil is operating properly with no appreciable degradation of image quality.

1. Check the external cable for cracks or breaks once each week.

2. Perform a Knee Phased Array Coil performance verification. Refer to Section 3-2, KNEE PHASED ARRAY COIL IMAGING PERFORMANCE VERIFICATION.

3. Record the date and value calculated in SNR QA DATA TABLE.

4. As instructed in the Data Table, divide the SNR value obtained in the periodic QA check by the original SNR value.

5. If this ratio is not greater than 85%, then there may be a problem with the Knee Phased Array Coil or the MR system. Contact the GE Service Representative.

SECTION 3 - FUNCTIONAL CHECKS

3-1 SIGNA ADVANTAGE™ 1.5T SCANNER VERIFICATION

Note

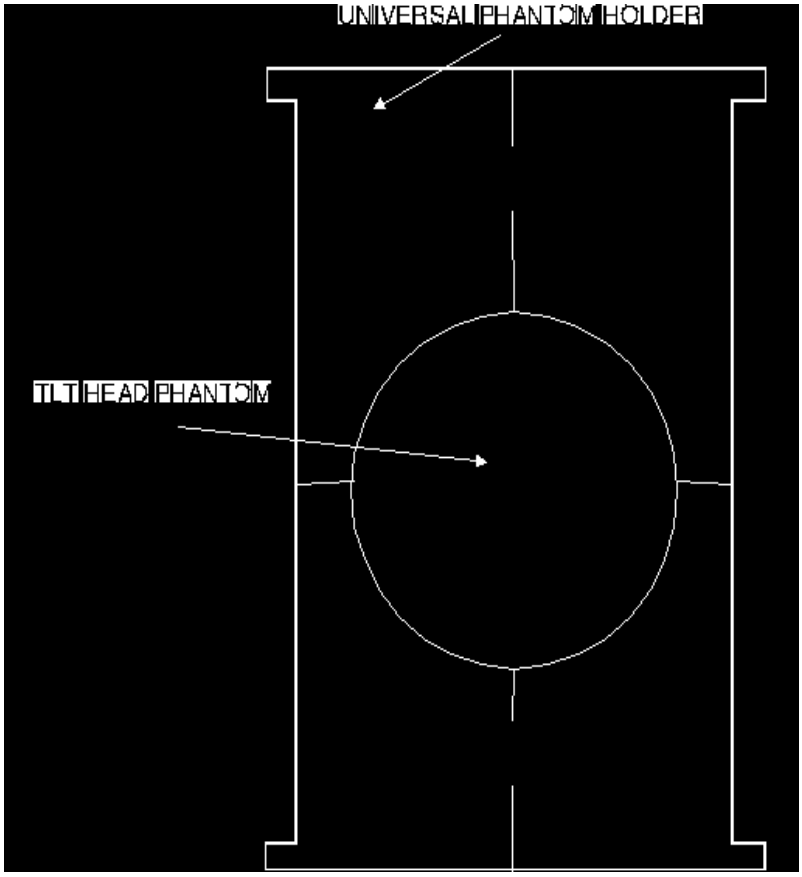
An alternative proprietary procedure is available for GE use and to customers with a valid Advanced Service Package Limited License. Refer to Direction 15520, MR Signa Advantage 1.5T, 1.0T, and 0.5T Service Documentation, Service Notes and FMI.

1. Scanner performance in the body coil mode should be verified. The RF power level calibration from the body coil mode is used to verify the surface coil decoupling.

2. Select [**NEW STUDY**] (4.x), or [**New Exam**] (5.x) for a new Landmark to be set. Place the Head Phantom on top of the Universal Phantom Holder and place in the center of the cradle. See ILLUSTRATION 3-1.

3. **LANDMARK** the center of the phantom, and advance the patient table to isocenter using the [**ADVANCE TO SCAN**] button.

4. Set up Scan Prescription as shown in TABLE 3-1 (4.x), or TABLE 3-2 (5.x). Coil Type: [**Body Coil**] and Number of Echos: [**4**] should be inserted. Perform an **[Auto Prescan]** to calibrate the RF power level. Record the value for TG, R1, and R2.



TLT PHANTOM PLACEMENT
ILLUSTRATION 3-1

5. Set up the scan using the parameters in TABLE 3-1 or 3-2.

6. Select **[Scan]**. Observe the resulting images. Ensure that there are no artifacts of any sort on any of the images.

7. Select [**Cancel**], [**New Series**], to perform SNR comparisons. Acquire two identical images after inserting Number of Echos: [**1**]. After acquiring the first image, select **[Scan]** to obtain a second. Note the series number .

TABLE 3-1
SCAN PARAMETERS (4.X)

ID:	**GESERVICE**	Frequency Mode:	**[Peak]**
Name:		Receive Bandwidth:	**[16kHz]**
Weight (lb):	**111**	Field of View:	**[24 cm]**
Patient Entry:	**[Feet First]**	Slice Thickness:	**[3 mm]**
Patient Position:	**[Supine]**	Scan Location	(S/I) **0**
Axial/Sag Landmark:	**[Sternal Notch]**	No of Scan Locations:	**1**
Coil Type:	**[++] See Note**	FOV Center (L/R):	**(R/L) 0(P/A): A0**
Scan Plane:	**[Axial]**	Acq. Matrix:	**[256 x 128]**
Image mode:	**[Single Scan]**	Frequency Direction:	**[R/L]**
		Phase FOV:	**default**
Pulse Sequence:	**[Spin Echo]**	Imaging Time:	**[1 Nex]**
Imaging Options:	**[None]**	Contrast:	**[No]**
Number of Echos:	**[*] See Note**	Table Delta	**0**
Echo Time (TE):	**[Other][40 ms]**		
Rep Time (TR):	**[400 ms]**		

NOTE: *** [4]** for Section 3-1 Step 4
[1] for Section 3-1 Step 7
++ **[Body]** for Section 3-1 Step 4
[Other][KNEEPA] for Section 3-1 Step 7

