

SERVICE MANUAL

MRI Devices Corporation
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Document TR0024S

Revision 1

GE Signa® 1.5T / 1.0T High Resolution Wrist Coil

GE Catalog Part Number:	M1087HW	(1.5T)
	M1887HW	(1.0T)
MRIDC Part Number:	800029	(1.5T)
	800030	(1.0T)



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, 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.

Immediately complete a "Damage Loss Claim Form", available via MS Exchange Mail, after the damage is found.

MS Exchange Path:

Outlook/Public Folder/All Public Folders/Medical Systems/!Global Initiatives/Information Management/Forms/Common Forms/DAMAGE LOSS CLAIM FORM.

Send the completed form to the email address listed in the form.

For more information about the Transportation Claim Procedure, access the GE Medical Systems Intranet and enter the following URL address (case sensitive):

<ftp://3.87.40.2/globepro/qualsys/Docs/190016MF.PDF>

Rev. 11/15/2000

Language Policy For Service Documentation (Dir. 2128126)

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- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

AVERTISSEMENT

- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
- SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.
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- FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.
- VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
- WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.

AVISO

- ESTE MANUAL DE SERVICIO SOLO EXISTE EN INGLES
- SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.
- NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.
- LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.

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- SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.
- NÃO TENHA TENTADO REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.
- O NÃO CUMPRIMENTO DESTA AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.

AVVERTENZA

- IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.
- SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.
- SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.
- NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

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- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

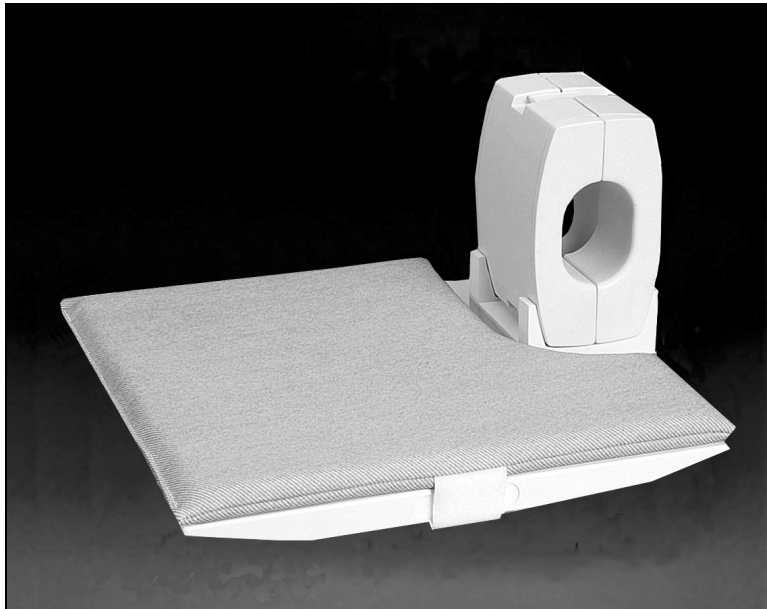
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SECTION 1 – INTRODUCTION

1-1 Product Identification and Shipping List

This is a service manual for the GE Signa 1.0T / 1.5T High Resolution Wrist Coil.



1.5T SHIPPING LIST – TABLE 1-1-1

Description	GE Part #	Supplier Part #	Qty
High Resolution Wrist Coil w/Baseplate Assembly	2293670-2	101752	1
Wrist Phantom	2293670-3	100885	1
Phantom Positioner	2293670-4	100868	1
Operators Manual	2293670-5	500040	1
Service Manual	2293670-6	TR0024S	1
Small Wrist Pad A, Palm R	E8801W	100864	1
Small Wrist Pad B, Back	E8801WA	100865	1
Large Wrist Pad A, Palm R	E8801WB	100866	1
Large Wrist Pad B, Back	E8801WC	100867	1
Baseplate Pad	E8801WD	100784	1