TABLE 3-2
SCAN PARAMETERS (5.X)

ID:	**geservice**	Auto CF:	**[Peak]**
Name:		Receive Bandwidth:	**[16kHz]**
Weight (lb):	**111**	Field of View:	**[24 cm]**
Patient Entry:	**[Head First]**	Slice Thickness:	**[3 mm]**
Patient Position:	**[Supine]**	Interscan Spacing:	**[0]**
Axial/Sag Landmark:	**[Sternal Notch]**	Start Location (I/S):	**0**
Coil Type:	**[++] See Note**	End Location (I/S):	**0**
Scan Plane:	**[Axial]**	No of Scan Locations:	**1**
Image mode:	**[2D]**	FOV Center (L/R):	**0 (P/A): 0**
	[Monitor SAR]	Acq. Matrix: (freq.)	**[256]**
Pulse Sequence:	**[Spin Echo]**	Acq. Matrix: (phase)	**[128]**
Imaging Options:	**[None]**	Frequency Direction:	**[R/L]**
Number of Echos:	**[*] See Note**	Phase FOV:	**default**
Echo Time (TE):	**[40 ms]**	Imaging Time:	**[1 Nex]**
Rep Time (TR):	**[Other] 400 ms**	Contrast:	**[No]**
		Table Delta	**0**

NOTE: *** [4]** for Section 3-1 Step 4
[1] for Section 3-1 Step 7
++ **[Body]** for Section 3-1 Step 4
[Other][KNEEPA] for Section 3-1 Step 7

3-2 KNEE PHASED ARRAY COIL IMAGING PERFORMANCE VERIFICATION

1. Set up the Knee Phased Array coil and Head Phantom as shown in ILLUSTRATION 3-2. Connect the surface coil cable to the **PHASED ARRAY PORT**.

2. Select [**Cancel**], [**New Series**], and repeat the scan using the parameters in TABLE 3-3 or 3-4. Coil Type: [**Other**][**KNEEPA**] Number of Echos: [**4**] should be used. Use **Auto Prescan** to determine the values of R1 and R2. If the value of TG does not match the value obtained in step 3-1-4, use **Manual Prescan** to set.

TABLE 3-3
SCAN PARAMETERS (4.X)

ID:	**GESERVICE**	Frequency Mode:	**[Peak]**
Name:		Receive Bandwidth:	**[16kHz]**
Weight (lb):	**111**	Field of View:	**[24 cm]**
Patient Entry:	**[Feet First]**	Slice Thickness:	**[3 mm]**
Patient Position:	**[Supine]**	Scan Location	(S/I) **0**
Axial/Sag Landmark:	**[Sternal Notch]**	No of Scan Locations:	**1**
Coil Type:	**[++] See Note**	FOV Center (L/R):	**(R/L) 0(P/A): A0**
Scan Plane:	**[Axial]**	Acq. Matrix:	**[256 x 128]**
Image mode:	**[Single Scan]**	Frequency Direction:	**[R/L]**
		Phase FOV:	**default**
Pulse Sequence:	**[Spin Echo]**	Imaging Time:	**[1 Nex]**
Imaging Options:	**[None]**	Contrast:	**[No]**
Number of Echos:	**[*] See Note**	Table Delta	**0**
Echo Time (TE):	**[Other][40 ms]**		
Rep Time (TR):	**[400 ms]**		

NOTE: *** [4]** for Section 3-2 Step 2 **[1}** for Section 3-2 Step 4
++ **[Other][KNEEPA]** for Section 3-2 Step 2

TABLE 3-4
SCAN PARAMETERS (5.X)

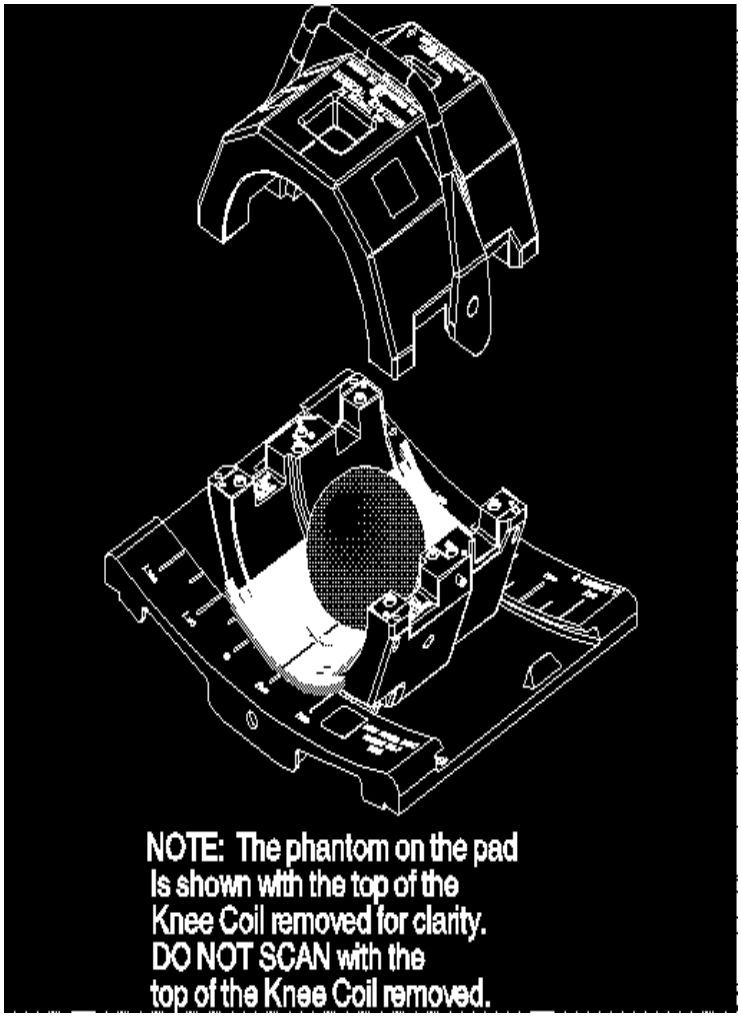
ID:	**geservice**	Auto CF:	**[Peak]**
Name:		Receive Bandwidth:	**[16kHz]**
Weight (lb):	**111**	Field of View:	**[24 cm]**
Patient Entry:	**[Head First]**	Slice Thickness:	**[3 mm]**
Patient Position:	**[Supine]**	Interscan Spacing:	**[0]**
Axial/Sag Landmark:	**[Sternal Notch]**	Start Location (I/S):	**0**
Coil Type:	**[++] See Note**	End Location (I/S):	**0**
Scan Plane:	**[Axial]**	No of Scan Locations:	**1**
Image mode:	**[2D]**	FOV Center (L/R):	**0 (P/A): 0**
	[Monitor SAR]	Acq. Matrix: (freq.)	**[256]**
Pulse Sequence:	**[Spin Echo]**	Acq. Matrix: (phase)	**[128]**
Imaging Options:	**[None]**	Frequency Direction:	**[R/L]**
Number of Echos:	**[*] See Note**	Phase FOV:	**default**
Echo Time (TE):	**[40 ms]**	Imaging Time:	**[1 Nex]**
Rep Time (TR):	**[Other] 400 ms**	Contrast:	**[No]**
		Table Delta	**0**

NOTE: *** [4]** for Section 3-2 Step 2 **[1]** for Section 3-2 Step 4
++ **[Other][KNEEPA]** for Section 3-2 Step 2

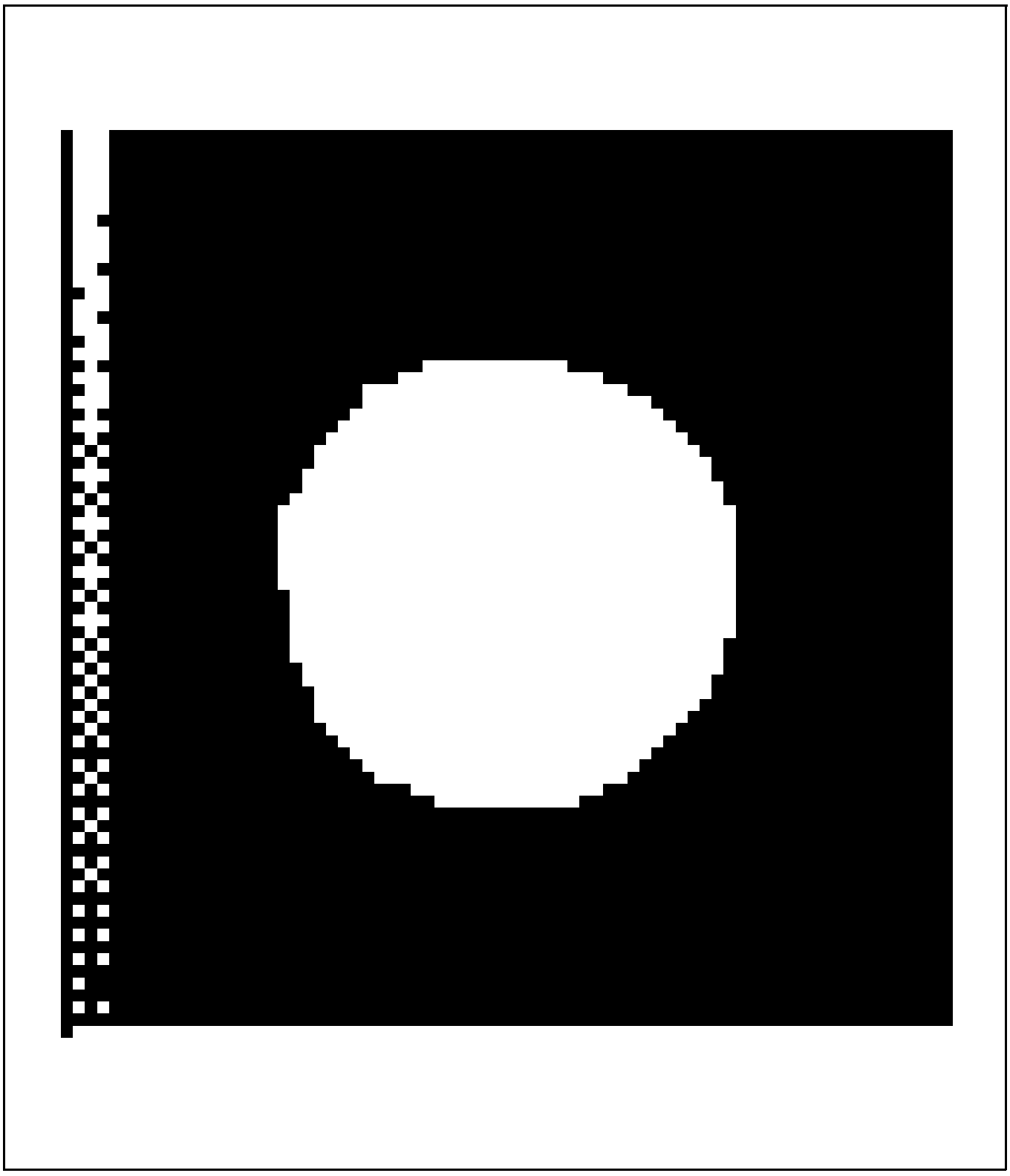
3. Run the scan. Ensure that there are no artifacts of any sort on any of the images. Study the image using a **Window Width** and **Window Level** to obtain good contrast. A properly functioning coil will produce an image with a smooth uniform signal pattern. See ILLUSTRATION 3-3. A decoupling failure will cause holes, distortions, or striped patterns in the image. Refer to Section 3-5 and 3-6 to troubleshoot decoupling failures. Inspect the images for visible ghosting (similar in appearance to motion artifact) in the phase encoding direction. If images contain ghosting artifacts, suspect an intermittent cable or connection. Refer to Section 3-5 to 3-6 for troubleshooting information.