1.0T SHIPPING LIST – TABLE 1-1-2

Description	GE Part #	Supplier Part #	Qty
High Resolution Wrist Coil w/Baseplate Assembly	2293671-2	101753	1
Wrist Phantom	2293670-3	100885	1
Phantom Positioner	2293670-4	100868	1
Operators Manual	2293670-5	500040	1
Service Manual	2293670-6	TR0024S	1
Small Wrist Pad A, Palm R	E8801W	100864	1
Small Wrist Pad B, Back	E8801WA	100865	1
Large Wrist Pad A, Palm R	E8801WB	100866	1
Large Wrist Pad B, Back	E8801WC	100867	1
Baseplate Pad	E8801WD	100784	1

1-2 Compatibility

This coil is compatible with the following hardware configurations:

- Signa Horizon and LX Horizon 1.5T
- Signa Horizon and LX Horizon 1.0T

1-3 Related Documentation

- Signa LX Service Methods CD, 2160623-1
- 1.5T/1.0T High Resolution Wrist Coil Operators Manual, 2293670-5

1-4 Environmental Requirements**Storage Requirements**

The coil should be stored in the Scanner Room. The coil dimensions and weight represent the coil, vertical holder and baseplate combined. The phantom dimensions represent the phantom and phantom holder combined. The phantom weight represents the phantom, filled with fluid, and the phantom holder combined.

Dimensions

Coil Dimensions:	214.8 mm x 438.0 mm x 356.0 mm	8.59 in x 17.52 in x 14.24 in
Phantom Dimensions:	81.5 mm x 152.4 mm x 65.0 mm	3.26 in x 6.10 in x 2.60 in