4. Repeat step 2 with Number of Echos: [**1**] inserted. Run the scan. Immediately after acquiring the first image, select **[Scan]** to obtain a second.

5. Compute the SNR using the procedure described in Section 3-3, SNR IMAGE ANALYSIS FOR 4.X SYSTEMS or Section 3-4, SNR IMAGE ANALYSIS FOR 5.X SYSTEMS. Compare the signal to noise ratio of the first echo of the Knee Phased Array Coil images with the signal to noise ratio of the first echo of the body coil images of step 3-1-6. The Knee Phased Array Coil scans should display a signal to noise ratio greater than 2.5 times that of the body coil scans.



TLT PHANTOM PLACEMENT IN KNEE PHASED ARRAY COIL
ILLUSTRATION 3-2



NORMAL DECOUPLING
ILLUSTRATION 3-3

3-3 SNR IMAGE ANALYSIS FOR 4.X SYSTEMS

1. On the left touch screen, touch the **UTILITIES** soft key. When the next screen appears, touch the **CLIPS** key.

2. Type **1** and **ENTER** on the next screen to run CLIPS.

3. Select the image processor at the Operator Console by typing **1** and **ENTER** at the next screen. It is not necessary to boot the image processor, so select **N** and **ENTER** when asked at the next screen.

4. It will take several seconds for the **CLIPS>** prompt to appear. When it does, type **LIST(STUDY);** and **ENTER**. A screen listing the available studies will appear. Type **S** and **ENTER** to enable the **SELECT STUDY** function. Enter the study number of the Body Coil SNR scans.

5. At the **CLIPS>** prompt, type **LIST(SERIES);** and **ENTER**. A list of the available series will appear. Type **S** and **ENTER** to select the proper series. Generally, the desired series will be the first one. Type "**1**" and **ENTER** to select the series.

6. To view several images at one time, type **VIEW(2,2)**; at the **CLIPS>** prompt. This will display images in a pattern of four images; the upper left image will be #1, the upper right image will be #2, the lower left will be #3, and the lower right will be #4. No images are displayed at this time.

7. At the **CLIPS>** prompt, type **LIST(IMAGE);** and **ENTER**. Type **2** and **ENTER** to select image by number. Type **A** to select all images. Type **E** to exit the image selection.

8. It is necessary to load the images to be analyzed to the **DISPLAY** function of CLIPS. Type **DIS(ALL);**

9. To obtain a mean signal value for the signal to noise ratio calculation, type **ROI**; at the **CLIPS>** prompt. A menu will appear allowing a selection of cursor types. Choose the elliptical cursor by typing **2** and **ENTER**.

10. Adjust the size of the cursor using the [**CURSOR POSITION/SIZE**] keys on the console and the trackball to an area covering approximately 80% of the phantom image in the upper left corner [**Display 1**]. Adjust the position of the cursor circle to center it on the phantom. Press the **ENTER** key on the keyboard to allow CLIPS to calculate the ROI parameters. Record the **MEAN SIGNAL** value for later use in the signal to noise ratio calculation.

11. Type #3=#1-#2; at the **CLIPS>** prompt. This will subtract the two images, creating a noise image in Display 3.

12. Type #1=#3; at the **CLIPS>** prompt. This action moves the image to the upper left display window to allow ROI calculations to be made.

13. At the **CLIPS>** prompt, type ROI; to select the image analysis function. Type **2** and select an elliptical cursor. Size and position the cursor to the same conditions as in step 10. Press the **ENTER** key, and record the Standard Deviation value for later use in the signal to noise ratio calculation.

14. Use the following formula to calculate the signal to noise ratio

    SIGNAL TO NOISE RATIO = 1.414 * MEAN SIGNAL (from 10) / SD (from step 13)

    Record the value determined for the signal to noise ratio and the coil type [surface or body] of the measurement on the SNR QA DATA TABLE.

15. Repeat steps 5 to 14 using the surface coil images to determine the signal to noise ratio for the surface coil scans.

16. Determine the relative performance of the surface coil against the body coil reference by dividing the surface coil signal to noise ratio value by the body coil signal to noise ratio value.

17. To end the CLIPS utility when all image calculations are completed, type **BYE**; and **ENTER** at the **CLIPS>** prompt.

18. Select the exit function by typing **5** at the select function screen. Touch the **CANCEL** soft key on the screen to exit the **UTILITIES** functions and return to normal system operation.

19. Upon exiting CLIPS, reset the **AUTO CENTER FREQUENCY** mode by touching the **SCAN MODES** key, and then **DEFAULT AUTO CF** followed by the **EXECUTE** key.

20. Record the data and value calculated in the appropriate column under QA SNR Value.

3-4 SNR IMAGE ANALYSIS FOR 5.X SYSTEMS

Description

The SNR tool retrieves two operator selected images. Signal value is computed as the mean pixel value in a ROI covering 80% of the image. The image is analyzed to determine the center for positioning the ROI. A difference image is created by subtracting the second image from the first and to calculate noise from the subtracted image. Signal value, noise value, and SNR are reported. The difference image can be saved with the results annotated (option).

Procedure

1. Touch [**Utilities**], [**MR Tools**], [**Image Quality**], then [**SNR Test**]. The SNR Test screen is displayed. See ILLUSTRATION 3-4.