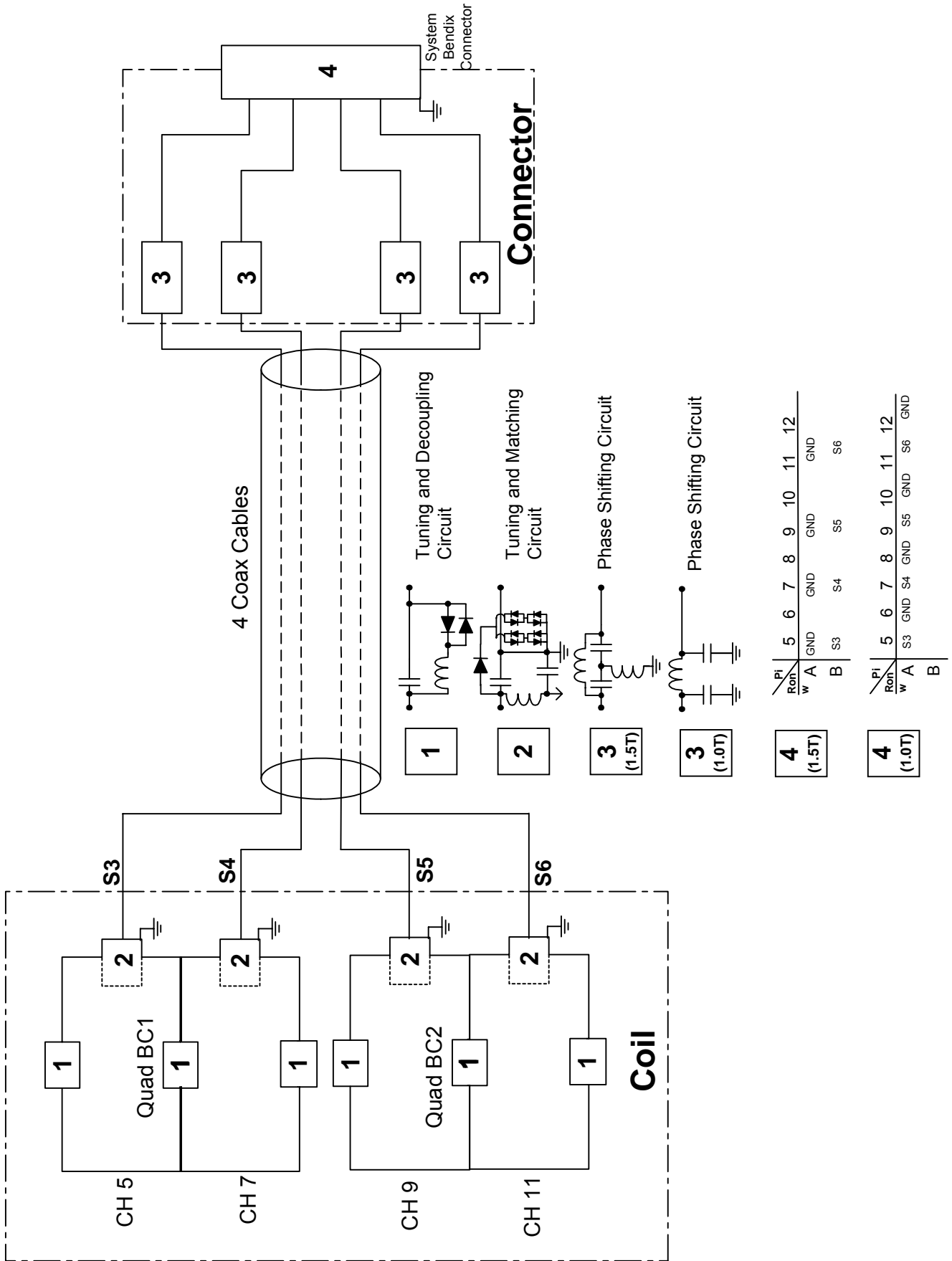
Weight

Coil Weight:	5.2 kg	11.44 lbs.
Phantom Weight:	0.596 kg	1.31 lbs.

1-5 Theory of Operation

Refer to the block diagram on the following page.

The Phased Array High Resolution Wrist Coil consists of one coil with 4 elements. Two quad birdcages provide four channels. Each channel contains items 1, 2, and 3. Item 1 is a tuning and decoupling circuit, which uses passive decoupling via back to back fast acting diodes which are enabled by the RF pulses. When the diodes short, the network creates a high impedance block to eliminate decoupling artifact and interaction with the excitation field. Item 2 is a tuning and matching circuit which not only tunes and matches the coil to the system resonant frequency and matches the coil to 50 ohms when loaded, it also provides DC bias routing through birdcages to decouple the coil during transmit. Item 3 provides the proper phase shift between the preamplifier and item 2 to create the phased array decoupling required during receive.



SECTION 2 – SETUP AND CALIBRATION

2-1 Coil Installation

2-1-1 Special Install Notes

None

2-1-2 Installing the Coil

The name for this coil is: **HRWRIST**

Add the coil using the Configuration File Manager. Refer to: Service Methods CD; System Level Procedures; Software Utilities.

If the coil does not exist in Coil Config File refer to the Adding New Coils to Config File Manager procedure and use the coil configuration information in Section 7-3 of this manual.

2-2 Installation Functional Checks

1. Perform system level Signal to Noise Check. Refer to Service Methods CD; System Level Procedures; Functional Checks; Signal to Noise Check.
2. Perform Section 3 – Coil Imaging Performance Verification.

2-3 Periodic Quality Assurance Check

On a periodic basis, such as during planned maintenance, perform the quality assurance checks as outlined below to ensure the coils is operating properly.

1. Check external cable for cracks or cuts.
2. Perform Section 3 – Coil Imaging Performance Verification and record data values in Data Sheet.

SECTION 3 – FUNCTIONAL CHECKS

3-1 Scanner Verification

Perform system level Signal to Noise Check. Refer to Service Methods CD; System Level Procedures; Functional Checks; Signal to Noise Check.

3-2 Coil Imaging Performance Verification

3-2-1 Tools Required

TOOLS REQUIRED – TABLE 3-2-1

Description	GE Part #	Supplier Part #	Qty
Wrist Phantom	2293670-3	100885	1
Phantom Positioner	2293670-4	100868	1

3-2-2 Explanation of Procedure

The 1.5T/1.0T High Resolution Wrist Coil is used in 1 mode of operation and has 1 coil name: **HRWRIST**. Since the HRW is a 4 channel phased array coil, SNR measurement requires 4 sets of signal and noise scans. Refer to the Data Sheet in Appendix 7-1 to understand the data required to calculate the individual element SNR for each mode of operation. All ROI measurements are made on the individual element images, **not** on the composite image.

The image quality check uses two different protocols for signal and noise image acquisition. The signal scan is an **FSE** sequence used to minimize susceptibility and B₀ inhomogeneity effects. The noise scan is a **GRE** sequence that has a Control Variable (do_noise) to eliminate the transmit RF completely during the scan. The signal scan **must** be run prior to the noise scan as the R1, R2, and TG values from the signal scan are used for the noise scan.

3-2-3 Signal Scan

1. From the Scan Desktop, start new scan by selecting [**New Pt**]; set **Patient ID** to “geservice” and **Patient Weight** to “111” pounds. Click [**Patient Position**] to open protocols window.
2. Remove any other surface coils from the cradle. Position the High Resolution Wrist Coil, in the vertical configuration, and Baseplate on the cradle with the coil cable extending into the magnet [Figure 2]. Place the phantom on the phantom positioner and insert them into the coil as illustrated in Figures 1 and 2.
3. At the magnet, press “**Alignment Light**” button to turn on the light. Move the cradle to align the coil to the alignment lights as shown in Figure 3. Press “**Landmark**” button to landmark the alignment.
4. Move the coil to scan position by pushing the “**Move to Scan**” button, ensuring cable does not get snagged.

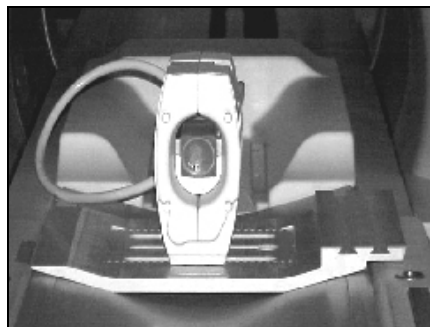
5. At the console, set the protocols per the Signal section from Table 3-2-4: Signal and Noise Protocols.
6. Click [**Save Series**] to download the protocols, then click [**Prepare to Scan**].
7. Open [**Display CVs**] menu under [**Research Operations**] (click right mouse button). Set the “**saveinter**” CV to “1” (saves the intermediate images so ROI measurements can be performed).
8. Run [**Auto Prescan**]. Record the R1, R2 and TG values on the SNR Data Sheet (found at the end of this manual).
9. Run [**Scan**].

Figure 1



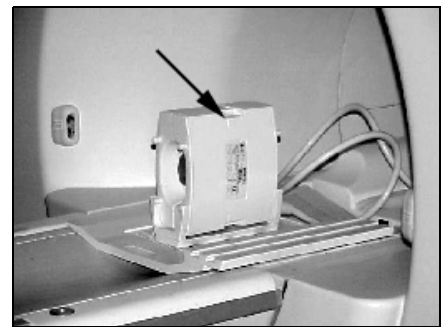
Phantom & Positioner

Figure 2



Coil Positioning

Figure 3



Coil Landmark

3-2-4 Noise Scan

A signal scan must be run **prior** to the noise scan as the same R1, R2 and TG values must be used for both the signal and noise scans. Do **not** run an Auto Prescan prior to the noise scan as the values will be changed.

1. Copy the signal scan series. Use [**Copy Series**] (highlight signal series and click right mouse button) and [**Paste Series**] in **RX Manager**.
2. Click [**View Edit**] and set the protocols per the Noise section from Table 3-2-4: Signal and Noise Protocols.
3. Click [**Save Series**] and click [**Prepare to Scan**].
4. Open [**Display CVs**] menu under [**Research Operations**]. Set the “**saveinter**”, “**rhformat**”, and “**do_noise**” CVs to “1”.
5. Run [**Manual Prescan**], do **not** make any changes, and click [**Done**].
6. Run [**Scan**].