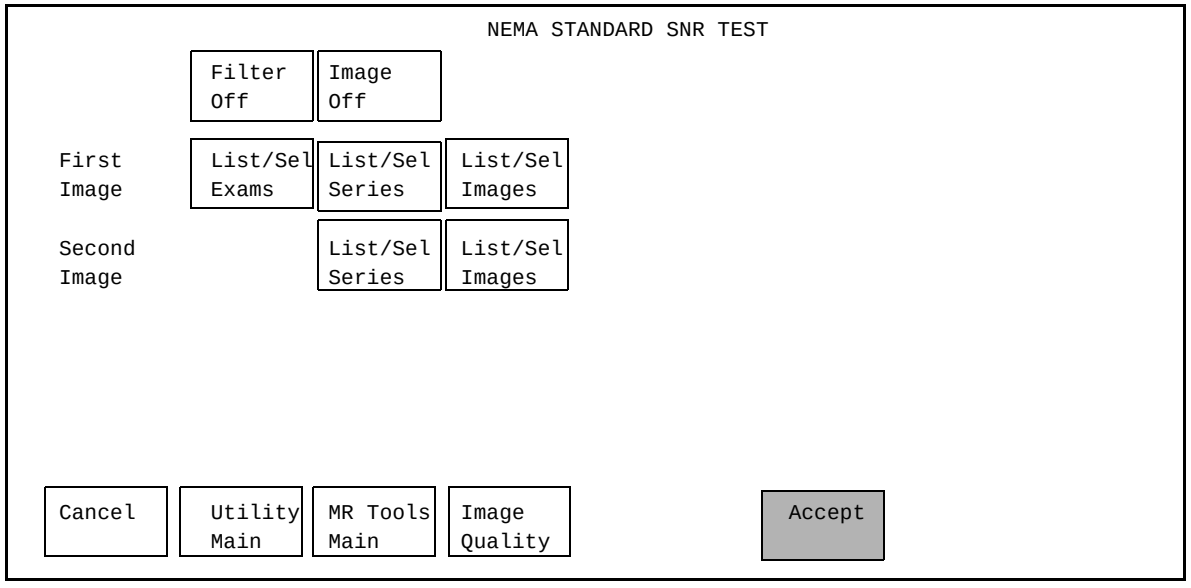
2. Enter first image exam, series, and image numbers. If exam, series, or image numbers are not known, select [**List Exams**], [**List Series**], or [**List Images**] to display list to choose from. Enter second image series and image number. The second image exam number is defaulted to the same as first image.

Note

lmage number selection must be back lit (highlighted) to be able to enter information. Use Switch key on keyboard to transfer control from left to right side of Touch Screen.

3. Select [**Filter Off**] and [**Image Off**]. Touch [**Accept**] to begin analysis. The final values are displayed on the screen.

4. Place Signal to Noise Ratio on SNR QA DATA TABLE. Touch [**Continue**], select the next exam and repeat for each pair.



Note: Accept changes to continue only after an analysis has been performed.

SNR TEST SCREEN
ILLUSTRATION 3-4

3-5 CHECKING THE PROTECTION PIN DIODES WITH DIGITAL MULTIMETER (DMM)

1. Select the **DIODE TEST** function on the Digital Multimeter (DMM).

2. Connect the **NEGATIVE** lead of the DMM to the Phased Array connector ground pin. Connect the **POSITIVE** lead to the Phased Array connector signal pin. Refer to TABLE 3-2 and ILLUSTRATION 3-5.

3. A reading of 0.400 to 0.900 should be observed on the DMM.

4. If a reading below 0.400 is observed, either the output cable is shorted or the PIN diode is shorted.

5. If a reading above 0.900 is observed in step 2, the PIN diode or the cable is open.

6. Connect the **NEGATIVE** lead of the DMM to the Phased Array connector signal pin. Connect the **POSITIVE** lead to the Phased Array connector ground pin. Refer to TABLE 3-2 and ILLUSTRATION 3-5.

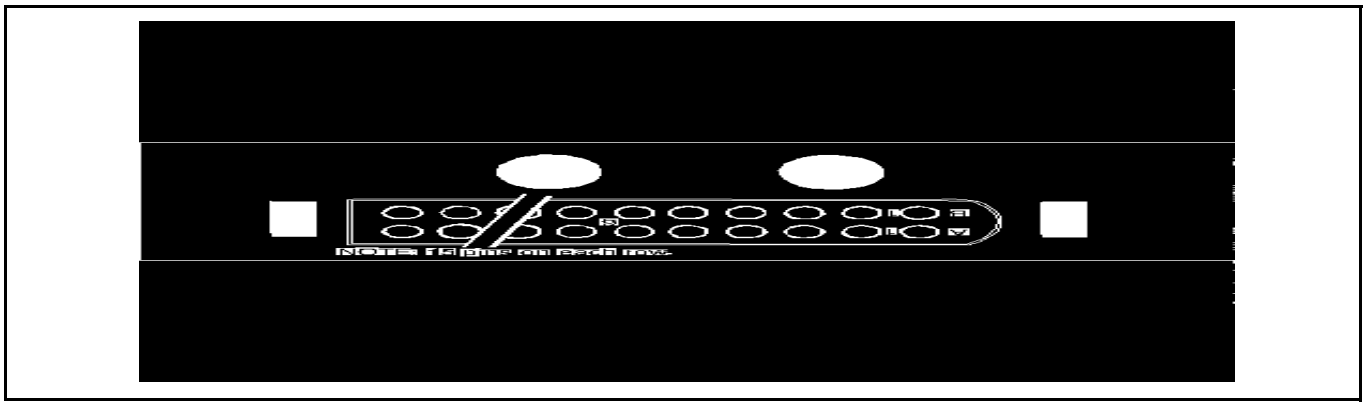
7. A reading of **INFINITY** should be observed on the DMM.

8. If a reading below **INFINITY** is observed, either the output cable is defective or the PIN diode is shorted or leaky.

9. If any of the above conditions fail, check the PIN diodes directly at the coils, and replace as necessary. Refer to Section 4-3, REPLACING THE PROTECTION/DECOUPLING PIN DIODES.