SIGNAL AND NOISE PROTOCOLS – TABLE 3-2-4

Protocol	Signal	Noise
<i>Patient/Exam Information</i>		
Patient ID	geservice	geservice
Patient Name	HRWRIST	HRWRIST
Patient Weight	111 lbs. (50 kg)	111 lbs. (50 kg)
<i>Patient Position</i>		
Patient Position	Supine	Supine
Patient Entry	Head First	Head First
Coil	HRWRIST	HRWRIST
Series Description	Signal	Noise
<i>Imaging Parameters</i>		
Plane	Sagittal	Sagittal
Mode	2D	2D
Pulse Seq	FSE	GRE
Imaging Options	Fast	None
PSD Name	<i>leave blank</i>	<i>leave blank</i>
Protocol	<i>leave blank</i>	<i>leave blank</i>
<i>Scan Timing</i>		
# of Echoes	1	1
TE	17	minfull
TR	500	34
Echo Train Length/Flip Angle	4	1
Bandwidth	15.63	15.63
<i>Additional Parameters</i>		
<i>no entries required in this area</i>		
<i>Acquisition Timing</i>		
Freq	256	256
Phase	256	256
NEX	1	1
Phase FOV	1	1
Freq DIR	S/I	S/I
Auto Center Freq	Peak	Peak
Autoshim	On	On
Phase Correct	On	On
Contrast	Off	Off
# of Reps B4 Pause	0	0
<i>Scanning Range</i>		
FOV	30	30
Slice Thickness	3.0	3.0
Spacing	1.5	1.5
Start R/L	0	0
P/A Center	P22.5	P22.5
I/S Center	0	0
End R/L	0	0
Slices	1	1
Table Delta	0.00	0.00

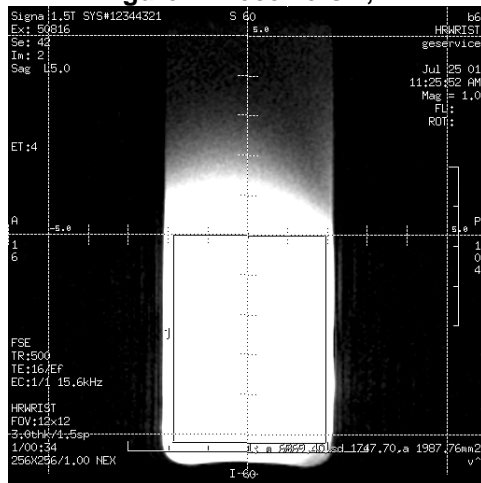
3-2-5 SNR Image Analysis

SNR Measurement

For the signal measurement, choose a rectangular ROI covering the appropriate section of the phantom for the receiver channel being scanned. Rectangular ROI should be about 2000 mm². ROIs are shown in Figures 1 through 3 below.

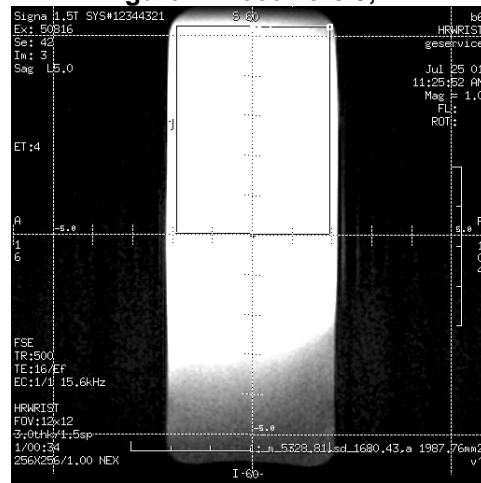
The SNR shall be calculated using the signal to noise ratios of the individual receiver channels. Individual receiver SNR is defined as the mean of data within the signal ROI divided by the standard deviation of data within the noise ROI:

Figure 1: Receivers 1, 2



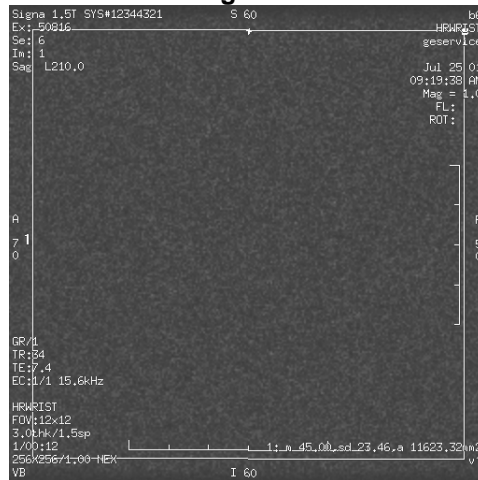
ROI \approx 2000 mm², 3.6 cm A-P, 5.3 cm S-I

Figure 2: Receivers 3, 4



ROI \approx 2000 mm², 3.6 cm A-P, 5.3 cm S-I

Figure 3



NOISE ROI \approx 11600 mm²

Individual Element Performance

Regions of interest in both signal and noise images can be measured directly in the image browser. Click the user interface button Measure, select the circular or rectangular shape, and adjust its size and orientation when the shape is displayed in the selected image. Mean, standard deviation, and area of the ROI will appear in the lower right corner of the image. Examples of typical Receiver Images are shown in Figures 4 through 8 below.