TABLE 3-2
DIODE TEST CONNECTIONS - PHASED ARRAY COIL

	POSITIVE LEAD CONNECTION		NEGATIVE LEAD CONNECTION	
COIL NUMBER	**FOR STEP 2**	**FOR STEP 6**	**FOR STEP 2**	**FOR STEP 6**
1	5B	5A	5A	5B
2	7B	7A	7A	7B
3	9B	9A	9A	9B
4	11B	11A	11A	11B



PIN LOCATIONS FOR PHASED ARRAY CONNECTOR
ILLUSTRATION 3-5

3-6 CHECKING THE EXTERNAL CABLE

1. Select the **DIODE TEST** function on the Digital Multimeter (DMM).

2. Connect the **NEGATIVE** lead of the DMM to the Phased Array connector ground pin. Connect the **POSITIVE** lead to the Phased Array connector signal pin. Refer to TABLE 3-2 and ILLUSTRATION 3-5.

3. Flex the cable, especially near the connectors and the strain relief. A reading of 0.400 to 0.900 volts should remain on the DMM, with no instability of fluctuations.

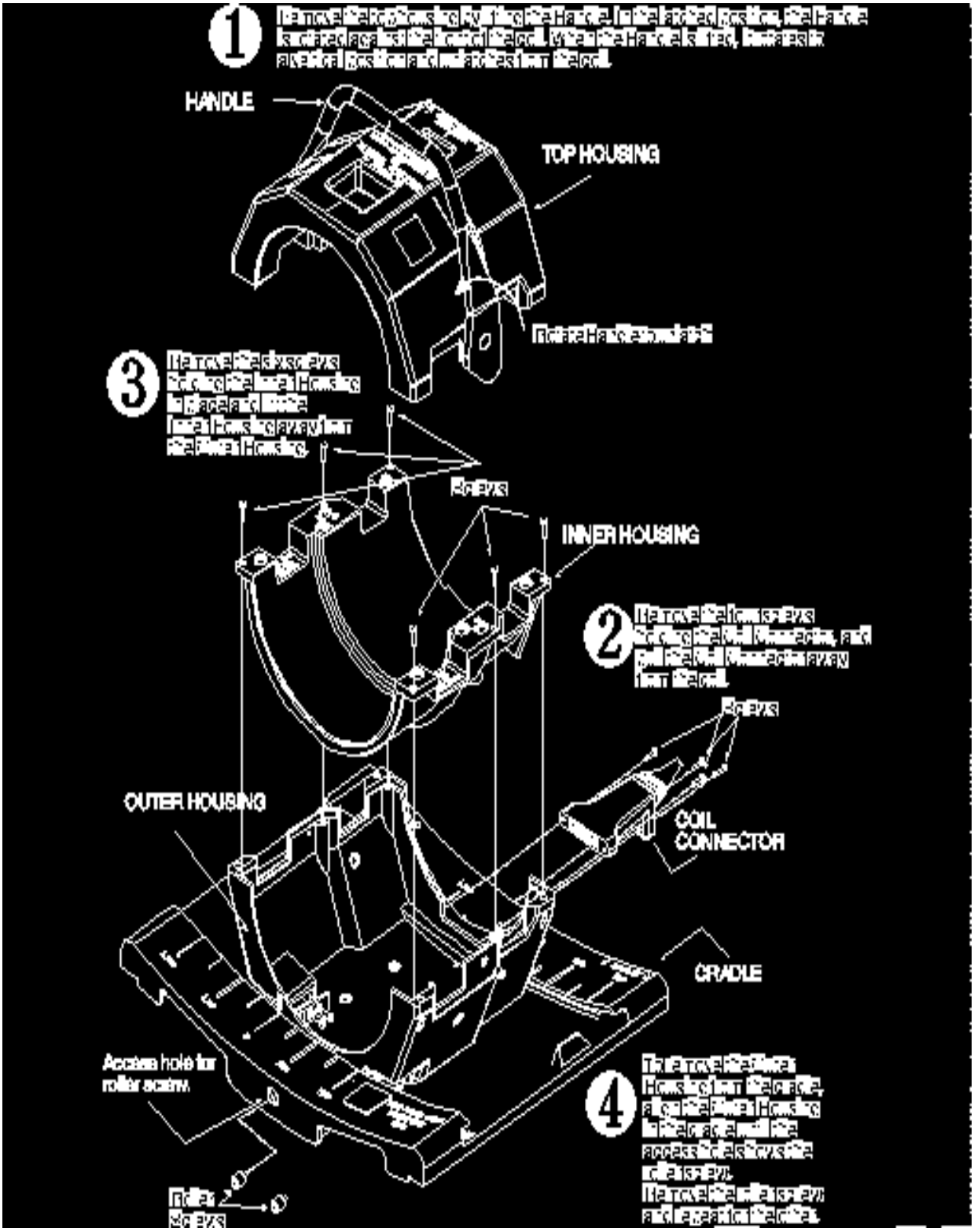
4. Connect the **NEGATIVE** lead of the DMM to the Phased Array connector signal pin. Connect the **POSITIVE** lead to the Phased Array connector ground pin. Refer to TABLE 3-2 and ILLUSTRATION 3-5.

5. Flex the external cable, especially near the connectors and the strain relief. A reading of **INFINITY** should remain on the DMM, with no instability or fluctuations.

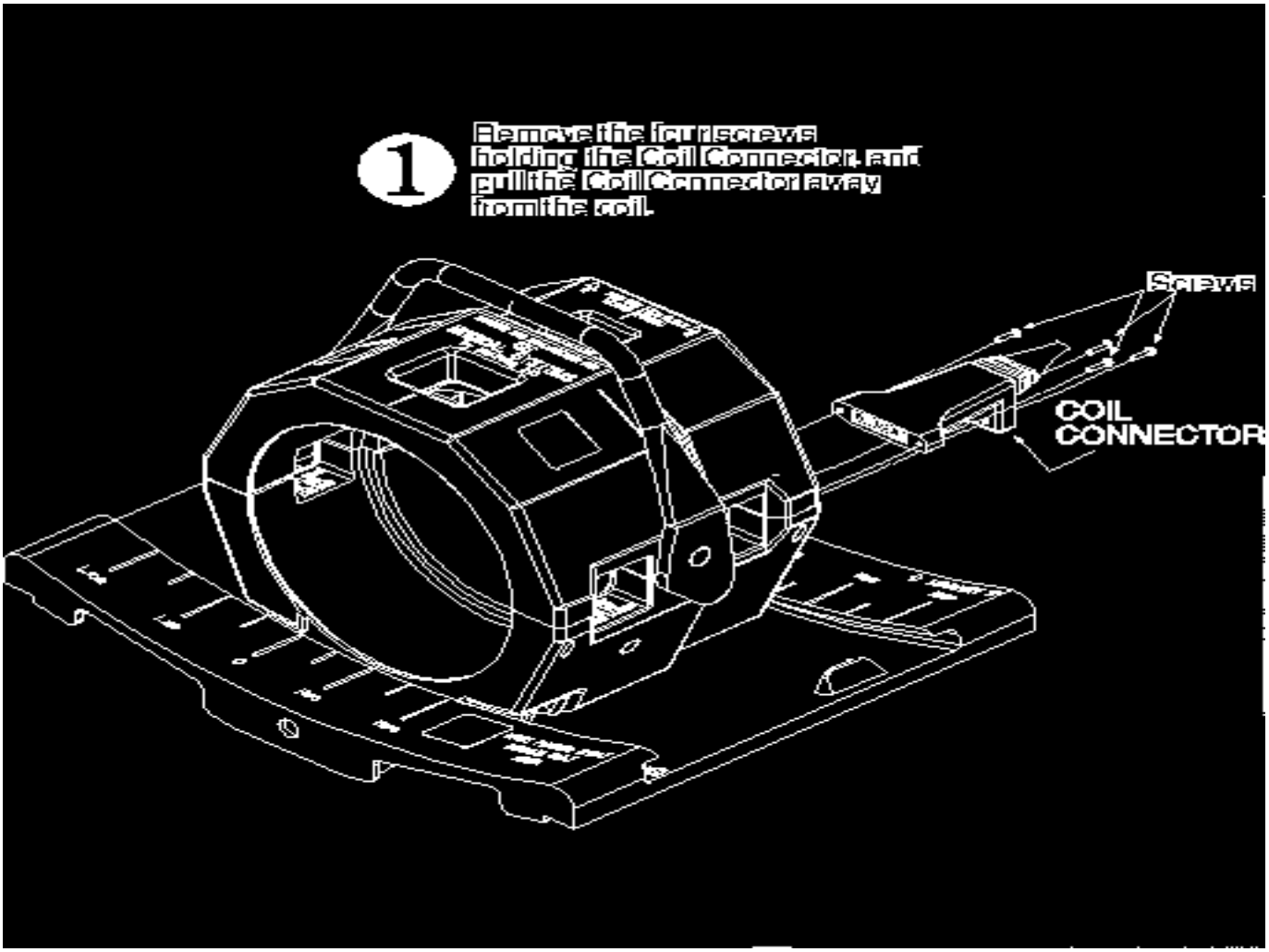
6. If the cable fails any of the above tests, it should be replaced. Refer to Section 4-2. REPLACING THE EXTERNAL CABLE.

SECTION 4 - REPLACEMENT/MAINTENANCE

4-1 DISASSEMBLY/ASSEMBLY OF KNEE PHASED ARRAY COIL



4-2 REPLACING THE EXTERNAL CABLE



4-3 REPLACING THE PROTECTION/DECOUPLING PIN DIODES

CAUTION

Use a 25W solder iron and protect the circuit board from static electricity. Be careful not to damage the circuit board by overheating.