Figure 4, Receiver 1

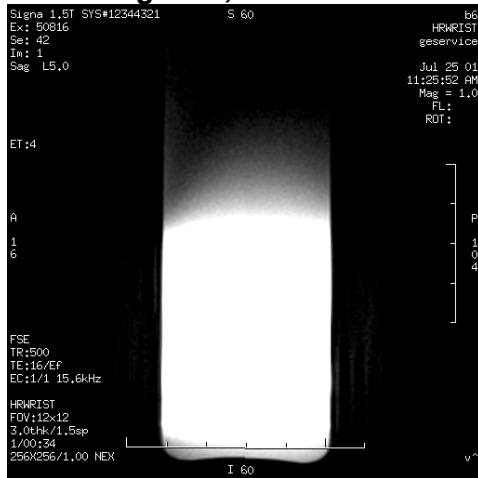


Figure 5, Receiver 2

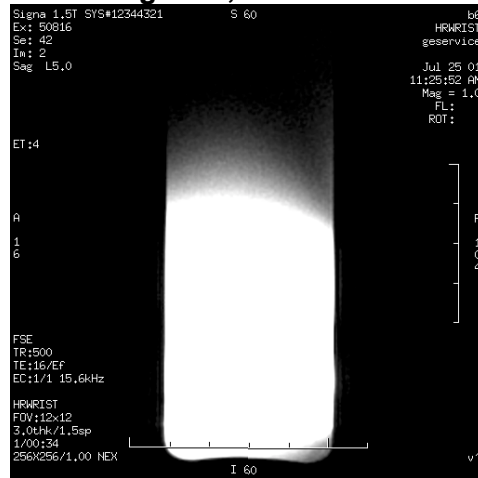


Figure 6, Receiver 3

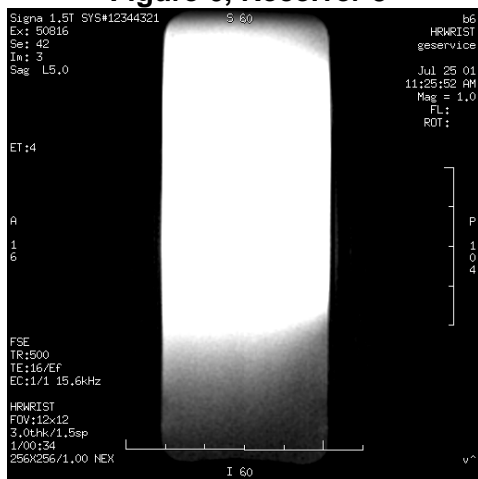


Figure 7, Receiver 4

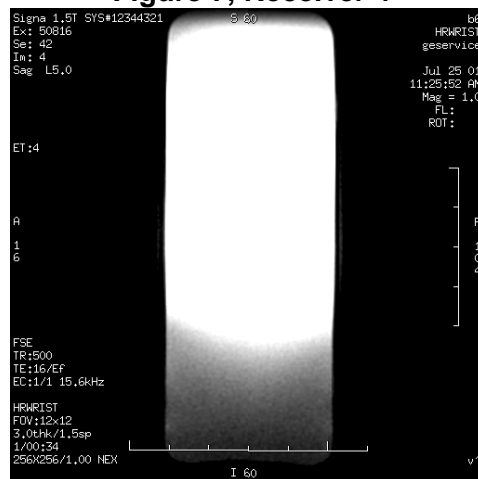
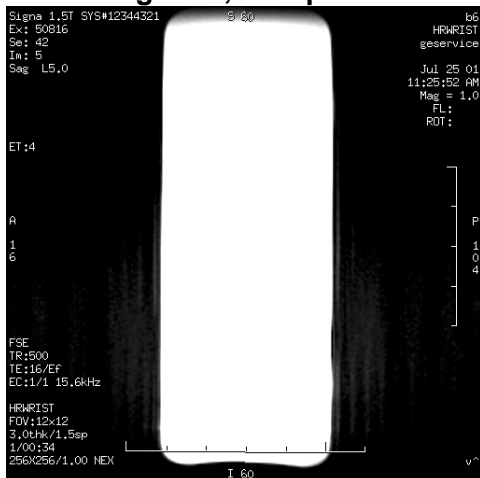


Figure 8, Composite



SNR Specification

The SNR measurements must be greater than or equal to the following specifications:

SNR SPECIFICATIONS – TABLE 3-2-5

Channel	SNR	
	1.5T	1.0T
0	197	90
1	183	108
2	181	89
3	172	84

3-3 External Cable Check

Not Applicable

3-4 PIN Diodes Check

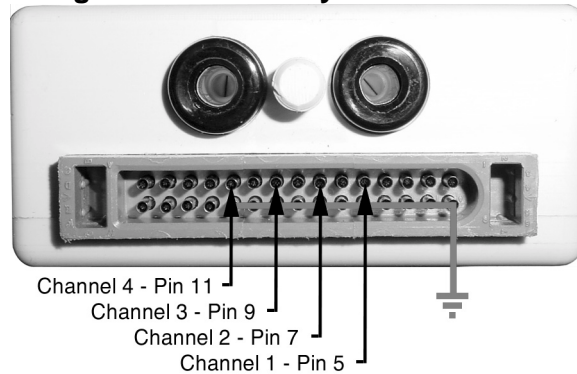
Use a multimeter to measure the Bendix System Connector pins (pinout below) as detailed in Table 3-4.

PIN DIODE EXPECTED READINGS – TABLE 3-4

Positive Lead	Negative Lead	Reading
Pin 5	GND	1.60 ±0.01
GND	Pin 5	0
Pin 7	GND	1.60 ±0.01
GND	Pin 7	0
Pin 9	GND	1.60 ±0.01
GND	Pin 9	0
Pin 11	GND	1.60 ±0.01
GND	Pin 11	0

If one or more of the readings indicate a short, replace the coil. If all of the above readings are correct, redo *3-2 Coil Imaging Performance Verification*. If the problem still exist, replace the 1.5T/1.0T High Resolution Wrist Coil.

Figure 9 – Bendix System Connector



3-5 Mechanical Hardware Check

Not Applicable

3-6 Troubleshooting Tips

If poor image quality or dead channels are present, use the following setup information and compare the resulting images to isolate any defective part(s).

TROUBLESHOOTING – TABLE 3-6

Element Name	Receiver 1	Receiver 2	Receiver 3	Receiver 4	not used	not used	not used	not used	not used
channel number	1	2	3	4	5	6	7	8	
selected channel	See Below				no	no	no	no	
mc bias driver #	1	2	3	4	5	6	7	8	
active bias driver	yes	yes	yes	yes	no	no	no	no	

selected channel	yes	no	no	no
------------------	-----	----	----	----

Receiver 1 ▶

selected channel	no	yes	no	no
------------------	----	-----	----	----

Receiver 2 ▶

selected channel	no	no	yes	no
------------------	----	----	-----	----

Receiver 3 ▶

selected channel	no	no	no	yes
------------------	----	----	----	-----

Receiver 4 ▶

selected channel	yes	yes	yes	yes
------------------	-----	-----	-----	-----

Composite ▶



SECTION 4 – MAINTENANCE

4-1 Coil Care

WARNING!

Detach coil connector from scanner before attempting to clean. Do not reattach after cleaning until coil has dried completely. Having the coil attached to the system during cleaning or when it is wet may result in electrical shock.

CAUTION

Do not spray or pour cleaning solution directly on coil. Do not submerge coil in solution. The coil contains sensitive electronics components that could be damaged by the solution.

To clean the 1.5T/1.0T High Resolution Wrist Coil and pads, use a cloth dampened with a solution of 30% isopropyl alcohol and 70% tap water or a 10% Bleach solution.

4-2 Special Care Requirements

None

SECTION 5 – REPLACEMENT

Simple removals that are clearly obvious are not described here.

Unless otherwise noted, the steps for re-assembly are simply the reverse order of the steps described for disassembly.