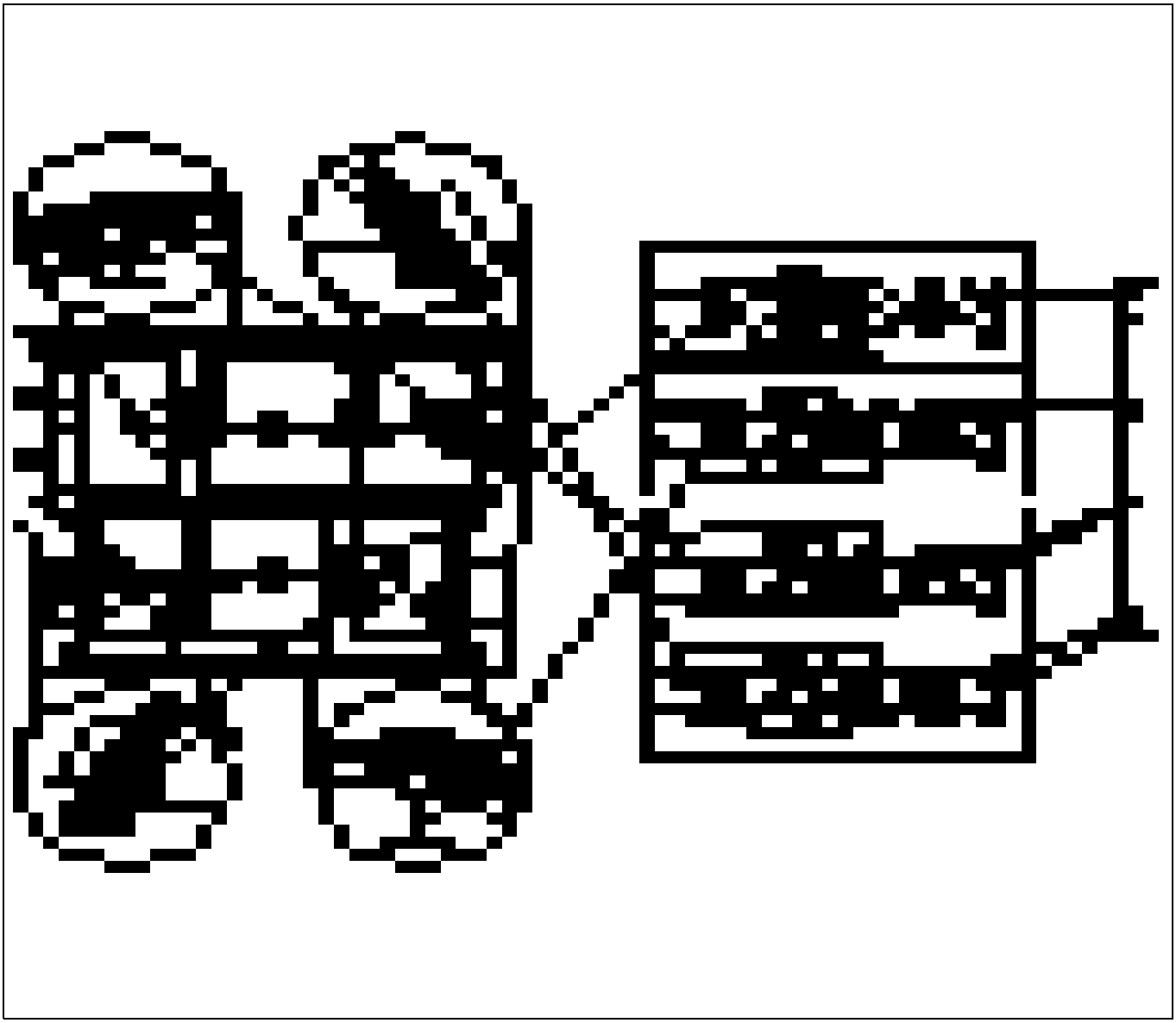
Note

Each antenna loop element is tuned at the factory to provide the proper input impedance. Circuit boards are not field replaceable. The PIN diodes are the only field replaceable component on the circuit boards.

1. Disassemble the bottom housing. Refer to Section 4-1.

2. Use an anti-static wrist band when touching the circuit board.

3. Replace the PIN diodes only with exact replacement diodes. OBSERVE POLARITY. See ILLUSTRATION 4-1.



DIODE REPLACEMENT
ILLUSTRATION 4-1

4-4 CHECKING THE CABLES

1. Check the external cable for cracks or breaks once each week. Replace the external cable if any damage or wear is found.

4-5 CLEANING THE KNEE PHASED ARRAY COIL

CAUTION

Avoid damaging sensitive electronic parts. Do not spray or pour dishwashing solution directly onto the Knee Phased Array coil, or external cable. Do not use alcohol to clean the Knee Phased Array coil. Never submerge the Knee Phased Array coil in any liquid.

1. Clean the Knee Phased Array coil and external cable with a mild dishwashing liquid and water solution. Wet a soft cloth with the solution and proceed to clean.

SECTION 5 - RENEWAL PARTS

KNEE PHASED ARRAY COIL 46-320406P1

Item	Part Number	FRU	Name	Quantity	Description/Remarks
1	46-221735P1	1	Diode	8	UM9415 PIN Diode
2	46-320406P1	1	Knee Phased Array Coil	1	Knee Phased Array Coil

PHASED ARRAY CABLE 2100937-10

Item	Part Number	FRU	Name	Quantity	Description/Remarks
1	2100937-10	1	Cable Kit	1	Phased Array Cable

SNR QA DATA TABLE

Use the space provided below to record the calculated signal to noise ratio—SNR, data obtained from Section 3, FUNCTIONAL CHECKS. After recording the SNR data obtained during the initial coil installation, record subsequent SNR data in column 2 below and the date in column 1 as a periodic QA check. If the ratio of any of the coils found is not greater than 85%, then there is a problem in the coil or the MR system.

Original SNR data obtained at initial coil installation:

Body Coil SNR Value: _____

Knee Phased Array SNR value: _____

Date: _____

SNR DATA QA (QUALITY ASSURANCE) CHECK:

1 Date	2 Phased Array Coil QA SNR-Value:	3 Is new value divided by original value >85%?
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N
_____	_____	_____ Y/N

Make additional copies of this document as needed.

DEFECTIVE SURFACE COIL RETURN FORM

NOTE

For proper assessment of defective returned coils, both sides of this form should be completely filled out and accompany all returned coils. Include films or prints of any image quality complaints with a description of the scan prescription used.

DATE: _____

SITE NAME: _____

SITE ADDRESS: _____

SERVICE ENGINEER: _____

COIL SERIAL NUMBER: _____

DATE COIL INSTALLED: _____

DESCRIPTION OF COIL PROBLEM: _____

(Please be descriptive;"Broken" is not enough) _____

_____

_____

_____

_____

Note

An alternate proprietary procedure is available to GE use and to customers with a valid Advanced Service Package Limited License. Refer to Direction 15520, MR Signa Advantage 1.5T, 1.0T, and 0.5T Service Documentation, Service Notes and FMI. Use the table to record the TLT results of the defective coil.

TABLE DR-1
TLT DATA FOR DEFECTIVE SURFACE COIL

SITE:	**NAME:**	**DATE:**
TLT FILE NUMBER:		
SNR: NOISE		
SNR MEAN		
SNR SIGNAL		
SNR AREA		
TRMAP: 89–91	%	%
85–95	%	%
65–115	%	%
FLIP MEAN		
FLIP SDV		
RCV MEAN		
RCV SDV		
DIFF MEAN		
DIFF SDV		

TABLE DR-2
TLT DATA FOR DEFECTIVE PHASED ARRAY COIL

SITE:	**NAME:**	**DATE:**
TLT FILE NUMBER:		
SNR: NOISE (0)		
NOISE (1)		
NOISE (2)		
NOISE (3)		
NOISE (C)		
SNR MEAN (0)		
SNR MEAN (1)		
SNR MEAN (2)		
SNR MEAN (3)		
SNR MEAN (C)		
TRMAP: 89–91 (C)	**%**	**%**
85–95 (C)	**%**	**%**
65–115 (C)	**%**	**%**
FLIP MEAN (C)		
FLIP SDV (C)		
RCV MEAN (C)		
RCV SDV (C)		
DIFF MEAN (C)		
DIFF SDV (C)		

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