5-1 disassembly of Coil

Not Applicable

5-2 External Cable Replacement

The 1.5T/1.0T High Resolution Wrist Coil external cable is not field replaceable.

5-3 Mechanical Hardware Replacement

Not Applicable

SECTION 6 – RENEWAL PARTS

6-1 Field Replaceable Units

1.5T FIELD REPLACEABLE UNITS LIST – TABLE 6-1-1

Description	GE Part #	Supplier Part #
High Resolution Wrist Coil w/Baseplate Assembly	2293670-2	101752
Wrist Phantom	2293670-3	100885
Phantom Positioner	2293670-4	100868

1.0T FIELD REPLACEABLE UNITS LIST – TABLE 6-1-2

Description	GE Part #	Supplier Part #
High Resolution Wrist Coil w/Baseplate Assembly	2293671-2	101753
Wrist Phantom	2293670-3	100885
Phantom Positioner	2293670-4	100868

6-2 Other Replaceable Accessories

OTHER REPLACEABLE ACCESSORIES LIST – TABLE 6-2

Description	GE Part #	Supplier Part #
Small Wrist Pad A, Palm R	E8801W	100864
Small Wrist Pad B, Back	E8801WA	100865
Large Wrist Pad A, Palm R	E8801WB	100866
Large Wrist Pad B, Back	E8801WC	100867
Baseplate Pad	E8801WD	100784

SECTION 7 – APPENDIX

7-1 SNR Data Sheet

Use the table provided below to record the calculated signal to noise ratio (SNR) data obtained from the Functional Checks section.

Date		Comments						
R1	R2	TG	Element	Signal Mean	Noise Std Dev	SNR	Spec Limit	
							1.5T	1.0T
			0				197	90
			1				183	108
			2				181	89
			3				172	84

Date		Comments						
R1	R2	TG	Element	Signal Mean	Noise Std Dev	SNR	Spec Limit	
							1.5T	1.0T
			0				197	90
			1				183	108
			2				181	89
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Date		Comments						
R1	R2	TG	Element	Signal Mean	Noise Std Dev	SNR	Spec Limit	
							1.5T	1.0T
			0				197	90
			1				183	108
			2				181	89
			3				172	84

7-2 Schematic

Refer to Block Diagram under Section 1-5 Theory of Operation

7-3 Coil Configuration

Parameter	1.5T BRM/Twin	1.5T CRM	1.0T
Coil Name	HRWRIST	HRWRIST	HRWRIST
Coil Type	3	3	3
Extremity Coil	no	no	no
Cable Loss	1.05	1.05	1.24
Coil Loss	1.72	0.313	0.549
Recon Scale Factor	0.75	0.75	1.282
Linear vrs Quadrature	1	1	1
Multiple Receiver Coil?	yes	yes	yes
Number of Receivers	4	4	4
Starting Receiver ID	0	0	0
Ending Receiver ID	3	3	3
Multi-Coil Port Enable	6	6	6
Multi-Coil Port Error Enable	6	6	6
Additional Transmit Attenuation	0	0	0
Number of Fast Receivers	0	0	0
Starting Fast Receiver ID	4	4	4
Ending Fast Receiver ID	4	4	4
Fast TG Start TA	90	90	90
Fist TG Start RG	12	12	12
Multi-Coil Recon Enable	0	0	0
Phased Array TR Coil for Autoshim	-1	-1	-1
Head Default Freq. Direction	1	1	1
SCIC Axial	0	0	0
SCIC Saggital	0	0	0
SCIC Coronal	0	0	0
Multi-coil Separation Direction	0	0	0
MC Switch Select	0	0	0

REVISION HISTORY

Rev	Date	Author	Primary Reason for Change
A		L. Hyler	Initial Issue
B	08-22-01	L. Hyler	Combine Coil and Baseplate into One FRU
C	09-05-01	L. Hyler	Correct Coil Configuration
D	09-14-01	L. Hyler	Added Signal and Noise Protocols & SNR Spec.
E	09-18-01	L. Hyler	Change SNR Data Sheet
F	09-19-01	L. Hyler	Correct SNR Data Sheet
G	09-24-01	L. Hyler	Correct Coil Configuration Upper Case to Lower Case Letters